REVISED FEASIBILITY STUDY

CLEANUP AND ABATEMENT ORDER NO. R9-2017-0021

Site Locations

Former Tow Basin Facility
Site # 2090016
3380 North Harbor Drive
San Diego, California 92101

Former Lockheed Marine Terminal and Railway
Site # 2090046
1160 Harbor Island Drive
San Diego, California 92101

Prepared by
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Irvine, California 92618

January 2020

FEASIBILITY STUDY

CLEANUP AND ABATEMENT ORDER NO. R9-2017-0021

Harbor Island – East Basin Sediment Assessment/Cleanup Site
(GeoTracker Site ID No. T10000002642)
Former Tow Basin and Former Marine Terminal and Railway Facilities
San Diego, California 92101

Prepared by
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January 2020

DUTY TO USE REGISTERED PROFESSIONAL

This Revised Feasibility Study was prepared under the direction of qualified professionals in accordance with the California Business and Professions Code Sections 6735, 7835, and 7835.1.

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ACRONYMS

µg/kg	microgram per kilogram
ARAR	Applicable or Relevant and Appropriate Requirement
BMP	best management practice
CAO	Cleanup and Abatement Order
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of San Diego
cm	centimeter
COC	contaminant of concern
cy	cubic yard
DTSC	Department of Toxic Substances Control
ERM	effects range medium
FS	Feasibility Study
IUDP	Industrial User Discharge Permit
Lockheed Martin	Lockheed Martin Corporation
mg/kg	milligram per kilogram
MLLW	mean lower low water
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PEL	Probable Effect Level
Port	San Diego Unified Port District
ppb	part per billion
ppm	part per million
PRMP	Post-remedial Monitoring Plan
RAP	Remedial Action Plan
RCP	reinforced concrete pipe
RCRA	Resource Conservation and Recovery Act
Site	Former Tow Basin and Former Marine Terminal and Railway Facilities
SMA	Sediment Management Area
SQO	Sediment Quality Objective
SWAC	surface weighted area concentration
TSCA	Toxic Substances Control Act
USEPA	U.S. Environmental Protection Agency

USFWS	U.S. Fish and Wildlife Service
Water Board	San Diego Regional Water Quality Control Board

1 INTRODUCTION

Discharges of polychlorinated biphenyls (PCBs), metals, and other pollutant wastes to San Diego Bay throughout the years have resulted in the accumulation of contaminants in marine sediments within the northwest corner of the East Basin of Harbor Island, along the north shore of central San Diego Bay, in San Diego, California. This accumulation has resulted in conditions identified by the San Diego Regional Water Quality Control Board (Water Board) as potentially impacting beneficial uses (i.e., aquatic life, aquatic-dependent wildlife, and human health).

Three San Diego Bay sediment investigations were conducted to assess sediment quality: 1) the Former Tow Basin (Department of Toxic Substances Control [DTSC] 1998 Remedial Action Order); 2) the Sunroad Resort Marina (Water Board Investigative Order No. R9-2011-0064); and 3) the Former Marine Terminal and Railway (Water Board Investigative Order R9-2011-0026). This revised Feasibility Study (FS) was prepared in accordance with Directive B of the Water Board Cleanup and Abatement Order (CAO) No. R9-2017-0021 (Water Board 2017) to address sediments present within the Harbor Island – East Basin Sediment Assessment/Cleanup area (GeoTracker Site ID No. T10000002642), adjacent to the Former Tow Basin and Former Marine Terminal and Railway Facilities (Site). Sunroad Resort Marina is not part of the Site. Observed concentrations of site-related contaminants of concern (COCs; PCBs and mercury) in the sediment are generally low compared to other sites in San Diego Bay, and the cleanup levels established for the Site are lower than the cleanup levels adopted for the nearby San Diego Shipyard Sediment Site. Additionally, CAO No. R9-2017-0021 resulted from extensive discussions and negotiations among the Water Board, Lockheed Martin Corporation (Lockheed Martin), General Dynamics, and the San Diego Unified Port Districts (Port). The Order acknowledges that it is directed to Lockheed Martin pursuant to a settlement agreement reached by the parties in a separate lawsuit, which agreement includes specific limitations on Lockheed Martin obligations. As Lockheed Martin has consistently made clear, if a Remedial Action Plan (RAP) is developed that materially deviates from the limitations on Lockheed Martin's settlement obligations, the settlement agreement may be cancelled and Lockheed Martin retains the right to request that the Water Board re-issue the CAO to all dischargers for performance of the remedy. CAO No. R9-2017-0021 establishes background concentrations of 84 parts per billion (ppb) for total PCBs and 0.57 parts per million (ppm) for mercury (Section 12). The Order requires Lockheed Martin to take corrective action to clean up and abate total PCB and mercury concentrations to background concentrations, or to higher alternative cleanup levels that meet Sediment Quality Objectives, if Lockheed Martin proposes that alternative levels are necessary.

Overview of Feasibility Study and Comments Received

An initial FS and Post-Remedial Monitoring Plan (PRMP) was submitted to the Water Board on June 30, 2017, by Anchor QEA, LLC, on behalf of Lockheed Martin. The FS underwent a public review period. On August 4 and October 27, 2017, respectively, the U.S. Fish and Wildlife Service and Water Board provided comments on the initial Feasibility Study.

On December 26, 2017, Lockheed Martin submitted a response to comments from the Water Board in regard to the October 27, 2017 letter. Finally, Lockheed Martin submitted a letter to the Water Board dated July 11, 2019, to address post remedial monitoring concerns. The Water Board provided a letter dated November 8, 2019, that provided conditional approval of the FS and PRMP pending receipt of acceptable responses to these comments. During a conference call on December 4, 2019, and as confirmed in the 4th Quarter Progress Report (2019) and in the December 8, 2019 response to comments, Lockheed Martin agreed to submit a revised FS that addresses the Water Board's November 8, 2019 comments. The PRMP will be submitted after further discussions with the Water Board and prior to submittal of the RAP. These response letters are reflected in this revised FS and are included in Appendix A.

Summary of Site Remediation Objectives

Demolition of existing structures at the Site will occur prior to implementing construction of the remedial action. Upland structures are to be demolished first, followed by in-water structures, and finally remedial construction. Active remediation is contemplated to address potential impacts, as required in the CAO, and navigation needs envisioned by the Port.

The objectives for remediation at the Site include the following:

- To address potential sediment impacts from the presence of chemical contamination through a cost-effective remedy that is consistent with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (USEPA 1988) on selection of a preferred alternative that is protective of human health and the environment, meets Applicable or Relevant and Appropriate Requirements (ARARs), and is based on evaluation of the five balancing criteria: short-term effectiveness; long-term effectiveness; implementability; reduction of toxicity, mobility, or volume through treatment; and cost.
- To remediate East Basin sediments to achieve the CAO-specified bulk sediment background concentrations of 84 micrograms per kilogram (µg/kg) for total PCBs and 0.57 milligrams per

kilogram (mg/kg) for total mercury as measured on a surface weighted average concentration basis (hereby referred to as the established bulk sediment cleanup levels).

- To address navigation needs envisioned by the Port to be consistent with future uses of the Site by keeping mudline elevations no higher than -10 feet mean lower low water (MLLW).
- To maintain beneficial uses of the Site.

1.1 PURPOSE

This revised FS was prepared by Anchor QEA on behalf of Lockheed Martin to evaluate cleanup alternatives capable of attaining the established bulk sediment cleanup levels applicable to East Basin sediments (84 µg/kg for total PCBs and 0.57 mg/kg for total mercury) as specified in Finding No. 12 of the CAO as measured on a surface weighted average concentration (SWAC) basis. This revised FS includes the following:

- An evaluation of the technical and economic feasibility of cleaning up sediment to the established bulk sediment cleanup levels.
- An evaluation of remedial alternatives capable of effectively cleaning up impacted sediments to the established bulk sediment cleanup levels.
- An evaluation of the cost and effectiveness of each alternative for the remediation of the waste constituents to attain a level of sediment cleanup that results in attainment of the established bulk sediment cleanup levels.
- A recommended remedial alternative(s) for the cleanup and/or abatement of wastes discharged. The recommended alternative(s) must be capable of achieving the established bulk sediment cleanup levels for all waste constituents at all monitoring points and throughout the remediation footprint affected by the waste constituents.

2 BACKGROUND AND SITE CONDITIONS

The East Basin is a relatively shallow (-15 to -10 feet MLLW), artificial embayment of San Diego Bay that is enclosed on three sides (Figure 1). The basin was formed by dredging in the early 1960s with dredged material used to create what is now Harbor Island (McLaren Hart 1991). The East Basin is bounded to the north by the constructed, riprap shoreline of the San Diego waterfront and to the west and south by a constructed peninsula known as Harbor Island, which has a narrow opening to the bay on the east side. Approximately two-thirds of the East Basin is presently occupied by the Sunroad Resort Marina, a 550-slip floating pier. The Former Tow Basin and Former Marine Terminal and Railway Facilities are in the northwest portion of the East Basin (Figure 1).

San Diego Bay is designated for navigation beneficial use in the Basin Plan. Navigation beneficial use exists in East Basin based on the presence of the Sunroad Resort Marina and the boats that use the marina (Water Board 2016). The Port has stated that water depths no shallower than 10 feet below MLLW are needed in the East Basin to support navigation beneficial use, and that the use is impaired in areas where sedimentation has caused water depths to become shallower than this elevation. For this site, the -10 feet MLLW elevation is used as a reasonable threshold for the water depth needed to support the navigation beneficial use in the East Basin (Water Board 2016).

Current and historical conditions and potential sources of sediment contaminants have been extensively reviewed and identified in reports documenting various East Basin sediment, upland, and shoreline investigations (Haley & Aldrich and Weston 2009, 2011; AMEC 2012; Tetra Tech and Weston 2012). Station locations from these investigations are shown in Figure 1, and compiled data are shown in Table 2-1. In general, concentrations of total PCBs in the sediment surface at the Site range from 18.8 µg/kg to 818.5 µg/kg, with the greatest concentrations found in the northwest portion of the Site. Mercury concentrations in the sediment surface range from 0.116 mg/kg to 13.00 mg/kg, with the greatest concentrations found offshore of the Former Marine Terminal and Railway Facility.

Table 2-1. Site Data

Station	PCBs (µg/kg)	Mercury (mg/kg)
2007 East Basin Characterization Data [a,b]		
C1	294.9	0.231
C2	804.6	0.116
C3	268.1	0.129
S1	445.0	0.341
S2	818.5	0.536
S3	451.0	0.721
S4	610.8	0.697
S5	663.4	0.136
S6	232.4	0.272
S7	187.1	0.443
S8	402.9	0.436
S9	446.8	0.689
S10	186.6	0.122
S11	126.4	0.302
S12	212.4	0.462
S13	76.7	0.116
S14	84.0	0.331
S15	213.2	0.392
S16	200.6	0.546
S17	347.4	0.633
S18	313.4	0.932
2010 Former Tow Basin SQO Data [b,c]		
SQO1	419.8	0.143
SQO2	132.8	0.496
SQO3	148.2	0.680
SQO4	306.9	0.692
SQO5	42.8	0.133
2011 LMT Data [d,e]		
LM1	268.9	0.807
LM2 Avg [f]	192.0	1.660
LM3	123.3	0.946
LM-C-1	41.2	0.485
LM-C-2	18.8	2.380
LM-C-3	25.4	0.211
LM-C-4	50.7	13.000
LM-C-5	126.9	1.190
LM-C-6 Avg [f]	25.6	0.428
LM-C-7	197.9	1.070

Notes:
LMT =Former Marine Terminal and Railway
SQO = Sediment Quality Objective
a Haley & Aldrich and Weston 2009
b Total PCBs estimated from sum of congeners 44, 87, 99, 105, 110, 118, 128, 138 (or 138/158), 149, 151, 153, 156, 170, 177, 180, 183, 187, 194, 206, with 1.82 adjustment factor
c Haley & Aldrich and Weston 2011
d Tetra Tech and Weston 2012

e Total PCBs estimated from sum of congeners 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138 (or 138/158), 153, 170, 180, 187, 195, 206, 209, with 1.72 adjustment factor
f Duplicate results averaged

Five outfalls are evident along the north shoreline of the East Basin. Outfall Nos. 1 and 3 discharge into the Site (Figure 1), Outfall No. 2 is within the Site boundary but is closed, and Outfall Nos. 4 and 5 discharge east of the Site. A 48-inch stormwater reinforced concrete pipe (RCP) outfall (Outfall No. 1), which originates in the City of San Diego (City) watershed, is in the northwest corner of the basin and drains the surrounding urban area (primarily roadways and parking lots) and a portion of San Diego International Airport and other Port properties. East of Outfall No. 1 is a visible, but closed, approximately 30-inch RCP outfall identified as Outfall No. 2. Outfall No. 3 is another active stormwater RCP outfall (30 inches) that drains the Harbor Police property and adjacent parking lot. The portion of the Outfall No. 3 system within the former Tow Basin Facility was partially replaced and the remainder of the line and catch basins were cleaned as part of the Tow Basin demolition project (ERM 2004) completed in 2004 with DTSC oversight (DTSC 2004). Additionally, the catch basin north of the Site connected to Outfall No. 3 was cleaned in 1991 (McLaren Hart 1991). Outfall Nos. 4 and 5 are located east of the Site, outside the boundaries of the property.

PCBs were determined to exist in the paint at the Former Tow Basin Facility. Paint was hydroblasted from the building and disposed, and the building was demolished in 2004 under DTSC oversight. Source control from landside releases at the Former Tow Basin Facility is well established based on soil and groundwater closure letters from DTSC (2004, 2009) and the Water Board (2010). Additionally, the Water Board concurred that the Former Marine Terminal and Railway Facility did not warrant further investigation and that no further action was required to address landside soil and groundwater based on results of the site assessment (Tetra Tech 2012). Based on this information, sources of COCs to the sediment entering the Site are controlled.

2.1 SETTLEMENT AGREEMENT MEDIATION PROCESS

Sediment impacts requiring remediation were identified as part of the State of California's Sediment Quality Objectives (SQO) process (Haley & Aldrich and Weston 2011). Due to the identification of sediment impacts, a draft Remedial Action Plan (RAP) was developed and submitted to the Water Board in 2014 (Anchor QEA 2014). As directed by the Water Board, the 2014 RAP served as the basis of the mediation between Lockheed Martin, the Port, and General Dynamics, and attended in part by the Water Board, to determine the overall scope and roles and responsibilities of the cleanup. The results of the mediation were documented in the 2017 Settlement Agreement signed by all parties (i.e., Lockheed Martin, the Port, and General Dynamics). The 2014 Draft RAP was revised to be consistent with agreements made during the mediation process and the 2016 Draft RAP (Anchor QEA 2016) was included as part of the 2017 Settlement Agreement. The preferred alternative within this revised FS (Alternative 4) is based on the submitted 2014 and 2016 RAPs and represents the results of the mediation between the responsible parties.

The original remedial design for the Site was placement of sand cover only. As shown in Appendix B, the established bulk sediment cleanup levels (as discussed in Section 3) can be met on a SWAC basis using this remedial technology alone. The addition of dredging as a remedial element, as described in Sections 4 and 5, was intended to increase the protectiveness and long-term effectiveness of the remedy based on stakeholder concerns (including navigational depths adjacent to the Former Marine Terminal and Railway Facility).

3 CAO-ESTABLISHED BULK SEDIMENT CLEANUP LEVELS

Cleanup levels to background concentrations of 84 µg/kg for total PCBs and 0.57 mg/kg for total mercury for bulk sediment applicable to East Basin sediments have been established by the Water Board in Section 12 of the CAO (Water Board 2017) (referred to herein as the established bulk sediment cleanup levels). The established bulk sediment cleanup levels for the East Basin sediments allow bulk sediment concentrations to serve as effective cleanup and monitoring criteria for the Site and do not further delay the Site's remediation. Lockheed Martin is proposing cleanup levels consistent with Section 12 of the CAO.

Prior to the CAO (Water Board 2017), sediments targeted for remediation at the Site were identified in part through the State of California's SQO process and are included in the 36 impacted locations shown in Figure 1. These data were then used to establish the pre-remedial SWACs that were compared to established bulk sediment cleanup levels to determine the COCs and areas requiring remediation. These SWACs have been determined using Thiessen polygon analysis as described in Appendix B. Thiessen polygons are defined by orthogonal lines drawn through the midpoints of lines connecting adjacent sample locations. In this way, each point on the map is associated with and presumed to be represented by the nearest sampling location, without interpolation or averaging between samples. SWAC values for total PCBs and total mercury have been calculated for the Site using existing data. The distribution and extents of Thiessen polygons at the Site are depicted in Appendix B. As described above, the analysis determined that only total PCBs and total mercury were sufficiently greater than established bulk sediment cleanup levels to warrant remediation. Table 3-1 presents current SWACs and established bulk sediment cleanup levels for total PCBs and total mercury.

Due to the spatial heterogeneity of sediment chemistry concentrations at the Site and the mobility of aquatic-dependent wildlife and angler-targeted game species, such as fish and lobster, a SWAC-based cleanup level is appropriate and protective for the Site. These species do not limit their movement to the small area represented by a single sediment sample but range throughout a larger area, exposing them to sediments of varying chemical concentrations throughout the Site and greater San Diego Bay. Because these species have foraging ranges larger than the small area represented by a single sediment sample and/or the Site, SWAC for sediment is a more appropriate measure of potential exposure to chemicals that fish and lobsters might incur during foraging. This technique is well established, in use throughout a broad range of sciences, and is being used at other sites in San Diego Bay and at many nationally known sediment remedial sites such as the Hudson River, Portland Harbor, Lower Duwamish River, Lower Passaic River, and Fort Ord cleanups.

Non-mobile members of the benthic community are expected to live in the top 10 to 15 centimeters (cm) of the sediment bed. By achieving cleanup criteria in the upper 10 to 15 cm of the sediment bed on a SWAC basis, benthic organisms are expected to be protected on a community basis. These established cleanup levels (84 µg/kg for total PCBs and 0.57 mg/kg for total mercury) are less than commonly accepted marine sediment screening criteria for the protection of the benthic community (i.e., 180 µg/kg effects range median [ERM] and 189 µg/kg Probable Effect Level [PEL] for total PCBs and 0.71 mg/kg ERM and 0.7 mg/kg PEL for total mercury). Protection of benthic organisms on a community basis is consistent with the State of California's SQO (State Water Resources Control Board 2009), which states, "pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities." The Water Board adopted amended Sediment Quality Provisions in June 2018, which were approved by the U.S. Environmental Protection Agency in March 2019.

In addition, protection of benthic organisms on a community basis is also consistent with the *Ecological Risk Assessment and Risk Management Principles for Superfund Sites* (USEPA 1999) that states, "remedial actions generally should not be designed to protect organisms on an individual basis (the exception being designated protected status resources, such as listed or candidate threatened and endangered species or treaty-protected species that could be exposed to site releases), but to protect local populations and communities of biota."

Consequently, the remedial footprint encompasses the area of the Site that if remediated will reduce the Site-wide SWAC to concentrations at or less than established bulk sediment cleanup levels (Figure 1).

Table 3-1. CAO-established Bulk Sediment Cleanup Levels and Existing Surface-area Weighted Average Concentrations

Primary COCs	Units (dry weight)	Pre-remedial SWAC	CAO-established Bulk Sediment Cleanup Levels [a]
Total Mercury	mg/kg	0.662	0.57
Total PCB Congeners [b]	µg/kg	242.9	84

Notes:
µg/kg = micrograms per kilogram
CAO = Cleanup and Abatement Order
COCs = contaminants of concern
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
SWAC = surface-weighted average concentrations
a Established bulk sediment cleanup levels defined in the Site CAO (Water Board 2017)
b Total PCBs Congeners = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206

4 REMEDIAL TECHNOLOGIES SCREENING

Prospective remedial technologies are identified and screened in this Section, and then assembled into combinations of remedial alternatives appropriate for the Site (see Section 5). Section 6 evaluates these remedial alternatives in terms of cost and effectiveness. Section 7 then identifies a preferred remedial alternative that will meet the established bulk sediment cleanup levels discussed in Section 3 on a SWAC basis and best balances the evaluation criteria described in Section 6.

- ✓ An evaluation of the technical and economic feasibility of cleanup sediment to established bulk sediment cleanup levels.
- ✓ An evaluation of remedial alternatives capable of effectively cleaning up impacted sediments to established bulk sediment cleanup levels.

The remedial technologies identified and screened are as follows:

- **No Action:** No remedial activities performed at the Site.
- **Monitored Natural Recovery:** Natural recovery of sediments is a process by which chemical concentrations in the upper sediment layers are reduced over a period of time, usually several years, following significant reduction or elimination of contaminant sources. Sediment quality improves through a combination of natural processes (e.g., biodegradation, sediment accumulation and mixing, diffusive losses) and source control activities. Monitoring of the bulk sediment concentrations is necessary to confirm that recovery is taking place.
- **Capping:** This technology uses an engineered cap of 2 to 4 feet in thickness to physically and chemically isolate contaminated sediments on a permanent basis.
- **Clean Sand Cover Placement:** This technology includes placing a 4-inch to 6-inch thin-layer of clean material (sand or gravelly sand), which will mix into the underlying surface sediment, to reduce the overall surface sediment concentrations in the biologically active zone. Clean sand is also used to cover areas after removal to address suspended material generated during the dredge process.
- **Removal:** This technology includes physically removing the sediment via dredging or excavation. Following removal, the sediment is typically transferred to a dewatering area, loaded for transport, and relocated to a treatment or disposal facility by truck or rail. Dredging requires consideration of available sediment trans load areas; in-water controls to control contaminant release during removal; dewatering to reduce sediment moisture content; dredge water treatment before discharge; and disposal and/or treatment of dredged/excavated material at a landfill.

In the remainder of this Section, these remedial technologies are evaluated based on technical implementability, which is a general indication of whether a technology type or process option can be reasonably implemented with respect to Site conditions; available technologies; and established precedent. The implementable technologies that can attain established bulk sediment cleanup levels are used to generate remedial alternatives for the Site (see Section 5).

4.1 NO ACTION

No action for the entire Site was retained as a representative process option during the initial screening step, as required by the National Contingency Plan. This option was used as a baseline against which other alternatives are evaluated.

4.2 MONITORED NATURAL RECOVERY

Natural recovery is the process by which contaminant concentrations within the sediment are reduced through a combination of naturally occurring physical, chemical, and/or biological processes to the point that surface sediment concentrations are acceptable. Some natural processes (e.g., deposition of cleaner sediments onto impacted sediments, mixing, and erosion) act as containment or dilution mechanisms and others (e.g., biodegradation of contaminants by native bacteria) act as in situ treatment mechanisms. Site-wide monitoring of sediments at specified intervals provides a mechanism to track natural recovery processes. Natural recovery refers to processes that act to reduce COC concentrations in the sediment in the absence of, or following, active remediation.

This technology was not retained for further evaluation based on the lack of deposition within the East Basin, which is essential to the success of the natural recovery process. However, the relatively quiescent nature of the East Basin supports the use of clean cover placement, discussed further in Section 4.4.

4.3 CAPPING

Capping is a form of engineered permanent in-place containment, which involves confining chemicals *in situ* by placing physical barriers or hydraulic controls. Caps are typically constructed of sand or similar material and may include armoring layers and reactive materials. Use of in-place containment technologies typically results in minimal short-term releases of contaminants during construction and can also provide an effective method of reducing the potential for exposure at a relatively lower cost. Placement of an engineered cap however reduces water depth and may impact navigation uses.

Sediment capping is a common remedial technology for contaminated sediments (USEPA 2005; Palermo et al. 1998). Its effectiveness as a remedial option is demonstrated by numerous successful projects. Sediment caps are primarily composed of sand and/or clean sediment and typically range from approximately 2 to 4 feet thick. Depending on the contaminants and environment, a cap is designed to reduce risk through the following primary functions (USEPA 2005):

- Physical isolation of the contaminated sediments sufficient to reduce exposure due to direct contact and to reduce the ability of burrowing organisms to move contaminants to the surface
- Stabilization of the contaminated sediments and erosion protection of the sediment and cap, sufficient to prevent resuspension and transport to other sites
- Contaminant isolation of the contaminated sediments sufficient to reduce exposure from dissolved and colloidally bound contaminants transported to the water column

The feasibility of sediment capping as a remedial technology is related to several factors, including underlying sediment strength, contaminant characteristics, physical and hydrological conditions at a site, and compatibility with potential future uses of the waterbody. Important fate and transport properties of the contaminants in question include partitioning rates to solid materials, solubility, and biodegradation rates (in the case of organic compounds). Key physical characteristics of the Site include groundwater seepage rates (which affect the rate of contaminant advection through the cap) and surface water velocities due to currents, propeller wash, and wind- and vessel-generated wave action (which potentially affect the stability of the cap). Sediment capping may not be feasible in some areas if it negatively affects future hydraulic conditions (e.g., increases flooding) or limits habitat or potential uses of the waterway, such as navigation and recreation.

Though capping is consistent with criteria described above, it is not compatible with future site navigational uses because it will increase the existing elevations within the East Basin, rendering it non-implementable at the Site. This increase in elevation will negatively affect the existing and future navigation and other beneficial uses within the basin. Therefore, sediment capping was not retained for further evaluation.

4.4 CLEAN SAND COVER PLACEMENT

Clean sand cover placement is typically accomplished through placement of sand directly onto the sediment bed. As time passes following placement, the placed clean sand cover layer will naturally mix into the underlying sediment via benthic interactions, such as bioturbation (a combination of organism burrowing, conveyor-belt feeding mechanisms, and porewater pumping), as well as external physical disturbances, such as propeller wash, tidally induced currents, or wave action, generating sufficient bottom shear force to intermix the placed sand cover with underlying sediment. The depth of bioturbation varies but is typically 10 to 15 cm (4 to 6 inches) in marine sediments (Clarke et. al. 2001). This mixing will reduce the overall chemical concentrations in this bioturbation area. The upper 10-cm of underlying sediment is expected to become mixed in with the clean cover material. If a 15-cm layer of clean sand material is placed, the result will be a reduction of chemical concentrations by approximately 75% in the resulting upper 10 cm.[1] Bioturbation induced and physical mixing will occur as the benthic community recovers and matures after material placement, which is expected to occur within 1 to 2 years. Because significant bioturbation or physical mixing is expected to extend to 10 cm, but not consistently down to 15 cm, the surface concentration will be less than if uniform mixing occurred. Gravelly sand may be used in place of sand in areas where greater erosion is expected, or on sloping areas to limit movement of the cover (the final specification for this material will be determined during design). Both clean sand and gravelly sand were used successfully in San Diego Bay as part of the San Diego Shipyard Sediment Site cleanup project. This technology does not result in a significant increase in bottom elevations since a thin layer (10 to 15 cm) of material will be placed and will have insignificant impact on present and future uses of the basin for navigation. Clean sand cover placement was retained for more detailed consideration as a potential remedy component.

4.5 REMOVAL

Dredging allows for the removal of sediments directly from the water, without needing to drain or divert water from the site. Two types of dredging removal are excavation and dredging, discussed in Sections 4.5.1 and 4.5.2, respectively. For this revised FS, "excavation" refers to the removal of sediment using equipment stationed on land, such as a hydraulic excavator from the shoreline or conducting removal "in-the-dry" using standard land-based equipment. "Dredging," refers to the removal of sediment using water-based equipment, such as a barge-mounted derrick or hydraulic excavator.

4.5.1 Excavation

Excavation involves using excavators, backhoes, and other conventional land-based earth-moving equipment to remove contaminated sediments, either from the shoreline or in-the-dry. Removal from the shoreline will be conducted "in-the-wet" by a long-reach excavator reaching from the existing shoreline, mechanically excavating the sediment, then transferring the sediment to an on-land stockpile area or directly into trucks for off-site disposal. This type of excavation is not likely to effectively remove all contaminated

[1] Following the placement of 15 cm of clean sand cover, the lower 10 cm of sand cover mixes with the upper 10 cm of contaminated sediment (mixed sediment layer), which results in a 50% contamination concentration reduction in the mixed sediment layer. A 10 cm surface sample will consist of 5 cm of clean sand, and 5 cm of the mixed sediment layer. The resulting surface sample will result in an additional 50% contamination concentration reduction (because the top 5 cm of sand is assumed to be clean), resulting in an overall reduction of surface chemical concentration of 75%.

sediments, leaving behind a thin layer of contaminated sediments, commonly referred to as residuals, due to limitations of the excavation equipment (i.e., turn radius). In addition, the excavator will require access along the entire shoreline and will require reaches greater than 150 feet (horizontal) to reach the extents of the required removal area.

Excavation can also occur after the water has been diverted or drained (i.e., in-the-dry). Diversion of water from the excavation area can be facilitated by installing temporary cofferdams, sheetpiles, or other water management structures and lowering of the surface water elevation within the excavation area (likely through pumping). Following dewatering of the area, equipment can be positioned on the existing sediment surface (or a crane mat for added stability) within an excavation area. Installing sheetpile or temporary cofferdams to support dry excavation may cause unintended consequences such as erosion adjacent to the work area due to constricted river flow or other hydrodynamic forces. In addition, sheetpile installation may be inhibited by the presence of debris and/or other natural obstructions.

Though excavation is technically feasible, this process was not carried forward due to implementation and cost concerns. Conducting excavation from the shoreline will prove challenging due to excavator access and long reaches. Conducting excavation in-the-dry will prove costly, including the cost to install and remove the sheetpiles or cofferdams as well as draining and managing the water drained from the excavation area.

4.5.2 Dredging

Two types of dredging include the following:

- **Hydraulic Dredging:** Hydraulic dredging involves the removal of sediment slurried with surrounding water. Hydraulically dredged material must be transported via piping directly to a staging/processing area. Booster pumps may be required to transport materials as the distance and elevation increases between the dredge and processing areas. The solids content of hydraulically dredged slurries normally averages less than 10% by weight, thereby resulting in significant amounts of water requiring treatment (see discussion below for water handling constraints). Additionally, solids content can vary considerably with the specific gravity, grain size and distribution of the sediment, and depth and thickness of the dredge cut. Technical limitations associated with hydraulic dredging include inability to remove large debris and clogging of the cutterhead or pipeline with weeds, wood, rocks, and other materials.

- **Mechanical Dredging:** Mechanical dredging involves the use of barge-mounted equipment, such as a clamshell bucket on a derrick barge or a hydraulic excavator. These dredges remove sediment at approximately the same water content as the in situ material, thereby minimizing the amount of water removed (USEPA 2005). Mechanical dredges operate in areas with limited space and are highly maneuverable. They are also able to remove large debris. Mechanically dredged material can be transported by barge or piped short distances. Mechanical dredges potentially cause spillage during dredging and offloading.

Though both hydraulic and mechanical dredging are technically feasible, mechanical dredging is typically the primary method of removal used in San Diego Bay for other cleanup projects, including at the San Diego Shipyard Sediment Site. Mechanical dredging was conducted, due to implementability concerns associated with hydraulic dredging, including extensive water generation (which will need to be treated and discharged) and slurry with high water content, which will need to be managed and dried appropriately (potentially through use of geotextile tubes) for upland disposal. Because hydraulic dredging is not typically used in San Diego Bay given the implementability issues, mechanical dredging was carried forward into the remedial alternatives for evaluation. Activities that will need to accompany the dredging process, and which are included in the feasibility evaluation, are provided below.

4.5.3 Dewatering

Dewatering is necessary to reduce the amount of water in dredged material to prepare it for further treatment or disposal at a landfill. The transport of dredged material to a landfill by truck or railcar, or disposal, requires the sediment to be free of standing water to avoid any spillage during transport and to meet landfill acceptance criteria. A dewatering operation requires having available on-site space in which to manage and dewater the material, termed here a Sediment Management Area (SMA).

Several factors must be considered when selecting an appropriate dewatering treatment technology including physical characteristics of the sediment, selected dredging method for sediments, and the required moisture content of the sediment to allow for the next re-handling, treatment, transport, or disposal steps in the process. Dewatering is separated into two subcategories: passive and active. As the moisture content of dredged material is anticipated to be relatively low (due to the expected use of mechanical dredging), only passive dewatering is anticipated and considered in this analysis.

Passive dewatering (also referred to as gravity dewatering) is a widely implemented dewatering technology for mechanically dredged material and occurs through a combination of natural evaporation, consolidation, and/or drainage of sediment porewater to reduce the water content of the removed material. At the San Diego Shipyard Sediment Site, a passive dewatering system was successfully implemented, which has been updated to be applicable to the Site. For the Site, similar methods are feasible though space is limited and a nearby sediment transload area will need to be identified and permitted. The final dewatering approach for the Site will be determined during design but a likely approach is provided below:

- Prior to placing dredged material within a scow, the dredge operator will decant the bucket, allowing the water to drain from the sediment, which will significantly reduce the amount of water placed in the scow.
- Standing water within the scow (at both the dredging location and the SMA) will be pumped into storage tanks located either on the dredge barge, on the water treatment barge, or directly into the water treatment facility (if the water is pumped at the SMA). All stored water will be transferred to the water treatment facility.
- Portland cement (or similar additive) will be added to the sediment at the SMA to increase the workability of the material and to reduce the water content to a level that will pass the paint filter test needed for disposal. The cement will be placed directly into the scow on top of the sediment using the dredge bucket. After the cement is placed, the offloading excavator will mix the sediment within the scow to a uniform consistency. The scow will then be staged for a period (typically overnight or longer depending on the water content of the sediment) to allow the Portland cement to absorb excess water.

This passive dewatering system was carried forward to remedial alternatives evaluation given its successful use during the San Diego Shipyard Sediment Site cleanup project.

4.5.4 Water Treatment

Water treatment is necessary following the dewatering of removed sediments, to allow for discharge. The following three process options were considered for the water treatment technology:

- **Activated Carbon Adsorption:** Activated carbon adsorption involves removing PCBs in the aqueous phase using activated carbon.
- **Filtration:** Filtration involves removing PCBs by passing water through various media, such as sand.

- **Settling:** Settling involves removing suspended sediment from the water by allowing sediment to settle from the water prior to discharge, thus removing PCBs. This method was used at the San Diego Shipyard Sediment Site as discussed below.

Each option is technically implementable and often combined as part of the overall water treatment train. The settling option was successfully used at the San Diego Shipyard Sediment Site, where the treatment train was comprised of a series of weir and storage tanks. The generated water (Section 4.5.3) was transferred to the treatment train, where the water was run through a minimum of three weir tanks and one settling tank (a simple storage or "frac" tank). After sufficient water was collected in the final discharge tank (following treatment), the water was discharged to the City sewer system under an Industrial User Discharge Permit (IUDP). Periodic sampling (monthly and quarterly) was conducted to confirm compliance with the IUDP's discharge limitations. Due to this successful recent experience, and having the lowest cost of the three alternatives, the settling water treatment option has been carried forward to the remedial alternatives evaluation (Section 6).

4.5.5 Sediment Disposal

Only off-site disposal was considered for the Site, because no suitable on-site disposal area is available due to the small size and planned future use of the Site. Off-site disposal consists of transporting the dewatered material via truck to a permitted and permanent disposal facility. The selection of disposal facility (hazardous or non-hazardous) depends on chemical concentration of the removed material. No PCB or total mercury concentrations were measured at the Site near the Toxic Substances Control Act (TSCA) or Resource Conservation and Recovery Act (RCRA) thresholds; thus, no TSCA or RCRA hazardous waste is expected to be generated during remediation.

Off-site disposal of sediment, similar to methods successfully implemented during the San Diego Shipyard Sediment Site cleanup project will include:

- The offloading excavator loads the Portland cement stabilized sediment into haul trucks. The truck drivers monitor the weight within their cab to ensure the hauling weight limits are met.
- The haul trucks then pass through a truck wash, where pressure washers are used to remove any sediment from the front, sides, back, and rails of the haul truck.
- The haul trucks then departs the SMA using a stabilized entrance (i.e., rumble strips) and travel to the Otay Landfill, located in Chula Vista, California, using the approved haul route (based on the permits obtained).

As off-site disposal was used successfully during the San Diego Shipyard Sediment Site cleanup project, this disposal method is retained for further consideration as a possible remedy component. An SMA will be required to complete this disposal, either constructed on site or off site at a location selected by the contractor. Potential SMA locations include the Former Marine Terminal and Railway Facility following demolition of the existing structure or within the Former Tow Basin Facility. The haul trucks will be required to follow an approved Traffic Control Plan, which will detail the hours of trucking along the allowable haul route. The Traffic Control Plan will need to consider traffic flow patterns. Approval of the Traffic Control Plan may be required by the Cities of San Diego, National City, and Chula Vista.

The Otay Landfill, used for the San Diego Shipyard Site cleanup project, is authorized to accept non-hazardous special waste material, including dredged material. The Otay Landfill is in Chula Vista, California, approximately 19 miles south of the Site. The landfill is easily accessible by highway, minimizing impacts to the surrounding communities. Prior to construction, sediment sampling will be conducted in accordance with the Otay Landfill acceptance criteria. The number of samples and required testing will be dictated by the Otay Landfill acceptance guidelines. Finally, the allowable number of truck trips will be dictated by the acquired haul permits as well as daily acceptance limitations by the Otay Landfill.

4.5.4 Removal Summary

In summary, based on our technical feasibility evaluation for removal, mechanical dredging with passive dewatering, water treatment by settling, and off-site landfill disposal of the dewatered sediment were retained, although the specific SMA will need to be identified and permitted.

5 DEVELOPMENT OF PROPOSED REMEDIAL ALTERNATIVES

- ✓ An evaluation of the technical and economic feasibility of cleaning up sediment to established bulk sediment cleanup levels.
- ✓ An evaluation of remedial alternatives capable of effectively cleaning up impacted sediments to established bulk sediment cleanup levels.

Clean sand cover placement and removal were retained remedial technologies and are assembled into a range of remedial alternatives for the Site. For the purposes of assembling the remedial alternatives, the remedial technologies included in the alternatives are broadly defined (e.g., what type of dredging method to employ or the type of sand to be included in the clean sand cover). Ultimately, the selection of specific remedial technologies depends on the context in which the technology is applied and will be addressed during development of the RAP.

The following evaluation of these technologies applicable as a remedial alternative at the Site uses steps generally consistent with CERCLA guidance (USEPA 1988).

5.1 COMMON ELEMENTS

Common elements shared by all or most of the remedial alternatives are described below. Clean cover placement and removal can meet the established bulk sediment cleanup levels individually or in combination. Based on available data and information presented in Section 2.0, Lockheed Martin believes sources to the site are controlled. For example, at the former Tow Basin facility, connections to the storm drains have been eliminated. As a result, the potential for recontamination of the Site is considered low.

- **Clean Sand Cover Placement:** A minimum of 15 cm (6 inches) of sand cover, consisting of sand and gravelly sand, is applicable to all areas at the Site. If a minimum of 15 cm (6 inches) of sand is placed, the upper 10 cm (4 inches) of underlying sediments is expected to become mixed in with the clean cover material. The result will be a reduction of chemical concentrations by approximately 75% in the resulting upper 10 cm (4 inches). Because significant bioturbation or physical mixing is not expected to consistently extend to 15 cm, the surface concentration will be less than if uniform mixing occurred. During design, some areas may be determined to receive a slightly thicker placement depth.

  Katie Zeeman of the U.S. Fish and Wildlife Service (USFWS) has indicated potential concerns regarding shorebird foraging habitat protection in the northwest corner (around Outfall No. 1). To that end, Lockheed Martin has agreed to work with USFWS during remedial design to find a substrate that can be placed over the coarser clean cover material (finer, with some organics) to facilitate recovery of the benthic community. This material must be sized appropriately to remain in place subject to wind, vessel, and tidal processes; it must also provide a suitable substrate for the benthic community and foraging habitat for shorebirds and waterfowl. The proposed material will not be placed within the discharge limits of Outfall No.1 but above and around it to avoid erosion.

- **Post-dredging Sand Cover Placement:** Due to the inherent nature of dredging, generated residuals are expected to be left on the post-dredge surface following the completion of dredging. Generated residuals are defined as sediment that has become dislodged or suspended by the dredging operation and subsequently re-deposited on the sediment bed either within or adjacent to the dredge footprint. Generated residuals are anticipated to be managed by placing clean sand cover 15 cm (6 inches) in thickness, which is anticipated to isolate or mix relatively quickly with any remaining underlying residuals to enhance the natural recovery process (Patmont and Palermo 2007).
- **Removal:** Sediment removal by mechanical dredging is appropriate for areas with elevated chemical concentrations or areas where navigational depths should be retained or to remove high concentration material. Passive dewatering of the sediment and transport for off-site disposal at a permitted local landfill is the most effective method of disposal.
- **Structure Removal:** The railway and piers associated with the Former Marine Terminal will be removed by others prior to, or in conjunction with, implementation of remedial actions at the Site.
- **Outfall Erosion Protection:**[2] Outfall Nos. 1 and 3 are currently active, and erosion is visually evident at the base of the pipes. Outfall erosion protection (otherwise known as a "splash pad") will be constructed at the discharge point of each outfall using riprap (maximum 1 foot in thickness, approximately 20 feet by 20 feet in surface area) and gravelly sand to protect the placed clean sand cover from erosion following the completion of construction. Finally, a coarser material will be placed "above" (i.e., at a higher elevation) the Outfall No. 1 outfall erosion protection to protect against erosion or disturbance. Erosion protection details and dimensions will be developed during design.
- **Post-Remedial Monitoring:** Below is a summary of the post-remedial monitoring activities. Specific details are provided in Section 8. Bulk sediment chemistry sampling (for total PCBs and total mercury) will be conducted approximately 1 year after the completion of construction activities to confirm that placement of the sand cover has achieved and maintained the specified cleanup level

[2] This detail will be evaluated during the design phase to confirm that there will be room to place both the primary (splash pad) and secondary (coarse material placed at a higher elevation). The coarse material may consist of 6-inch to 12-inch angular rock.

of 84 μg/kg for total PCBs and 0.57 mg/kg for total mercury measured on a SWAC basis. Surface samples will be collected from 36 previously sampled stations in and adjacent to the remedial footprint, and a site-wide SWAC will be re-calculated based on new data. The results of these analyses will be used to calculate a post-remedial SWAC to evaluate the post-remedial concentration compared with predicted performance across the area.

Benthic community sampling will consist of benthic infauna analyses. For benthic infauna analyses, the entire grab sample will be processed and sent to the laboratory for analysis. Eight of the 36 bulk sediment locations will be sampled pre- and post-remediation for site-wide benthic community analysis. These results will not be used as a direct evaluation of compliance with the CAO. An additional 2 samples will be collected post-remediation in the northwest corner of the Site near Outfall 1 to address USFWS concerns regarding shorebird foraging habitat. Porewater samples will be collected from 12 of the 36 bulk sediment locations using in situ passive sampling methods and analyzed for total PCBs and total mercury. The passive samplers will be placed in situ and will be deployed and retrieved by divers. As agreed, if post-remedial monitoring SWAC results indicate that background levels of 84 ppb for total PCBs and 0.57 ppm for mercury have been achieved and maintained at the Site, the remedial action will comply with the requirement of CAO. Pre- and post-remedial porewater monitoring results will be used to measure any reduction in the bioavailability of these contaminants but will not be used as a direct evaluation of compliance with the CAO.

5.2 ASSUMED CONSTRUCTION EQUIPMENT AND PROCESSES

The assumed construction equipment for the placement of clean sand (including its placement after dredging) and for removal (including sediment management, dewatering, and off-site transportation) are listed below.

- **Clean Sand Cover Equipment:** Clean sand cover placement is expected to be conducted using mechanical equipment, either using a slip-box connected to a derrick barge, an excavator, or a telescoping conveyor belt, operating from a barge.
- **Removal Equipment:** Sediment removal is expected to be conducted by dredging in-the-wet using mechanical equipment, either using a barge-mounted derrick or a hydraulic excavator. Dredged material will be placed into an adjacent watertight scow and transported to an SMA.
- **Dewatering:** During and/or following dredging into a watertight scow, water that has settled at the top of the sediment will be pumped into water tanks either staged on the dredge barge, on a water holding barge, or directly into the water treatment system located at the offloading facility. The

remaining wet sediment will be stabilized using a drying agent (such as Portland cement or fly ash) to allow the sediment to pass the paint filter test (U.S. Environmental Protection Agency [USEPA] Method 9095B), required for disposal by truck.

- **Water Treatment:** The water treatment train will be located at the offloading area and will consist of a series of weirs and storage tanks (consistent with the treatment system used at the San Diego Shipyard Sediment Site). Following treatment, the water will be discharged into the City's sewer system.
- **Transportation and Disposal:** Following stabilization and passing of the paint filter test, sediment will be loaded into haul trucks and transported to the Otay Landfill in Chula Vista, California.

5.3 REMEDIAL ALTERNATIVES

Four remedial alternatives, based on elements described in Section 5.1, were considered for the Site. The evaluation of these alternatives is included in Section 6.

5.3.1 Remedial Alternative 1: No Action

Alternative 1 is the required baseline alternative for comparison of all other alternatives per USEPA guidance. Under this alternative, no remediation or monitoring will occur. Though the Site may recover naturally over time; no monitoring of natural recovery is provided in this alternative to evaluate the extent of the recovery.

5.3.2 Remedial Alternative 2: Clean Sand Cover Placement

Alternative 2 contains the following components:

- Placing clean sand cover over the entire remedial footprint as presented in Figure 2
- Constructing outfall erosion protection at the terminus of Outfall Nos. 1 and 3. Outfall splash pad details will be determined in design phase
- Post-remedial monitoring to confirm that established bulk sediment cleanup levels set forth in the CAO are met

Clean sand cover will be placed over an area of approximately 115,000 square feet, resulting in approximately 6,000 tons of clean sand cover placed (Figure 2).

Ancillary activities will include the following:

- Environmental protection (e.g., silt curtain)

- Surveying (including but not limited to pre- and post-sand cover placement surveys and pre-construction side scan surveys to detect debris and other conditions that will inhibit clean sand placement)
- Other non-construction elements such as project management, remedial design, and construction management

5.3.3 Remedial Alternative 3: Removal

Alternative 3 contains the following components:

- Removing the maximum practical volume of sediments exceeding established bulk sediment cleanup levels within the remedial footprint shown in Figure 3, using a minimum 5-foot stabilizing offset from the existing toe of revetment
- Placing clean sand cover over the entire dredge footprint (post-dredging sand cover), as a residuals management measure, and in areas where dredging is not practical, such as adjacent to outfalls or within the 5-foot structural offset
- Constructing outfall erosion protection at the terminus of Outfall Nos. 1 and 3
- Post-remedial monitoring to confirm that established bulk sediment cleanup levels set forth in the CAO are met

This alternative involves removal of the maximum practical amount of sediment with COC concentrations greater than established bulk sediment cleanup levels at the Site. Any areas where it is impractical to remove these sediments (i.e., where side slopes will undermine the shoreline and where outfalls are present) will receive clean sand cover. The sediment removal areas developed for Alternative 3 allow room for a stable cut side slope (inclined at approximately 3 horizontal to 1 vertical [3H:1V]) to avoid destabilizing the adjoining banks. Following the completion of dredging, post-dredging sand cover will be placed over the entire dredge footprint to stabilize residuals.

The dredge prism shown in Figure 3 will result in approximately 11,100 cubic yards (cy) of sediment dredged. Dredged material will be handled in accordance with Section 5.2. Finally, approximately 6,000 tons of clean sand cover will be placed over the dredge footprint (post-dredging sand cover) as a residual management layer and in areas where dredging is impractical.

Ancillary activities will include the following:

- Water handling system installation and operation

- Debris removal and disposal
- SMA improvements, if necessary (and lease if an off-site SMA is selected by the contractor)
- Environmental protection (e.g., floating silt curtains)
- Surveying (including but not limited to pre- and post- dredging/sand cover placement surveys and pre-construction side scan surveys to detect debris and other conditions which will inhibit dredging and clean sand placement)
- Other non-construction elements such as project management, remedial design, and construction management

5.3.4 Remedial Alternative 4: Combination

Alternative 4 contains the following components:

- Removing sediments from a localized area with navigation depth requirements and COC concentrations exceeding the established bulk sediment cleanup levels as shown in Figure 4, using a minimum 5-foot stabilizing offset from the existing toe of revetment
- Removing sediments with elevated mercury concentrations (i.e., LM-C-4 location) as shown in Figure 4
- Placing clean sand cover over the entire remedial area and over the dredge footprint as a residuals management measure and to address the side slopes
- Constructing outfall erosion protection pads the terminus of Outfall Nos. 1 and 3
- Post-remedial monitoring to confirm that the established bulk sediment cleanup levels set forth in the CAO are met

Although placement of clean sand only was originally shown to meet cleanup objectives on a SWAC basis, dredging was added to the remedy during the settlement negotiation process as a compromise to address the Port's requests, including minimization of impacts on navigation use of the East Basin. This alternative involves removing sediments within a discrete area shown in Figure 4 to address elevated mercury concentrations that exceed established bulk sediment cleanup levels (i.e., LM-C-4) and to meet navigation depth requirements that may prevent placement of the clean sand cover. The Port stated that water depths of -10 feet MLLW are needed in the East Basin to support navigation beneficial use and that the use is impaired in areas where sedimentation has caused water depths to be shallower than -10 feet MLLW. For this Site, the -10 feet MLLW level is a reasonable threshold for the water depth needed to support the navigation beneficial use in the East Basin (Water Board 2016). Following the completion of dredging, post-dredging sand cover will be placed over the dredge footprint to stabilize residuals, and clean sand cover will be placed throughout the remainder of the remedial footprint as shown in Figure 4.

The dredge prism shown in Figure 4 will result in approximately 4,000 cy of sediment dredged. Removal of sediments with elevated mercury concentrations will increase the protectiveness and long-term effectiveness and permanence of Alternative 4. Dredged material will be handled in accordance with Section 5.2. Finally, approximately 6,000 tons of clean sand cover will be placed over the dredged footprint as a post-dredging residual management layer throughout the remainder of the remedial footprint.

Ancillary activities will include the following:

- Water handling system installation and operation
- Debris removal and disposal
- Sediment offloading facility improvements and lease
- Environmental protection (e.g., floating silt curtains)
- Surveying (including but not limited to pre- and post-dredging/sand cover placement surveys and pre-construction side-scan surveys to detect debris and other conditions which will inhibit dredging and clean sand placement)
- Other non-construction elements such as project management, remedial design, and construction management.

6 EVALUATION OF REMEDIAL ALTERNATIVES

Remedial alternatives are evaluated based on criteria used in conducting feasibility studies under CERCLA. This evaluation generally adheres to the current guidance document used in conducting a CERCLA feasibility study, which is *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA 1988). The nine criteria used in this section to evaluate the remedial alternatives include:

✓ An evaluation of the cost and effectiveness of each alternative for the remediation of the waste constituents to attain a level of sediment cleanup that results in attainment of established bulk sediment cleanup levels.

1. Overall protection of human health and the environment
2. Short-term effectiveness
3. Long-term effectiveness and performance
4. Compliance with ARARs
5. Implementability
6. Reduction of toxicity, mobility, or volume through treatment
7. Cost
8. State acceptance
9. Community acceptance

6.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

This criterion addresses the overall ability of an alternative to reduce risks to human health and the environment by eliminating, reducing, or controlling potential exposure to hazardous substances in both the short and long term and evaluates whether an alternative provides adequate overall protection to human health and the environment based on the CAO bulk sediment established bulk sediment cleanup levels for total PCBs (84 µg/kg DW) and total mercury (0.57 mg/kg DW) on a SWAC basis.

Alternative 1 (No Action) does not immediately reduce risk to human health and the environment and does not eliminate, reduce, or control potential exposures to site sediments. Because there is no active remediation associated with this alternative, chemical concentrations greater than the established bulk sediment cleanup levels will be reduced neither in the short term nor the long term.

Alternatives 2, 3, and 4 are all capable of immediately reducing risk to human health and the environment by eliminating, reducing, or controlling potential exposures to hazardous substances and protecting human health and the environment in both the short and long term. Each alternative will achieve the established bulk sediment cleanup levels on a SWAC basis through clean sand cover placement and removal to varying degrees. Removal and clean sand cover placement are proven and are reliable methods for addressing sediment with chemical concentrations greater than the established bulk sediment cleanup levels. Alternative 2 (Clean Sand Cover) includes placing clean sand with a minimum thickness of 15 cm (6 inches) that is expected to mix with underlying sediment and lead to a reduction in chemical concentrations of up to 75% within the top 10 cm (4 inches), which is predicted to achieve the established bulk sediment cleanup levels on a SWAC basis.

In Alternative 3 (Removal), dredging will remove sediment contamination sufficient to meet the sediment established bulk sediment cleanup levels on a SWAC basis and support navigation depth requirements. However, there are areas where dredging is not feasible (and not consistent with navigation depth requirements) due to slope or structure stability concerns. These areas will be addressed by placing clean sand cover.

Alternative 4 (Combination) includes both dredging and placing clean sand cover and is expected to achieve the CAO objectives on a SWAC basis equivalently to Alternatives 2 and 3, while remaining compatible with current and future site uses. Dredging will occur in a discrete area to address elevated PCB and mercury concentrations and to meet navigational concerns. Targeted dredging will remove some, but not all, sediments with elevated COC concentrations greater than the CAO cleanup level (e.g., LM-C-4 and C-2). Placement of clean sand cover will occur over the entire remedial footprint, including dredging side slopes, areas where dredging is not feasible, and areas with existing elevations below -11 feet MLLW.

Based on available data, it is believed that all off-site sources are controlled, thus the potential for post-remedy contamination is considered low.

6.2 SHORT-TERM EFFECTIVENESS

Short-term effectiveness addresses the short-term risks posed during implementation of an alternative, the immediate environmental effects of the remedial alternative, potential effects on the community and workers during remedial action, and the time until protection is achieved.

No short-term impacts to the community, construction workers, or the environment will occur during implementation of Alternative 1 as no construction will occur. However, this alternative will not be effective at minimizing risks within the remediation area since no remedial actions are proposed.

There will be short-term impacts associated with both placement of clean sand cover as well as removal activities that are a part of Alternatives 2, 3, and 4, as follows:

- Placement of clean sand cover
  - Potential for short-term impacts to the existing benthic community during material placement, which will be expected to recover in less than 1 year after construction because benthic species will recolonize the newly placed material quickly following placement
  - Water quality impacts from turbidity from placing clean sand cover material, which will be minimized by using best management practices (BMPs) and operational controls
- Removal
  - Removal and disruption of the existing benthic community and vegetation, which will be expected to recover within 1 to 3 years after construction (longer than with placement of clean sand cover) because the benthic community will be completely removed and will take longer to recolonize (Newell et al. 1998)
  - Water quality impacts from suspended sediments being released to the water column, which will be minimized by using BMPs (e.g., use of a silt curtain) and operational controls
  - Human health risks to the public from transportation of the dredged material to the disposal facility due primarily to exhaust and risk of spillage, although controls to protect against these impacts will be required and implemented
- Both
  - Human health risks to the workers associated with safety and working around the water with heavy equipment (All remediation workers involved with activities associated with handling sediments will need to comply with Occupational Safety and Health Administration [OSHA] health and safety regulations.)

The short-term impacts listed above will be minimized through the implementation of BMPs, operational controls, and OSHA-mandated safety measures during construction. Overall, dredging activities have the most short-term impacts Thus Alternative 3 has the greatest amount of dredging and the longest construction period and will have the most potential for extended short-term impacts to the community (marina and hotel), site workers, and the environment. Human health risks along the dredged material transport route to the disposal facility due to exhaust emissions and the risk of spillage of material will be greatest for Alternative 3. Estimated durations of dredging and sand cover placement for each alternative are as follows (details provided in Section 6.5):

- Alternative 2: 27 working days
- Alternative 3: 70 working days
- Alternative 4: 50 working days

Thus, Alternative 2 will have the least amount of short-term impacts and the lowest risk to human health and the environment from exhaust emissions and risk of spillage of material. Note that the construction durations listed above include ancillary activities, such as contractor mobilization, SMA construction (for Alternatives 3 and 4), and surveying.

Alternative 4 will have fewer short-term impacts and a lower risk to human health and the environment from exhaust emissions and risk of spillage of material than Alternative 3 due to a smaller footprint of dredging and a shorter implementation time but will have more than Alternative 2 due to the inclusion of dredging. Although short-term impacts will occur through implementation of Alternatives 2, 3, and 4, once complete, the remediation will be immediately effective at controlling risks to the environment and the public from sediments containing concentrations of COCs greater than the established bulk sediment cleanup levels on a SWAC basis; none of the alternatives rely on monitored natural recovery to achieve the established bulk sediment cleanup levels on a SWAC basis. Although dredging could result in residual chemical concentrations greater than established bulk sediment cleanup levels to remain in the dredge footprint immediately after construction, post-dredging sand cover will be placed to stabilize residuals and address this potential.

Placement of clean sand cover material as part of Alternatives 2, 3, and 4 will be effective in the short-term immediately after placement, because the benthic community is still viable (versus removal) and the biologically active zone in the top 10 cm will immediately contain sediment with concentrations of COCs less than the established bulk sediment cleanup levels. Because the established bulk sediment cleanup levels on a SWAC basis are expected to be achieved through implementation of these alternatives, the overall risk associated with the Site will be reduced over existing conditions.

6.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence addresses the permanence of an alternative along with the degree of certainty that the alternative will prove successful. The assessment considers the magnitude of the residual risk remaining after the remedial activities and the adequacy and reliability of controls.

Alternative 1 will likely not be successful at achieving the established bulk sediment cleanup levels on a SWAC basis. Thus, site risks will remain long term.

Long-term effectiveness of Alternative 3 is expected to be higher than Alternatives 2 and 4 but is dependent on limitations associated with the dredging equipment and presence of residuals following removal. The removal of elevated concentrations of mercury (e.g., removal of LM-C-4) will increase the long-term effectiveness and permanence of Alternative 4. All dredged areas will be managed via placement of post-dredging sand cover to proactively address any incidences of residual concentrations of COCs being greater than the established bulk sediment cleanup levels. Placement of clean sand cover material as part of Alternatives 2, 3, and 4 effectively mimics the natural deposition of clean sediments and limits exposure through separation of contaminants from the biologically active zone. In the long term, mixing of the clean cover material with underlying sediment and with fine-grained material depositing over the clean cover material will occur and will likely increase the chemical concentrations in the clean cover material. Post-remedial monitoring of COCs and contingencies for all alternatives will be in place to confirm that the established bulk sediment cleanup levels continue to be achieved after construction on a SWAC basis. Therefore, Alternatives 2, 3, and 4 are anticipated to be effective in achieving CAO cleanup levels on a SWAC basis in the long term and the no action alternative will not be effective in the long term.

6.4 COMPLIANCE WITH ARARS

This criterion assesses whether the alternative is expected to attain chemical-, location-, and action-specific ARARs. Potential ARARs that could apply to the remedial alternatives is included in Table 6-1. A description of the three different categories of ARARs is provided below. Note that some ARARs may be considered in more than one of these categories:

- **Chemical-specific Requirements:** Chemical-specific ARARs are typically the environmental laws or standards that result in establishment of health- or risk-based numerical values. Chemical-specific ARARs presented in Table 6-1 include Clean Water Act water quality criteria and waste standards.
- **Location-specific Requirements:** Location-specific ARARs include restrictions placed on concentrations of hazardous substances or the implementation of certain types of activities based on the location of a site. Some examples of specific locations include floodplains, wetlands, historic places, land use zones, and sensitive habitats. Location-specific ARARs presented in Table 6-1 include the Rivers and Harbors Act and Coastal Zone Management Act.
- **Action-specific Requirements:** The action-specific ARARs are generally technology or activity-based limitations or guidelines for actions taken with respect to hazardous wastes. These ARARs are triggered by the type of remedial activity selected, and these requirements may indicate how the potential alternative must be achieved. Action-specific ARARs presented in Table 6-1 include Clean

Water Act Water Quality Certifications (Section 401) and discharges of dredged and fill material (Section 404), Clean Air Act, Endangered Species Act, and other wildlife protection acts.

No short- or long-term exceedances of action- or location-specific ARARs are anticipated for Alternative 1, because no active remediation measures will be implemented. However, this No Action alternative will not achieve the established bulk sediment cleanup levels and will not be accepted by regulatory agencies.

No long-term exceedances of chemical-specific ARARs (e.g., water quality standards and established bulk sediment cleanup levels) are anticipated with any of the active remediation alternatives (Alternatives 2, 3, and 4); however, short-term, localized exceedances are possible with these alternatives during clean sand cover placement and dredging activities. Measures such as installation of silt curtains and best management practices will be taken during remediation to minimize water quality impacts. Clean sand cover placement and dredging activities will be conducted during the biologically protective in-water construction window for San Diego Bay (i.e., September 15 – March 31), unless other agreements are reached with the resource agencies. The following state and federal permits and approvals are anticipated to be required prior to implementation of any of the remedial alternatives, except Alternative 1, to achieve compliance with action-specific and location-specific ARARs:

- California Environmental Quality Act compliance
- Rivers and Harbors Act Section 10 and Clean Water Act Section 404 Permits
- Endangered Species Act/Magnuson-Stevens Fishery Conservation and Management Act
- Section 401 Water Quality Certification and Waste Discharge Requirements
- California Coastal Act Consistency

Table 6-1. Site ARARs

Regulation	Citation	Criterion/Standard	Applicability
Federal ARARs			
Clean Water Act, Section 404 and Section 404(b)(1) Guidelines	33 USC 1344, 40 CFR Part 230	Regulates discharge of dredged and fill material into navigable waters of the United States.	Action and location specific. Applicable to the discharge of material to waters of the United States during dredging and placement of clean sand cover material.
Clean Water Act, Section 304	33 USC 1313, 1314 Most recent 304(a) list	Under Section 304(a), minimum criteria are developed for water quality programs established by states. Two kinds of water quality criteria are developed: one for protection of human health and one for protection of aquatic life.	Chemical and action specific. Relevant and appropriate for cleanup standards for surface water and contaminated groundwater discharging to surface water if more stringent than promulgated state criteria. Relevant and appropriate to short-term impacts to surface water from implementation of the remedial action that result in a discharge to navigable water, such as dredging and placement of clean sand cover, only if more stringent than promulgated state criteria.
Clean Water Act, Section 401	33 USC 1341, 40 CFR Section, 121.2(a)(3), (4) and (5)	Any federally authorized activity that may result in any discharge into navigable waters requires reasonable assurance that the action will comply with applicable provisions of Sections 1311, 1312, 1313, 1316, and 1317 of the CWA.	Action specific. Relevant and appropriate to implementation of the remedial action that results in a discharge to the bay, only if more stringent than state implementation regulations.
Clean Water Act, Section 402	33 USC 1342	Regulates discharges of pollutants from point sources to waters of the United States and requires compliance with the standards, limitations, and regulations promulgated per Sections 301, 304, 306, 307, 308 of the CWA.	Action specific. Relevant and appropriate to remedial activities that result in a discharge of pollutants from point sources to the river, only if more stringent than state promulgated point source requirements.
Safe Drinking Water Act	42 USC 300f, 40 CFR Part 141, Subpart O, App. A. 40 CFR Part 143	Establishes national drinking water standards to protect human health from contaminants in drinking water	Chemical specific. Relevant and appropriate as a performance standard for groundwater and surface water that are potential drinking water sources.
Resource Conservation and Recovery Act	40 CFR 260, 261	Establishes identification standards and definitions for material that is exempt from the definition of a hazardous waste.	Action specific. Applicable to characterizing wastes generated from the action and designated for off-site or upland disposal.
Resource Conservation and Recovery Act – Solid Waste	40 CFR 257 Subpart A	Applies to upland disposal.	Location specific. RCRA solid waste requirements may be relevant and appropriate to remedial actions that result in upland or in-water disposal of dredged material. Requirements for the management of solid waste landfills may be relevant and appropriate to upland disposal.

Regulation	Citation	Criterion/Standard	Applicability
Hazardous Materials Transportation Act	49 USC § et seq. 40 CFR Parts 171-177	Applies to remedial actions that involve the transport of hazardous materials (i.e., dredged material)	Action specific. Applicable to dredging that requires the transport of material from the removal site to an upland disposal area if dredged material is deemed to be a hazardous material.
Fish and Wildlife Coordination Act Requirements	16 USC 662, 663 50 CFR 6.302(g)	Requires federal agencies to consider effects on fish and wildlife from projects that may alter a body of water and mitigate or compensate for project-related losses, which includes discharges of pollutants to waterbodies.	Action specific. Potentially applicable to determining impacts and appropriate mitigation, if necessary, for effects on fish and wildlife from filling activities or discharges from point sources.
Magnuson-Stevens Fishery Conservation and Management Act	16 USC §1801	Requires an evaluation of impacts to EFH for activities that may adversely affect EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" and is designated for groundfish, coastal pelagic, and Pacific salmon composites.	Location specific. Potentially applicable if the removal action may adversely affect EFH.
Federal Emergency Management Act	44 CFR 60.3(d)(2) and (3)	Contains flood rise requirements that are considered relevant and appropriate requirements for remedial actions.	Location and action specific. Capping and work within the floodplain cannot result in a significant decrease in flood capacity.
River and Harbors Act	33 USC 401 et seq. 33 CFR parts 320 to 323	Section 10 prohibits the unauthorized obstruction or alteration of any navigable water. Structures or work in, above, or under navigable waters are regulated under Section 10.	Action specific. Applicable requirements for how remedial actions are implemented in and over navigable waters of the United States.
Clean Air Act	42 USC §7401 et seq.	Establishes limits for air emissions from a range of sources including vehicles and industrial processes.	Chemical specific. Applicable to remedial activities that generate air emissions.
Toxic Substances Control Act	15 USC §2601 et seq.	Applies to contaminated material or surface water with PCB contamination	Chemical and location specific. May apply to remedial actions proposed for locations with PCB contamination at certain concentrations. For example, dredged material with a PCB concentration greater than 50 ppm must be disposed of in a hazardous waste landfill or PCB disposal facility.
Marine Mammal Protection Act	16 USC §1361 et seq. 50 CFR 216	Makes it unlawful to take any marine mammal. "Take" is defined as pursuing, hunting, wounding, killing, capturing, trapping and collecting.	Action specific. Applicable to remedial actions that have the potential to affect marine mammals.
Migratory Bird Treaty Act	16 USC §703 50 CFR §10.12	Makes it unlawful to take any migratory bird. "Take" is defined as pursuing, hunting, wounding, killing, capturing, trapping and collecting.	Action specific. Applicable to remedial actions that have the potential to affect a migratory bird species.

Regulation	Citation	Criterion/Standard	Applicability
National Historic Preservation Act	16 USC 470 et seq. 36 CFR Part 800	Requires the identification of historic properties potentially affected by the agency undertaking and assessment of the effects on the historic property and seeks ways to avoid, minimize, or mitigate such effects. Historic property is any district, site, building, structure, or object included in or eligible for the National Register of Historic Places, including artifacts, records, and material remains related to such a property.	Action specific. Potentially applicable if historic properties are potentially affected by remedial activities.
Archeological and Historic Preservation Act	16 USC 469a-1	Provides for the preservation of historical and archeological data that may be irreparably lost because of a federally approved project and mandates only preservation of the data.	Action specific. Potentially applicable if historical and archeological data may be irreparably lost by implementation of the remedial activities.
Endangered Species Act	16 USC 1531 et seq. 50 CFR 17	Actions authorized, funded, or carried out by federal agencies may not jeopardize the continued existence of endangered or threatened species or adversely to avoid jeopardy or take appropriate mitigation modify or destroy their critical habitats. Agencies are to avoid jeopardy or take appropriate mitigation measures to avoid jeopardy.	Action and location specific. Applicable to remedial actions that may adversely impact endangered or threatened species or critical habitat that are present at the site.
Executive Order for Wetlands Protection	Executive Order 11990 (1977) 40 CFR 6.302 (a) 40 CFR Part 6, App. A	Requires measures to avoid adversely impacting wetlands whenever possible, minimize wetland destruction, and preserve the value of wetlands.	Location specific. Relevant and appropriate in assessing impacts to wetlands, if any, from the remedial action and for developing appropriate compensatory mitigation for the project.
Executive Order for Floodplain Management	Exec. Order 11988 (1977) 40 CFR Part 6, App. A 40 CFR 6.302 (b)	Requirements for Flood Plain Management Regulations Areas: requires measures to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Location specific. Relevant and appropriate for assessing impacts, if any, to the floodplain and flood storage from the response action and developing compensatory mitigation that is beneficial to floodplain values.
National Flood Insurance Act and Flood Disaster Protection Act	42 USC 4001 et seq. 44 CFR National Flood Insurance Program Subpart A	Requirements for Flood Plain Management Regulations Areas: requires measures to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Location specific. Relevant and appropriate for assessing impacts, if any, to the floodplain and flood storage from the remedial action and developing compensatory mitigation that is beneficial to floodplain values.

Regulation	Citation	Criterion/Standard	Applicability
State ARARs			
California Coastal Act	USC 16 §1451; 20 PRC Section 30000	Requires that any applicant for a federal license or permit to conduct an activity in the coastal zone must submit a certification of compliance with the state's approved coastal zone management program to the agency and the state (CCC) and that the CCC must concur with the certification before the federal agency may issue the permit.	Action and location specific. Relevant and appropriate to dredging or clean sand cover placement activities that occur as part of a remedial action in the coastal zone.
Porter-Cologne Water Quality Control Act	Division 7 of the California Water Code, beginning with §13000	Establishes water quality standards through state and regional water quality control plans, including the California Ocean Plan (point source discharges to territorial marine waters of the state, excluding enclosed bays, estuaries, and coastal lagoons), and regional basin plans (all surface and groundwaters in a region). The plans designate beneficial uses for bodies of water and establish narrative and numerical water quality standards/objectives. The Water Board enforces the standards through NPDES permits or waste discharge requirements.	Chemical and action specific. Relevant and appropriate for remedial actions that discharge to waters of the State.
California Drinking Water Regulations	22 CCR §64431 through 64444	Establishes state equivalents to the federal Safe Drinking Water Act regulations for protection of public water systems. Sets maximum and secondary contaminant levels.	Chemical specific. Relevant and appropriate for remedial actions that have the potential to impact drinking water supplies.
California Air Quality Control Regulations	17 CCR §70200	Establishes state ambient air quality standards and emissions standards. Local and regional authorities may set stricter standards than the state.	Chemical and action specific. Applicable to remedial activities that generate air emissions.
Regional Water Quality Control Board Sediment Cleanup Guidelines	State Water Board Resolution No. 92-49 under Water Code §13304	Establishes cleanup goal of attaining background water quality, unless doing so is technologically or economically infeasible. If infeasible, the Water Board may select an alternative cleanup level that is feasible and that will not impair beneficial uses in San Diego Bay.	Chemical and action specific. Applicable and relevant to the development of sediment established bulk sediment cleanup levels for contaminates of concern at the site.

Regulation	Citation	Criterion/Standard	Applicability
California Environmental Quality Act	PRC §21000	Evaluates the potential environmental effects of proposed projects and may require project modifications or mitigation measures to avoid or minimize environmental impacts.	Action specific. Sediment cleanup at the site may be exempt from CEQA review for the following reasons but will need to be confirmed by the lead agency: 1) “actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment” (Class 7); 2) “actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement or protection of the environment where the regulatory process involves procedures for protection of the environment” (Class 8); and 3) actions by agencies related to “enforcement of a law, general rule, standard, or objective, administered or adopted by the regulatory agency” (Class 21) (CEQA Guidelines Sections 15307, 15308 and 15321).
California Endangered Species Act	§2050-2116 California Department of Fish and Wildlife Code	Requires review to confirm projects will not jeopardize threatened or endangered species or habitats that are essential to sustain those species, if there are "reasonable and prudent alternatives" that will better protect listed species. Projects may need to include mitigation and enhancement measures to minimize impacts to listed species.	Action and location specific. Applicable and relevant to remedial actions if implementation may impact listed species or their habitat. State-listed species in San Diego Bay include the California least tern and California brown pelican.
California Hazardous Waste Management Regulations	22 CCR §66261 (characteristics of hazardous waste); 23 CCR §2510 (regulates discharges to land)	Sets criteria for evaluating the toxicity of waste and addresses the management of hazardous wastes through standards for generators and transporters of hazardous wastes, and requirements for treatment, storage, and disposal facilities.	Action specific. Applicable and relevant if dredged sediment exceeds criteria for identification of hazardous wastes.
California Solid Waste Management Regulations	27 CCR §20005	Addresses the management of solid waste disposal facilities.	Action specific. Applicable and relevant if the sediments are determined to be solid waste and if they will be disposed of in an approved off-site solid waste disposal facility or approved on-site disposal facility.
California Bay Protection and Toxic Cleanup Act	Division 7 of the California Water Code, §13390-13396	Requires the State and Regional Water Boards to identify and characterize toxic hot spots in bays, estuaries, and ocean waters of the state and to develop a plan for cleaning up the hot spots.	Action specific. Applicable and relevant if remedial activities will disturb a toxic hot spot. If so, this regulation requires a CWA Section 401 Certification or Waste Discharge Requirements from the Water Board and disposal of dredge material must not impair beneficial uses of the receiving water or adversely impact aquatic life or wildlife.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirements
CCR = California Code of Regulations
CEQA = California Environmental Quality Act
CFR = Code of Federal Regulations
CWA = Clean Water Act
EFH = Essential Fish Habitat
NPDES = National Pollutant Discharge Elimination System
PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act
USC = United States Code
Water Board = Water Quality Control Board

Measures will be taken to prevent spills or runoff associated with dewatering dredged material as part of Alternatives 3 and 4. Also, workers who handle the contaminated sediments will comply with all OSHA health and safety requirements. The chemical concentrations of site sediment do not exceed California hazardous waste criteria; therefore, disposal at an upland landfill is expected. Disposal will be conducted only at disposal facilities that are specifically permitted to accept sediment waste with site characteristics. Testing of the dredged material will occur in accordance with California waste discharge requirements to determine concentrations of indicator chemicals and suitability for disposal. For Alternatives 3 and 4, dredged material will be transported and disposed of in accordance with state and local requirements, including a Traffic Control Plan, haul permits, and Otay Landfill disposal testing requirements. Alternatives 2, 3 and 4 are anticipated to be implemented in a manner that will achieve compliance with ARARs.

6.5 IMPLEMENTABILITY

This criterion evaluates the ease or difficulty of implementing the alternative by considering technical feasibility, administrative feasibility, and availability of services and materials required for implementation.

Alternative 1 has no implementability issues, because no active remediation will occur. Alternatives 2, 3, and 4 will be accomplished using common marine navigation and construction equipment (e.g., dredges, barges, excavators) and can be technically implemented using local contractors as done on other cleanup projects such as the San Diego Shipyard Sediment Site. Implementation of any of the alternatives may be limited to the period between September 15 and March 31 to protect the endangered California least tern (*Sterna antillarum browni*); although work within the least tern nesting season may be requested per the terms of the Programmatic Environmental Impact Report for sediment remediation in San Diego Bay (Water Board 2012).

The remedial activities proposed as part of Alternatives 2, 3, and 4 will require the cooperation of the Sunroad Resort Marina, which is not expected to impede implementation. Only a small portion of boats is expected to be affected because of the Site's location within the East Basin. Implementation of Alternative 3 will impact the marina the most because Alternative 3 is expected to have the longest construction duration. Expected construction durations are provided in Table 6-2.

Table 6-2. Estimated Construction Durations

Element	Duration (Working Days)		
	Alternative 2 (Clean Sand Placement)	Alternative 3 (Removal)	Alternative 4 (Combination)
Mobilization	5	5	5
SMA Preparation	0	10	10
Dredging [a]	0	23	8
Clean Sand Cover Placement [b]	12	12	12
Outfall Erosion Protection	5	5	5
Demobilization	5	5	5
SMA Site Restoration	0	10	5
Estimated Working Days [c]	27	70	50

Notes:
SMA = Sediment Management Area
a Assumes dredging will be conducted at a rate of 500 cy per day.
b Assumes clean sand will be placed at a rate of 500 tons per day.
c Assumes only one working shift with one contractor crew.

Clean sand placement associated with Alternatives 2, 3, and 4 has been implemented recently within San Diego Bay as part of the San Diego Shipyard Sediment Site. Clean sand can be delivered to the Site from a quarry by land (trucking) or by barge. If the clean sand arrives on site by land, then the sand will then need to be transferred to a barge, likely using a land-based or barge-mounted excavator or derrick crane. After the sand is transferred to a barge, it can be placed using mechanical methods (i.e., excavator, derrick crane, or a telescoping conveyor).

Water depths are sufficient for water-based dredging operations associated with Alternatives 3 and 4; however, an offloading facility will need to be located or constructed by the selected contractor to facilitate offloading of sediment from a barge to land for subsequent stabilization/drying and upland disposal. Site constraints, such as the availability of the offloading facility and existing dock structures may lead to implementability issues. Disposal at an upland landfill facility is implementable, since chemical concentrations in the sediment do not exceed California hazardous waste criteria.

Therefore, all the alternatives appear to be implementable, although the alternatives that incorporate dredging, Alternatives 3 and 4 are more complex to implement due to the need for a sediment offloading facility and management area for sediment and generated water. Dredging and clean sand placement associated with Alternatives 2, 3, and 4 are also able to achieve established bulk sediment cleanup levels while maintaining the navigational needs of the Site, although dredging as part of Alternatives 3 and 4 will best maintain navigational needs since material will be removed and depths increased.

6.6 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

This criterion addresses the degree to which an alternative reduces the toxicity, mobility, or volume of chemical constituents through treatment. CERCLA has a statutory preference for selecting remedial actions that use treatment technologies to the maximum extent practicable.

Alternative 1 has no treatment technologies proposed that will reduce the principal threats at the Site through destructing toxic contaminants, reducing the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reducing total volume of contaminated media.

Dredging activities included in Alternatives 3 and 4 will remove chemically impacted sediments from the site and may include the addition of Portland cement to the dredged material to accelerate the drying process once the material was transferred to an upland area for processing. Alternative 3 includes removal of approximately 11,100 cy of material while Alternative 4 includes removal of approximately 4,000 cy of material, including sediment with the highest mercury concentration (i.e., LM-C-4). Alternatives 3 and 4, although not needed to achieve the established bulk sediment cleanup levels on a SWAC basis, will achieve those levels more quickly than Alternative 2 through the removal of contaminated sediments from the Site. While Alternative 4 is targeted to select the most contaminated sediments for removal, Alternative 3 removes more total sediment.

6.7 COST AND ECONOMIC FEASIBILITY ANALYSIS

Cost evaluates direct and indirect capital, operating, and maintenance costs of implementing an alternative. The evaluation of this criterion is in general compliance with USEPA Method 2000b guidance. Costs include capital costs (both direct and indirect), pre-design submittals and studies, project management, remedial design, permitting, construction management, environmental monitoring, long-term monitoring and maintenance, and contingency in net present value dollars. A summary of costs by alternative is provided in Table 6-3 and backup for each cost estimate is provided in Appendix C. Alternatives 2, 3, and 4 achieve the established bulk sediment cleanup levels on a SWAC basis.

Table 6-3. Remedial Alternative Cost Summary

Remedial Alternative	Most Probable Cost Estimate	Cost Estimate—Low Range (-30%)	Cost Estimate—High Range (+50%)
Alternative 1 (No Action)	None	None	None
Alternative 2 (Clean Sand Cover Placement)	$1.89 M	$1.32 M	$2.84 M
Alternative 3 (Removal)	$6.60 M	$4.62 M	$9.90 M
Alternative 4 (Combination)	$4.00 M	$2.80 M	$6.00 M

Alternative 2 is the lowest-cost alternative, and Alternative 3 is the highest-cost alternative, driven mainly by the need to handle the removed material, transport the removed material through the community, and dispose of the removed material at an off-site disposal facility. Alternative 4 costs are substantially lower than Alternative 3 costs, because dredging is focused on the area with the highest chemical concentrations and clean sand is applied in the remainder of the remedial area.

Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304,* determining "economic feasibility" requires an objective balancing of the incremental benefit of attaining further reduction in the concentrations of primary COCs as compared with the incremental cost of achieving those reductions. Generally, as dredged materials are removed, benefits increase and the concentration of contaminants declines. However, the rate of increase in benefits declines as more material is dredged (the concave curve). At a certain width and depth, no additional navigation benefits are provided. At very low levels of contamination, the removal of remaining contaminants may do little or nothing to reduce toxicity or mobility of contaminants or to improve ecological functions.

Economic feasibility was assessed by comparing the relative exposure reduction to the estimated implementation cost for each for the four alternatives. Each of the four alternatives resulted in a post-remedial SWAC value (as presented in Appendix B), and a corresponding construction cost (presented in Table 6-3 and Appendix C). The calculations performed for this analysis are presented in Appendices E and F. Exposure reduction was defined for this purpose as the percent reduction in sediment SWAC for both constituents of interest, relative to median background concentrations. Background concentrations used for this purpose were taken as median concentrations from the Shipyards Site reference pool used to derive the background-based established bulk sediment cleanup levels (Water Board 2012, Tables 18-2 and 18-4). The pre-remedial SWAC is considered zero reduction and background is considered 100 percent reduction. SWAC reductions to levels below background are greater than 100 percent.

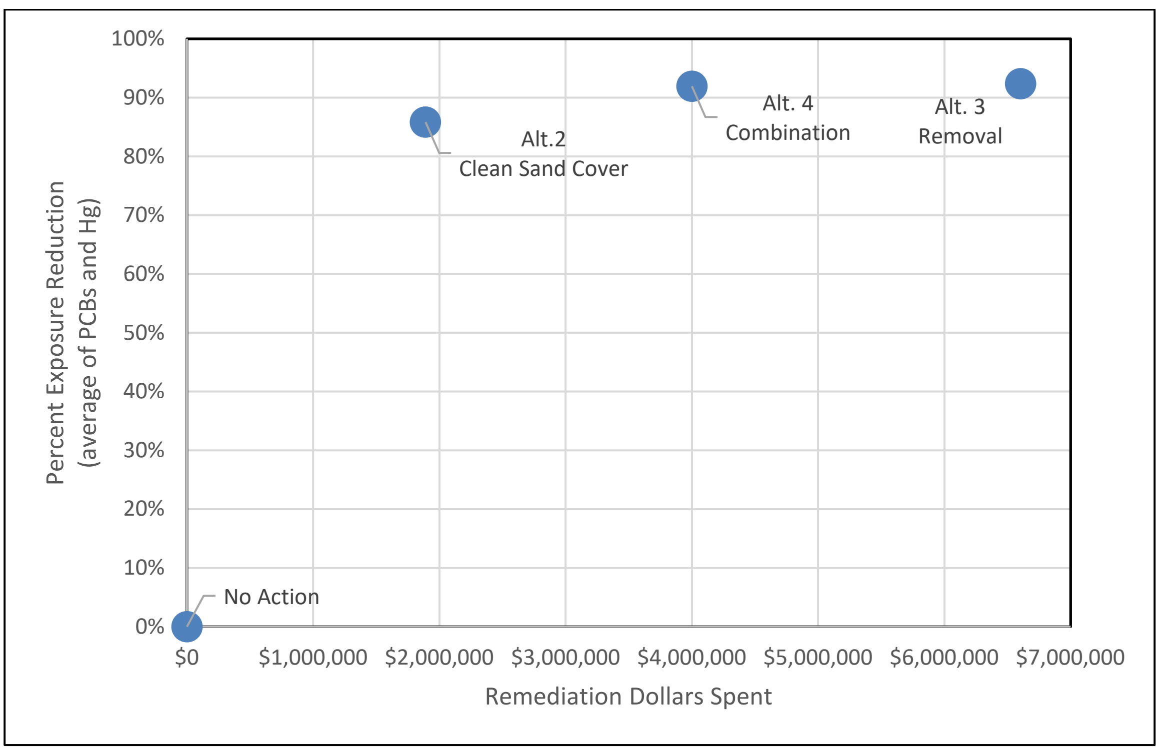
$$\text{Exposure Reduction} = \text{SWAC}_{\text{current}} - \text{SWAC}_{\text{post-remedy}}$$

To estimate the relative exposure reduction of a given alternative, it is appropriate to normalize the exposure reduction to median background levels. This equation is the calculation of percent exposure reduction relative to background:

$$\%\ \text{Exposure Reduction} = 100 \times (\text{SWAC}_{\text{current}} - \text{SWAC}_{\text{post-remedy}}) / (\text{SWAC}_{\text{current}} - \text{Background})$$

Percent exposure reduction was calculated for both COCs (total PCBs and mercury) using the SWAC values developed in Appendix B, and median background concentrations of 22.4 ug/kg for PCBs and 0.25 mg/kg for mercury. A cost-benefit relationship is shown on Figure 7 by plotting implementation costs against percent exposure reduction for each of the four alternatives (averaged for the two COCs):

Figure 7 – Percent Exposure Reduction versus Remediation Dollars Spent



The initial costs required to accomplish Alternative 2 (Clean sand cover) return a relatively high exposure reduction benefit, compared to No Action. However, additional costs as needed to reach Alternative 4 (Combination) yield a much lower return per dollar spent on remediation. Further costs beyond that, as needed to accomplish Alternative 3 (Removal), result in negligible additional exposure reduction benefits. In other words, for additional money spent, the environmental condition is not substantially improved.

Alternatives 2, 3, and 4 achieve the established bulk sediment cleanup levels on a SWAC basis. Alternative 4, which combines dredging in the area of the highest chemical concentrations with sand cover placement in other areas, will achieve an estimated 83.9 percent exposure reduction for PCBs and a 100 percent reduction (matching median background levels) for mercury, on a SWAC basis. While the dredging prescribed in Alternative 4 will require approximately $2.11M in additional costs over Alternative 2, it will not only allow the remedy to effectively meet the CAO's bulk chemistry requirements on a SWAC basis, but will also remove the highest chemical concentrations in the remedial area.

Alternative 3 is not economically feasible or justified because it will greatly increase costs while providing little or no incremental benefit in protection of beneficial uses beyond the Alternative 4 combination option. For a marginal increase in the bulk reduction in chemical concentrations, Alternative 3 will add approximately $2.6M in costs and pose a potential net risk due to the large quantities of dredged material moving through the material handling chain and the associated risks in long-distance trucking, traffic congestion near the airport, and disposal. The cost-benefit analysis demonstrates a net risk in the implementation of Alternative 3.

6.8 STATE ACCEPTANCE

The Water Board will assess the technical and administration issues raised by the supporting agencies about the alternatives. This criterion will be evaluated after the Water Board reviews and approves this document.

6.9 COMMUNITY ACCEPTANCE

This element accounts for any issues and concerns raised by interested persons in the community about the potential remedial alternative. The proposed remedy was subject to a public comment and review period. The Water Board received no comments based on the original preferred alternative (Alternative 4 with less removal). The Water Board did receive comments from the U.S. Fish and Wildlife Service, which are addressed in this revised FS and included in Appendix A. The RAP will go through a public comment and review period and the community acceptance evaluation criterion will be addressed upon receipt of comments.

6.10 SUMMARY OF ALTERNATIVES EVALUATION

The evaluation of alternatives presented in Sections 6.1 through 6.9 provides a comparison of the four proposed alternatives based on seven of the nine CERCLA evaluation criteria as a guide to address the following evaluation elements outlined in Section B of the CAO (Water Board 2017):

- An evaluation of the technical and economic feasibility of cleaning up sediment to established bulk sediment cleanup levels
- An evaluation of remedial alternatives capable of effectively cleaning up sediments to established bulk sediment cleanup levels
- An evaluation of the cost and effectiveness of each alternative for the remediation of the waste constituents to attain a level of sediment cleanup that results in attainment of established bulk sediment cleanup levels.

Table 6-4 summarizes the outcome of the alternatives evaluation. Overall, the Alternative 1 (No Action) is not an acceptable option, because it does not reduce risk to human health or the environment and does not eliminate exposure to site sediments. Alternatives 2, 3, and 4 will all reduce risk to human health and the environment, achieve established bulk sediment cleanup levels on a SWAC basis, and be implemented in a manner that achieves chemical-, action-, and location-specific ARARs. Alternative 2 (Clean Sand Placement) is the most cost effective and will have the least amount of short-term impacts to the aquatic environment but does not meet the navigation needs of the East Basin. Alternative 3 (Removal) is the costliest and will best meet the navigation needs of the East Basin, because dredging will occur, but will also have the highest potential for short-term impacts to the environment over the longest period. Alternative 3 also has more implementability issues related to locating an offloading facility to facilitate offloading sediment from barge to land and impacting ongoing operations at the marina during implementation. Alternative 3 is also economically infeasible under Resolution No. 92-49 because it will greatly increase costs while providing little or no incremental benefit in protection of beneficial uses. Alternative 4 (Combination) is the most economically feasible because it cost effectively achieves the established bulk sediment cleanup levels, is readily implementable, and will meet navigation needs of the East Basin with a moderate level of short-term impacts.

Table 6-4. Summary of Alternatives Evaluation

Evaluation Criteria	Alternatives			
	Alternative 1 No Action	**Alternative 2 Clean Sand Cover**	**Alternative 3 Removal**	**Alternative 4 Combination**
Protective	No	Yes	Yes	Yes
Achieves ARARs	No	Yes	Yes	Yes
Long-Term Effectiveness and Permanence	Low	Medium	High	High
Short-Term Effectiveness	High	Medium	Low	Medium
Reduction in Toxicity, Mobility and Volume through Treatment	Low	Medium	High	Medium
Implementability	High	High	Low	Medium
Cost	$0	$1.89 M	$6.60 M	$4.00 M

Notes:
ARARs = Applicable or Relevant and Appropriate Requirements
State and community acceptance will be evaluated after approval of the selected remedy by the Water Board and through the public review and comment of the RAP.

7 RECOMMENDED REMEDIAL ALTERNATIVE

> ✓ A recommended remedial alternative(s) for the cleanup and/or abatement of wastes discharged. The recommended alternative(s) must be capable of achieving the established bulk sediment cleanup levels for all waste constituents at all monitoring points and throughout the zone affected by the waste constituents.

Directive B of the CAO requires a recommended remedial alternative for the cleanup and/or abatement of wastes discharged. Based on the evaluation consistent with CERCLA guidance (USEPA 1988), the recommended remedial alternative is Alternative 4 (Combination). This alternative includes placement of a clean sand cover over large areas of the Site and is augmented with sediment removal from a localized area to meet navigation depth requirements (i.e., elevations above -10 feet MLLW) and to address areas with elevated PCB and mercury concentrations (Figure 4). Established bulk sediment cleanup levels are achieved on a site-wide SWAC basis by Alternative 4, without interfering with navigational uses. This alternative accomplishes project goals with the most beneficial ratio of costs to benefits. Cross sections further detailing this remedial alternative are presented on Figures 5, 6a, 6b, and 6c.

Alternative 4 is consistent with agreements made during the settlement agreement process, meets threshold criteria of protectiveness and compliance with ARARs, and is the alternative that best achieves and balances criteria described in Section 6, including cost effectiveness.

The recommended alternative is expected to meet the established bulk sediment cleanup levels on a SWAC basis as shown in Table 7-1, to remove localized areas of sediment with elevated PCB mercury concentrations, and to maintain a draft depth of approximately -10 feet MLLW; thus, the navigation beneficial use of the area will not be impacted. Both active outfalls, Nos. 1 and 3, will have splash pads installed to minimize erosion during low tide storm water discharges. The higher elevations in these areas will also receive coarse material to reduce the potential of disturbance.[3]

[3] During discussions with Katie Zeeman of USFWS, Lockheed Martin understood her concerns regarding shorebird foraging habitat protection in the northwest corner. To that end, Lockheed Martin agreed to work with USFWS during remedial design to find a substrate that can be placed over the coarser clean cover material (finer, with some organics) to facilitate recovery of the benthic community. This material must be sized appropriately to remain in place subject to wind, vessel, and tidal processes. It must also provide a suitable substrate for the benthic community and foraging habitat for shorebirds and waterfowl.

Table 7-1. CAO-established Bulk Sediment Cleanup Levels and Estimated Post-remedial Surface-Area Weighted Average Concentrations

Primary COCs	Units (dry weight)	Pre-remedial SWAC	CAO-established Bulk Sediment Cleanup Levels	Estimated Post-remedial SWAC
Total Mercury	mg/kg	0.662	0.57	0.21
Total PCB Congeners[b]	µg/kg	242.9	84	77.3

Notes:
Table adapted from the San Diego Shipyard Sediment Site CAO (Water Board 2012).
µg/kg = micrograms per kilogram
COCs = contaminants of concern
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
SWAC = surface-weighted average concentrations
a Established bulk sediment cleanup levels as defined in the Site CAO (Water Board 2017)
b Total PCBs Congeners = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206

Dredging of 4,000 cy is proposed as part of this recommended alternative, as shown in Figure 4. Dredging will remove sediments with elevated COC concentrations, including the area around LM-C-4, which contains sediment with the highest mercury concentration, and will address navigational concerns by removing sediment at elevations above -10 feet MLLW. The dredging will supplement the placement of clean sand cover while also meeting the navigation beneficial uses adjacent to the Site. The amount of dredging in this alternative is limited and results in fewer short-term impacts than Alternative 3, yet removes surface and subsurface sediment with high concentrations of both PCBs (e.g., C-2) and mercury (e.g., LM-C-4). After removing existing in-water structures on the Site, sediments will be dredged to an elevation of -10 feet MLLW to a point where a 3H:1V slope ratio can be established, with a minimum set back of 5 feet from the existing toe of revetment. A small area (i.e., the area represented by LM-C-4) with elevations lower than -10 feet MLLW will have 2 feet of sediment removed. Post-dredging sand cover of a minimum 15 cm (6 inches) will be placed over the dredged areas to manage residuals.

The placement of 15 cm (6 inches) of clean sand cover is recommended for the areas outside of the dredge area, because it cost-effectively achieves the established bulk sediment cleanup levels on a SWAC basis and meets the criteria detailed in Section 6. The relatively quiescent nature of the East Basin and lack of sediment deposition provides conditions amenable for placement of the clean sand cover. Furthermore, placement of clean sand cover will have little effect on the existing sediment elevations within the East Basin by maintaining a draft depth of -10 feet MLLW, thus not impacting the navigation beneficial use of the area. Outfall erosion protection at the terminus of Outfall Nos. 1 and 3 will also be placed as part of this alternative to prevent erosion from the outfall discharges during low tide.

Dredging and placing clean sand material as part of this alternative will immediately remove and/or isolate the chemicals in the original surface, achieving immediate risk reduction. Sand cover placement also serves as a practical, implementable, and time- and cost-effective alternative that maintains navigation depths and allows for rapid re-colonization of the benthic habitat. This proposed cleanup approach achieves established cleanup objectives on a SWAC basis and is consistent with current navigation beneficial uses of the Site and is anticipated to limit disturbance associated with boat traffic in and out of the marina and bioturbation.

The Sunroad Resort Marina is in the East Basin adjacent to the Site, and coordination will need to occur during remedial implementation. Impacts to the marina are expected to be minimal. For example, access to the west side of the western most pier may need to be limited to early and late hours during sand cover placement activities.

8 NEXT STEPS

After this revised FS is approved in writing by the Water Board, a RAP will then be prepared for review and approval. The RAP will describe the activities needed to implement the selected alternative resulting from the revised FS. A revised PRMP will be submitted prior to submittal of the RAP. As discussed above, Lockheed Martin's obligations in CAO R9-2017-0021 derive from agreement among the Water Board and parties to a litigation settlement agreement that Lockheed Martin would take on the implementation of a remedy as contemplated in that settlement agreement. If the approved RAP and PRMP materially deviate from the limitations on Lockheed Martin's settlement obligations (i.e., the cleanup of total PCBs and mercury to background concentrations of 84 ppb and 0.57 ppm, respectively), the settlement agreement may be cancelled and Lockheed Martin retains the right to request that the Water Board re-issue the CAO to all dischargers for performance of the remedy. CAO No. R9-2017-0021 establishes (Section 12).

Once the RAP is approved, it will be implemented and a Final Cleanup and Abatement Completion Report will be prepared to document implementation. Finally, post-remedial monitoring will be performed as described in the forthcoming PRMP.

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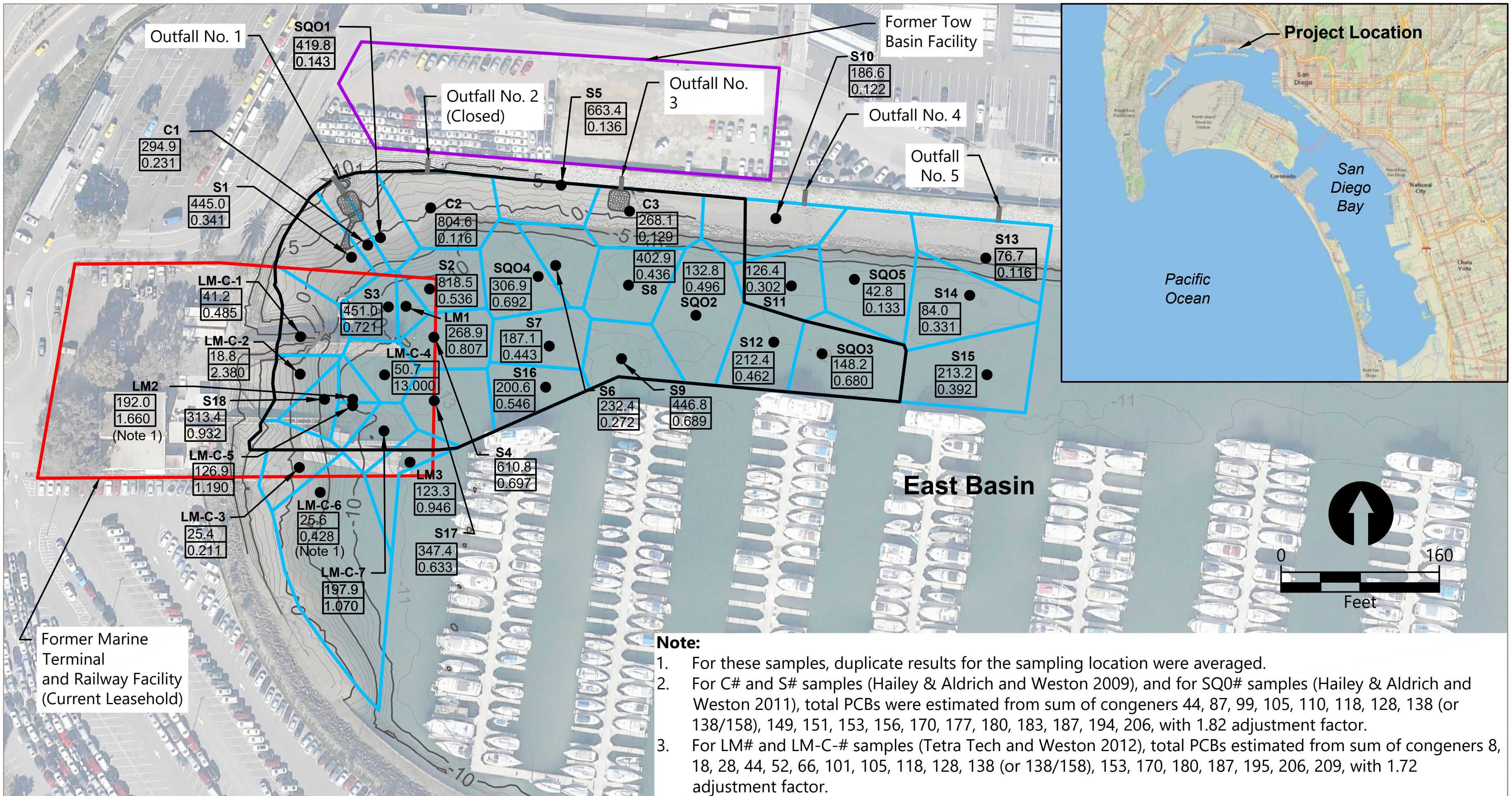
FIGURES



Note:

1. For these samples, duplicate results for the sampling location were averaged.
2. For C# and S# samples (Hailey & Aldrich and Weston 2009), and for SQ0# samples (Hailey & Aldrich and Weston 2011), total PCBs were estimated from sum of congeners 44, 87, 99, 105, 110, 118, 128, 138 (or 138/158), 149, 151, 153, 156, 170, 177, 180, 183, 187, 194, 206, with 1.82 adjustment factor.
3. For LM# and LM-C-# samples (Tetra Tech and Weston 2012), total PCBs estimated from sum of congeners 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138 (or 138/158), 153, 170, 180, 187, 195, 206, 209, with 1.72 adjustment factor.

SOURCE: Aerial from Google Earth Pro. Thiessen polygons from Exponent figure dated November 29, 2017. Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

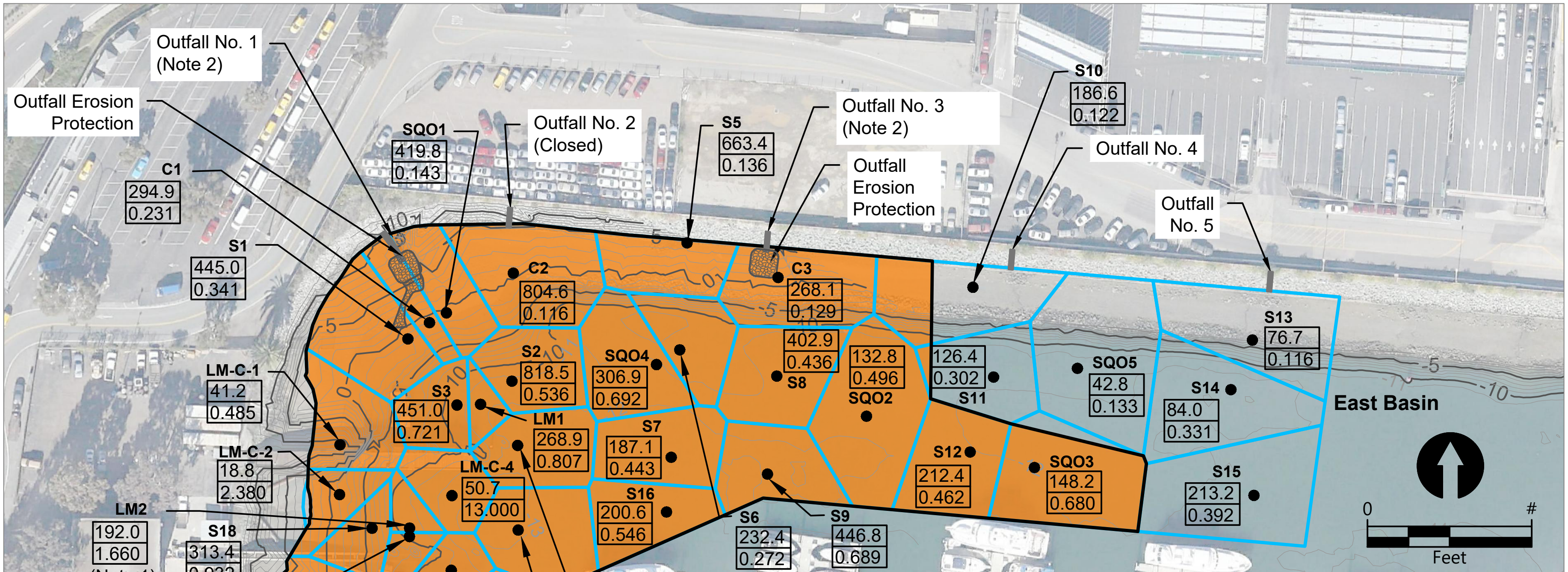
LEGEND:

- Approximate Marine Terminal and Railway
- Former Tow Basin Facility
- ● # Total PCBs (µg/kg) / Mercury (mg/kg) — Previous Sampling Location
- Remedial Footprint
- Thiessen Polygons

Publish Date: 2019/07/10 3:57 PM | User: mpratschner
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-001 SAP SITE.dwg Figure 1

ANCHOR QEA

Figure 1
Site Plan
Former Tow Basin and Former Marine Terminal and Railway Facilities



Note:

1. For these samples, duplicate results for the sampling location were averaged.
2. Outfall erosion protection prescribed at the terminus of Outfall Nos. 1 and 3 and is anticipated to consist of a 20-ft by 20-ft riprap pad to protect the clean cover following placement. Finally, a coarser material will be placed at a higher elevation than the outfall erosion protection to avoid further erosion onto the constructed pad.
3. For C# and S# samples (Hailey & Aldrich and Weston 2009), and for SQ0# samples (Hailey & Aldrich and Weston 2011), total PCBs were estimated from sum of congeners 44, 87, 99, 105, 110, 118, 128, 138 (or 138/158), 149, 151, 153, 156, 170, 177, 180, 183, 187, 194, 206, with 1.82 adjustment factor.
4. For LM# and LM-C-# samples (Tetra Tech and Weston 2012), total PCBs estimated from sum of congeners 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138 (or 138/158), 153, 170, 180, 187, 195, 206, 209, with 1.72 adjustment factor.

SOURCE: Aerial from Google Earth Pro. Thiessen polygons from Exponent figure dated November 29, 2017. Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

Remedial Footprint

● # Previous Sampling Location

Total PCBs (µg/kg)
Mercury (mg/kg)

Clean Sand Cover Placement Area

Thiessen Polygons

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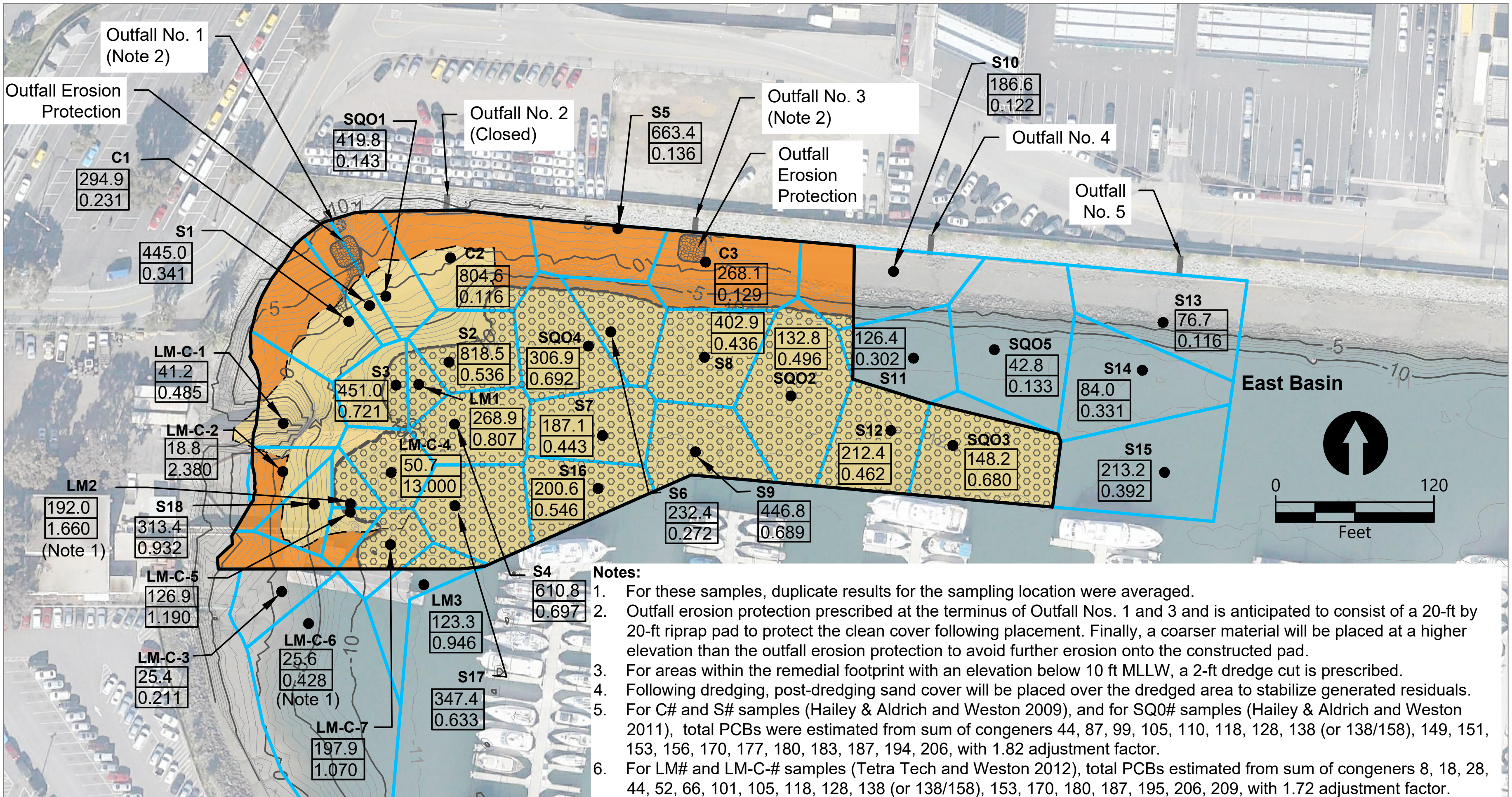
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-004 ALT 2 CLEAN SAND.dwg Figure 2

ANCHOR QEA

Figure 2
Remedial Alternative 2: Clean Sand Cover Placement
Former Tow Basin and Former Marine Terminal and Railway Facilities



Notes:

1. For these samples, duplicate results for the sampling location were averaged.
2. Outfall erosion protection prescribed at the terminus of Outfall Nos. 1 and 3 and is anticipated to consist of a 20-ft by 20-ft riprap pad to protect the clean cover following placement. Finally, a coarser material will be placed at a higher elevation than the outfall erosion protection to avoid further erosion onto the constructed pad.
3. For areas within the remedial footprint with an elevation below 10 ft MLLW, a 2-ft dredge cut is prescribed.
4. Following dredging, post-dredging sand cover will be placed over the dredged area to stabilize generated residuals.
5. For C# and S# samples (Hailey & Aldrich and Weston 2009), and for SQ0# samples (Hailey & Aldrich and Weston 2011), total PCBs were estimated from sum of congeners 44, 87, 99, 105, 110, 118, 128, 138 (or 138/158), 149, 151, 153, 156, 170, 177, 180, 183, 187, 194, 206, with 1.82 adjustment factor.
6. For LM# and LM-C-# samples (Tetra Tech and Weston 2012), total PCBs estimated from sum of congeners 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138 (or 138/158), 153, 170, 180, 187, 195, 206, 209, with 1.72 adjustment factor.

SOURCE: Aerial from Google Earth Pro. Thiessen polygons from Exponent figure dated November 29, 2017. Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- ●# Previous Sampling Location
- Total PCBs (µg/kg) / Mercury (mg/kg)
- Clean Sand Cover Placement Area
- Removal Area
- Removal Area, Remove 2 feet of Material
- Remedial Footprint
- Thiessen Polygons

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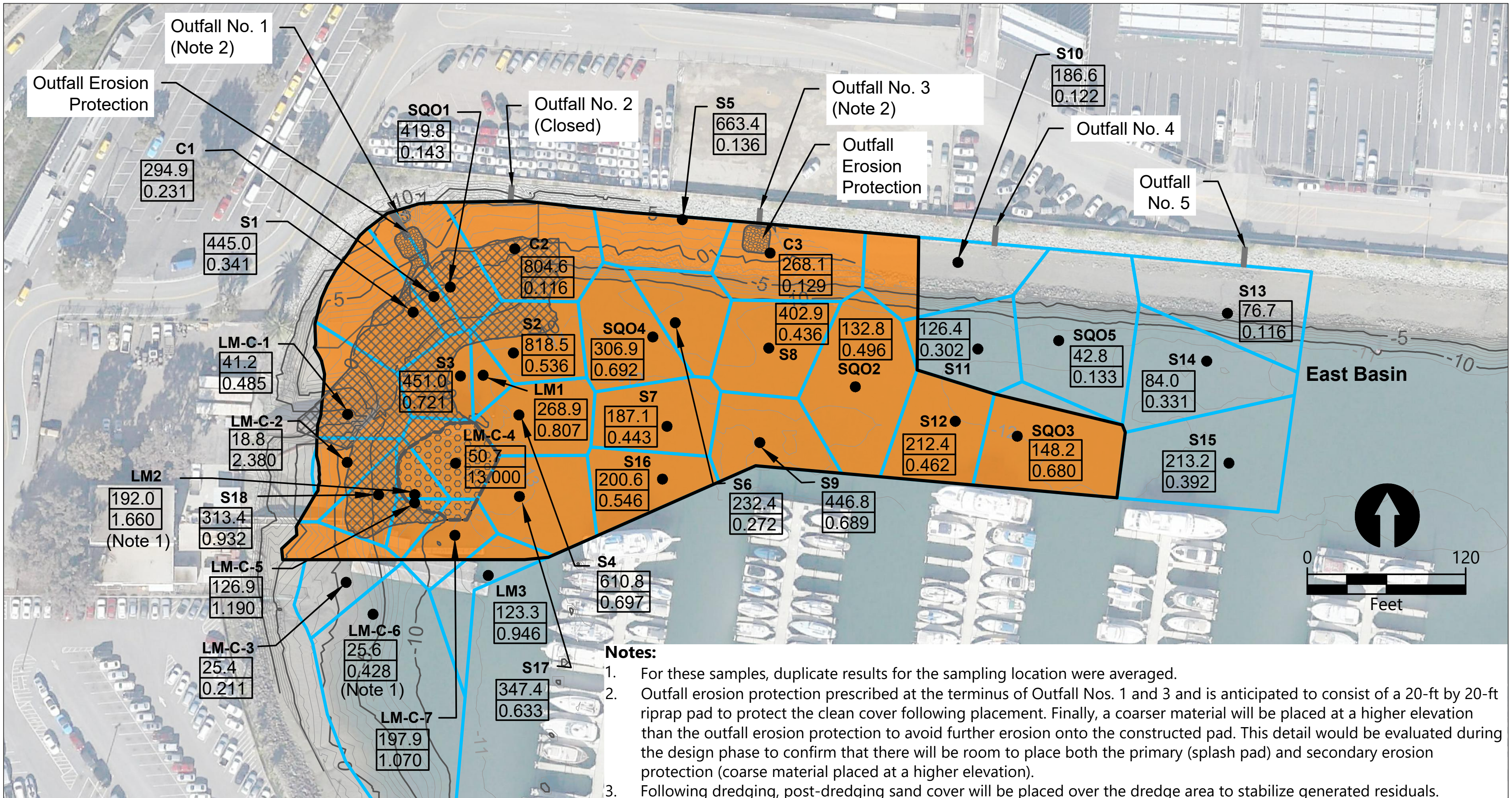
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-006 ALT 3 REMOVAL.dwg Figure 3

ANCHOR QEA

Figure 3
Remedial Alternative 3: Removal
Former Tow Basin and Former Marine Terminal and Railway Facilities



Notes:

1. For these samples, duplicate results for the sampling location were averaged.
2. Outfall erosion protection prescribed at the terminus of Outfall Nos. 1 and 3 and is anticipated to consist of a 20-ft by 20-ft riprap pad to protect the clean cover following placement. Finally, a coarser material will be placed at a higher elevation than the outfall erosion protection to avoid further erosion onto the constructed pad. This detail would be evaluated during the design phase to confirm that there will be room to place both the primary (splash pad) and secondary erosion protection (coarse material placed at a higher elevation).
3. Following dredging, post-dredging sand cover will be placed over the dredge area to stabilize generated residuals.

SOURCE: Aerial from Google Earth Pro. Thiessen polygons from Exponent figure dated November 29, 2017. Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

●# Total PCBs (µg/kg) / Mercury (mg/kg) — Previous Sampling Location

Clean Sand Cover Placement Area

Removal Area

Remedial Footprint

Thiessen Polygons

Removal Area, Remove 2 feet of Material

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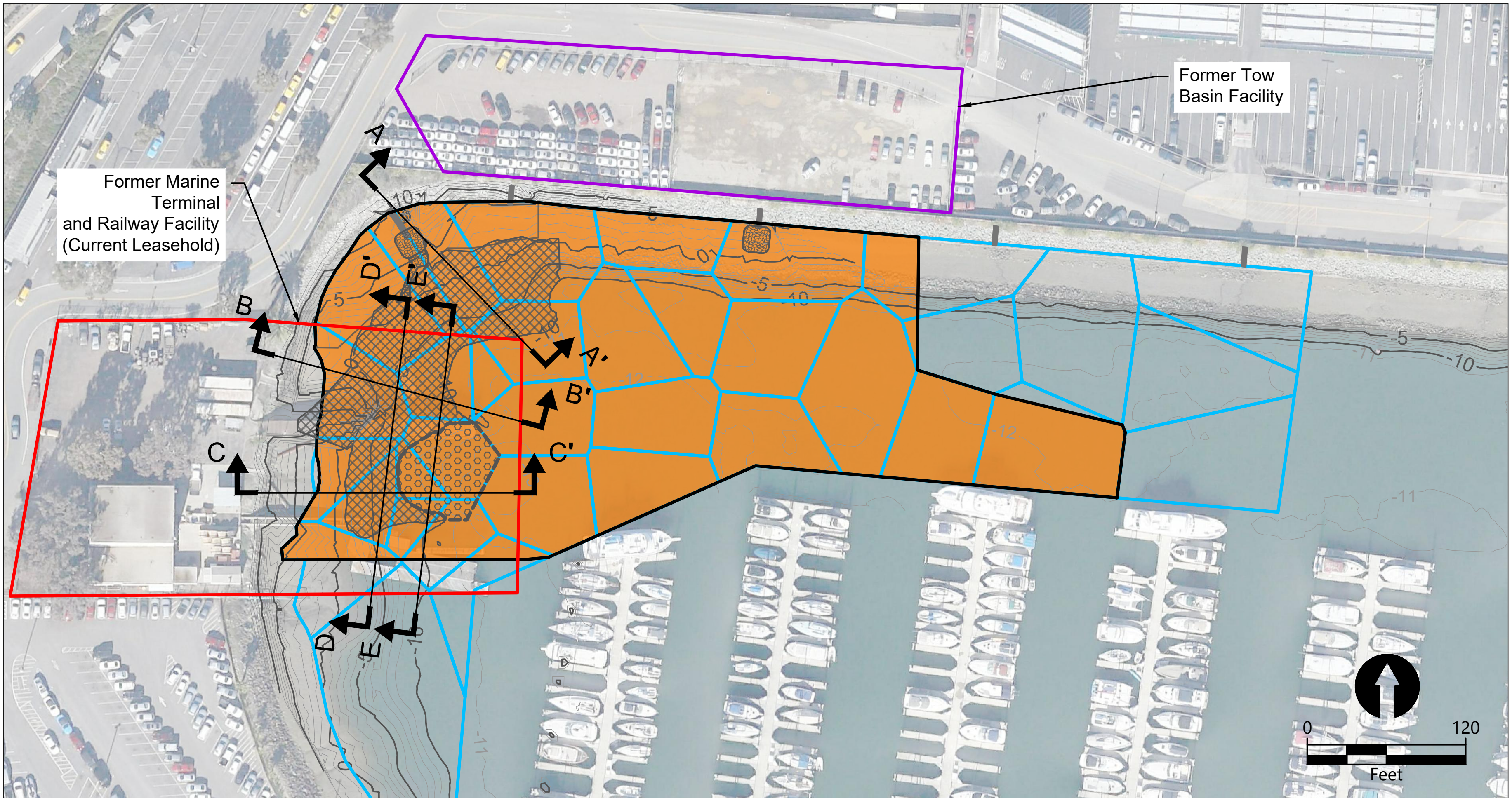
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-001 DREDGE.dwg Figure 4

Figure 4
Remedial Alternative 4: Combination
Former Tow Basin and Former Marine Terminal and Railway Facilities



SOURCE: Aerial from Google Earth Pro. Thiessen polygons from Exponent figure dated November 29, 2017. Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Thiessen Polygons
- Remedial Footprint
- Removal Area
- Clean Sand Cover Placement Area
- Removal Area, Remove 2 feet of Material

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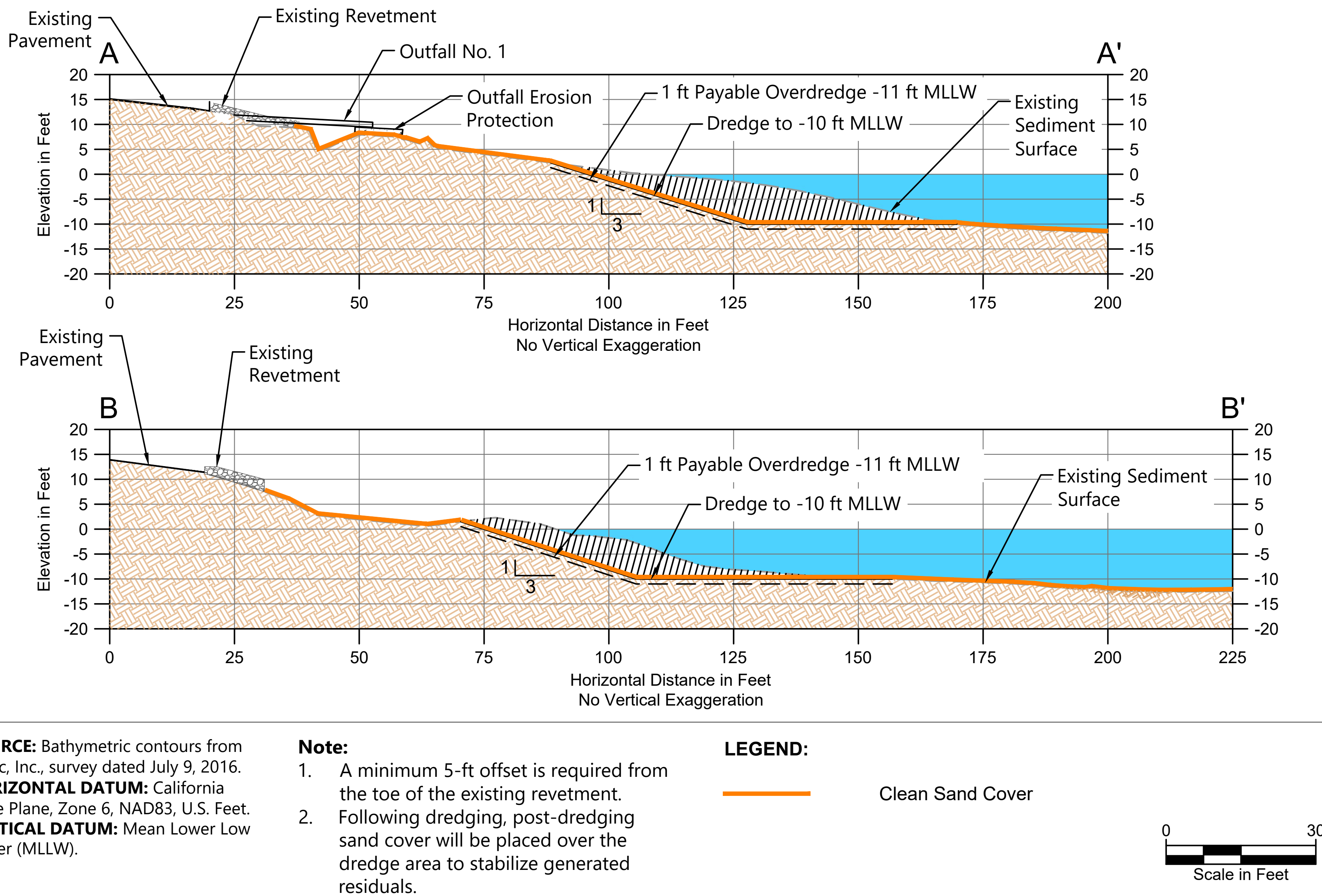
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-002 SECTIONS.dwg Figure 5

ANCHOR QEA

Figure 5
Remedial Alternative 4: Section Locations
Former Tow Basin and Former Marine Terminal and Railway Facilities



SOURCE: Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

Note:
1. A minimum 5-ft offset is required from the toe of the existing revetment.
2. Following dredging, post-dredging sand cover will be placed over the dredge area to stabilize generated residuals.

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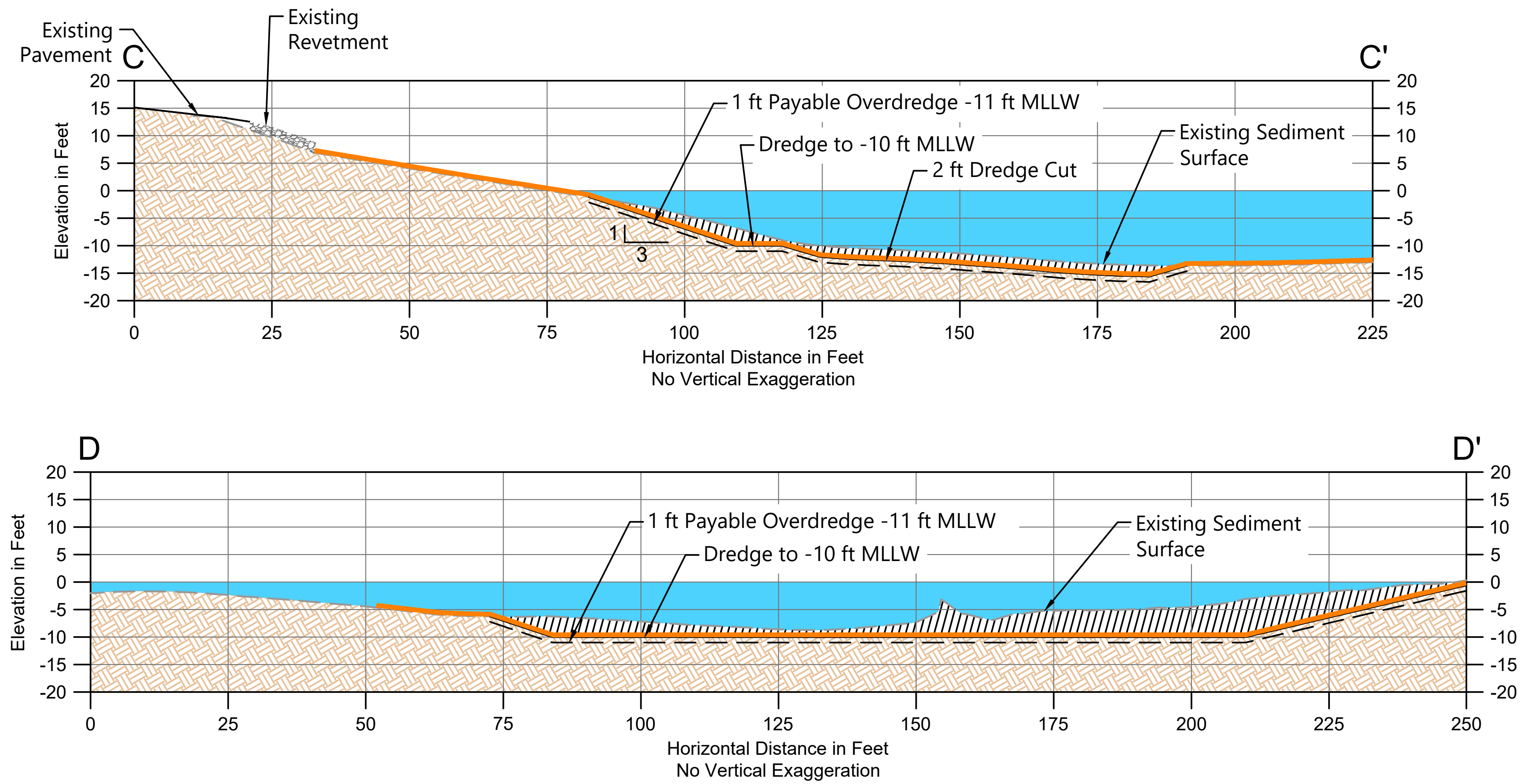
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-003 X-SECTIONS.dwg Figure 6a

ANCHOR QEA

Figure 6a
Remedial Alternative 4: Cross Sections A and B
Former Tow Basin and Former Marine Terminal and Railway Facilities



SOURCE: Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

Note:

1. A minimum 5-ft offset is required from the toe of the existing revetment.
2. Following dredging, post-dredging sand cover will be placed over the dredge area to stabilize generated residuals.

LEGEND:

Clean Sand Cover

0 30
Scale in Feet

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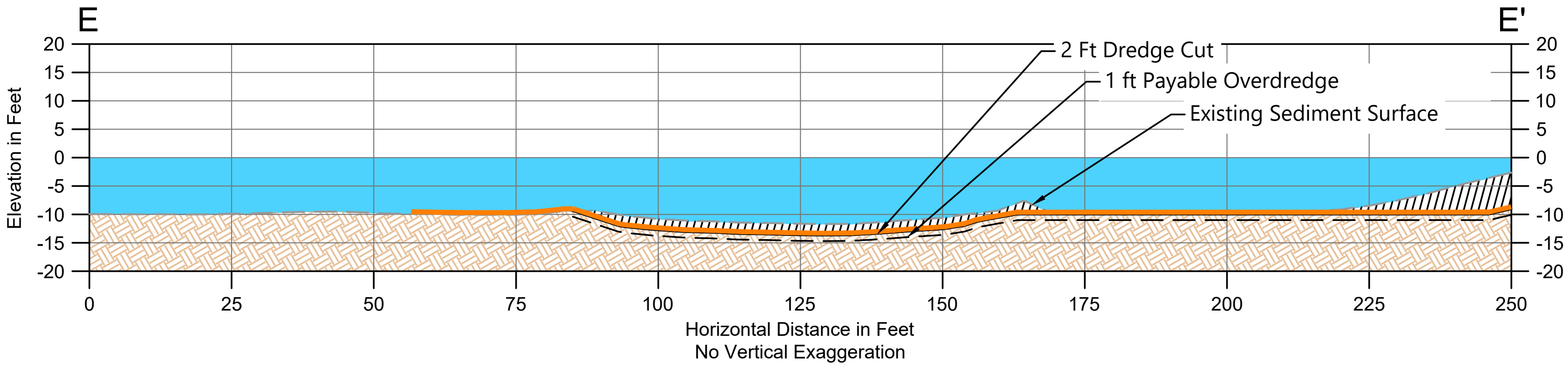
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-003 X-SECTIONS.dwg Figure 6b

ANCHOR QEA

Figure 6b
Remedial Alternative 4: Cross Sections C and D
Former Tow Basin and Former Marine Terminal and Railway Facilities



SOURCE: Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

Note:

1. A minimum 5-ft offset is required from the toe of the existing revetment.
2. Following dredging, post-dredging sand cover will be placed over the dredge area to stabilize generated residuals.

LEGEND:

Clean Sand Cover

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ANCHOR QEA

Figure 6c
Remedial Alternative 4: Cross Section E

Former Tow Basin and Former Marine Terminal and Railway Facilities

APPENDIX A: RESPONSE TO WATER BOARD COMMENTS

Lockheed Martin Corporation
Energy, Environment, Safety and Health
2550 North Hollywood Way, Suite 406   Burbank, CA 91505
Telephone: 818.847.0197   Facsimile: 818.847.0256

December 26, 2017

David Gibson
Executive Officer
California Regional Water Quality Control Board, San Diego Region
2375 Northside Drive, Suite 100
San Diego, California 92108-2700
Attn: Sarah Mearon

Via Electronic Mail

Subject: **Response to Regional Board Feasibility Study Comments Dated October 27, 2017 Cleanup and Abatement Order No. R9-2017-0021**

Case/ Site: **Feasibility Study and Post-Remedial Monitoring Plan – Harbor Island East Basin Sediment Assessment/Cleanup, San Diego, California Geotracker Site ID No. T10000002642 Reference Code: T10000002642: Smearon**

Dear Mr. Gibson and Regional Board Members:

On October 27, 2017, the San Diego Regional Water Quality Control Board (Regional Board) provided 47 separate written comments on the July 2017 Feasibility Study and Post-Remedial Monitoring Plan (Feasibility Study), prepared by Anchor QEA LLC on behalf of Lockheed Martin Corporation for the Harbor Island East Basin Sediment Assessment/Cleanup (Site). The U.S. Fish and Wildlife Service also submitted comments on the Feasibility Study on August 4, 2017. On November 20, 2017, Lockheed Martin Corporation (Lockheed Martin) requested an extension of time to respond due to the scope and nature of the Regional Board's comments. On December 8, 2017, the Regional Board denied Lockheed Martin's extension request, asserting that the "Board has been consistent in its position on the need to remove high-concentration mercury hotspots, rather than treat them with sand cover" and that the "Board's main comments should have been foreseeable."

In subsequent communications with Regional Board staff, Lockheed Martin indicated that it will provide interim responses to the Board comments as it revises the Feasibility Study and negotiates a revised proposed remedy with other responsible parties. Those responses are set forth below.

The Feasibility Study was prepared as a requirement of Cleanup and Abatement Order No. R9-2017-20017, and in furtherance of a Court-approved settlement agreement with General Dynamics and the Port District, which contemplated implementation of a heavily-negotiated, and protective, proposed remedy. The settlement agreement was the culmination of years of mediation proceedings before the experienced environmental mediator, Timothy V. P. Gallagher, and status conferences before the Honorable Judge William V. Gallo, along with close direction and oversight from the Regional Board. The Regional Board participated in many mediation sessions and Court hearings and was apprised of the parties' discussions related to the proposed remedy. The Regional Board also previously reviewed and commented on the October 2014 Remedial Action Plan for the Site, which proposed a clean sand cover remedy. Lockheed Martin believes the proposed Alternative 4 is protective of human health and the environment, adheres to the Regional Board's historical guidance, and accounts for multiple responsible parties' and stakeholder interests. (See March 4, 2016 guidance letter on Navigational Beneficial Uses, enclosed hereto as Attachment 1). Lockheed Martin does not agree that the Board's extensive comments were "foreseeable."

Nevertheless, Lockheed Martin, with input from General Dynamics and the Port District, prepared the below responses to the Regional Board's Comments on the Feasibility Study, as well as a response to the comments from the U.S. Fish and Wildlife Service dated August 4, 2017. Lockheed Martin continues to review and assess the Regional Board's comments, and is now in the process of revising the Feasibility Study, as described in greater detail below.

RESPONSES TO REGIONAL BOARD COMMENTS

Response to Comment 1: The Regional Board commented that the Feasibility Study's statement that the "concentrations of contaminants of concern (COC) at the site are less than the cleanup levels adopted for the nearby San Diego Shipyard Sediment Site" is "incorrect." Lockheed Martin will revise the statement contained in the Feasibility Study to state that "the cleanup levels for the site are lower than the cleanup levels adopted for the nearby San Diego Shipyard sediment site."

Response to Comment 2: The Regional Board commented that it is more accurate to state that "Active remediation is contemplated to address potential impacts as required in the CAO and navigation needs envisioned by the Port." Lockheed Martin will revise the text as suggested in the comment.

Response to Comment 3: The Regional Board commented that "other performance measures will also be considered" in selecting a recommended alternative. Lockheed Martin acknowledges this approach taken by the Regional Board.

Response to Comment 4: The Regional Board requested that the July 9, 2009, *Technical Memorandum: East Basin Evaluation of Data Distribution and Identification of Former Tow Basin COPCs, San Diego, California* (Haley & Aldrich and Weston Solutions 2009) be added to the list of historical reports and that the data from the report be include in Figures 1 through 4 and Table 2-1. Lockheed Martin will include the July 9, 2009 Technical Memorandum prepared by Haley & Aldrich and Weston Solutions in the historical report list as requested by the comment. The 2007 sediment data (included in the July 9, 2009 Technical Memorandum) were not collected as part of the Sediment Quality Objective (SQO) sampling efforts but is being added to the text, figures and tables referenced, and will be utilized in the revised Feasibility Study at the request of the Regional Board. This has resulted in the generation of a new Theisen polygon configuration.

Response to Comment 5: The Regional Board commented that the outfall descriptions should be revised for consistency in future submittals with attention given to the definitions of the site and landside property. Lockheed Martin will clarify and revise the outfall descriptions in the text of the revised Feasibility Study.

Response to Comment 6: The Regional Board commented that the Feasibility Study should be revised to reflect that the Site, as defined for purposes of the Order, consists of a portion of the East Basin. Lockheed Martin will revise the text throughout the revised Feasibility Study to be consistent with the Site definition in the CAO.

Response to Comment 7: The Regional Board commented that the Feasibility Study should be revised to "reflect that background concentrations have not been established for San Diego Bay." Lockheed Martin will revise the text to state that “Cleanup to background concentrations of 84 µg/kg PCBs and 0.57 milligrams per kilogram (mg/kg) mercury for bulk sediment are applicable to East Basin sediments as stated in Finding No. 12 of the CAO.“ In the revised Feasibility Study, references to background concentrations established for San Diego Bay will be removed.

Response to Comment 8: The Regional Board commented that it will require pre- and post-remedial porewater sampling as part of the monitoring program to demonstrate a reduction in bioavailability to biota.

In the revised Feasibility Study, the sentence, “bulk sediment concentrations are accepted and proven effective cleanup and monitoring criteria at numerous sediment sites throughout the country” will be deleted.

The CAO establishes bulk sediment concentrations as cleanup levels for the Site as stated in Finding No. 12. The CAO does not establish any cleanup levels for the reduction of bioavailability to biota as measured through porewater sampling. Thus, there are no applicable criteria to determine performance against remedial goals based on the results of porewater sampling and there is no way to determine success or failure of the remedy based on porewater sample data.

The responsible parties do not believe that any additional monitoring beyond what was detailed in the Feasibility Study is required to assess the effectiveness of the remedy’s ability to attain the bulk sediment cleanup levels established in the CAO. Therefore, Lockheed Martin will not modify the Long-Term Monitoring Program to address pre- and post-remedial porewater sampling to demonstrate a reduction in bioavailability to biota.

The statement in the comment that “Recent bioaccumulation studies in San Diego Bay and Los Angeles/Long Beach Harbors (LA/LB) indicate that water column PCB concentrations can account for 50 percent or more of the body burden in seafood that resides in the water column and/or feeds primarily on plankton” does not justify requiring porewater sampling as part of the monitoring program for this small area of San Diego Bay, for which the CAO-specified cleanup objectives are based on bulk sediment concentrations.

From a watershed/bay-wide perspective, PCBs in the water column that accumulate in the food web are not solely coming from sediment flux of PCBs to the water column. In LA/LB Harbors, it has been shown that watershed sources contribute significantly to loading of PCBs in the water column within LA/LB Harbors (Arms and Jirik 2015).[1] The PCBs released by ongoing sources (e.g., storm water point and non-point sources) into the water-column are absorbed by phytoplankton and then consumed by zooplankton and other filter-feeding organisms such as oysters and brachiopods. Small pelagic fishes, or those that dwell primarily in the mid to upper portion of the water column, accumulate PCBs through the consumption of these water-column dwelling aquatic invertebrates and the small prey fishes are, in turn, consumed by higher trophic level piscivorous pelagic fishes. The parallel route of exposure from the benthos is sediment, worms/benthic organisms, benthic fishes, higher trophic level (piscivorous fishes). In LA/LB Harbors, the accumulation is happening by both routes and is split roughly 50/50 (Arms and Jirik 2015), and therefore, both exposure routes are likely present in San Diego Bay. This study demonstrates that not all PCBs found in the water-column are coming from sediment flux and the percent fluxing from the sediment porewater to the overlying water is variable. Although reduction in bulk sediment concentrations within the East Basin will contribute to the reduction of mercury and PCB in fish tissue

[1] Arms, M. and Jirik, A., 2015. Los Angeles and Long Beach Harbor Toxics TMDL Program Overview. Available online at: https://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/66_New/15_0617/05LALBTMDLprogramandstudies_stakeholdermtg_20150612.pdf
June 16, 2015.

within San Diego Bay, this contribution is expected to be limited due to the small size of the site and relatively low concentrations of mercury and PCBs in East Basin sediment.

Response to Comment 9: The Regional Board commented that the underlined portion (stating that background concentrations are deemed to be protective of beneficial uses within San Diego Bay, including the Site) should state that background concentrations are consistent with Resolution 92-49. Lockheed Martin will delete the second paragraph of Section 3 in the revised Feasibility Study.

Response to Comment 10: The Regional Board commented that the 2009 data should also be used to establish pre-remedial surface-weighted area concentrations and requested that the revised Feasibility Study revise the pre-remedial SWAC calculations by including the 2009 data. Lockheed Martin will revise the SWAC calculations accordingly (see response to Comment 4, above).

Response to Comment 11: The Regional Board commented that the statement in the Feasibility Study that the previously collected SQO data were used to "establish the pre-remedial … SWACs…that meet the CAO background cleanup levels" is "not correct." The Regional Board requested that the text be revised accordingly. Lockheed Martin will revise the second sentence in the third paragraph of Section 3 to say: "These data were then used to establish the pre-remedial surface-area weighted average concentrations (SWACs) that were compared to CAO background cleanup levels to determine the chemicals of concern (COCs) and areas requiring remediation."

Response to Comment 12: The Regional Board inquired why SQO3 is not included in the remedial footprint. In response, Lockheed Martin will include SQO3 in the revised Clean Sand Cover Placement Area in the remedial footprint. The corresponding sections of the Feasibility Study (including, but not limited to, the remedial alternatives and SWAC analysis) will be revised accordingly.

Response to Comment 13: The Regional Board requested information on whether the SWAC approach is also protective of members of the benthic community that are not mobile.

In response, Lockheed Martin asserts that the SWAC approach is protective of members of the benthic community that are not mobile. First, the CAO-specified background-based bulk sediment cleanup levels are below benthic risk screening levels for marine sediments such as the Probable Effect Level (PEL – 0.7 mg/kg for Hg and 189 ug/kg for PCBs) and the Effect Range Median (ER-M – 0.71 mg/kg for Hg and 180 ug/kg for PCBs). Secondly, the revised remedial footprint will address all likely impacted SQO stations within the East Basin site.

Further, since non-mobile members of the benthic community are expected to live in the top 10 to 15 cm of sediment, the community at the Site will be protected as follows:

1. In removal areas, sediment containing concentrations above cleanup levels will be removed and a 6-inch (15 cm) sand cover will be placed to address residuals, thereby leaving clean surface material.

2. In clean sand cover areas, a 6-inch (15 cm) layer of sand will be placed over the existing surface. Mixing in the bottom 10 cm is expected (see Response to Comment #17) to occur, leading to at least a 75% reduction of contaminant concentrations in the biologically active zone for 6-inch placement areas.

In areas within the Site not subject to sand cover placement or removal and represented by chemical concentrations above cleanup levels, deposition of clean material is expected to reduce concentrations over time and reduce the exposure concentrations to the benthic community and higher trophic level organisms.

<u>Response to Comment 14</u>: The Regional Board commented that the effects range median and probable effect level values cited in Section 3 are not regulatory criteria and are therefore not enforceable, which is why the cleanup levels prescribed in Finding 12 of the CAO have been chosen for the Site. The Regional Board's comment is noted.

<u>Response to Comment 15</u>: The Regional Board requested that the figures be revised to match the original polygon boundaries. Lockheed Martin responds that the polygons presented in Figures 1 through 5 of the Feasibility Study will be revised to match those presented in Appendix A (and utilized for the SWAC analysis).

<u>Response to Comment 16</u>: The Regional Board requested an explanation on the rationale for placement of the remedial footprint boundaries as shown on Figures 1 through 4.

The purpose of the SWAC-based cleanup objective was to calculate the average surface area weighted chemical concentration across the entire Site for each alternative. The SWAC analysis conducted in Appendix A of the Feasibility Study differentiates between active remediation (i.e. sand cover or dredging) and no remediation within a polygon, and accounts for those areas in the analysis. Specifically, each SWAC is represented by a sample location and a PCB and Hg concentration. If the polygon includes both dredging and sand cover based on constructability issues, then the area of sand cover and the area for removal (and sand cover) are calculated and addressed separately in the SWAC table (Appendix A). The combined result is then incorporated into the predicted site-wide SWAC.

Based on the results of the SWAC analysis, the proposed remedial footprints in the preferred remedial alternative (Alternative 4) meet the SWAC-based cleanup objectives presented in the CAO. This will be confirmed during long-term monitoring of the surface sediment concentrations at the polygon.

As discussed in the Feasibility Study, this type of remediation goal is appropriate as the aquatic-dependent wildlife and angler-targeted game species at the Site do not limit their movement to a small area represented by a single sediment sample, but move through the larger area (exposing them to sediment of various chemical concentrations throughout San Diego Bay). As described in the response to Comment 13, this approach is also expected to be protective of the benthic community.

This is the identical approach used at the San Diego Shipyard Sediment Site, except the ultimate use of remedial approaches (removal with sand cover placement, sand cover placement) for polygons varied.

It is important to note that during the development of the final design drawings, the areas identified for removal and sand cover placement will be represented in cleanup units that will supersede polygon lines (polygons won't ultimately define clean-up areas.) Removal and sand cover placement and constructability considerations will define dredge management and placement areas. Post-remedial monitoring will then verify the original SWAC evaluation and demonstrate that the CAO-specified cleanup objectives have been achieved.

<u>Response to Comment 17</u>: The Regional Board requested an explanation for the source of the 75 percent reduction in the upper 10cm if a 15-cm layer of clean sand cover is placed.

In response, the estimation of contaminant reduction for areas with placement of 6 inches (15 cm) of clean sand cover assumes the following:

- Following the placement of 15 cm of clean sand cover, the lower 10 cm of sand cover mixes with the upper 10 cm of contaminated sediment (mixed sediment layer), which results in a 50% contamination concentration reduction in the mixed sediment layer.

- A 10 cm surface sample would consist of 5 cm of clean sand, and 5 cm of the mixed sediment layer. The resulting surface sample would result in an additional 50% contamination concentration reduction (as the top 5 cm of sand is assumed to be clean), resulting in an overall reduction of surface chemical concentration of 75%.

Response to Comment 18: The Regional Board requested clarification on the expected depth of mixing for the clean sand cover scenario for the purpose of evaluating remedial success, and also requested the expected timeline for mixing.

The depth of bioturbation, or disturbance of sediment layers by biological activity, from the sediment surface down into the placed clean sand cover is expected to extend to 10 cm, but not consistently down to 15 cm because the depth of bioturbation is typically 10 to 15 cm (4 to 6 inches) in marine sediments (Clarke et. al. 2001). This mixing would occur as the benthic community recovers and matures after material placement, typically within 1 to 2 years.

Response to Comment 19: The Regional Board observed that the Granulated Activated Carbon (GAC) Amendment was only proposed to be used in the northwest portion of the basin and had several questions regarding use of the remedy in this area.

Lockheed Martin responds that the addition of activated carbon to the northwestern corner of the Site does not increase the ability of the remedy to attain of the bulk sediment cleanup levels established in the CAO. The activated carbon was not accounted for in the post-construction SWAC analysis provided in Appendix A of the Feasibility Study, thus, carbon-amended sand is not needed at the Site to meet the SWAC-based cleanup objectives. Activated carbon nevertheless was included in the northwest portion of the East Basin to address desires expressed by a responsible party during the settlement negotiations. .

(a) The Regional Board asked why carbon amendment has not been proposed for the entire remedial footprint and asked for an explanation of the rationale for using amended carbon in the northwest area only.

Activated carbon was included in the placement of clean sand cover in the northwest portion of the East Basin to reach agreement regarding design of the remedy to address implementation concerns.

The Port District observes that the northwest corner of the basin where GAC is proposed is not typical of other areas that are within the remedial footprint, as (1) the area is a sloped bank, (2) it has riprap for bank stabilization, and (3) it is intertidal and in some portions above mean higher high water (MHHW) elevation. While there is evidence of elevated PCBs in the that footprint, applying more traditional technologies, such as dredging, would not be cost-effective nor efficient since the rip-rap slope area would hinder reliable removal of sediment. The Port District asserts that the addition of GAC-augmented sand is an appropriate additional measure in this specific area given these limitations on effectuation of other technologies.

(b) The Regional Board commented that amended carbon can also be used to limit the bioavailability of mercury uptake by benthic organisms and asked why amended carbon was not proposed to be applied in areas where mercury concentrations are elevated.

As has been discussed with the Regional Board (Anchor QEA, 2016), the bioavailability of Hg is complex due to the various factors that can affect generation of methyl mercury (and the effectiveness of GAC). Mercury will be less of an issue, however, because the highest concentrations of Hg (LM-C-4) will be removed under the revised Alternative 4.

(c) The Regional Board asked for data supporting the use of the carbon-amended sand cover remedy in an area where there is wind and wave action and where there is the possibility that carbon material could "potentially be washed away" or "entrained in the wind."

To address such potentialities, GAC would be mixed in with the sand cover material and fully wetted (soaked) prior to placement. This sand cover under the revised Alternative 4, regardless if GAC is added, will be designed to resist wind, vessel drive wakes, and tidal currents. Further, a layer of coarse-grained material will be placed on top of the sand cover to further reduce the potential that that material will be disturbed by birds or people. This proposal will enhance erosion protection. This area is not expected to be subjected to significant storm-generated wind activity given the prevailing wind direction and lack of significant fetch within the basin.

(d) The Regional Board asked how "adding coarse material" in the northwest area will affect the "ecology of the area and specifically the ability of birds to use this area for foraging."

The use of coarse sand material is not expected to significantly affect foraging behavior for shorebirds. Smaller probing shorebirds, such as sandpipers, would not likely feed within the footprint because of the relatively steep bank. Their preferred foraging habitat is mud flats. For larger shorebirds, the added texture may enhance feeding opportunities because the increased surface roughness will increase the density of small macroinvertebrates that are a primary food source.

The area of the Site where coarser material (e.g., coarse sand and/or gravel) to be finalized during design) will be placed on the existing substrate, is approximately 0.2 acres, which is a very small area relative to the foraging area of birds in San Diego Bay. In addition, it is expected that in the long-term fine-grained material will settle on top of the coarser placed material (to be finalized during design) and will return to a similar grain size as the existing surface sediment. Therefore, the placement of the coarser material in the northwestern corner of the site is not expected to significantly impact the ability of birds to use the site for foraging and is not expected to impact overall bird foraging opportunities within San Diego Bay. The most important habitat areas for birds in the Bay include much of the southern portion of the Bay that consists of the South Bay and Sweetwater units of San Diego National Wildlife Refuge, which provide foraging opportunities for a variety of bird species.

<u>Response to Comment 20</u>: The Regional Board requested clarification on how far away the discharge point is from the outfall pipes to verify that there is adequate room for the secondary erosion protection. The Regional Board asked whether the secondary erosion protection will be placed at Outfall No. 1 only.

This detail will be evaluated during the design phase of the final remedy.

<u>Response to Comment 21</u>: The Regional Board requested an explanation for why the approach for polygon LM3 has been proposed, as "it does not remediate this polygon to background concentrations." The Regional Board also observed that the approach does not "remediate this polygon to background concentrations… [and] Polygon LM-C-7 also is not proposed to be fully within the remedial footprint."

Lockheed Martin refers the Regional Board to our response to Comment 16. The SWAC analysis presented in Appendix A considers the remediated and un-remediated portions of a polygon. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the background based cleanup objectives provided in the CAO on a SWAC basis.

As described in Section 3 of the draft Feasibility Study, a SWAC-based cleanup level is appropriate and meets the CAO objectives due to the home range of the receptors of interest. Because the goal of the cleanup is to achieve the background-based cleanup objectives on a SWAC basis, remediation of all polygons above background concentrations is not required.

Response to Comment 22: The Regional Board requested an explanation for the approach for polygon SQO3, as it "does not remediate this polygon to background concentrations."

The "Clean Sand Cover Placement Area" was expanded to include the area represented by samples SQO2, S12, and SQO3 for remedial alternatives 2 and 4 (and will be depicted in the revised Feasibility Study). See response to Comment 16 regarding SWAC methodology and how a site-wide SWAC meets the objectives of the CAO.

Response to Comment 23: The Regional Board requested an explanation for the approach proposed for polygons LM-C-3 and LM-C-6.

LM-C-3 and LM-C-6 are not included in the active remediation area for the revised Alternative 4.

The dredge prism was initially designed to meet the Port District's navigation requirements (note that sand cover attains the post remedial SWAC and the CAO cleanup objectives) and further modified to address the higher mercury concentrations. The dredge areas also considered a final configuration that would not impact the stability of the existing revetment. Specifically, side slopes were necessary landward of the dredge prism to allow for dredging to -11 feet MLLW (inclusive of one foot over-dredge). These side slopes are detailed on the cross-sections presented on Figures 6a through 6c. All dredge areas and slide slopes will receive sand cover.

Response to Comment 24: The Regional Board requested clarification on whether the sources of PCBs to the site are controlled.

Based on available data, Lockheed Martin believes such sources to the site are controlled. For example, at the former Tow Basin facility, connections to the storm drains have been eliminated. As a result, the potential for post-remedy recontamination is considered low. The text in the Feasibility Study will be updated as necessary to reflect this clarification.

Lockheed Martin does not consider the addition of activated carbon as a necessary source control measure. As addressed above, the addition of activated carbon may reduce pore water concentrations, but does not alter bulk sediment concentrations nor the attainment of the bulk sediment clean levels set forth in the CAO.

Response to Comment 25: The Regional Board requested additional rationale for not using carbon-amended sand across the entire remedial footprint.

As noted in the response to comment 19, the application of activated carbon is not required to meet the bulk sediment cleanup goals set forth in the CAO. GAC-mixed media was proposed for the northwest corner at the request of the Port because of the unique characteristics of the footprint, including the fact that the area is sloped, contains riprap, and intertidal. See response to Comment 19.

Proposed long-term monitoring includes the collection of surface sediment during three sampling periods over five years post-remediation, such that the prediction derived from modeled contaminant reduction can be verified. Corrective actions are identified as needed if the sand cover does not meet the performance goals stated in the Feasibility Study and Remedial Action Plan.

Response to Comment 26: The Regional Board requested an explanation for why the selected remedy, Alternative 4, considers navigational requirements as the primary rationale in addition to elevated contaminant concentrations, whereas, Alternative 3 focuses on removal of the maximum practical volume of contaminants.

The evaluation of remedial technologies as combined to develop alternatives, used USEPA guidance developed under the Comprehensive Environmental Response and Liability Act (CERCLA) (USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA 1988)). The process provided in US EPA's guidance requires evaluation of each alternative against each of nine criteria, including the five balancing criteria of long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short term effectiveness, and implementability.

Placement of clean sand only was originally shown to meet clean up objectives on a SWAC basis. Application of activated carbon in the northwest corner and dredging were measures added to the remedy during the settlement negotiation process as a compromise to address the Port District's requests, including minimization of impacts on navigation use of the East Basin. Section 5.1 of the Feasibility Study states that sediment removal by mechanical dredging is appropriate for areas with elevated chemical concentrations or areas where navigational depths should be retained. The revised recommended remedial alternative (Alternative 4) includes removal of sediment to address elevated mercury concentrations (LM-C-4) and navigation requirements. This alternative was developed based on input from all the responsible parties, the Regional Board, and U.S Fish and Wildlife Service (USFWS). Alternative 4 meets the threshold criteria of protectiveness and compliance with ARARs and led the alternatives based on an evaluation of the five balancing criteria described in Section 6 (not simply criterion 6, reduction of toxicity, mobility, or volume through treatment). As stated above in the response to Comment 16, the results of the SWAC analysis (Appendix A) show that the preferred remedial Alternative 4 meets the SWAC-based cleanup objectives provided in the CAO and meets the CERCLA requirement of being cost effective. Alternative 3 is economically infeasible under Res. No. 92-49, as it would enormously increase costs while providing little or no incremental benefit in protection of beneficial uses. Also considered were short-term impacts of dredging which include water quality, impacts to the community from dredge material handling-transportation and sustainability. From many perspectives, sand cover placement has fewer environmental impacts than removal.

Response to Comment 27: The Regional Board requested additional explanation for various remedial activities shown on Figure 4 and as described in Remedial Alternative 4.

Alternative 4 relies on application of clean sand cover to achieve the CAO-specified cleanup levels on a SWAC basis. In addition to clean sand cover placement, sediment removal by mechanical dredging has been included for areas with relatively elevated chemical concentrations (i.e., the elevated mercury levels detected at LM-C-4) and in areas where navigational depth requirements prevent placement of the clean sand cover. Placement of clean sand augmented with activated carbon has been included in the northwest corner of the East Basin to address some concerns presented by another responsible party during the settlement negotiations. Other elements of Alternative 4 include construction of a splash pad to prevent erosion of the clean sand cover adjacent to Outfall Nos 1 and 3 and long-term monitoring. It should be noted that placement of the clean sand cover alone is sufficient to achieve the CAO-specified cleanup levels on a SWAC basis and other elements have added to increase the long-term effectiveness and permanence, and implementability of the alternative (including other responsible party's concerns). See Comment 19 regarding the application of GAC in the northwest corner.

(a) The Regional Board commented that LM-C-4 is not proposed for removal activities, which "does not provide protection to sedentary benthos in this area." In response to the Regional Board's comments, the eastern extents of the dredge prism will be extended east to include the area of relatively elevated mercury concentrations represented by sample LM-C-4. This revision will be included in the revised Feasibility Study.

(b) The Regional Board asked for a reference for the cited "navigational depth requirements" and an explanation for how navigational depths have been defined for this portion of the East Basin. In response to the Board's comments, the Port District has stated that water depths of 10 feet below mean lower low water level (MLLW) are needed in the East Harbor Basin to support the navigation beneficial use, and that the use is impaired in areas where sedimentation has caused water depths to be shallower than -10 feet MLLW. For this site the minus ten feet MLLW is a reasonable threshold for the water depth needed to support the navigation beneficial use in the East Harbor Basin (Water Board 2016).[2]

(c) The Regional Board commented that the area within the base of the dredge prism will "not be subject to mixing in the top 10 cm that will result in lower concentrations in the top portion of the affected sediment." In response to the Regional Board's comments, this area has been incorporated into the dredge prism to remove material associated with sample location LM-C-4 and will receive a 6-inch layer of sand cover to address residuals. As such, in the revised Feasibility Study, there will be no areas receiving the 12-inch layer of sand cover.

<u>Response to Comment 28</u>: The Regional Board commented that it is "unclear why dredging of LM-C-4 has not been proposed under Alternative 4, which would be the most protective of human health and the environment in the long term and would provide higher environmental benefit in this area of the East Basin, in addition to cleaning up this polygon to background."

See response to Comment 27. Lockheed Martin will revise Alternative 4 in the Feasibility Study to include the area designated by LM-C-4 within the remedial dredge prism.

<u>Response to Comment 29</u>: The Regional Board asked whether dredging was proposed for navigational needs or to address COC concentrations exceeding background-based cleanup levels.

See response to Comments 16 and 27. For clarification, the text in Section 5.1 and 6.1 does not state that dredging will occur in all areas with elevated COC concentrations greater than the CAO cleanup level, as that is not necessary to achieve background concentrations on a SWAC basis. The recommended remedial alternative presented in the Feasibility Study is predicted to meet the SWAC for the entire Site and includes removal to address relatively elevated mercury concentrations and to meet navigational concerns.

<u>Response to Comment 30</u>: The Regional Board commented that the Feasibility Study proposes to use different remedial treatments for different portions of the same polygons, and requested an explanation as to the rationale for this approach.

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[2] *See* Water Board 2016. Navigation Beneficial Use-East Basin. Letter from Julie Chan, Water Board to Kara Edewaard, Lockheed Martin. March 4, 2016. (Attachment 1)

See response to Comment 16, above.

<u>Response to Comment 31</u>: The Regional Board commented that there is a discrepancy between time periods for recovery for the placement of clean sand cover and for removal, as "the time periods under both activities are identical at 1 to 3 years."

In the revised Feasibility Study, the timelines will be clarified as follows:

- The benthic community and aquatic vegetation within the East Basin is expected to recover from placement of clean sand cover in less than one year because the benthic community will not be destroyed and there will be species that use the newly placed material quickly after placement. The 2017 SPAWAR pilot study at Quantico Marine Base found that at two-months post-placement of the thin sand layer, the abundance, richness, and diversity of the benthic community was like areas that did not receive the thin layer placement and was significantly increased compared to pre-cap benthic surveys for both areas with and without the placement of the layer of thin sand.

- For areas that will be dredged, it is expected that the benthic community will recover in one to three years (Newell et al. 1998) since the benthic community will be completely removed from the area.

<u>Response to Comment 32</u>: The Regional Board commented that "[s]everal polygons with elevated COC concentrations are proposed to be outside the dredge footprint and to be covered with clean sand as part of Alternative 4." The Regional Board indicated that it is "also uncertain what the impact will be of leaving this material in place in the long term, particularly to sedentary benthic biota."

See response to Comments 16, 27 and 27a. The Feasibility Study will be revised to include the area designated by LM-C-4 within the remedial dredge prism. Additionally, as described for Alternative 2, the SWAC-based bulk sediment remediation goals can be achieved through placement of sand cover alone. However, dredging was incorporated into the remedy to address navigation concerns and to increase long-term effectiveness and permanence through removal of the relatively elevated levels of mercury observed in LM-C-4.

<u>Response to Comment 33</u>: The Regional Board requested additional discussion and revision related to the implementability criterion, which focused on the disruption of marina and Port activities.

Section 6.5 of the Feasibility Study will be revised to include further discussion on the disruption of marina operations, including an estimation of the construction timelines. It should be noted that remedies that take longer will have a greater impact on marina operations and are thus more difficult to implement.

<u>Response to Comment 34</u>: The Regional Board expressed disagreement with the assertion that "Alternative 3 and 4 include treatment technologies to the maximum extent practicable," and that Alternative 4 does not propose removing sediment with "some of the highest COC concentrations (e.g., LM-C-4)."

See response to Comment 27a. The Feasibility Study will be revised to include the area designated by LM-C-4 within the remedial dredge prism. As described for Alternative 2, the SWAC-based bulk sediment remediation goals can be achieved through placement of sand cover alone. However, dredging was incorporated into the remedy to address navigation concerns through negotiations during the settlement process.

<u>Response to Comment 35</u>: The Regional Board requested additional explanation for Alternative 4 that appears to "dredge material in shallower areas that have navigational needs but areas with high levels of COCs are not proposed to be dredged."

See response to Comments 26, 27 and 27a.

<u>Response to Comment 36</u>: The Regional Board requested additional explanation for Alternative 4, as it "does not propose to consistently remove surface and subsurface sediment with high PCB and mercury concentrations (refer to Comment no. 29)."

See response to Comments 26, 27 and 27a.

<u>Response to Comment 37</u>: The Regional Board requested information concerning the source of the upper concentration limits (169 µg/mg and 1.15 mg/kg) and requested an explanation of the rationale for assessing natural attenuation.

Lockheed Martin and General Dynamics submitted a Remedial Action Plan (RAP) for the Regional Board's consideration on October 31, 2014. Appendix E of the RAP proposed post-remedial monitoring using these levels, which are based on twice the cleanup level. Monitoring would have occurred one year after the remedy, and five years thereafter only if the one-year results were above 169 ppb for PCBs or 1.15 ppm for mercury. In the Regional Board's December 18, 2014, comments on the RAP, a concern was raised that the five-year event was not at an appropriate frequencies. Accordingly, all parties – and the Regional Board – agreed to revise the second monitoring event to occur two years after the remedy if necessary.

<u>Response to Comment 38</u>: The Regional Board commented that there are "no regional background concentrations for San Diego Bay" and requested that the text be revised accordingly.

In the revised Feasibility Study, the text will not include reference to background levels for San Diego Bay and instead reference the background-based bulk sediment cleanup level specified in Finding 12 of the CAO. This change will be made throughout the revised Feasibility Study.

<u>Response to Comment 39</u>: The Regional Board commented that a statement in the Background Concentration subsection is "incorrect," and that "background concentrations for total PCBs and mercury applicable to East Basin sediments are 84 parts per billion and 0.57 parts per million, respectively." The Feasibility Study will be revised to reflect this change. See response to Comment 38.

<u>Response to Comment 40</u>: The Regional Board requested that the 2009 study be included in the calculations and in the bulleted list of data sources.

The data presented in the 2009 study will be utilized in the revised Feasibility Study. See response to Comment 4.

<u>Response to Comment 41</u>: The Regional Board commented that the explanation under Study Area Data Sources is not correct, noting the following issues:

(a) The Regional Board commented that the polygon containing LM-C-4 contains the highest mercury concentrations and is only proposed to be covered with sand over the majority of the surface. In response, Lockheed Martin refers the Board to Comments 27 and 27(a). The Feasibility Study will be revised to include the area designated by LM-C-4 within the remedial dredge prism.

(b) The Regional Board commented that "LMC-7 and LM2 have some of the highest mercury concentrations but will not be fully dredged." See response to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based cleanup objectives provided in the CAO. See response to Comments 27 and 27a. As part of including LM-C-4 in the dredge prism, LM2 was included in the dredging footprint to facilitate constructability of the remedy.

(c) The Regional Board commented that "[a]bout half of the LM3 polygon is not being remediated, yet it contains one of the highest mercury concentrations (0.946 mg/kg)." See response to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based cleanup objectives provided in the CAO. As noted in the response to Comment 21, remediation of all polygons above background concentrations is not required to meet the SWAC-based cleanup objectives provided in the CAO.

(d) The Regional Board commented that SQO1 "contains the highest total PCBs concentration but is proposed to mostly be dredged...it may be inferred that the reason for this remedial approach has more to do with navigation than with removal of sediments with high PCB concentrations." See responses to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based cleanup objectives provided in the CAO.

(e) The Regional Board commented that the rationale for the placement of the remedial footprint boundary midway across several polygons "is not explained." See response to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based cleanup objectives provided in the CAO.

Response to Comment 42: The Regional Board commented that background levels were established in Finding 12 of the Order and should be referenced as such. See response to Comment 38.

Response to Comment 43: The Regional Board requested that the columns in Table 3 be revised to show the predicted post-remedial contaminant concentrations that were used to calculate the post-remedial SWACs.

The columns were revised in Table 3 to show the projected concentrations at each station. Additionally, subsequent spreadsheet tabs were included to clearly show the assumption for post-remediation concentrations in each polygon in sand cover, dredge, or no active remedy areas.

Response to Comment 44: The Regional Board commented that SWAC calculations "use the background concentrations even for polygons that already have concentrations less than background…explain why this methodology was used."

In the revised Feasibility Study, the SWAC analysis will be updated to include the lower of current concentrations and median background for post-remediation concentrations in the dredge areas.

Response to Comment 45: The Regional Board commented that the monitoring plan should be revised to address appropriate study questions.

The CAO requires the site to be remediated to meet bulk sediment cleanup levels for COCs and provides the specific clean up levels. Based on these bulk sediment clean up objectives, the following questions listed in Comment 45 are applicable to evaluate the effectiveness of the remedy:

- Has the sand cover been placed over the designated area and has it remained relatively stable over time?
- Have concentrations of PCBs and mercury in surface sediment been reduced to background levels?

The long-term monitoring activities that address these relevant questions include the following:

- Performing post-remedial bathymetric surveys
- Monitoring changes in sediment chemical concentrations at the surface

Bathymetry surveys were added to the Sampling and Analysis Plan in Appendix C.

Response to Comment 46: The Regional Board requested revisions to the monitoring plan to include monitoring of the engineering controls as a result of "climate change and the possibility of more intense rain storms, as well as sea level rises."

The potential for more intense rain storms will be considered during remedial design. The monitoring plan was revised to include visual monitoring of the clean sand proposed to be placed near the outfalls. Movement of sand cover is expected to some degree, but the observations will be designed to identify any significant movement of material that might expose the underlying material.

Response to Comment 47: The Regional Board commented that the Quality Assurance Project Plan (QAPP) should be revised to be consistent with the revised Sampling and Analysis Plan (SAP) as discussed in Comment Nos. 45 and 46.

In the revised Feasibility Study, the QAPP will be updated to address changes that occur in the SAP through this comment response process.

RESPONSE TO COMMENTS BY US FISH & WILDLIFE SERVICE

Response to USFWS Comment 1: USFWS commented that "our preferred response would be to remove the contaminated sediments using risk-based remediation goals," and that the Recommended Alternative in the FS (Alternative 4) "should reduce contaminant-related risks to Service trust resources by reducing overall concentrations and/or potential for exposure, and as such is acceptable."

The USFWS comment is noted and discussed in part in the previous responses. We agree that the preferred alternative cannot practically include full removal and believe it will reduce contaminant-related risks to aquatic species under the jurisdiction of USFWS by reducing overall concentrations and/or potential for exposure.

Response to USFWS Comment 2: USFWS recommended that future cleanup projects incorporate the more detailed risk-based analysis to determine cleanup goals. See response to USFWS Comment No. 1, above.

Response to USFWS Comment 3: USFWS requested that the parties consider extending the 12-inch cover to the southern edge of the Clean Sand Placement Area, and thereby covering sample site LM-C-7, where reported concentrations for mercury and PCBs are 1,070 µg/kg dw and 198 µg/kg dw, respectively.

Lockheed Martin proposes to place a 6-inch cover over the LM-C-7 polygon to meet the cleanup criteria on a SWAC basis. However, the dredging footprint has been changed to include polygon LM-C-4 which has the highest mercury concentration at the site. In addition, the sand placement area has been expanded to include polygons SQO2, SQ12, and SQO3, which have PCB concentrations above criteria—132.8, 148.2, and 212.4 ug/kg, respectively, which will further reduce the potential for exposure of aquatic biota to sediments with some of the higher contaminant levels observed at the Site.

Response to USFWS Comment 4: USFWS commented that it considers the Site to be an important contributor to a type of habitat that is scarce in the northern part of the bay, and that "cumulative exposure can result in tissue PCB and mercury concentrations that are of concern and even actionable." Lockheed Martin notes this comment, which is discussed in part in the previous responses. We believe the preferred alternative will reduce contaminant-related risks to aquatic species under the jurisdiction of USFWS by reducing overall concentrations and/or potential for exposure.

Response to USFWS Comment 5: USFWS commented that the term "background" is misleading and "the specific numeric values that were used may not be representative of current conditions in the part of San Diego Bay where the Site occurs." USFWS noted that, "to be clear, there are no formally established or adjudicated background concentrations for contaminants in sediments of San Diego Bay as a whole." See response to Comments 7, 9, 38, 39 and 42.

Response to USFWS Comment 6: USFWS commented that it had a question about how accurately the mercury and PCB concentrations selected for use as remediation goals represent current reference concentrations for the Site, observing that the "target concentrations may not fully address contaminant risks to fish and wildlife that forage in habitat provided by the Site." In response, Lockheed Martin believes the preferred alternative will reduce contaminant-related risks to aquatic species under the jurisdiction of USFWS by reducing overall concentrations and/or potential for exposure.

Response to USFWS Comment 7: USFWS commented that "[p]ost-remedy monitoring as described in Section 8 is focused on mercury and PCB levels only," and it requested that the parties "please consider monitoring for benthic community condition as well." See response to Comment 45.

Response to USFWS Comment 8: USFWS commented on the overall strategy for post-remedy monitoring (Section 8), which raised "some questions about the improvements in contaminant concentrations that should be expected." USFWS asked "what specific actions will be considered and over what time frame will they be implemented if SWACs for mercury and PCBs are greater than the target SWACs (and, in fact, potentially greater than current SWACs) after three years?" Lockheed Martin refers back to its responses to Comments 37 and 45.

Response to USFWS Comment 9(a): USFWS commented that the "sampling and analysis plan (SAP) would need to be modified if benthic community is added to the monitoring plan (comment 7)." See response to Comment 45. The SAP will be revised to reflect changes made to the monitoring plan.

Response to USFWS Comment 9(b): USFWS commented that it "prefer[s] that the top 15 cm (6 in) be sampled" and requested an explanation if it cannot be done. The top 10 cm are targeted for sediment sampling associated with the monitoring plan to evaluate the biologically active zone. See response to Comment 18.

Response to USFWS Comment 9(c): USFWS recommended that samples be analyzed for PCBs as homologs or Aroclors. Lockheed Martin proposed Total PCBs as the sum of concentrations of 41 individual congeners to be consistent with past data for comparison purposes. Specifically, total PCBs Congeners = sum of 41 congeners:

18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

Response to USFWS Comment 9(d): USFWS commented that "it might be helpful to add percent moisture, or conversely, solids to the list of conventional analytes." Lockheed Martin agrees.

Lockheed Martin appreciates the Regional Board's detailed review and comments and those of the US Fish and Wildlife Service and would be pleased to discuss the responses in greater detail. Please do not hesitate to contact me at 303-335-5489 (cell) or at liaht.rosenstein@lmco.com. Otherwise, I look forward to a coordinated approach in selecting an appropriate remedial alternative.

Sincerely,

Liaht Rosenstein
Environmental Remediation Project Lead
Lockheed Martin Corporation

Enclosure:
Attachment 1— Navigation Beneficial Use-East Basin Letter
Comment and Response Matrix

cc: Ms. Sarah Mearon, Regional Water Quality Control Board, San Diego
Mr. Norm Varney, Lockheed Martin Corporation
Mr. George Gigounas, DLA Piper
Ms. Kim Hyde, DLA Piper
Mr. Mark Russell, Russell Environmental Group
Mr. Kelly Richardson, Latham and Watkins
Ms. Karen Holman, Port of San Diego
Mr. John Carter, Port of San Diego
Mr. Cris Carrigan, Regional Water Quality Control Board, San Diego
Ms. Heather Maples, Regional Water Quality Control Board, San Diego

ATTACHMENT 1

CALIFORNIA
Water Boards

Edmund G. Brown Jr.
Governor

Matthew Rodriquez
Secretary for
Environmental Protection

San Diego Regional Water Quality Control Board

TO: Former TOW Basin
Responsible Parties

In reply refer to / attn:
T10000002323:Janderson

FROM: Julie Chan
Chief, Groundwater Protection Branch
San Diego Regional Water Quality Control Board, Region 9

DATE: March 4, 2016

SUBJECT: NAVIGATION BENEFICIAL USE – EAST HARBOR BASIN

The San Diego Water Board provides this guidance with respect to the Tow Basin site. It is based on the information and status known at this time. It is not intended, nor should it be used, as guidance for any other existing or future site within San Diego Water Board's jurisdiction or the State of California. The San Diego Water Board reserves the right to revise and/or modify its guidance at any time for any reason.

Navigation (NAV) Beneficial Uses

San Diego Bay, including its marinas and harbors, is designated with the Navigation beneficial use (NAV) in the Basin Plan. According to the Basin Plan, NAV includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels. The NAV beneficial use exists in the East Harbor Basin of San Diego Bay as evidenced by the hundreds of water craft that use the basin. The San Diego Unified Port District has stated that water depths of 10 feet below mean lower low water level (MLLW) are needed in the East Harbor Basin to support the NAV beneficial use, and that the use is impaired in areas where sedimentation has caused water depths to be shallower than 10 feet MLLW. The San Diego Unified Port District Act named the Port District as trustee of the tidelands and submerged lands of San Diego Bay, and vested the Port District with the authority to, among other things, promote navigation within these lands. The legislature also granted the Port District broad police powers to make and enforce rules and regulations governing the use of the tidelands, and to balance the needs of various uses including navigation within the tidelands. Because of its status as a trustee agency for San Diego Bay, the San Diego Water Board gives deference to the Port's position concerning NAV. For this site the ten feet MLLW is a reasonable threshold for the water depth needed to support the NAV beneficial use in the East Harbor Basin.

Subsequent to our meeting, Kara Edewaard sent an email dated February 29, 2016, asking the following question: **"There are areas of the proposed remedy that currently do not have a depth of -10' MLLW. In those remedy areas less than -10' MLLW, we only need to remove contaminates at depth to achieve background on a SWAC basis, correct? This depth of removal may only be a few feet and likely less than a draft depth of -10' MLLW."**

Response: For the situation at this site, if the parties remove sediment in areas where the water depth is less than -10 feet MLLW, sediment need only be removed to target depths to achieve the background SWAC cleanup level across the site. The parties are not obligated to remove additional sediment to achieve a depth of -10 feet MLLW in NAV impaired areas of the basin. However, the San Diego Water Board reserves any and all of its rights to require any discharger and/or responsible party to perform additional investigation, mitigation, or cleanup if additional site-related pollutants are discovered or exposed as a result of maintenance dredging of the East Basin Harbor or if site conditions change.

cc: Ms. AnnaKathryn Benedict, State Water Board, Office of Enforcement
AnnaKathryn.Benedict@waterboards.ca.gov
Ms. Sherrie Komeylyan, San Diego Water Board,
Chehreh.Komeylyan@waterboards.ca.gov

Tech Staff Info & Use	
Geotracker Global ID	T10000002323
Cost Recovery IDs	2090016
	2090046

Comment and Response Matrix
Feasibility Study and Post-Remedial Monitoring Plan
Harbor Island: East Basin Sediment Assessment/Cleanup, San Diego, California
(Site ID T10000002642)

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
1	Water Board	10/27/2017	Section 1: Introduction	The Feasibility Study states that the concentrations of contaminants of concern (COCs) at the site are less than the cleanup levels adopted for the nearby San Diego Shipyard sediment site. This is incorrect. Please revise this statement.	The statement was revised to say: "the cleanup levels for the site are lower than the cleanup levels adopted for the nearby San Diego Shipyard sediment site."
2	Water Board	10/27/2017	Section 1: Introduction	The text states, "[A]ctive remediation is contemplated to address potential impacts and navigation needs envisioned by the Port." We think it is more accurate to state the following: "Active remediation is contemplated to address potential impacts as required in the CAO and navigation needs envisioned by the Port."	The text was revised as suggested in the comment.
3	Water Board	10/27/2017	Section 1: Introduction	The Feasibility Study states that the "recommended alternative(s) must be capable of achieving the proposed cleanup levels for all waste constituents at all monitoring points and throughout the zone affected by the waste constituents." This is consistent with Directive B of the CAO and is one of the performance measures that is used by the San Diego Water Board to evaluate compliance with the directive. Other performance measures will also be considered as detailed in some of the comments below.	Comment noted.
4	Water Board	10/27/2017	Section 2: Background and Site Conditions	The second paragraph of Section 2 lists historical reports that document current and historical conditions and potential sources of sediment contaminants. Please add to this list the July 9, 2009, Technical Memorandum: East Basin Evaluation of Data Distribution and Identification of Former Tow Basin COPCs, San Diego, California (Haley & Aldrich and Weston Solutions 2009). Also add the data from this report to Figures 1 through 4 and to Table 2-1. The data from the 2009 report range from 40.05 to 1,485 micrograms per kilogram (µg/kg) polychlorinated biphenyls (PCBs) based on summation of detected Aroclors, and from 5.75 to 890.71 µg/kg PCBs based on summation of a congener summation algorithm. The higher PCB concentrations exceed the maximum concentration cited in the Feasibility Study of 419.8 µg/kg but are located in the same areas of the East Basin as the high concentrations cited in the Feasibility Study, as shown on Figure 14 of the 2009 data report. These data were not collected as part of Sediment Quality Objective (SQO) sampling efforts but represent additional chemical data that should be used to develop the remedy for the site.	The July 9, 2009 Technical Memorandum prepared by Haley & Aldrich and Weston Solutions was added to the historical report list as suggested in the comment. The 2007 sediment data (included in the July 9, 2009 Technical Memorandum) were not collected as part of Sediment Quality Objective (SQO) sampling efforts but were added to the text, figures, and tables referenced, and was utilized in the revised Feasibility Study at the request of the Water Board. This has resulted in the generation of a new Theisen polygon configuration.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
5	Water Board	10/27/2017	Section 2: Background and Site Conditions	The Feasibility Study (page 4) states that five outfalls along the north shoreline of the East Basin discharge into the Site, then later states that Outfall Nos. 4 and 5 are located east of the site, outside the property boundaries. To clarify, three of the five outfalls discharge into the East Basin (the site) and Outfall Nos. 4 and 5 are located east of the Tow Basin property boundaries. Please revise these descriptions for consistency in future submittals with attention given to the definitions of the site and landside property.	The outfall descriptions were clarified and revised in the text.
6	Water Board	10/27/2017	Section 2: Background and Site Conditions	Following on comment no. 5, as defined in Finding No. 2 of the Order, "The Site encompasses the area of the East Basin where sediment has been contaminated by discharges from the former Tow Basin and former Marine Terminal and Railway (Railway) facilities." The end of Section 2 states that, "…the Site did not warrant further investigation…" and "sources of COCs to the sediment emanating from the Site are controlled." To clarify, the landside portion of the Tow Basin received no further action status in 2004 (soil, Department of Toxic Substances Control [DTSC]), 2009 (groundwater, DTSC), and 2010 (San Diego Water Board), and the landside portion of the Former Marine Terminal and Railway Facility received no further action status in 2016 (San Diego Water Board). The site, as defined for the purposes of the Order, consists of a portion of the East Basin. Please revise portions of the document that refer to the site as being located landside.	Text throughout the document referring to the site was revised to be consistent with the site definition in the CAO.
7	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	The Feasibility Study states that the background concentrations of 84 µg/kg PCBs and 0.57 milligrams per kilogram (mg/kg) mercury have been adopted as cleanup levels for the site "based on the established background concentration derived from multiple areas in San Diego Bay with characteristics similar to the Site." This is incorrect. Background concentrations have not been established for San Diego Bay or for "multiple areas in San Diego Bay with characteristics similar to the Site." The Order states in Finding No. 12: "For the purposes of this CAO, background concentrations for total PCBs and mercury…applicable to East Basin sediments are 84 parts per billion and 0.57 parts per million, respectively." The Order clearly states that these background concentrations have been established for this site specifically. Revise the text to reflect that background concentrations have not been established for San Diego Bay.	The text was revised to state that "Cleanup to background concentrations of 84 µg/kg PCBs and 0.57 milligrams per kilogram (mg/kg) mercury for bulk sediment are applicable to East Basin sediments as stated in Finding No. 12 of the CAO. References to background concentrations established for San Diego Bay were removed.

8	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	The Feasibility Study states that, "bulk sediment concentrations are accepted and proven effective cleanup and monitoring criteria at numerous sediment sites throughout the country." Please provide references for this statement from sources with multiple years of post-remedial monitoring data illustrating this point. Recent bioaccumulation studies in San Diego Bay and Los Angeles/Long Beach Harbors indicate that water column PCB concentrations can account for 50 percent or more of the body burden in seafood that resides in the water column and/or feeds primarily on plankton. For this reason we will require pre- and post-remedial porewater sampling as part of the monitoring program to demonstrate a reduction in bioavailability to biota (see comment no. 45).	The sentence, "bulk sediment concentrations are accepted and proven effective cleanup and monitoring criteria at numerous sediment sites throughout the country" was deleted. This statement was deleted because the CAO established bulk sediment concentrations as cleanup levels for the site as stated in Finding No. 12. The CAO did not establish any cleanup levels for the reduction of bioavailability to biota as measured through porewater sampling. Thus, there is no criteria available to determine whether the remedial goals will be met based on the results of any porewater sampling and there is no way to determine success or failure of the remedy based on that collected data. Therefore, Lockheed Martin did not modify the Long-Term Monitoring Program to address pre- and post-remedial porewater sampling to demonstrate a reduction in bioavailability to biota. The statement in the comment that "Recent bioaccumulation studies in San Diego Bay and Los Angeles/Long Beach Harbors indicate that water column PCB concentrations can account for 50 percent or more of the body burden in seafood that resides in the water column and/or feeds primarily on plankton" does not provide justification for requiring porewater sampling as part of the monitoring program for this small area of San Diego Bay since the CAO specified cleanup objective is based on bulk sediment concentrations. From a watershed/bay wide perspective, PCBs in the water column that accumulate in the food web are not solely coming from sediment flux of PCBs to the water column. In LA/LB Harbor, it has been shown that watershed sources contribute significantly to loading of PCBs in the water column within LA/LB Harbor (Arms and Jirik 2015). The PCBs released by ongoing sources (i.e. stormwater point and non-point sources) into the water column are absorbed by phytoplankton, and then consumed by zooplankton and other filter-feeding organisms such as oysters and brachiopods. Small pelagic fishes, or those that dwell primarily in the mid to upper portion of the water column, accumulate PCBs through the consumption of these water-column dwelling aquatic invertebrates and the small prey fishes are in turn consumed by higher trophic level piscivorous pelagic fishes. The parallel route of exposure from the benthos is sediment, worms/benthic organisms, benthic fishes, higher trophic level (piscivorous fishes). In LA/LB Harbors, the accumulation is happening by both routes and it is roughly split 50/50 (Arms and Jirik 2015) and therefore both exposure routes are likely present in San Diego Bay. However, not all PCBs found in the water column are coming from sediment flux and the percent fluxing from the sediment pore water to the overlying water is not 100%, and

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
					has been shown to be occurring at varying degrees. Although reduction in bulk sediment concentrations within the East Basin will contribute to the accumulation of mercury and PCB in fish tissue within San Diego Bay, this contribution is expected to be limited due to the small size of the site.
9	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	The second paragraph of Section 3 states, "Background sediment data were based on several reference pools considered by the Water Board, resource agencies, and nongovernmental organizations (NGOs); therefore, these background concentrations are deemed to be protective of beneficial uses within San Diego Bay, including the Site [emphasis added], and are the extent to which State Water Resources Control Board Resolution 92-49 requires cleanup." The San Diego Water Board, however, did not deem these values protective. Background is the lowest concentration that the San Diego Water Board can enforce under Resolution 92-49. Revise the underlined portion and state only that background concentrations are consistent with Resolution 92-49.	The second paragraph of Section 3 was deleted.
10	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	Following on comment no. 4, the 2009 data should also be used to establish pre-remedial surface-weighted area concentrations (SWACs). Revise the pre-remedial SWAC calculations by including the 2009 data.	See response to Comment 4
11	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	The Feasibility Study states that the previously collected SQO data were used to "establish the pre-remedial…SWACs…that meet the CAO background cleanup levels." This is not correct. The pre-remedial SWACs do not meet CAO background cleanup levels, and should instead be used to determine the areas requiring remediation to attain background cleanup levels as prescribed in the Order. Post-remedial SWACs are used to verify that cleanup has been sufficient to meet the background cleanup levels. Revise the text accordingly.	The second sentence in the third paragraph of Section 3 was revised to say: "These data were then used to establish the pre-remedial surface-area weighted average concentrations (SWACs) that were compared to CAO background cleanup levels to determine the COCs and areas requiring remediation."
12	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	SQO3 was designated as "likely impacted" based on the benthic triad analysis but is not included in the remedial footprint. Please explain why SQO3 is not included in the remedial footprint.	SQO3 will be included in the revised Clean Sand Cover Placement Area for Alternatives 2 and 4. The corresponding sections of the Feasibility Study (including but not limited to the remedial alternatives and SWAC analysis) were revised.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
13	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	We understand the utility of SWACs in addressing toxicity of bioaccumulative constituents to certain species of mobile aquatic wildlife as described on pages 5 and 6 of the Study. Is the SWAC approach also protective of members of the benthic community that are not mobile? Please explain.	Yes. First, the CAO specified background based bulk sediment cleanup levels are below benthic risk screening levels for marine sediments such as the Probable Effect Level (PEL – 0.7 mg/kg for Hg and 189 ug/kg for PCBs) and the Effect Range Median (ER-M – 0.71 mg/kg for Hg and 180 ug/kg for PCBs). 2) the revised remedial footprint addresses all the likely impacted SQO stations within the East Basin site. Further, non-mobile members of the benthic community are expected to live in the top 10 to 15 cm of sediment and the community at the Site will be protected as follows: 1. In removal areas, sediment containing concentrations above cleanup levels will be removed and a 6-inch (15 cm) sand cover will be placed to address residuals thereby leaving a clean surface material. 2. In clean sand cover areas, a 6-inch (15 cm) layer of sand will be placed over the existing surface. Mixing in the bottom 10 cm is expected (see Response to Comment #17) to occur leading to at least a 75% reduction of contaminant concentrations in the biologically active zone for 6-inch placement areas. In areas within the Site not subject to sand cover placement or removal and represented by chemical concentrations above cleanup levels, deposition of clean material is expected to reduce concentrations over time and reduce the exposure concentrations to higher trophic levels.
14	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	To be clear, the effects range median and probable effect level values cited in Section 3 are not regulatory criteria and are therefore not enforceable, which is why the cleanup levels prescribed in Finding 12 of the CAO have been chosen for this site.	Comment noted.
15	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	The remedial footprint (Figure 1) is described as “the area of the Site that if remediated would reduce the Site-wide SWAC to concentrations at or less than background concentrations.” The Thiessen polygons as shown on Figures 1 through 4 are different from those shown on Figure 3 of Appendix A, which presents the SWAC calculations. The landside boundaries for all of the polygons that intersect land appear to be truncated and do not extend to the boundary of the remedial footprint. Revise the figures to match the original polygon boundaries.	The polygons presented on Figures 1 through 5 of the FS were revised to match those presented in Appendix A (and utilized for the SWAC analysis).

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
16	Water Board	10/27/2017	Section 3: Background-based Cleanup Levels	In addition to extending outside the boundaries of Thiessen polygons, the remedial footprint omits some polygons completely and bisects other polygons. The Feasibility Study states, "[T]he remedial footprint encompasses the area of the Site that if remediated would reduce the Site-wide SWAC to concentrations at or less than background concentrations." It is unclear why partial polygons have been selected for remediation. This is inconsistent with the approach taken at the San Diego Shipyard Sediment site, which is frequently cited in the Feasibility Study as an example of a comparable approach to that in the East Basin. The sample location within a polygon is meant to be representative of an entire polygon. Further, due to sediment heterogeneity the concentration at that sample location may not represent the maximum concentration within the polygon. Although the remedial plans differ, the approach adopted at the Shipyard site and proposed to be used at the NTC Boat Channel site is to treat an entire polygon in the same manner (with minor "smoothing" of polygon boundaries to facilitate remedy implementation). Explain the rationale for placement of the remedial footprint boundaries as shown on Figures 1 through 4.	The purpose of the SWAC-based clean up objective was to calculate the average weighted surface chemical concentration across the entire Site. The SWAC analysis conducted in Appendix A of the Feasibility Study differentiates between active remediation (i.e. sand cover or dredging) and no remediation within a polygon, and accounts for those areas in the analysis. Specifically, each SWAC is represented by a sample location and a PCB and Hg concentration. If the polygon includes both dredging and sand cover based on constructability issues, then the area of sand cover and the area for removal (and sand cover) are calculated and addressed separately in the SWAC table (Appendix A). The combined result is then incorporated into the predicted site wide SWAC. Based on the results of the SWAC analysis, the proposed remedial footprints in the preferred remedial alternative (Alternative 4) meet the SWAC based clean-up objectives presented in the CAO. This will be confirmed during long-term monitoring of the surface sediment concentrations at the polygon As discussed in the FS, this type of remediation goal is appropriate as the aquatic-dependent wildlife and angler-targeted game species at the Site do not limit their movement to a small area represented by a single sediment sample, but move through the larger area (exposing them to sediment of various chemical concentrations throughout San Diego Bay). This is the identical approach used at the San Diego Shipyard Sediment Site except the ultimate use of remedial approaches (removal with sand cover placement, sand cover placement) for polygons varied. It is important to note that during the development of design drawings for the contractor, the areas identified for removal and sand cover placement will be represented in clean up units that will supersede polygon lines (polygons won't ultimately define clean up areas. Removal and sand cover placement, constructability considerations will define dredge management and placement areas. Post-remedial monitoring will then verify the original SWAC evaluation and demonstrate that the CAO specified cleanup objectives have been achieved.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
17	Water Board	10/27/2017	Section 4.4: Clean Sand Cover Placement	The Feasibility Study states, "The upper 10 cm of underlying sediment is expected to become mixed in with the clean cover material. If a 15-cm layer of clean sand material is placed, the result would be a reduction of chemical concentrations by approximately 75% in the resulting upper 10 cm." Please explain the source of the 75 percent reduction estimation.	The estimation of contaminant reduction for areas with placement of 6 inches (15 cm) of clean sand cover assumes the following: • Following the placement of 15 cm of clean sand cover, the lower 10 cm of sand cover mixes with the upper 10 cm of contaminated sediment (mixed sediment layer), which results in a 50% contamination concentration reduction in the mixed sediment layer. • A 10 cm surface sample would consist of 5 cm of clean sand, and 5 cm of the mixed sediment layer. The resulting surface sample would result in an additional 50% contamination concentration reduction (as the top 5 cm of sand is assumed to be clean), resulting in an overall reduction of surface chemical concentration of 75%.
18	Water Board	10/27/2017	Section 5.1: Common Elements	Section 4.4 states that significant bioturbation or physical mixing is not expected to extend to 15 centimeters (cm); however, under Clean Sand Cover Placement, it states that these processes are not expected to extend to 10 cm. Please clarify the expected depth of mixing for the clean sand cover scenario for the purpose of evaluating remedial success. Also provide the expected timeline for mixing.	The depth of bioturbation, or disturbance of sediment layers by biological activity, from the sediment surface down into the placed clean sand cover is expected to extend to 10 cm, but not consistently down to 15 cm because the depth of bioturbation is typically 10 to 15 cm (4 to 6 inches) in marine sediments (Clarke et. al. 2001). This mixing would occur as the benthic community recovers and matures after material placement, typically within 1 to 2 years.
19	Water Board	10/27/2017	Section 5.1: Common Elements	Under Activated Carbon Amendment, activated carbon is proposed to be used in "areas where PCB concentrations are elevated." This amendment, however, is only proposed to be used in the northwest portion of the basin. We have several questions about the use of this remedy in this area:	The addition of activated carbon to the northwestern corner of the Site does not increase the ability of the remedy to attain of the bulk sediment cleanup levels established in the CAO. The activated carbon was not accounted for in the post construction SWAC analysis conducted in Appendix A of the Feasibility Study, thus, carbon-amended sand is not needed at the site to meet the SWAC-based clean up objectives. It was, however, included in the northwest portion of the East Basin to address some concerns presented by other responsible parties during the settlement negotiations.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
19a	Water Board	10/27/2017	Section 5.1: Common Elements	The northwest corner of the basin is not the only area with elevated PCB concentrations. Why has carbon amendment not been proposed for the entire remedial footprint (i.e., including areas that will contain sediment with elevated PCB concentrations in perpetuity under the clean sand cover)? Explain the rationale for using amended carbon in the northwest area only.	Activated carbon was included in the placement of clean sand cover in the northwest portion of the East Basin to reach agreement with other responsible parties regarding the design of the remedy to primarily address implementability concerns. The Port District comments that the northwest corner of the basin where GAC is proposed is not typical of other areas that are within the remedial footprint, as (1) the area is a sloped bank, (2) it has riprap for bank stabilization, and (3) it is intertidal and in some portions above mean higher high water (MHHW) elevation. While there is evidence of elevated PCBs in the that footprint, applying more traditional technologies, such as dredging, would not be cost-effective nor efficient since the rip-rap slope area would hinder reliable removal of sediment. The Port District asserts that the addition of GAC-augmented sand is an appropriate additional measure in this specific area given the inability to apply other technologies (also recognizing that activated carbon will reduce pore water concentrations). Activated carbon was included in the placement of clean sand cover in the northwest corner, and not other areas, of the basin because this area is not typical of the other areas that are within the remediation footprint. Using coarse sand material is not expected to significantly affect foraging behavior for shorebirds. Smaller probing shorebirds, such as sandpipers would not likely feed within the footprint because of the relatively steep bank. Their preferred foraging habitat is mud flats. For larger shorebirds, there is the possibility that the added texture will enhance feeding opportunities because of the increased surface roughness will increase the density of small macroinvertebrates that are a primary food source. The placement of GAC was not related to concerns regarding source control. Nor were there any questions as to whether the material will be relatively stable over time when coarser material is designed to resist any wind or vessel driven waves or tidal currents. Specifically, the proposal is to mix the GAC with coarse sand material will enhance erosion protection and this area is not expected to be subjected to significant storm-generated wind activity given the prevailing wind direction and lack of significant fetch within the basin. Storm water discharge at low tide is addressed with the use of “splash pads”. The responsible parties do not believe that any additional monitoring would be required to assess the effectiveness of remedies ability to attain the bulk sediment cleanup levels established in the CAO.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
19b	Water Board	10/27/2017	Section 5.1: Common Elements	Amended carbon also can be used to limit the bioavailability of mercury uptake by benthic organisms. Why hasn't amended carbon been proposed to be applied in areas where mercury concentrations also are elevated?	As we have discussed with the Water Board previously (Anchor QEA, 2016), the bioavailability of Hg is complex due to the various factors that can control the generation of methyl mercury (and the effectiveness of GAC). However, this is less of an issue since the highest concentrations of Hg (LM-C-4) will be removed under the revised Alternative 4.
19c	Water Board	10/27/2017	Section 5.1: Common Elements	Also, the northwest portion of the basin is within the intertidal zone, which is periodically exposed. Provide data supporting the use of this remedy in an area where there is wind and wave action and where there is the possibility that the carbon material could potentially be washed away or entrained in the wind during periods of exposure.	In this situation GAC would be mixed in with the sand cover material and fully wetted (soaked) prior to placement. This sand cover under the revised Alternative 4, regardless if GAC is added, will be designed to resist wind, vessel drive wakes, and tidal currents. Further, a layer of coarse grained material will be placed on top of the sand cover to further reduce the potential that that material will be disturbed by birds or people.
19d	Water Board	10/27/2017	Section 5.1: Common Elements	The carbon is proposed to be mixed in with coarser material (e.g., sand or gravel) that will be placed on the existing substrate, which is dominantly mudflats. There are few remaining areas along San Diego Bay that are suitable for foraging birds. How would adding coarse material in this area affect the ecology in this area and specifically the ability of birds to use this area for foraging?	The area of the site where coarser material (e.g., coarse sand and/or gravel) to be finalized during design) will be placed on the existing substrate, is approximately 0.2 acres, which is a very small area relative to the foraging area of birds in San Diego Bay. In addition, it is expected that in the long-term fine-grained material will settle on top of the coarser placed material (to be finalized during design) and will return to a similar grain size as the existing surface sediment. Therefore, the placement of the coarser material in the northwestern corner of the site is not expected to significantly impact the ability of birds to use the site for foraging and is not expected to impact overall bird foraging opportunities within San Diego Bay. The most important habitat areas for birds in the Bay include much of the southern portion of the Bay that consists of the South Bay and Sweetwater units of San Diego National Wildlife Refuge that provide foraging opportunities for a variety of bird species.
20	Water Board	10/27/2017	Section 5.1: Common Elements	Under Outfall Erosion Protection the placement of a coarser material at a higher elevation than the Outfall No. 1 outfall erosion protection is proposed to further protect against erosion and disturbance. The primary erosion protection, consisting of riprap and gravelly sand, will be placed at the discharge point of Outfall Nos. 1 and 3. Please clarify how far away the discharge point is from the outfall pipes to verify that there is adequate room for the secondary erosion protection. Will the secondary erosion protection be placed at Outfall No. 1 only? Please clarify.	This detail would be evaluated during the design phase to confirm that there will be room to place both the primary (splash pad) and secondary erosion protection (coarse material placed at a higher elevation).

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21	Water Board	10/27/2017	Section 5.3: Remedial Alternatives	Polygon LM3 has total PCBs and mercury concentrations above the prescribed background concentrations yet Figures 2 through 4, as well as Table 3 of Appendix A, indicate that about 38 percent of the polygon is within the remedial footprint. Explain why this approach has been proposed for polygon LM3 as it does not remediate this polygon to background concentrations. Polygon LM-C-7 also is not proposed to be fully within the remedial footprint. See also comment no. 16.	See response to Comment 16. The SWAC analysis presented in Appendix A considers the remediated and un-remediated portions of a polygon. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the background-based clean-up objectives provided in the CAO on a SWAC basis. As described in Section 3 of the draft FS, a SWAC-based cleanup level is appropriate and meets the CAO objectives due to the home range of the receptors of interest. Because the goal of the cleanup is to achieve the background based cleanup objectives on a SWAC basis, remediation of all polygons above background concentrations is not required.
22	Water Board	10/27/2017	Section 5.3: Remedial Alternatives	Polygon SQO3 also has total PCBs and mercury concentrations above the background concentrations yet is not within the remedial footprint. Explain why this approach has been proposed for polygon SQO3 as it does not remediate this polygon to background concentrations. See also comment no. 16.	The "Clean Sand Cover Placement Area" was expanded to include the area represented by samples SQO2, S12, and SQO3 for remedial alternatives 2 and 4 (and will be depicted in the revised Feasibility Study). See response to Comment 16 regarding SWAC methodology and how a site-wide SWAC meets the objectives of the CAO.
23	Water Board	10/27/2017	Section 5.3: Remedial Alternatives	Polygon LM-C-3 has total PCBs and mercury concentrations below the prescribed background concentrations yet Figures 2 through 4, as well as Table 3 of Appendix A, indicate that about 66 percent of the polygon is within the remedial footprint. Similarly, polygon LM-C-6 has concentrations below background but a small portion at the north end is included within the footprint. The environmental benefit of placing sand cover or dredging where concentrations are already low may be outweighed by the impacts of this action (e.g., greenhouse gas emission, traffic impacts, etc.). Given the location of these polygons at the south end of the remedial footprint it also is not clear why they has been included in the footprint. If this area already has concentrations below background levels, explain why this approach has been proposed for polygons LM-C-3 and LM-C-6.	LM-C-3 and LM-C-6 are not included in the active remediation area for the revised Alternative 4. The dredge prism was initially designed to meet the Port's navigation requirements (note that sand cover attains the post remedial SWAC and the CAO cleanup objectives) and further modified to address the higher mercury concentrations. The dredge areas also considered a final configuration would not impact the stability of the existing revetment. Specifically, side slopes were necessary landward of the dredge prism to allow for dredging to -11 feet MLLW (inclusive of one-foot over dredge). These side slopes are detailed on the cross-sections presented on Figures 6a through 6c. All dredge areas and slide slopes will receive sand cover.

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24	Water Board	10/27/2017	Section 5.3.2: Remedial Alternative 2: Clean Sand Cover Placement	The Feasibility Study states that Outfall No. 1 is active and may convey water outflows that contain elevated PCB concentrations and therefore adjacent sand cover would be augmented by activated carbon. However, Section 2 states, "[S]ources of COCs to the sediment emanating from the Site are controlled." Section 7 further attests that the carbon amendment will be used to address "higher PCB bulk sediment concentrations found within the Site" (i.e., there is no reference to a continual source of PCBs). Please clarify whether the sources of PCBs to the site are controlled.	Based on available data, LMC believes sources to the site are controlled. For example, at the former Tow Basin facility, connections to the storm drains have been eliminated. As a result, the potential for recontamination of the remedy is considered low. The text in the FS was updated as necessary to clarify this. We also don't believe that the addition of activated carbon is necessary as a source control measure. As discussed previously, the addition of activated carbon does reduce pore water concentrations but does not alter bulk sediment concentrations nor the attainment of the bulk sediment clean levels set forth in the CAO.
25	Water Board	10/27/2017	Section 5.3.2: Remedial Alternative 2: Clean Sand Cover Placement	Following on comment no. 19, the San Diego Water Board has reviewed preliminary post-remedial monitoring data for a site abated by placement of a clean sand cover with and without carbon amendment that indicates that the carbon-amended sand performs much more favorably in terms of reducing contaminant bioavailability. Provide additional rationale for not using carbon-amended sand across the entire remedial footprint.	As noted in the response to comment 19, the application of activated carbon is not required to meet the CAO specified bulk sediment cleanup goals and limited to the northwest corner because of the unique characteristics of the footprint, including the fact that the area is sloped, contains riprap, and intertidal. See Comment 19 for additional information on this topic. As a result, monitoring a reduction in contaminant bioavailability is not required. Post-remedial monitoring will focus on confirming that the CAO specified bulk sediment cleanup goals have been attained. Proposed long-term monitoring includes the collection of surface sediment during three sampling periods over 5 years post-remediation, such that the prediction of reduction in modeled contaminant reduction can be verified. Corrective actions are identified as needed if the sand cover does not meet the performance goals stated in the FS and RAP.

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26	Water Board	10/27/2017	Section 5.3.4: Remedial Alternative 4: Combination	Alternative 4 proposes "removing sediments from a localized area with navigation depth requirements and COC concentrations exceeding the background-based cleanup levels." In contrast, Alternative 3 (Section 5.3.3) proposes "removing the maximum practical volume of sediments exceeding background-based cleanup levels within the remedial footprint." It appears that Alternative 3 is more consistent with the objectives of the remedial action as described in Sections 1 and 5.1 of the Feasibility Study and, further, is consistent with Finding 9 of the CAO, which provides the basis for the CAO under Water Code section 13304. Under Removal in Section 5.1, it states: "Sediment removal by mechanical dredging is appropriate for areas with elevated chemical concentrations or areas where navigational depths should be retained or to remove high concentration material." As such removal is appropriate for remediating high-concentration sediments although Alternative 4 does not propose to do this consistently across the entire remedial footprint. Please explain why the selected remedy, Alternative 4, considers navigational requirements as the primary rationale in addition to elevated contaminant concentrations whereas Alternative 3 focuses on removal of the maximum practical volume of contaminants.	The evaluation of the remedial technologies as combined to develop alternatives used CERCLA guidance for developing feasibility study, which is *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA 1988). This process requires a balancing of factors to address each of the nine criteria. Placement of clean sand only was originally shown to meet clean up objectives on a SWAC basis and removal and inclusion of dredging and activated carbon in the northwest corner were measures that were added to the remedy during the settlement negotiation process as a compromise to address Port requests and to minimize impacts on the navigation use of the East Basin. Section 5.1 of the FS states that sediment removal by mechanical dredging is appropriate for areas with elevated chemical concentrations or areas where navigational depths should be retained. The revised recommended remedial alternative (Alternative 4) includes removal of sediment to address elevated mercury concentrations (LM-C-4) and navigation requirements. This alternative was generated based on input from all the responsible parties, the Water Board, and USFW, and led the alternatives based on balancing of the evaluation criteria described in Section 6 (not only criteria 6, reduction of toxicity, mobility, or volume through treatment). As stated above in the response to Comment 16, the results of the SWAC analysis (Appendix A) show that the preferred remedial Alternative 4 meets the SWAC-based clean-up objectives provided in the CAO. Alternative 3 is economically infeasible under Res. No. 92-49, as it would enormously increase costs while providing little or no incremental benefit in protection of beneficial uses. We also considered short term impacts of dredging which include water quality, impacts to the community from dredge material handling-transportation and sustainability. From many perspectives, sand cover placement has less impacts than removal.

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27	Water Board	10/27/2017	Section 5.3.4: Remedial Alternative 4: Combination	The various remedial activities shown on Figure 4 and described in this section for Remedial Alternative 4 require additional explanation:	Alternative 4 relies on application of the clean sand cover to achieve the CAO specified cleanup levels on a SWAC basis. In addition to clean sand cover placement, sediment removal by mechanical dredging has been included for areas with elevated chemical concentrations (i.e., the elevated mercury levels detected at LM-C-4) and in areas where navigational depth requirements prevent placement of the clean sand cover. Placement of clean sand augmented with activated carbon has been included in the northwest corner of the East Basin to address some concerns presented by other responsible parties during the settlement negotiations. Other elements of Alternative 4 include construction of a splash pad to prevent erosion of the clean sand cover adjacent to Outfall Nos 1 and 3 and long-term monitoring. It should be noted that placement of the clean sand cover alone is sufficient to achieve the CAO specified cleanup levels on a SWAC basis and other elements have added to increase the long-term effectiveness and permanence and implementability of the alternative (including other responsible party's concerns). See Comment 19 regarding the application of GAC in the northwest corner.
27a	Water Board	10/27/2017	Section 5.3.4: Remedial Alternative 4: Combination	The polygon containing the highest mercury concentration on the site (LM-C-4; 13 mg/kg) is not proposed for removal activities with the exception of a small portion in the northwest corner. This does not provide protection to sedentary benthos in this area. This is not consistent with remedial efforts elsewhere in the Bay. To what depth are non-mobile benthic biota active?	The eastern extents of the dredge prism were extended east to include the area of elevated mercury concentrations represented by sample LM-C-4. This revision was included in the revised FS.
27b	Water Board	10/27/2017	Section 5.3.4: Remedial Alternative 4: Combination	Provide a reference for the cited "navigation depth requirements," and explain how navigational depth has been defined for this portion of the East Basin.	The Port has stated that water depths of 10 feet below mean lower low water level (MLLW) are needed in the East Harbor Basin to support the NAV beneficial use, and that the use is impaired in areas where sedimentation has caused water depths to be shallower than -10 feet MLLW. For this site the minus ten feet MLLW is a reasonable threshold for the water depth needed to support the NAV beneficial use in the East Harbor Basin (Water Board 2016).
27c	Water Board	10/27/2017	Section 5.3.4: Remedial Alternative 4: Combination	The thicker sand placement (12 inches) at the base of the dredge prism is proposed as additional protection against erosive forces; however, this means that the material within this area will not be subject to mixing in the top 10 cm that will result in lower concentrations in the top portion of the affected sediment.	This area has been incorporated into the dredge prism to remove material associated with sample location LM-C-4 and will receive a 6-inch layer of sand cover to address residuals. As such, there will be no areas receiving the 12-inch layer of sand cover.

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28	Water Board	10/27/2017	Section 6.1: Overall Protection of Human Health and the Environment	The discussion pertaining to Alternative 4 states, "Dredging would occur in a discrete area that would remove sediments with elevated COC concentrations greater than the CAO cleanup level." This is not correct. As stated under comment no. 27, the polygon with the maximum concentration of mercury (LM-C-4; 13 mg/kg), for example, would be covered with 12 inches of clean sand and would not be removed. Section 5.3.4 states that the 12-inch sand cover would be used in areas as additional protection against erosive forces. Provide more information about the nature of these erosive forces given the relatively quiescent nature of the East Basin. In contrast, Alternative 3 proposes dredging of the majority of the LM-C-4 polygon, which would remove most of the footprint characterized as having the highest mercury concentration. It is unclear why dredging of LM-C-4 has not been proposed under Alternative 4, which would be the most protective of human health and the environment in the long term and would provide higher environmental benefit in this area of the East Basin, in addition to cleaning up this polygon to background.	See response to Comment 27a. The FS was revised to include the area designated by LM-C-4 within the remedial dredge prism.
29	Water Board	10/27/2017	Section 6.1: Overall Protection of Human Health and the Environment	The remedial plan shown on Figure 4 is inconsistent with the objective of the cleanup and abatement efforts as outlined in Section 1. LM-C-1 (total PCBs 41.2 µg/kg; mercury 0.485 mg/kg) and LM-C-3 (total PCBs 25.4 µg/kg; mercury 0.211 mg/kg), both of which have COC concentrations below background levels, are within the dredge footprint whereas LM1, LM2, LM3, LM-C-2, LM-C-4, and LM-C-7, all of which have at least one of the COCs above background levels, are outside of the dredge footprint. Section 5.1 states, "Sediment removal by mechanical dredging is appropriate for areas with elevated chemical concentrations or areas where navigational depths should be retained or to remove high-concentration material." Further, the analysis in Section 6.1 states, "Dredging would occur in a discrete area that would remove sediments with elevated COC concentrations greater than the CAO cleanup level." Arguably only LM-C-2 and LM-C-5, which exceed mercury background levels, and SQ01 and LM-C-5, which exceed total PCBs background levels, are in the dredge footprint and would be consistent with this statement. Few polygons with "elevated COC concentrations greater than the CAO cleanup level" are in fact within the dredge footprint. The rationale for the remedial plan as shown on Figure 4 is therefore unclear. Has dredging been proposed for navigational needs or to address COC concentrations exceeding background-based cleanup levels? See also comments regarding the validity of perceived environmental benefit as stated under comment no. 23.	See response to Comments 16 and 27. For clarification, the text in Section 5.1 and 6.1 of the FS does not state that that dredging will occur in all areas with elevated COC concentrations greater than the CAO cleanup level, as that is not necessary to achieve background concentrations on a SWAC basis. The recommended remedial alternative presented in the FS is predicated to meet the SWAC for the entire Site and includes removal to address elevated mercury concentrations and to meet navigation requirements.

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30	Water Board	10/27/2017	Section 6.1: Overall Protection of Human Health and the Environment	The Feasibility Study proposes to use different remedial treatments for different portions of the same polygons. This is inconsistent with the remedial plan executed for the San Diego Shipyard Sediment Site cleanup and with the proposed plan for the NTC Boat Channel. Explain the rationale for this approach. See also comment no. 16.	See response to Comment 16.
31	Water Board	10/27/2017	Section 6.2: Short-term Effectiveness	The placement of clean sand cover and the removal activities components of Alternatives 2, 3, and 4 both cite a recovery period for the benthic community and vegetation of 1 to 3 years, although under removal, it states that the recovery period is: "much longer than with placement of clean sand cover." The time periods under both activities are identical at 1 to 3 years. Explain this discrepancy.	Timelines in the FS were clarified as follows: • The benthic community and aquatic vegetation within the East Basin is expected to recover from placement of clean sand cover in less than 1 year because the benthic community will not be destroyed and there will be species that use the newly placed material quickly after placement. The 2017 SPAWAR pilot study at Quantico Marine Base found that at 2-months post placement of the thin sand layer, abundance, richness, and diversity of the benthic community was like areas that did not receive the thin layer placement and was significantly increased compared to pre-cap benthic surveys for both areas with and without the placement of the layer of thin sand. • For areas that will be dredged, it is expected that the benthic community will recover in 1-3 years (Newell et al. 1998) since the benthic community will be completely removed from the area.
32	Water Board	10/27/2017	Section 6.3: Long-term Effectiveness and Permanence	Several polygons with elevated COC concentrations are proposed to be outside the dredge footprint and to be covered with clean sand as part of Alternative 4 (e.g., LM-C-4 with mercury concentration of 13 mg/kg). Although a large portion of this polygon is proposed to be covered with 12 inches of clean sand the highly contaminated sediment will remain. This is inconsistent with the need to clean up to background concentrations. It is also uncertain what the impact will be of leaving this material in place in the long term, particularly to sedentary benthic biota. Please address these concerns.	See responses to Comments 16, 27 and 27a. The FS was revised to include the area designated by LM-C-4 within the remedial dredge prism. Additionally, as described for Alternative 2, the SWAC based bulk sediment remediation goals can be achieved through placement of sand cover alone. However, dredging was incorporated into the remedy to address navigation requirements and to increase long-term effectiveness and permanence through removal of the elevated levels of mercury observed in LM-C-4.
33	Water Board	10/27/2017	Section 6.5: Implementability	Much of the discussion of the implementability criterion focuses on evaluation of disruption of marina and Port activities. Although we concur that remedial activities will require cooperation with the marina during execution of Alternatives 2, 3, and 4 and should be considered as part of the analysis, the complications inherent in working in this portion of the East Basin do not translate to an impediment to implementation. Although disruption to marina operations for any selected remedial alternative is unavoidable, the remedial footprint is located in the northeast corner of the basin and would only be disruptive to a small number of boats. Please revise this discussion.	Section 6.5 of the Feasibility Study was revised to include further discussion on the disruption of marina operations, including an estimation of the construction timelines. It should be noted that remedies that take longer will have a greater impact on marina operations and are thus more difficult to implement.

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34	Water Board	10/27/2017	Section 6.6: Reduction of Toxicity, Mobility, or Volume through Treatment	We disagree with the assertion that, "Alternatives 3 and 4 include treatment technologies to the maximum extent practicable." This assertion is made in relation to the use of activated carbon over an area near Outfall No. 1. Alternative 4, however, does not propose removing sediment with some of the highest COC concentrations (e.g., LM-C-4). Clean sand cover is proposed to be placed over much of this sediment that does not contain a carbon amendment. Please explain.	See response to Comment 27a. The FS was revised to include the area designated by LM-C-4 within the remedial dredge prism. As described for Alternative 2, the SWAC based bulk sediment remediation goals can be achieved through placement of sand cover alone. However, dredging was incorporated into the remedy to address navigation requirements through negotiations during the settlement process.
35	Water Board	10/27/2017	Section 7: Recommended Remedial Alternative	The selection of Alternative 4 states that it includes "placement of a clean sand cover over large areas of the Site and is augmented with sediment removal from a localized area which has navigation depth requirements and elevated PCB and mercury concentrations." It appears that this alternative proposes to dredge material in shallower areas that have navigational needs but areas with high levels of COCs are not proposed to be dredged. Please explain.	See response to Comments 26, 27 and 27a.
36	Water Board	10/27/2017	Section 7: Recommended Remedial Alternative	Justification for selection of Alternative 4 includes: "The amount of dredging in this alternative is limited and results in fewer short-term impacts than Alternative 3, yet removes surface and subsurface sediment with high concentrations of both PCB and mercury." Alternative 4, however, does not propose to consistently remove surface and subsurface sediment with high PCB and mercury concentrations (e.g., refer to comment no. 29). Please explain.	See response to Comment 26, 27 and 27a.
37	Water Board	10/27/2017	Section 8.3: Activities Completion Schedule	The post-remedial monitoring plan states that if the post-remedial SWAC exceeds 84 µg/kg PCBs (but is less than 169 µg/kg) and exceeds 0.57 mg/kg mercury (but is less than 1.15 mg/kg) then additional monitoring will be performed 2 years after the first sampling event "to determine if natural attenuation (including sediment deposition) is continuing, such that the SWAC is approaching and will achieve background concentrations within a reasonable time." If the post-remedial SWACs exceed 84 µg/kg PCBs or 0.57 mg/kg mercury then this indicates that the remedial objectives (i.e., cleanup to background) have not been achieved. What is the source of the upper concentration limits cited above (i.e., 169 µg/mg and 1.15 mg/kg)? Explain the rationale for assessing that natural attenuation would be determined to be occurring, such that additional monitoring 2 years later would be used to assess that it is "continuing," using these ranges of values. Also explain the rationale for waiting an additional 2 years to determine if additional remedial efforts would need to be conducted.	Lockheed Martin and General Dynamics submitted a Remedial Action Plan (RAP) for the Regional Board's consideration on October 31, 2014. Appendix E of the RAP proposed post-remedial monitoring using these levels, which are based on twice the cleanup level. Monitoring would have occurred one year after the remedy, and five years after only if the one-year results were above 169 ppb for PCBs or 1.15 ppm for mercury. In the Regional Board's December 18, 2014 comments on the RAP, a concern was raised that the five-year event was not at an appropriate frequencies. Accordingly, all parties – and the Regional Board – agreed to revise the second monitoring event to occur two years after the remedy if necessary.

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38	Water Board	10/27/2017	Appendix A	Under Concentration Analysis it states that target SWAC concentrations are based on regional background values. Under Background Concentrations, it states: "In 2012, the background concentration of PCBs in San Diego Bay was adjudicated as 84 parts per billion (ppb)." This is incorrect. Background PCB values have not been adjudicated for San Diego Bay. There are no regional background concentrations for San Diego Bay. Please revise and correct the text.	The text has been revised to eliminate reference to background levels for San Diego Bay and instead reference the background based bulk sediment cleanup level specified in Finding 12 of the CAO. This change has been made throughout the FS.
39	Water Board	10/27/2017	Appendix A	The Background Concentrations subsection states, "Background concentrations for all sediment constituents assessed here are taken from the Shipyard Sediment Site CAO." This is incorrect. As stated in Finding No. 12 of the Order, background concentrations for total PCBs and mercury applicable to East Basin sediments are 84 parts per billion and 0.57 parts per million, respectively. Revise the text accordingly.	Revised, see response to Comment 38.
40	Water Board	10/27/2017	Appendix A	Under Study Area Data Sources, "all available surficial sediment chemistry data" sources for the study area are listed, but omits the 2009 study referenced in comment no. 4. The 2009 study includes three outfall stations, 18 other stations, and six background reference stations. This study is cited in the reference list but is not listed in the bulleted list of data sources. Please include these data in the calculations and revise accordingly.	The data presented in the 2009 study have been utilized in the FS. See response to Comment 4.
41	Water Board	10/27/2017	Appendix A	Under Study Area Data Sources, the shape of the remedial footprint shown in Figure 3 is explained. It states that a sand cover is proposed to be placed over the highest PCB polygons and the area with highest mercury concentrations is proposed to be dredged. This does not appear to be the case based on review of Figure 3 for the following reasons:	See response to Comment 16. Text was modified as needed to reflect the Alternative 4 remedy modeled in the SWAC calculations. Alternative 4 was developed based on input from the Water Board and Alternative 4 meets the clean-up objectives (based on the SWAC analysis presented in Appendix A) and includes mechanical dredging to meet navigation requirements and increase long-term effectiveness and permanence by removing elevated mercury levels.
41a	Water Board	10/27/2017	Appendix A	The polygon containing LM-C-4 contains the highest mercury concentrations and is only proposed to be covered with sand over the majority of its surface.	See response to Comments 27 and 27a. The FS was revised to include the area designated by LM-C-4 within the remedial dredge prism.
41b	Water Board	10/27/2017	Appendix A	LMC-7 and LM2 have some of the highest mercury concentrations but will not be fully dredged.	See response to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based clean-up objectives provided in the CAO. See response to Comments 27 and 27a. As part of including LM-C-4 in the dredge prism, LM2 was included in the dredging footprint to facilitate constructability of the remedy.
41c	Water Board	10/27/2017	Appendix A	About half of the LM3 polygon is not being remediated yet it contains one of the highest mercury concentrations (0.946 mg/kg).	See response to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based clean-up objectives provided in the CAO.
41d	Water Board	10/27/2017	Appendix A	SQO1 contains the highest total PCBs concentration but is proposed to mostly be dredged, from which it may be inferred that the reason for this remedial approach has more to do with navigation than with removal of sediments with high PCB concentrations.	See responses to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based clean-up objectives provided in the CAO.

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41e	Water Board	10/27/2017	Appendix A	The rationale for the placement of the remedial footprint boundary midway across several polygons is not explained.	See response to Comment 16. The results of the analysis show that the preferred remedial alternative (Alternative 4) meets the SWAC-based clean-up objectives provided in the CAO.
42	Water Board	10/27/2017	Appendix A	Footnote b in Tables 2 and 3 references the 95% upper predictive level from the Shipyard CAO background levels. Background levels were established in Finding 12 of the Order and should be referenced as such throughout the Feasibility Study.	See response to Comment 38.
43	Water Board	10/27/2017	Appendix A	Table 3 lists current (i.e., pre-remedial) contaminant concentrations but tabulates projected (i.e., post-remedial) SWAC calculations. This is misleading because the current concentrations are not used to determine the post-remedial SWACs except in areas that are not subjected to either sand cover or dredging. Revise the columns to show the predicted post-remedial contaminant concentrations that were used to calculate the post-remedial SWACs.	The columns were revised in Table 3 to show the projected concentrations at each station Additionally, subsequent spreadsheet tabs were included to clearly show the assumption for post-remediation concentrations in each polygon in sand cover, dredge, or no active remedy areas.
44	Water Board	10/27/2017	Appendix A	In Dredge Area in Table 3, it is apparent that the SWAC calculations use the background concentrations even for polygons that already have concentrations less than background (and as noted in footnote d). For example, polygon LM-C-2 has a PCB concentration of 18.8 µg/kg but the post-remedial SWAC is calculated using the background PCB concentration of 84 µg/kg. Explain why this methodology was used.	The SWAC analysis was updated to include the lower of current concentrations and median background for post-remediation concentrations in the dredge areas.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
45	Water Board	10/27/2017	Appendix C	The post-remedial monitoring plan as outlined in the Sampling and Analysis Plan in Appendix C needs to include study questions that address remedial success of the sand cover such as: • Has the sand cover been placed over the designated area and has it remained relatively stable over time? • Has sediment mixing occurred to the extent predicted in the Feasibility Study? • Have concentrations of PCBs and mercury in surface sediment been reduced to background levels? • Has bioavailability of PCBs and mercury been reduced? • Has the benthic community benefited following sand cover placement? These questions can be addressed in several ways, including, but not limited to, the following: • Performing post-remedial bathymetric surveys • Collecting sediment cores • Monitoring changes in sediment chemical concentrations at the surface and also within the sand cover to evaluate degree of mixing • Monitoring changes in bioavailability • Performing benthic community assessments • Monitoring changes in toxicity • Monitoring changes in tissue concentrations Revise the monitoring plan accordingly to address appropriate study questions.	The CAO requires the site to be remediated to meet bulk sediment cleanup levels for COCs and provides the specific clean up levels. Based on these bulk sediment clean up objectives, the following questions listed in Comment 45 are applicable to evaluate the effectiveness of the remedy: • Has the sand cover been placed over the designated area and has it remained relatively stable over time? • Have concentrations of PCBs and mercury in surface sediment been reduced to background levels? The long-term monitoring activities that address these relevant questions include the following: • Performing post-remedial bathymetric surveys • Perform visual monitoring of the NW corner area • Monitoring changes in sediment chemical concentrations at the surface Bathymetry surveys were added to the Sampling and Analysis Plan in Appendix C.
46	Water Board	10/27/2017	Appendix C	Climate change and the possibility of more intense rain storms, as well as sea level rise, necessitate consideration of these impacts during remedial design. Revise the monitoring plan to include monitoring of the engineering controls (i.e., amended carbon and coarse material) proposed to be installed near the outfalls.	As discussed in the response to Comment 19, the use of activated carbon has been removed from the remedial alternatives. The potential for more intense rain storms will be considered during remedial design. The monitoring plan was revised to include visual monitoring of the clean sand proposed to be placed near the outfalls. Sand cover is expected to move but the observations will be designed to identify any significant movement of material that might expose the underlying material.
47	Water Board	10/27/2017	Appendix D	Revise the Quality Assurance Project Plan to be consistent with the revised Sampling and Analysis Plan as discussed in comment nos. 45 and 46.	The QAPP was updated as needed to address changes that occur in the SAP through this comment response process.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
48	USFWS	08/04/2017		While risks posed by contaminants in Site sediments to human health and the environment are briefly discussed, and concentration-based remediation goals were developed for PCBs and mercury, the “active remediation contemplated (in the FS) is to address potential impacts and navigation needs envisioned by the San Diego Unified Port.” The occurrence of contaminants, especially those that are man-made at elevated levels is of potential concern for aquatic biota and aquatic-dependent wildlife. We consider concentrations of contaminants in Site sediments to be elevated, even if they are not as elevated as at other contaminated sites in the bay. Our preferred response would be to remove the contaminated sediments using risk-based remediation goals. However, we recognize that complete removal, even to the reference-based concentrations identified, is not feasible for a number of reasons. The Recommended Alternative in the FS (Alternative 4) should reduce contaminant-related risks to Service trust resources by reducing overall concentrations and/or potential for exposure, and as such is acceptable. Although an improvement, post-remedy concentrations of contaminants in Site sediments may pose ongoing risk to ecological receptors and may continue to be of some concern to the Service.	Commented noted and discussed in part in the previous responses. We agree that the preferred alternative cannot practically include full removal and believe it reduces contaminant-related risks to aquatic species under the jurisdiction of USFWS by reducing overall concentrations and/or potential for exposure.
49	USFWS	08/04/2017		SWACs were used to identify contaminants of concern. Had this analysis included an ecological risk-based approach, which would more fully assess impacts to Service trust resources, the use of SWACs instead of individual sample concentrations to identify contaminants of concern would be inappropriate. We recommend that future cleanup projects incorporate the more detailed risk-based analysis to determine cleanup goals.	See response to Comment 48.
50	USFWS	08/04/2017		If feasible, please consider extending the 12-inch cover to the southern edge of the Clean Sand Placement Area, and thereby covering sample site LM-C-7, where reported concentrations for mercury and PCBs are 1,070 µg/kg dw and 198 µg/kg dw, respectively. Doing so would further reduce the potential for exposure of aquatic biota to sediments with some of the higher contaminant levels observed at the Site.	Lockheed Martin proposes to place a 6-inch cover over the LM-C-7 polygon to meet the cleanup criteria on a SWAC basis. However, the dredging footprint has been changed to include polygon LM-C-4 which has the highest mercury concentration at the site. In addition, the sand placement area has been expanded to include polygons SQO2, SQ12, and SQO3, which have PCB concentrations above criteria—132.8, 148.2, and 212.4 ug/kg, respectively, which will further reduce the potential for exposure of aquatic biota to sediments with some of the higher contaminant levels observed at the Site.
51	USFWS	08/04/2017		One of the reasons given for not considering risks posed by bioaccumulative contaminants to fish and wildlife is essentially that the Site is said to be too small to result in significant exposure by mobile species. Although small, we consider the Site to be an important contributor to a type of habitat that is scarce in the northern part of the bay. In addition, the Site (regardless of size) contributes to cumulative exposure and risks for species that forage in San Diego Bay. San Diego Bay is on the Clean Water Act 303(d) list for mercury and PCBs in fish, indicating that cumulative exposure can result in tissue PCB and mercury concentrations that are of concern and even actionable.	Commented noted and discussed in part in the previous responses. We believe the preferred alternative reduces contaminant-related risks to aquatic species under the jurisdiction of USFWS by reducing overall concentrations and/or potential for exposure.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
52	USFWS	08/04/2017		As defined and used in the FS, the term "background" is misleading, and the specific numeric values that were used may not be representative of current conditions in the part of San Diego Bay where the Site occurs. The "background" contaminant levels considered in the FS are actually values used to characterize upper limits on "reference," "site-specific background" or "ambient" contaminant levels specifically for the Shipyards Sediment Site. The values developed for that site are based on concentrations reported for sediments collected as part of the 1998 Regional Bight Monitoring Program (Bight '98) from stations considered representative of reference conditions in the central part of San Diego Bay. There is some uncertainty about whether contaminant levels reported for reference stations in the central part of the bay accurately represent reference concentrations for sites in other parts of the bay, and there is even greater uncertainty about whether contaminant levels observed in reference sediments collected in 1998 accurately represent current conditions at that site or any other sites within San Diego Bay. Consequently, we would like to clarify that the "background" used in the FS should not be automatically interpreted as representative of concentrations that are: (1) naturally occurring, (2) ambient for other sites or for the bay as a whole, or (3) present at this time. To avoid misinterpretation, statements like: "the background concentration of PCBs in San Diego Bay was adjudicated as ..." are more correctly stated as: "the background concentration of PCBs for the Shipyards Site CAO was adjudicated as ..." To be clear, there are no formally established or adjudicated background concentrations for contaminants in sediments of San Diego Bay as a whole.	See response to Comments 7, 9, 38, 39, and 42.
53	USFWS	08/04/2017		As indicated in comment 52, we have questions about how accurately the mercury and PCB concentrations selected for use as remediation goals represent current reference concentrations for the Site (site-specific background). In addition, being reference-based rather than risk-based, the target concentrations may not fully address contaminant risks to fish and wildlife that forage in habitat provided by the Site. However, target concentrations of 570 µg/kg dw for mercury and 84 µg/kg dw for total PCBs are viewed as an improvement over existing conditions for sediments on the Site, and we look forward to seeing that improvement, and the associated reduced risk, over time.	Comment noted. We believe the preferred alternative reduces contaminant-related risks to aquatic species under the jurisdiction of USFWS by reducing overall bulk sediment concentrations and/or potential for exposure.
54	USFWS	08/04/2017		Post-remedy monitoring as described in Section 8 is focused on mercury and PCB levels only. This is important, but the Site provides important benthic habitat that is a limited resource in the northern end of the bay. Monitoring the benthic community would provide some measure of whether the area is realizing the desired habitat improvements. Please consider monitoring for benthic community condition as well.	See response to Comment 45.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
55	USFWS	08/04/2017	Section 8	The overall strategy for post-remedy monitoring (Section 8) raises some questions about the improvements in contaminant concentrations that should be expected. As described in Section 8, the plan is for monitoring to commence one year after implementation of the remedy. Results obtained from that sampling event will be used to estimate post-remedy SWACs for total PCBs and mercury. Those values will be compared with project targets, and potential needs for further action will be assessed. According to the plan, if the newly determined SWACs are between their respective targets and levels at two-times those targets (which are higher than current SWACs), more sampling will be conducted 2 years later (3 years after remedy implementation) to "determine if natural attenuation is continuing." If the new SWACs exceed two-times the target values, Lockheed will be required to reconsider their conceptual site model, and the potential for ongoing sources may need to be investigated. This discussion is concerning because it suggests that final SWACs for mercury and PCBs may be unchanged or worse than current SWACs and may remain that way for an indefinite period of time. We understand that contaminant concentrations in surface sediments sampled at a fixed depth interval (e.g., 6 inches) will change over time if the cover materials are undergoing mixing with Site sediments, settling and compaction. However, the document needs to be more specific in terms of: (1) what the conceptual site model estimates for the timeline over which surface sediments will stabilize; (2) what concentrations not represented in the current SWACs are likely to be present at the site that warrant no additional remedial action (pending additional time for "natural attenuation") for two additional years upon finding SWACs that are up to two times the target SWACs and may be greater than current SWACs; (3) if the remedial effort is limited to a single 2-year monitoring interval, or under what conditions more 2-year monitoring intervals could be added; and (4) how target SWACs are to be ensured as the final concentrations in the top six inches of sediment and over what maximum time frame that will occur. In other words, what specific actions will be considered and over what time frame will they be implemented if SWACs for mercury and PCBs are greater than the target SWACs (and, in fact, potentially greater than current SWACs) after three years?	See response to Comments 37 and 45.
56a	USFWS	08/04/2017	Appendix C	The sampling and analysis plan (SAP) would need to be modified if benthic community is added to the monitoring plan (comment 7).	See response to Comment 45. The SAP was revised to reflect changes made to the monitoring plan.
56b	USFWS	08/04/2017	Appendix C	Surface sediment samples will consist of material from the top 10 cm (4 inches). We prefer that the top 15 cm (6 in) be sampled. If this cannot be done, please explain why.	The top 10 cm are targeted for sediment sampling associated with the monitoring plan to evaluate the biologically active zone. See response to Comment 18.

ID No.	Reviewer	Comment Date	Section Name/Topic	Comment Text	Response Text
56c	USFWS	08/04/2017	Appendix C	Total PCBs will be quantified as the sum of concentrations of 41 individual congeners (Σ41). This allows for direct comparisons with total PCB levels reported by the Bight Regional Monitoring Program (including data used for site-specific reference values at the Shipyards Sediment Site). However, it underestimates what the total PCB concentration would be if quantified as the sum of 100 or more (out of 209) congeners, the sum of homolog classes or as an Aroclor mixture. To provide more accurate measures of total PCB concentrations we recommend that samples also be analyzed for PCBs as homologs or Aroclor.	Lockheed Martin proposed Total PCBs as the sum of concentrations of 41 individual congeners to be consistent with past data for comparison purposes. Specifically, total PCBs Congeners = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206
56d	USFWS	08/04/2017	Appendix C	It might be helpful to add percent moisture, or conversely, solids to the list of conventional analytes.	Agreed.

Notes:

Arms, M. and Jirik, A., 2015. Los Angeles and Long Beach Harbor Toxics TMDL Program Overview. Available online at:
https://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/66_New/15_0617/05LALBTMDLprogramandstudies_stakeholdermtg_20150612.pdf
June 16, 2015.

Lockheed Martin Corporation
Energy, Environment, Safety and Health
2550 North Hollywood Way, Suite 406 Burbank, CA 91505
Telephone: 818.847.0197 Facsimile: 818.847.0256

July 11, 2019

David Gibson
Executive Officer
California Regional Water Quality Control Board, San Diego Region
2375 Northside Drive, Suite 100
San Diego, California 92108-2700
Attn: Sarah Mearon, PG

Via Electronic Mail

Subject: **Proposed Monitoring Program Components – Former Tow Basin and Former Maritime Terminal and Railway Facilities, 3380 North Harbor Drive and 1160 Harbor Drive, San Diego, California (Site ID #2090046)**

Case/Site: **Former Tow Basin and Marine Terminal and Railway**
Cleanup and Abatement Order No. R9-2017-0021
Geotracker Site ID No. T10000002323C

Dear Mr. Gibson and Ms. Mearon:

This letter responds to your May 21, 2019, letter regarding the Feasibility Study (FS) and Post-Remedial Monitoring Plan (Plan). As I mentioned in my May 29, 2019, email, we are in overall agreement with the various monitoring components reflected in your letter, with two important clarifications regarding the Regional Water Quality Control Board's (RWQCB's) comments on adding HEIB-C3 to the bulk sediment sampling locations and on benthic sampling. Our proposed approach to these two monitoring components is discussed below.

As reported to RWQCB counsel, we have also come to agreement (pending final wording and Port Commission approval) with the Port of San Diego (Port) staff to eliminate the use of activated carbon amendments to the clean sand cover in the northwest corner. With approval from the Port Commissioners, the preferred Alternative 4 identified in the FS will be modified to remove the use of activated carbon. We will keep you updated once the Port Commissioners have voted on this issue.

Our response to RWQCB's comments regarding the six post-remedial monitoring components is below, and will be addressed in the revised FS and Plan:

Bulk Sediment Concentrations – The Plan will include surface sediment sampling approximately 1 year after construction is complete at the 36 locations presented on the attached figures (January 2018). The data from these 36 locations and their corresponding polygons were used to establish the predicted post-remedial surface weighted average concentrations (SWAC) for the Site. Post-remedial monitoring will assess the actual post-remedial Site SWAC to determine compliance with the bulk sediment cleanup levels set forth in the Cleanup and Abatement Order [CAO]). Specifically, a site-wide SWAC will be re-calculated to evaluate the post-remedial concentration compared to predicted performance across the area. If the post-remedial SWAC is greater than

84 parts per billion (ppb) but less than 169 ppb for total polychlorinated biphenyls (PCBs) and/or greater than 0.57 part per million (ppm) but less than 1.15 ppm for total mercury, then monitoring will be conducted again 2 years (Year 5) after the first sampling event (Year 2) to determine if natural attenuation (including sediment deposition) is continuing, such that the SWAC is approaching and will achieve background concentrations within a reasonable time. If the post-remedial SWAC is greater than 169 ppb for PCBs or 1.15 ppm for total mercury, then a plan would be submitted for additional actions needed to understand the site conceptual model, including the possibility of post-remedial releases.

The polygon that includes HEIB-C3 is currently represented by SQ01 and Outfall No. 1 is located in this area. A splash pad and channel protection material will be placed to dissipate energy during low tide storm events and minimize sediment erosion. The splash pad and channel protection material will extend over the HEIB-C3 sample location, so sampling in that area will not be possible. We also want to note that there are outstanding issues regarding the collection and analysis of HEIB-C3.

We propose to move SQ01 further upslope to be more representative of the intertidal area (Figure 1). The Final FS will include SQ01 as part of a revised predicted post-remedial SWAC and the sample location modification will be noted in the Plan results. The 36 surface sediment samples will be submitted for total PCBs (congeners), total mercury, total solids, total organic carbon, and grain size.

Bathymetry – We confirm that bathymetry surveys will be included in the final Sampling and Analysis Plan (SAP) as an attachment to the Plan. It is standard practice to perform pre- and post-remedial bathymetry surveys within the remedial footprint. In addition to what will be presented in the SAP, we will perform various bathymetry surveys as part of the construction management process to assess the contractor's compliance with the plans and specifications. Specific methods will be detailed in the Plan and in the revised Remedial Action Plan (RAP).

Porewater Concentrations – We confirm that we will collect and analyze porewater samples from 12 of the 36 bulk sediment locations using in situ passive sampling methods. As agreed, if post-remedial monitoring SWAC results indicate that background levels of 84 ppb for total PCBs and 0.57 ppm for mercury have been achieved and maintained at the Site, the remedial action will comply with the requirements of the CAO. Pre- and post-remedial porewater monitoring will be used to measure any reduction in the bioavailability of these contaminants but will not be used as a direct evaluation of compliance with the CAO. We understand that RWQCB reserves its right to use the porewater monitoring results for all purposes consistent with its enforcement authority.

We will use a stratified random grid sampling design with the purpose of providing coverage of the entire Site (partitioned to provide coverage across the different remedial technologies). Specific methods and locations will be detailed in the Plan and the attached SAP and Quality Assurance Project Plan.

Benthic Community - During discussions with Katie Zeeman of the U.S. Fish and Wildlife Service (USFWS), we understood her concerns regarding shorebird foraging habitat protection in the northwest corner. To that end, we agreed to work with her during remedial design to find a substrate that can be placed over the coarser clean cover material (finer, with some organics) to facilitate recovery of the benthic community. This material must be sized appropriately to remain in place subject to wind, vessel, and tidal processes; it must also provide a suitable substrate for the benthic community and foraging habitat for shorebirds and waterfowl. We agreed to conduct physical monitoring of the northwest corner, consisting of photo documentation at low tide, grain-size determination, and bathymetry. This monitoring will verify that the placed material has remained in place and determine if there is deposition of finer grained material. We also agreed to collect two substrate samples (surface sediment) of the placed material in the northwest corner for enumeration of the benthic community in years 2 and 5.

We included the following response regarding remedial success of the sand cover in our December 26, 2017, letter responding to RWQCB comments provided on October 27, 2017:

The CAO requires the site to be remediated to meet bulk sediment cleanup levels for COCs and provides the specific clean up levels. Based on these bulk sediments clean up objectives, the following questions listed in Comment 45 are applicable to evaluate the effectiveness of the remedy:

- *Has the sand cover been placed over the designated area and has it remained relatively stable over time?*
- *Have concentrations of PCBs and mercury in surface sediment been reduced to background levels?*

The long-term monitoring activities that address these relevant questions include the following:

- *Performing post-remedial bathymetric surveys*
- *Monitoring changes in sediment chemical concentrations at the surface*

Bathymetry surveys were added to the Sampling and Analysis Plan in Appendix C.

Our concern with the collection and interpretation of these types of samples as part of a remedial action is that factors out of our control, including deposition and physical mixing of the surface sediment from vessel traffic and tidal exchanges, will continue to limit ecological conditions within the surface sediment to an early successional stage benthic community following the recolonization process. Technical studies and literature indicate that after the placement of a thin layer of clean cover, the benthic invertebrate community is expected to generally recolonize rapidly within months (Kirtay et al. 2018). Nonetheless, we understand that RWQCB values this information because it is consistent with the San Diego Basin Plan.

To provide data to support the San Diego Basin Plan, we propose to collect benthic community information at eight locations (in addition to the two locations we agreed to collect with Katie Zeeman of USFWS) across the different remedial technologies pre- and post-remedial (Year 2) to assess changes in the benthic community but not to be used as a direct evaluation of compliance with the CAO. We are not including a "background" reference location and will only collect one sample per location. As agreed to regarding porewater sampling, if post-remedial monitoring SWAC results indicate that background levels of 84 ppb for total PCBs and 0.57 ppm for mercury have been achieved and maintained at the Site, the remedial action will comply with the requirements of the CAO.

Any need for compensatory mitigation requirements will be assessed during the permit and approval process after the California Environmental Quality Act process is complete. It is important to note that modifications to existing elevations are minor and over water structures will be permanently removed. This permitting and approval process will also include the 401 Water Quality Certification. This Certification addresses water quality during construction (and monitoring elements) and will need to be in place prior to construction. Specifics related to water quality monitoring, developed with RWQCB, during construction will be detailed in the RAP.

Grain Size – Consistent with your expectations, the 36 surface sediment samples will be submitted for grain size.

Total Organic Carbon - Consistent with your expectations, the 36 surface sediment samples will be submitted for total organic carbon.

Should you have any questions regarding the content of this letter, please do not hesitate to contact me at office: (818) 847-0584 or cell: (818) 641-8290, or at patrick.t.mccullough@lmco.com so we can discuss. Once the FS is submitted, we would appreciate the opportunity to sit down with you to lay out the RAP so we can move forward with the cleanup.

Sincerely,

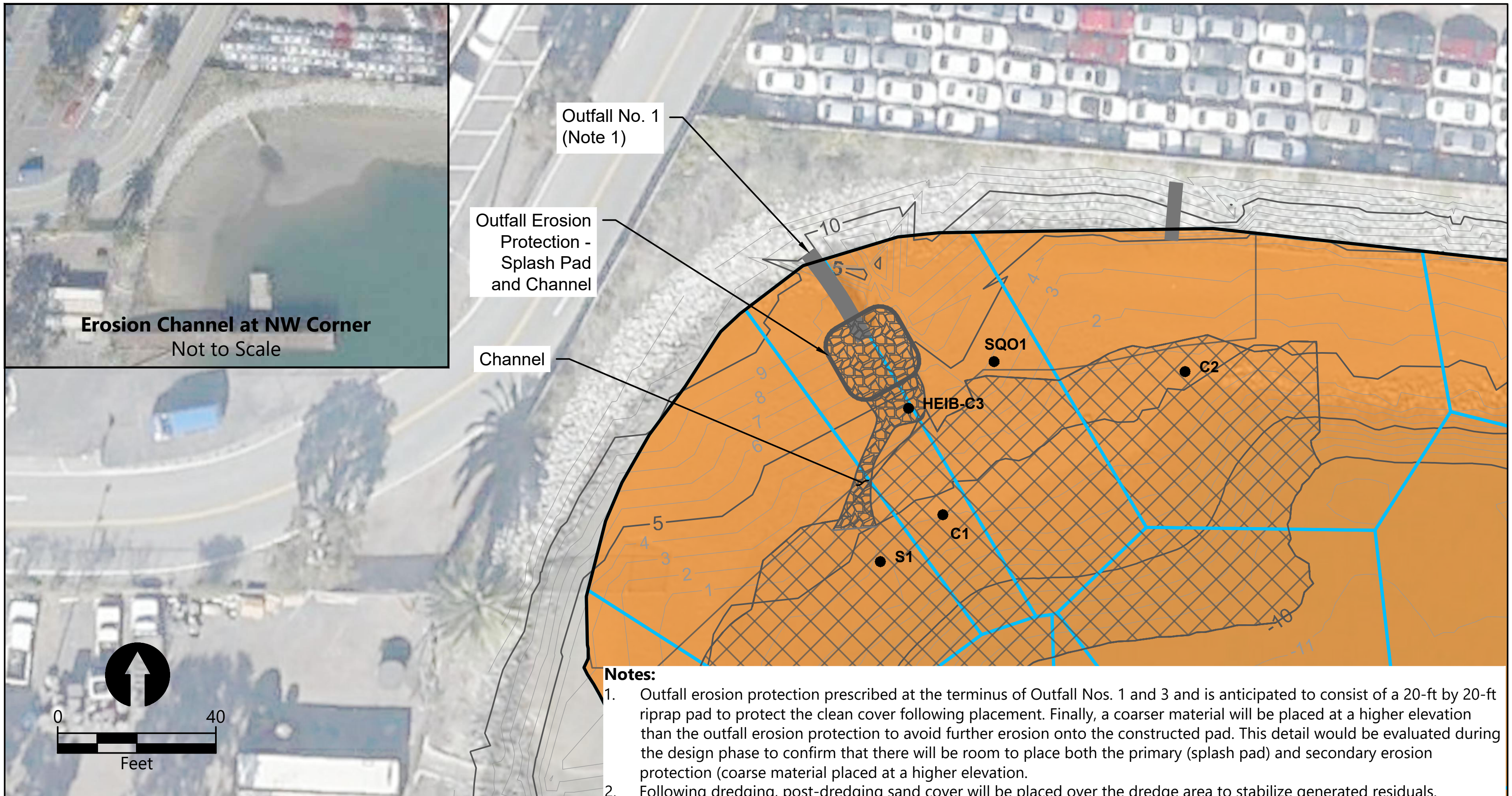
Patrick T. McCullough. PG, CHg, QSD
Environmental Remediation Project Lead
Lockheed Martin Corporation

cc:

Mr. Matthew Schultz. P.E., CDM Smith
Mr. David Templeton, Anchor QEA, LLC
Mr. Norm A. Varney, Lockheed Martin Corporation
Mr. George J. Gigounas, DLA Piper LLP

Attachments:

Figure 1 - Remedial Alternative 4: Sampling Stations at Outfall No. 1



Notes:

1. Outfall erosion protection prescribed at the terminus of Outfall Nos. 1 and 3 and is anticipated to consist of a 20-ft by 20-ft riprap pad to protect the clean cover following placement. Finally, a coarser material will be placed at a higher elevation than the outfall erosion protection to avoid further erosion onto the constructed pad. This detail would be evaluated during the design phase to confirm that there will be room to place both the primary (splash pad) and secondary erosion protection (coarse material placed at a higher elevation.
2. Following dredging, post-dredging sand cover will be placed over the dredge area to stabilize generated residuals.

SOURCE: Aerial from Google Earth Pro. Thiessen polygons from Exponent figure dated November 29, 2017. Bathymetric contours from eTrac, Inc., survey dated July 9, 2016.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- ●# Previous Sampling Location
- Clean Sand Cover Placement Area
- Removal Area
- Remedial Footprint
- Thiessen Polygons
- Splash Pad/Channel Protection

Publish Date: 2019/07/02 2:05 PM | User: mpratschner
Filepath: K:\Projects\1208-General Dynamics\1208- General Dynamics\Alt 4\1208-RP-008 SPLASH PAD.dwg Figure 1

ANCHOR QEA

Figure 1
Remedial Alternative 4: Sampling Stations at Outfall No. 1
Former Tow Basin and Former Marine Terminal and Railway Facilities

CALIFORNIA
Water Boards

GAVIN NEWSOM
GOVERNOR

JARED BLUMENFELD
SECRETARY FOR
ENVIRONMENTAL PROTECTION

San Diego Regional Water Quality Control Board

November 8, 2019

In reply refer to/attn:
T10000002642:Smearon

Mr. Patrick T. McCullough
Lockheed Martin Corporation
2550 North Hollywood Way, Suite 406
Burbank, CA 91505

Subject: **Revised Feasibility Study and Post-Remedial Monitoring Plan – Former Tow Basin and Former Marine Terminal and Railway Facilities, 3380 North Harbor Drive and 1160 Harbor Island Drive, San Diego, California (Site ID #2090046)**

Mr. McCullough:

The California Regional Water Quality Control Board, San Diego Region (San Diego Water Board), has reviewed the August 2019 Revised Feasibility Study and Post-Remedial Monitoring Plan prepared by Anchor QEA LLC. The Feasibility Study (Study) and Post-Remedial Monitoring Plan (Plan) were prepared to address Directives B and E of Cleanup and Abatement Order No. R9-2017-0021 (Order). Lockheed Martin Corporation (LMC) submitted a Feasibility Study and Plan in June 2017. The Board provided comments on the Study and Plan in October 2017. The table below summarizes the formal correspondence between LMC and the Board regarding the Study and Plan between June 2017 and August 2019.

Date	Author	Document Description
June 29, 2017	LMC	Feasibility Study and Post-Remedial Monitoring Plan
October 27, 2017	Water Board	Comments on Feasibility Study and Plan
December 26, 2017	LMC	Response to October 27, 2017, Comments
March 13, 2018	LMC	Additional Response to October 27, 2017, Comments
March 30, 2018	Water Board	Response to March 13, 2018, Letter
May 14, 2018	LMC	Response to March 30, 2018, Letter
July 17, 2018	Water Board	Response to May 14, 2018, Letter
May 21, 2019	Water Board	Summary of Proposed Monitoring Program Components
July 11, 2019	LMC	Response to May 21, 2019, Letter
August 9, 2019	LMC	Revised Feasibility Study and Post-Remedial Monitoring Plan

Our comments on the Revised Study and Plan are provided below. Provide a response to comments by **December 9, 2019**. The Study and Plan are conditionally approved pending receipt of acceptable responses to these comments.

General

1. The San Diego Water Board issued the Order on April 4, 2017. The Order was based on legal authority including Resolution No. 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California*, and *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (Enclosed Bays and Estuaries Plan) (Finding 1). The Enclosed Bays and Estuaries Plan was amended in 2011 and in 2018. [1] The 2018 amendments were approved in March 2019 by the Office of Administrative Law, and while they do not include new objectives, provide an analytical framework based on scientific information, including chemical monitoring, bioassays, and established modeling procedures. That analytical framework should be incorporated into this and future documents, as stated herein. The San Diego Water Board retains full discretion and authority to apply prescribed scientific methods and other performance measures, as appropriate, to evaluate the effectiveness of the remedies implemented.

Section 2: Background and Site Conditions

2. The Study states, "the Water Board concurred that the Former Marine Terminal and Railway Facility did not warrant further investigation and that no further action was required to address landside soil and groundwater based on results of the site assessment (Tetra Tech 2012)." The Water Board's response to the 2012 Tetra Tech report concluded that no further investigation was warranted to address soil impacts but requested additional work to address landside groundwater impacts. The groundwater investigative work was performed in 2015, and the Water Board concurred in 2016 that no additional assessment of landside groundwater impacts was needed. No response is required.

Section 3: CAO-Established Bulk Sediment Cleanup Levels

3. The Study states, "Prior to the CAO (Water Board 2017), sediments targeted for remediation at the site were identified in part through the State of California's SQO process and bracket the 36 impacted locations shown in Figure 1." Please explain what is meant by "bracket."

4. Page 8 of the Study states, "Due to the spatial heterogeneity of sediment chemistry concentrations at the site and mobility of aquatic-dependent wildlife and angler-targeted game species, such as fish and lobster, a SWAC (surface weighted average concentration)-based cleanup level is appropriate and protective for the site." Page 9 of the Study states, "Non-mobile members of the benthic community are expected to live in the top 10 to 15 centimeters (cm) of the sediment bed. By achieving cleanup criteria in the upper 10 to 15 cm of the sediment bed on a SWAC basis, benthic organisms are expected to be protected on a community basis." The Study, therefore, justifies the use of SWACs on a cleanup basis for mobile wildlife and game species, and uses the same justification for the use of SWACs to protect benthic fauna. The San Diego Water Board does not necessarily agree with the reasoning presented in the Study regarding use of SWACs. We do, however, accept the overall approach to the remedy. No response is required.

[1] State Water Resources Control Board. 2018. Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries of California: Sediment Quality Provisions. June 5.

5. The Study references “the State of California’s SQO (State Water Resources Control Board 2009).” The State Water Board adopted amended Sediment Quality Provisions in June 2018, which were approved by the U.S. Environmental Protection Agency in March 2019. The 2018 reference should be used throughout the document. See also comment no. 7.

Section 5.3.4: Remedial Alternative 4: Combination

6. There is a stray character in the last sentence of the second paragraph on page 25. Is there text missing from this sentence? Please clarify.

Section 8.1: Sampling and Analysis Plan

7. The Enclosed Bays and Estuaries Plan was amended in 2011 and 2018 and was approved by the Office of Administrative Law in March 2019. The Study therefore needs to include sample collection and analysis for evaluation of sediment quality objectives. Revise the Plan to include post-remedial sediment quality analysis in accordance with the new regulations. See also comment no. 5.

Appendix A

8. The response to comment 16 in LMC’s December 26, 2017, letter cites, “the SWAC [surface-weighted average concentrations]-based cleanup objectives presented in the CAO.” To clarify, Finding 12 of the Order, which establishes cleanup levels for the site, does not reference SWACs. No response is required.

9. LMC responded to the San Diego Water Board’s May 21, 2019, letter summarizing the monitoring program components in a July 11, 2019, letter. In the letter LMC states that it will include benthic community data collection at ten site locations but will not include a reference or background location. The need for a reference location was discussed at our August 26, 2019, meeting with you and your consultants. Revise the benthic community assessment approach to include a reference location.

Appendix E

10. *General*. The Plan does not include sample collection and analysis for evaluation of sediment quality objectives in accordance with the Enclosed Bays and Estuaries Plan. Revise the Plan to include post-remedial sediment quality analysis in accordance with the new regulations.

11. *General*. The Plan needs to be revised to address comments related to pre- and post-remedial monitoring stated in comments 7, 9, and 10.

12. *Section 1.1*. The Plan lists the following two study questions that will be addressed through collection of surface sediment samples for chemical analysis, and performance of bathymetry surveys:

    - Have concentrations of polychlorinated biphenyls (PCBs) and mercury in surface sediment been reduced to established cleanup levels?
    - Has the sand cover been placed over the designated area and has it remained relatively stable over time?

Other pre- and post-remedial monitoring components have been included in the Plan following discussions with the San Diego Water Board (e.g., porewater sampling and benthic community assessment). These components have been included to address the following study questions that were not included in the Plan:

- Has bioavailability of PCBs and mercury been reduced?
- Has the benthic community been protected from degradation in accordance with the Water Quality Control Plan for Enclosed Bays and Estuaries of California following sand cover placement?

All of the above study questions will be addressed through implementation of the Plan. No response is required.

13. *Table 2.* Table 2 lists the post-remedial monitoring activities. There is a column for pre-remediation sampling and footnote 1 also indicates monitoring activities that will have a pre-remedial component. Provide a revised version of Table 2 that simplifies the proposed sampling scheme for clarity.

14. *Figure 1*. The map shows 11 locations for porewater sampling. Table 3 indicates that 12 locations will be subjected to porewater sampling. Revise the map to include all 12 porewater sampling locations.

15. *Section 4.3*. The Plan proposes to sort the benthos and identify organisms to the lowest taxonomic level for enumeration. How will this information be used to assess benthic community health? Will benthic indices be developed for comparison purposes? Provide additional information on how the pre- and post-remedial benthic community data will be evaluated. Refer to the amended Sediment Quality Provisions as appropriate.

16. *Section 7.1.* The Plan states that reports will be submitted to the San Diego Water Board with reference code T10000002323. Please use the reference code T10000002642 for submitted reports.

Appendix F

17. *General*. The Quality Assurance Project Plan needs to be revised to address comments related to pre- and post-remedial monitoring stated in comments 7, 9, and 10.

18. *Table 1.* Table 1 lists sample containers, sample sizes, holding times, and preservatives. The details for these items are different from those listed in Tables 5 and 7 of Appendix E. Please rectify this information and revise the tables accordingly.

In the subject line of any response, include the reference code **T10000002642:Smearon**. For questions or comments, please contact me by phone at (619) 521-3363 or by email at sarah.mearon@waterboards.ca.gov.

Respectfully,

Sarah Mearon, PG
Senior Engineering Geologist
Site Restoration Unit

SAM/jpa/jm/sam

cc: Ms. Julie Macedo, State Water Resources Control Board Office of Enforcement (Julie.Macedo@waterboards.ca.gov)
Mr. George Gigounas, DLA Piper (George.Gigounas@dlapiper.com)
Ms. Kimberly Hyde, DLA Piper (Kimberly.Hyde@dlapiper.com)
Mr. Norm Varney, LMC (Norman.A.Varney@lmco.com)
Mr. Matthew Schultz, CDM Smith (schultzMF@cdmsmith.com)
Mr. David Templeton, Anchor QEA (dtempleton@anchorqea.com)
Mr. Mark Russell, Russell Environmental Group LLC (mark@RussellEnv.com)
Mr. John Carter, Port of San Diego (jcarter@portofsandiego.org)
Mr. Kelly Richardson, Latham & Watkins (Kelly.Richardson@LW.com)
Dr. Katie Zeeman, USFWS (Katie_Zeeman@fws.gov)

Tech Staff Info & Use	
Order No.	R9-2017-0021
Geotracker Global ID	T10000002642
Cost Recovery ID	2090046

Lockheed Martin Corporation
Energy, Environment, Safety and Health
2550 North Hollywood Way, Suite 406   Burbank, CA 91505
Telephone: 818.847.0197   Facsimile: 818.847.0256

December 9, 2019

Sarah Mearon
California Regional Water Quality Control Board, San Diego Region
2375 Northside Drive, Suite 100
San Diego, California 92108-2700

Via Electronic Mail

Subject: **Response to November 8, 2019 Comment Letter**
Feasibility Study and Post-Remedial Monitoring Plan
Cleanup and Abatement Order No. R9-2017-0021

Case/ Site: **Former Tow Basin and Marine Terminal and Railway**
Geotracker Site ID No. T10000002642
Reference Code: T10000002642:Smearon

Dear Ms. Mearon:

This letter presents Lockheed Martin Corporation (LMC) responses to the San Diego Regional Water Quality Control Board's (Water Board's) November 8, 2019 comment letter regarding the Feasibility Study and Post-Remedial Monitoring Plan in connection with the Former Tow Basin and Former Marine Terminal and Railway Facilities Site (Site; IDs # 2090016 and #2090046). Table 1 includes both the Water Board's comments and LMC response to each comment.

Based on our December 4, 2019 conference call, LMC recommends that the FS be approved separate from the Post Remedial Monitoring Plan. By separating these two documents, the Remedial Action Plan (RAP) can be finalized (pending written approval of the FS) and the permitting and approval process can be advanced. This allows for additional discussion regarding the scope of and approach for the Post Remedial Monitoring Plan. The FS will then address specific November 8, 2019 comments (1 through 9), remove Section 8, remove Appendices E and F and note that the Post Remedial Monitoring Plan will be submitted prior to the RAP. LMC expects to submit a revised Final FS to this effect in early 2020 and receive subsequent written approval.

Meanwhile, we will coordinate mutually acceptable times to continue our discussion regarding the Post Remedial Monitoring Plan.   Should you have any questions regarding our responses, please do not hesitate to contact me at office: (818) 847-0584 or cell: (818) 641-8290, or at patrick.t.mccullough@lmco.com.

Sincerely,

Patrick T. McCullough. PG, CHg, QSD
Environmental Remediation Project Lead
Lockheed Martin Corporation

Attachment – Table 1- Comment and Response Matrix – November 8, 2019 Water Board Letter

cc: Mr. David Templeton, Anchor QEA, LLC

Ms. Julie Macedo, State Water Resources Control Board (Julie.Macedo@waterboards.ca.gov)

Mr. George Gigounas, DLA Piper (George.Gigounas@dlapiper.com)

Ms. Kimberly Hyde, DLA Piper (Kimberly.Hyde@dlapiper.com)

Mr. Norm Varney, LMC (Norman.A.Varney@lmco.com)

Mr. Matthew Schultz, CDM Smith (schultzMF@cdmsmith.com)

Mr. David Templeton, Anchor QEA (dtempleton@anchorqea.com)

Mr. Mark Russell, Russell Environmental Group LLC (mark@RussellEnv.com)

Mr. John Carter, Port of San Diego (jcarter@portofsandiego.org)

Mr. Kelly Richardson, Latham & Watkins (Kelly.Richardson@LW.com)

Dr. Katie Zeeman, USFWS (Katie_Zeeman@fws.gov)

Mr. David Templeton, Anchor QEA, LLC

Table 1 - Comment and Response Matrix – November 8, 2019 Water Board Letter

Feasibility Study and Post-Remedial Monitoring Plan
Former Tow Basin and Former Marine Terminal and Railway Facilities/Harbor Island: East Basin Sediment Assessment/Cleanup, San Diego, California
(Site ID 2090046)
Reference Code T10000002642

ID No.	Section Name/Topic	Comment Text	Response Text
	Introduction	Provide a response to comments by December 9, 2019. The Study and Plan are conditionally approved pending receipt of acceptable responses to these comments.	Based on a discussion with San Diego Regional Water Quality Control Board (Water Board) staff on December 4, 2019, Lockheed Martin Corporation (LMC) recommends that the Feasibility Study (FS) be approved separate from the Post Remedial Monitoring Plan. By separating these two documents, the Remedial Action Plan (RAP) can be finalized (pending written approval of the FS) and the permitting and approval process can be advanced. This allows for additional discussion regarding the scope of and approach for the Post Remedial Monitoring Plan. The FS will then address specific November 8 comments (1 through 9), remove Section 8, remove Appendices E and F, and note that the scope and approach for the Post Remedial Monitoring Plan, to be submitted prior to the RAP, will address and integrate the following: • The 2017 Settlement Agreement. • CAO (Water Board 2017) Section 12 that establishes a bulk sediment cleanup to background (not risk based) concentrations of 84 micrograms per kilogram (µg/kg) total PCBs and 0.57 milligrams per kilogram (mg/kg) total mercury. • The 2011 and 2018 amended Enclosed Bays and Estuaries Plan, where the 2018 amendments were approved in March 2019 by the Office of Administrative Law.
1	General	The Enclosed Bays and Estuaries Plan was amended in 2011 and in 2018. 1 The 2018 amendments were approved in March 2019 by the Office of Administrative Law, and while they do not include new objectives, provide an analytical framework based on scientific information, including chemical monitoring, bioassays, and established modeling procedures. That analytical framework should be incorporated into this and future documents, as stated herein. The San Diego Water Board retains full discretion and authority to apply prescribed scientific methods and other performance measures, as appropriate, to evaluate the effectiveness of the remedies implemented.	See response to the Introduction Comment. Under State Water Board Resolution No. 92-49, Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304, the Water Board may prescribe alternative cleanup levels less stringent than background sediment chemistry concentrations if attainment of background concentrations is technologically or economically infeasible. Specifically, LMC was directed to take all corrective actions necessary to clean up and abate COC concentrations in Site sediments to background concentrations or to alternative cleanup levels that meet the California Sediment Quality Objectives (SQOs) for benthic community protection and human health in the Bays and Estuaries Plan and the toxicity water quality objective in the Basin Plan for the protection of aquatic-dependent wildlife. The CAO (Water Board 2017) Section 12 establishes a bulk sediment cleanup to background concentrations of 84 µg/kg total polychlorinated biphenyls (PCBs) and 0.57 mg/kg total mercury. The scope and approach for the Post Remedial Monitoring Plan will need to address and integrate the following: • The 2017 Settlement Agreement. • CAO (Water Board 2017) Section 12 that establishes a bulk sediment cleanup to background concentrations of 84 µg/kg total PCBs and 0.57 mg/kg total mercury. • The 2011 and 2018 amended Enclosed Bays and Estuaries Plan, where the 2018 amendments were approved in March 2019 by the Office of Administrative Law.

ID No.	Section Name/Topic	Comment Text	Response Text
2	Background and Site Conditions	The Study states, "the Water Board concurred that the Former Marine Terminal and Railway Facility did not warrant further investigation and that no further action was required to address landside soil and groundwater based on results of the site assessment (Tetra Tech 2012)." The Water Board's response to the 2012 Tetra Tech report concluded that no further investigation was warranted to address soil impacts but requested additional work to address landside groundwater impacts. The groundwater investigative work was performed in 2015, and the Water Board concurred in 2016 that no additional assessment of landside groundwater impacts was needed. No response is required.	No response required.
3	CAO – Established Bulk Sediment Cleanup Levels	The Study states, "Prior to the CAO (Water Board 2017), sediments targeted for remediation at the site were identified in part through the State of California's SQO process and bracket the 36 impacted locations shown in Figure 1." Please explain what is meant by "bracket."	The SQO analytical framework (Part 1) was applied to a number of stations within the Site that is now defined by the 36 polygons. Specifically, investigations at both the former Tow Basin and Lockheed Marine Terminal and Railway (LMT) sites have indicated elevated levels of chemicals in surface sediments, as well as indications of possible benthic community impairment at some stations (Haley & Aldrich and Weston 2011; TetraTech and Weston 2012). Mercury and PCBs were identified by the Water Board as elevated chemicals, possibly site-related (RWQCB 2013). A stressor identification conducted according to SQO guidance was unable to clearly establish chemical causation for the observed impairment (Exponent 2013) and these locations were inclusive of areas further detailed with the 36 locations. Rather than continue to a higher tier of assessment at these sites, including analysis of possible food-web risks, a decision was made to evaluate the feasibility of remediation to reduce surface sediment concentrations to background levels. Subsequently, background-based bulk sediment cleanup levels applicable to the East Basin have been established as cleanup targets by Finding 12 of the CAO for the Tow Basin and LMT Sites (RWQCB 2017) and are referred to as "established bulk sediment cleanup levels."

ID No.	Section Name/Topic	Comment Text	Response Text
4	CAO – Established Bulk Sediment Cleanup Levels	Page 8 of the Study states, "Due to the spatial heterogeneity of sediment chemistry concentrations at the site and mobility of aquatic-dependent wildlife and angler-targeted game species, such as fish and lobster, a SWAC (surface weighted average concentration)-based cleanup level is appropriate and protective for the site." Page 9 of the Study states, "Non-mobile members of the benthic community are expected to live in the top 10 to 15 centimeters (cm) of the sediment bed. By achieving cleanup criteria in the upper 10 to 15 cm of the sediment bed on a SWAC basis, benthic organisms are expected to be protected on a community basis." The Study, therefore, justifies the use of SWACs on a cleanup basis for mobile wildlife and game species, and uses the same justification for the use of SWACs to protect benthic fauna. The San Diego Water Board does not necessarily agree with the reasoning presented in the Study regarding use of SWACs. We do, however, accept the overall approach to the remedy. No response is required.	No response required. See response to Comment 1.
5	CAO – Established Bulk Sediment Cleanup Levels	The Study references "the State of California's SQO (State Water Resources Control Board 2009)." The State Water Board adopted amended Sediment Quality Provisions in June 2018, which were approved by the U.S. Environmental Protection Agency in March 2019. The 2018 reference should be used throughout the document. See also comment no. 7.	See response to Comment 1.
6	Remedial Alternative 4: Combination	There is a stray character in the last sentence of the second paragraph on page 25. Is there text missing from this sentence? Please clarify.	The ", 1," is a typo and will be corrected.
7	Sampling and Analysis Plan	The Enclosed Bays and Estuaries Plan was amended in 2011 and 2018 and was approved by the Office of Administrative Law in March 2019. The Study therefore needs to include sample collection and analysis for evaluation of sediment quality objectives. Revise the Plan to include post-remedial sediment quality analysis in accordance with the new regulations. See also comment no. 5.	See response to Comment 1.

ID No.	Section Name/Topic	Comment Text	Response Text
8	Appendix A	The response to comment 16 in LMC's December 26, 2017, letter cites, "the SWAC [surface-weighted average concentrations]-based cleanup objectives presented in the CAO." To clarify, Finding 12 of the Order, which establishes cleanup levels for the site, does not reference SWACs. No response is required.	No response required.
9	Appendix A	LMC responded to the San Diego Water Board's May 21, 2019, letter summarizing the monitoring program components in a July 11, 2019, letter. In the letter LMC states that it will include benthic community data collection at ten site locations but will not include a reference or background location. The need for a reference location was discussed at our August 26, 2019, meeting with you and your consultants. Revise the benthic community assessment approach to include a reference location.	See response to Comment 1. Please note the SQO benthic community framework does not include the collection reference location(s) in the vicinity of the Site.
10	Appendix E	*General.* The Plan does not include sample collection and analysis for evaluation of sediment quality objectives in accordance with the Enclosed Bays and Estuaries Plan. Revise the Plan to include post-remedial sediment quality analysis in accordance with the new regulations.	See response to Comment 1.
11	Appendix E	*General.* The Plan needs to be revised to address comments related to pre- and post-remedial monitoring stated in comments 7, 9, and 10.	See response to Comment 1.

ID No.	Section Name/Topic	Comment Text	Response Text
12	Appendix E	*Section 1.1.* The Plan lists the following two study questions that will be addressed through collection of surface sediment samples for chemical analysis, and performance of bathymetry surveys: • Have concentrations of polychlorinated biphenyls (PCBs) and mercury in surface sediment been reduced to established cleanup levels? • Has the sand cover been placed over the designated area and has it remained relatively stable over time? Other pre- and post-remedial monitoring components have been included in the Plan following discussions with the San Diego Water Board (e.g., porewater sampling and benthic community assessment). These components have been included to address the following study questions that were not included in the Plan: • Has bioavailability of PCBs and mercury been reduced? • Has the benthic community been protected from degradation in accordance with the Water Quality Control Plan for Enclosed Bays and Estuaries of California following sand cover placement? All of the above study questions will be addressed through implementation of the Plan. No response is required.	See response to Comment 1.
13	Appendix E	*Table 2.* Table 2 lists the post-remedial monitoring activities. There is a column for pre-remediation sampling and footnote 1 also indicates monitoring activities that will have a pre-remedial component. Provide a revised version of Table 2 that simplifies the proposed sampling scheme for clarity.	Table 2 will be revised to increase clarity.
14	Appendix E	*Figure 1.* The map shows 11 locations for porewater sampling. Table 3 indicates that 12 locations will be subjected to porewater sampling. Revise the map to include all 12 porewater sampling locations.	Figure 1 will be corrected.

ID No.	Section Name/Topic	Comment Text	Response Text
15	Appendix E	*Section 4.3.* The Plan proposes to sort the benthos and identify organisms to the lowest taxonomic level for enumeration. How will this information be used to assess benthic community health? Will benthic indices be developed for comparison purposes? Provide additional information on how the pre- and post-remedial benthic community data will be evaluated. Refer to the amended Sediment Quality Provisions as appropriate.	See response to Comment 1.
16	Appendix E	*Section 7.1.* The Plan states that reports will be submitted to the San Diego Water Board with reference code T10000002323. Please use the reference code T10000002642 for submitted reports.	This reference code will be used.
17	Appendix F	*General.* The Quality Assurance Project Plan needs to be revised to address comments related to pre- and post-remedial monitoring stated in comments 7, 9, and 10.	See response to Comment 1.
18	Appendix F	*Table 1.* Table 1 lists sample containers, sample sizes, holding times, and preservatives. The details for these items are different from those listed in Tables 5 and 7 of Appendix E. Please rectify this information and revise the tables accordingly.	See response to Comment 1.

San Diego Regional Water Quality Control Board

January 14, 2020

In reply refer to/attn:
T10000002642:Smearon

Mr. Patrick T. McCullough
Lockheed Martin Corporation
2550 North Hollywood Way, Suite 406
Burbank, CA 91505

Subject: Response to November 8, 2019, Comment Letter, Feasibility Study and Post-Remedial Monitoring Plan – Former Tow Basin and Former Marine Terminal and Railway Facilities, 3380 North Harbor Drive and 1160 Harbor Island Drive, San Diego, California (Site ID #2090046)

Mr. McCullough:

The California Regional Water Quality Control Board, San Diego Region (San Diego Water Board), has reviewed Lockheed Martin Corporation's (LMC) December 9, 2019, *Response to November 8, 2019, Comment Letter* (Response to Comments) regarding the Feasibility Study (Study) and Post-Remedial Monitoring Plan (Plan) for the above site.

Our November 8, 2019, comment letter (November 8, 2019, Letter) stated that the San Diego Water Board would conditionally approve the Study and Plan pending receipt of acceptable responses to these comments. We do not find the Response to Comments to be acceptable because the responses regarding sediment quality objectives and the benthic reference station imply that these required modifications to the Plan are up for further negotiation; however, that is not the case. The Study and Plan, therefore, are not approved at this time.

We agree, however, with LMC's suggestion that the Study be approved separately from the Plan to facilitate finalization of the Remedial Action Plan (RAP) as well as associated permitting tasks. The Response to Comments proposes that a Revised Final Study be submitted in early 2020 that will address comments 1 through 9 of the November 8, 2019, letter, all of which are specific to the Study. The Revised Final Study will remove Section 8 as well as Appendices E and F, which are specific to the Plan. These components of the Study will be part of the separate Plan. The submittal date for the Plan is to be determined but will occur prior to RAP submittal. We concur with this proposal.

LMC also states that separating the two approvals "allows for additional discussion regarding the scope of and approach for the [Plan]." To this end we have scheduled a teleconference with LMC and its consultants on February 5, 2020, as requested by LMC. Given the 2018 amendments to the Enclosed Bays and Estuaries Plan, approved by the Office of Administrative Law and now in effect, our position is that all ongoing and future cleanups must comply with such amendments. We can resolve this informally, or refer the matter to the San Diego Regional

Board or its delegate for consideration. Such referral would not require a hearing, but would seek confirmation of staff's position that all orders and work must comply with current environmental regulations. Should you wish to have counsel present at the February 5, 2020, meeting, please let us know. In the interim, you may submit a revision to the Plan prior to that date consistent with our position as stated in the November 8, 2019, Letter and this response.

In the subject line of any response, include the reference code **T10000002642:Smearon**. For questions or comments, please contact me by phone at (619) 521-3363 or by email at sarah.mearon@waterboards.ca.gov.

Respectfully,

Kelly Dorsey for

Sarah Mearon, PG
Senior Engineering Geologist
Site Restoration Unit

SAM/kkd/jm/sam

cc: Ms. Julie Macedo, State Water Resources Control Board Office of Enforcement (Julie.Macedo@waterboards.ca.gov)
Mr. George Gigounas, DLA Piper (George.Gigounas@dlapiper.com)
Ms. Kimberly Hyde, DLA Piper (Kimberly.Hyde@dlapiper.com)
Mr. Norm Varney, LMC (Norman.A.Varney@lmco.com)
Mr. Matthew Schultz, CDM Smith (schultzMF@cdmsmith.com)
Mr. David Templeton, Anchor QEA (dtempleton@anchorqea.com)
Mr. Mark Russell, Russell Environmental Group LLC (mark@RussellEnv.com)
Mr. John Carter, Port of San Diego (jcarter@portofsandiego.org)
Mr. Kelly Richardson, Latham & Watkins (Kelly.Richardson@LW.com)
Dr. Katie Zeeman, USFWS (Katie_Zeeman@fws.gov)

Tech Staff Info & Use	
Order No.	R9-2017-0021
Geotracker Global ID	T10000002642
Cost Recovery ID	2090046

APPENDIX B: SWAC ANALYSIS OF EAST BASIN REMEDIATION TECHNICAL MEMORANDUM

Exponent®
15375 SE 30th Place, Suite 250
Bellevue, WA 98007

July 2019

Feasibility Analysis of East Basin Remediation

Objective

Investigations at both the former Tow Basin and Lockheed Marine Terminal and Railway (LMT) sites have indicated elevated levels of chemicals in surface sediments, as well as indications of possible benthic community impairment at some stations (Haley & Aldrich and Weston 2011; TetraTech and Weston 2012). Mercury and PCBs have been identified by the San Diego Regional Water Quality Control Board (the Board) as elevated chemicals, possibly site-related (RWQCB 2013). A stressor identification conducted according to California Sediment Quality Objective (SQO) guidance was unable to clearly establish chemical causation for the observed impairment (Exponent 2013). Rather than continue to a higher tier of assessment at these sites, including analysis of possible food-web risks, a decision was made to evaluate the feasibility of remediation to reduce surface sediment concentrations to background levels. Background-based bulk sediment cleanup levels applicable to the East Basin have been established as cleanup targets by Finding 12 of the Cleanup and Abatement Order (CAO) for the Tow Basin and LMT Sites (RWQCB 2017), and are hereafter referred to as "established bulk sediment cleanup levels". The following is a summary of the feasibility of remediation to these target levels on a Surface-Area Weighted Average Concentration (SWAC) basis. The primary remedial alternative assessed is Alternative 4, which consists of placement of a 6" sand cover over areas of elevated contaminant concentration to reduce surface sediment concentration and associated exposure, combined with limited dredging of areas with elevated mercury (e.g., LM-C-4) concentrations and navigation requirements (i.e., areas at an elevation higher than -10 feet MLLW). The thickness of the cover was set to insure a concentration attenuation factor sufficient to achieve SWACs that will be at or below established bulk sediment cleanup levels.

Remedial Footprint Determination

Study Area

This analysis is for the combined former Tow Basin and LMT sites, forming a contiguous area of approximately 4 acres at the extreme northwestern end of the East Basin—a shallow,

APPENDIX B
EXPONENT JULY 2019 TECHNICAL MEMORANDUM
NORTHWEST PORTION OF EAST BASIN

Site Locations

Former Tow Basin Facility
T10000002642
3380 North Harbor Drive
San Diego, California 92101

Lockheed Marine Terminal and Railway
T10000002323
1160 Harbor Island Drive
San Diego, California 92101

Prepared by
Anchor QEA, LLC
9700 Research Drive
Irvine, California 92618

July 2019

artificial impoundment, created by the manmade peninsula known as Harbor Island (Figure 1). The study area is bordered by rip-rap shoreline to the north and west (toe of the rip-rap slope), by the Sunroad Resort Marina (SRM) to the southeast, and by a line parallel to and equidistant from the 4th and 5th finger piers from the west end of the SRM. This study area is consistent with the spatial extent and focus of all previous in-water investigations at the two constituent sites.

Concentration Analysis

All evaluations of sediment concentrations that follow are based on SWACs for surficial sediments (either 0 to 10 cm or 0 to 6 in., depending on the source study). SWACs have been determined using Thiessen polygon analysis. Thiessen polygons are defined by orthogonal lines drawn through the midpoints of lines connecting adjacent sample locations. In this way, each point on the map is associated with and presumed to be represented by the nearest sample location, without interpolation or averaging between samples. SWAC values for total PCBs and mercury have been calculated for the study area from existing data (see below).

Target Cleanup Concentrations

Bulk sediment cleanup levels for PCBs and mercury at the Site have been established as 84 µg/kg dw and 0.57 mg/kg dw, respectively, as defined in Finding 12 of the CAO. The primary cleanup objective is to achieve post-remedial SWACs at or below these established bulk sediment cleanup levels.

Study Area Data Sources

The SWAC analysis is based on a pool of available surficial sediment chemistry data from the study area, and includes the following sources:

- 2007 East Basin characterization study surface grabs and piston core surficial samples (0 to 6 in. depth, 21 total stations)
- 2010 Former Tow Basin SQO study surface grabs (0 to 10 cm depth, 5 stations)
- 2011 LMT SQO study surface grabs (0 to 10 cm depth, 3 stations, with 1 duplicate)

- 2011 LMT vertical extent piston-core surficial samples (0 to 6 in. depth, 7 stations, with 1 duplicate).

Data compiled from these sources are shown in Table 1. Figure 2 is the Thiessen polygon map resulting from the station distribution of this composite data set.

SWAC Calculation

Current PCB and mercury SWAC calculations and ratios of current SWACs to established bulk sediment cleanup levels are shown in Table 2. Several alternative approaches were evaluated for reducing PCB and mercury SWACs, including a strict "hill-topping" approach (highest concentration polygons remediated first) for PCBs and mercury. The selected remedial footprint (Alternative 4, Figure 3) is a combination sand cover and dredging approach that was designed based on input from project stakeholders, as well as the established bulk sediment cleanup levels specified in the CAO. Final dredge and cover footprints were straightened to form a contiguous, implementable design, Based on these constructability considerations, any given polygon could include sub-areas that fall into multiple remedial categories (i.e., no action, sand cover, or dredge and cover). In such cases, polygons are subdivided further, according to the remedial categories for purposes of calculating the SWAC. The sub-areas are calculated and addressed separately, as shown in the post-remedial SWAC calculation tables (Tables 3, 4, and 5). The combined result is then incorporated into the predicted site-wide SWAC.

If a sand cover is designed such that surficial sediment concentrations are reduced by 75%, a sand cover only remedy over the entire footprint (without dredging; Alternative 2) would be sufficient to achieve SWACs at the established bulk sediment cleanup levels, within an error of 1 percent (Table 3).

In order to address additional stakeholder concerns, it was agreed that a portion of the Site would be dredged and replaced with clean fill (see Figure 3). Even though surficial PCB and mercury concentrations in the dredged areas immediately following dredging will be negligible, redistribution of surface sediments will occur over time between sand cover, dredge, and natural attenuation areas, resulting in an eventual equilibrium concentration within the dredged footprint. For purposes of predicting stable post-remedial SWACs under the selected cover/dredge remedy (Alternative 4), we have conservatively assumed that concentrations within the removal footprint will be the lower of current conditions or "typical" background concentrations. Typical background levels used solely for this purpose were taken as median concentrations from the Shipyards Site reference pool used to derive the background-based established bulk sediment cleanup levels (RWQCB 2012b, Tables 18-2 and 18-4). Both PCB and mercury SWACs are further reduced under this set of assumptions, resulting in predicted post-remedial SWACs well below established bulk sediment cleanup levels for both chemicals (Table 4).

Further expansion of the dredge footprint is unnecessary to achieve the established bulk sediment cleanup levels. However, application of the post-remedial assumptions described above to an expanded dredging remedial scenario (Alternative 3, see Figure 4) would further reduce PCB and mercury SWACs across the site (Table 5).

Post-remedial monitoring will be required to demonstrate that SWACs are below the established bulk sediment cleanup levels after a year of equilibration. Under the selected remedy (Alternative 4), the area of the sand cover is 115,000 ft^2 (76% of the study area). The dredge area footprint covers 23,444 ft^2 (16% of the study area).

References

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Haley & Aldrich and Weston. 2009. East Basin evaluation of data distribution and identification of former Tow Basin COPCs, San Diego, California. Technical Memorandum. July 9, 2009.

Haley & Aldrich and Weston. 2011. Report on sediment quality objectives sampling, former Tow Basin, East Basin of San Diego Bay, San Diego, California. Prepared for the San Diego Unified Port District, Lockheed Martin Corp., and General Dynamics Corp. Submitted to

Regional Water Quality Control Board, San Diego CA. March 10, 2011. Haley & Aldrich, Inc., and Weston Solutions, Inc. 3412 pp.

California Regional Water Quality Control Board, San Diego Region (RWQCB). 2012a. Cleanup and Abatement Order No. R9-2012-0024. Shipyard Sediment Site, San Diego Bay, San Diego, CA. March 14, 2012. 49 pp.

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California Regional Water Quality Control Board, San Diego Region (RWQCB). 2013. Letter to D.W. Moore, General Dynamics, Corp., San Diego, CA, dated June 25, 2103, regarding report on sediment quality objectives sampling, former Tow Basin study area of East Basin of San Diego Bay, San Diego, California, March 10, 2011. California Regional Water Quality Control Board, San Diego Region.

California Regional Water Quality Control Board, San Diego Region (RWQCB). 2014. Cleanup and Abatement Order No. R9-2014-0085. An order directing TDY Industries, LLC, TDY Holdings LLC, and Teledyne Ryan Aeronautical Company to cleanup and abate the effects of waste discharged from the former facility at 2701 North Harbor Drive to the Laurel Hawthorn embayment of San Diego Bay, San Diego, California. July 25, 2014. 31 pp.

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California Regional Water Quality Control Board, San Diego Region (RWQCB). 2017. An order directing Lockheed Martin Corporation to clean up and abate the effects of waste discharged from the former Tow Basin and former Marine Terminal and Railway facilities at 3380 North Harbor Drive and 1160 Harbor Island Drive to the East Basin of San Diego Bay, San Diego, California. Cleanup and Abatement Order No. R9-2017-0021. April 4, 2017.

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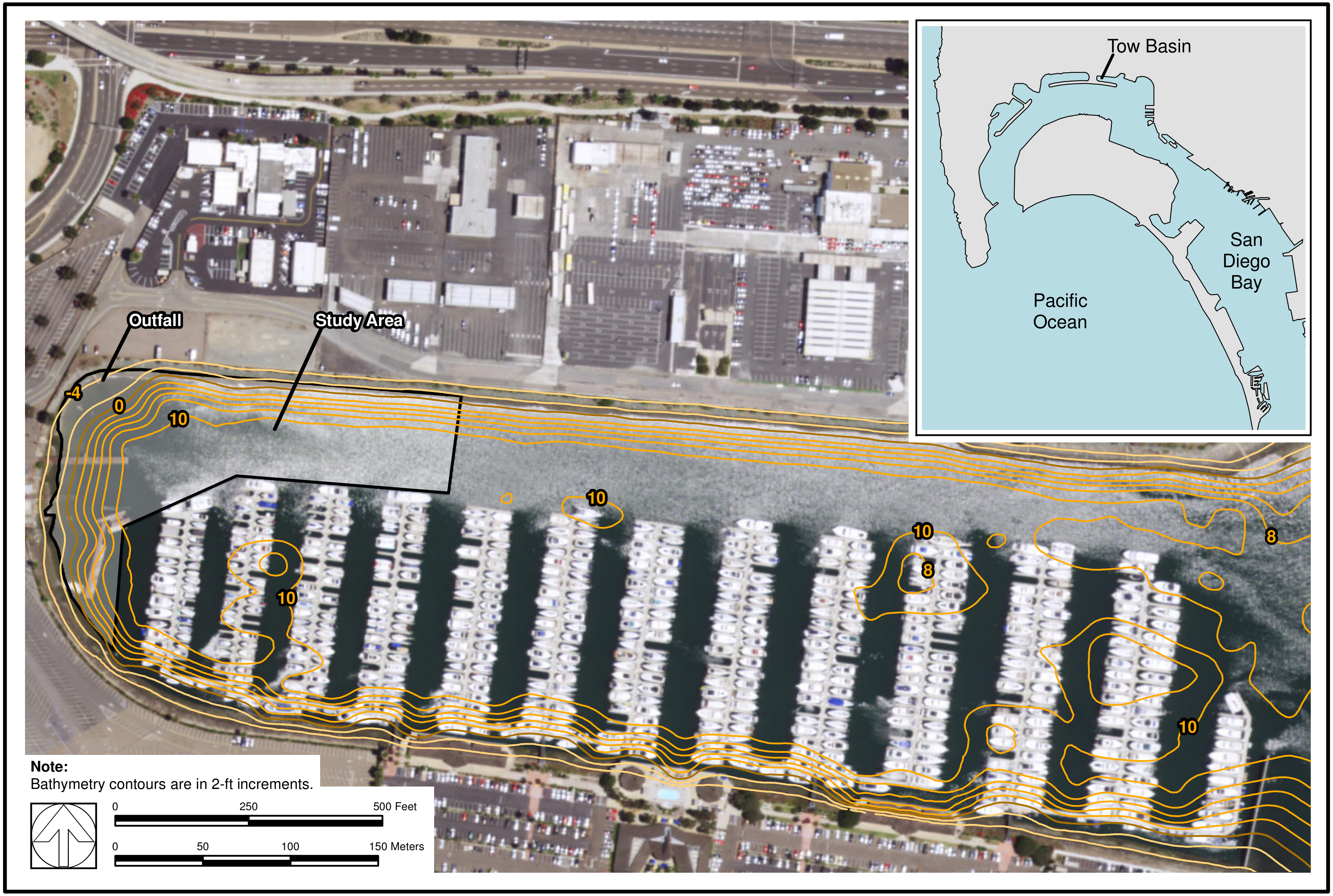

Figure 1. East Basin Bathymetry

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January 8, 2018

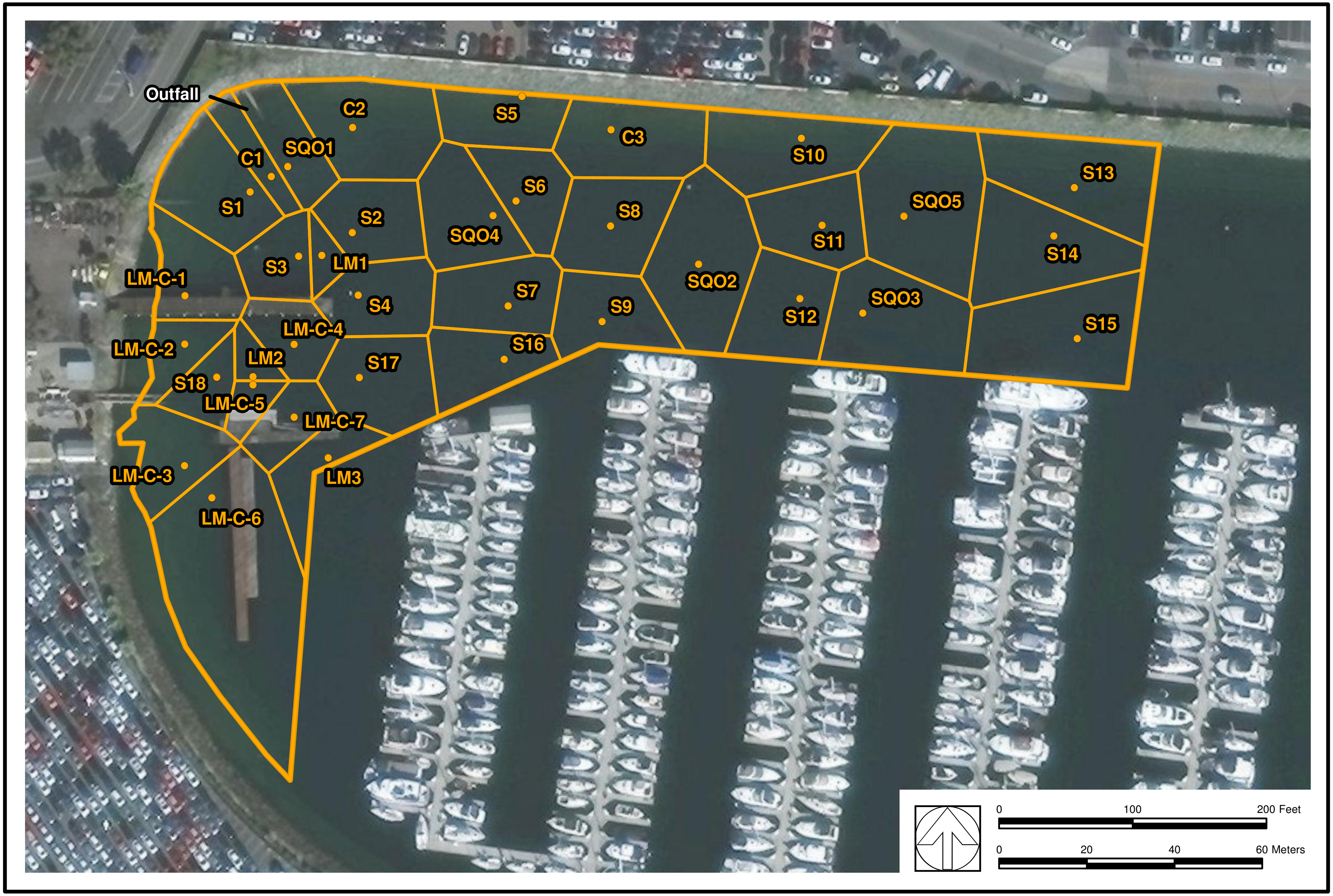

Figure 2. Thiessen polygons

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January 8, 2018

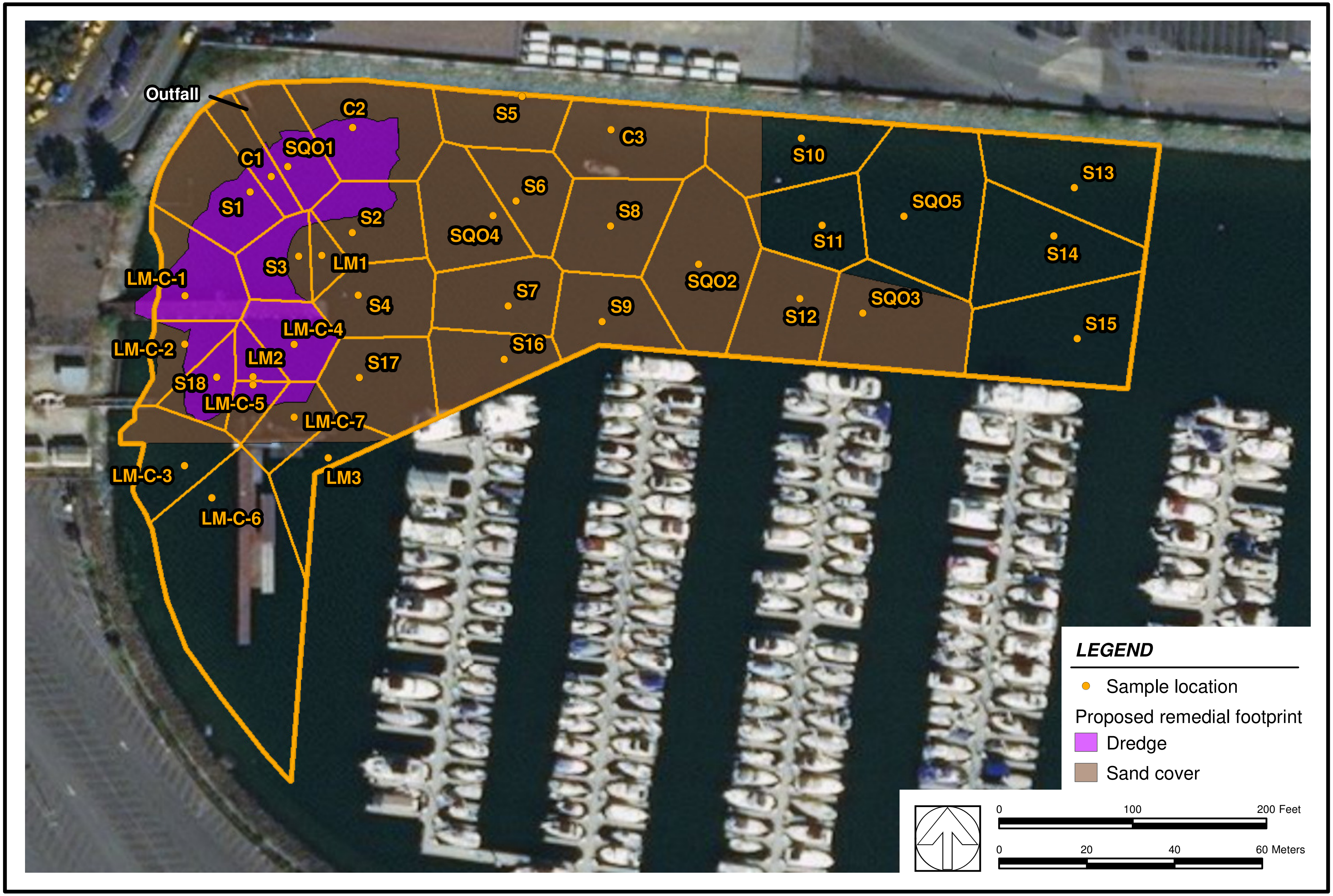

Figure 3. Remedial alternative 4 footprint

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January 29, 2018

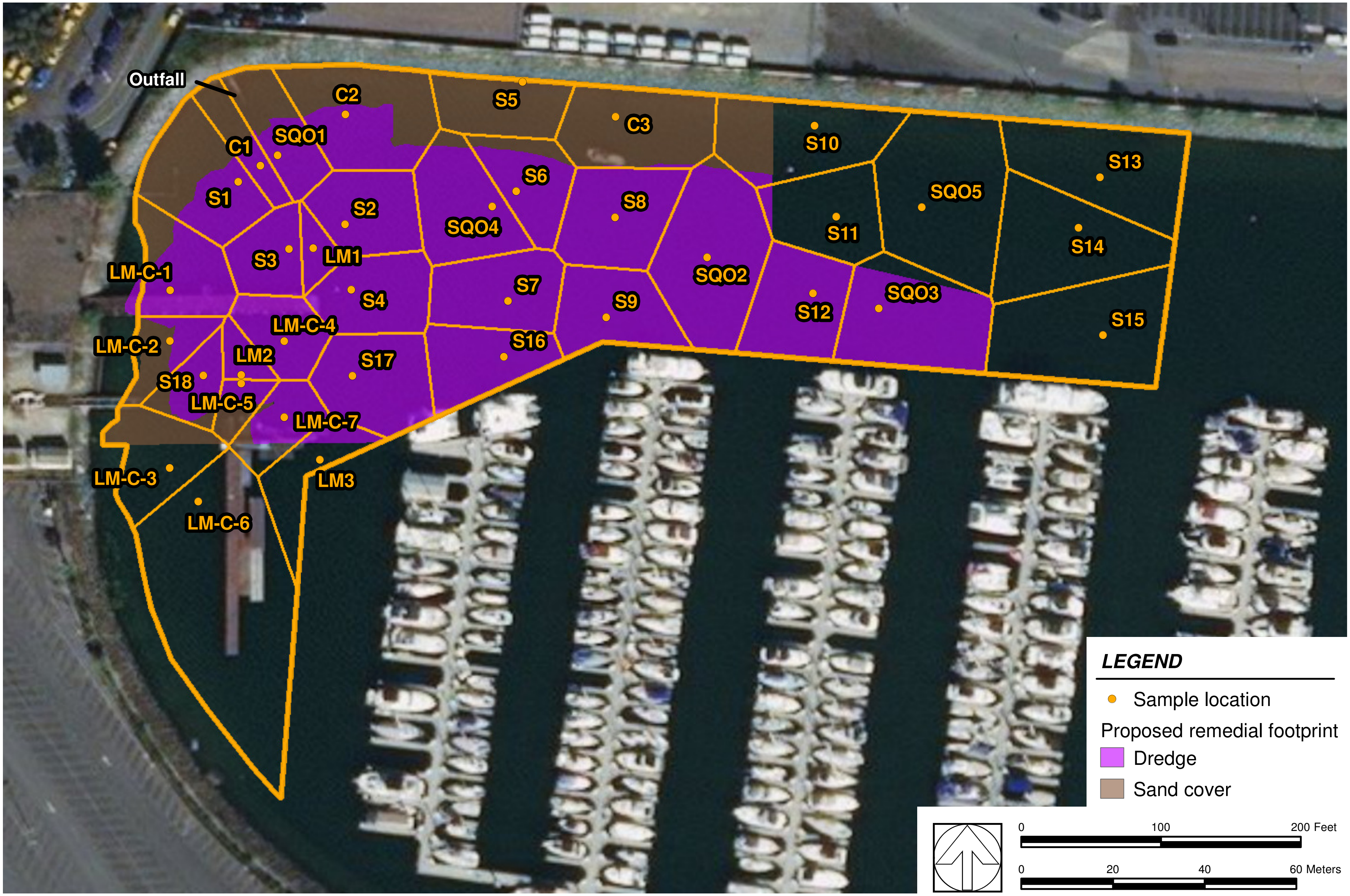

Figure 4. Remedial alternative 3 footprint

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January 29, 2018

Table 1. Study Area Data

Station	PCBs (µg/kg)	Hg (mg/kg)
2009 East Basin Characterization Data		
C1	294.9	0.231
C2	804.6	0.116
C3	268.1	0.129
S1	445.0	0.341
S2	818.5	0.536
S3	451.0	0.721
S4	610.8	0.697
S5	663.4	0.136
S6	232.4	0.272
S7	187.1	0.443
S8	402.9	0.436
S9	446.8	0.689
S10	186.6	0.122
S11	126.4	0.302
S12	212.4	0.462
S13	76.7	0.116
S14	84.0	0.331
S15	213.2	0.392
S16	200.6	0.546
S17	347.4	0.633
S18	313.4	0.932
2010 Former Tow Basin SQO Data [b,d]		
SQO1	419.8	0.143
SQO2	132.8	0.496
SQO3	148.2	0.680
SQO4	306.9	0.692
SQO5	42.8	0.133
2011 LMT Data [c,e]		
LM1	268.9	0.807
LM2 Avg [f]	192.0	1.660
LM3	123.3	0.946
LM-C-1	41.2	0.485
LM-C-2	18.8	2.380
LM-C-3	25.4	0.211
LM-C-4	50.7	13.000
LM-C-5	126.9	1.190
LM-C-6 Avg [f]	25.6	0.428
LM-C-7	197.9	1.070

Data Sources and Notes:

[a] Haley & Aldrich and Weston 2009

[b] Haley & Aldrich and Weston 2011

[c] Tetra Tech and Weston 2012

[d] Total PCBs estimated from sum of congeners 44, 87, 99, 105, 110, 118, 128, 138 (or 138/158), 149, 151, 153, 156, 170, 177, 180, 183, 187, 194, 206, with 1.82 adjustment factor

[e] Total PCBs estimated from sum of congeners 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138 (or 138/158), 153, 170, 180, 187, 195, 206, 209, with 1.72 adjustment factor

[f] Duplicate results averaged

Table 2. Current SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	PCBs (µg/kg)	[PCBs] x Area Product	Hg (mg/kg)	[Hg] x Area Product
C1	181.79	1.1%	294.9	53,620	0.231	42.0
C2	639.19	3.8%	804.6	514,305	0.116	74.1
C3	557.25	3.3%	268.1	149,390	0.129	71.9
LM1	102.78	0.6%	268.9	27,642	0.807	82.9
LM2 Avg[a]	97.54	0.6%	192.0	18,729	1.660	161.9
LM3	293.10	1.8%	123.3	36,131	0.946	277.3
LM-C-1	394.58	2.4%	41.2	16,255	0.485	191.4
LM-C-2	219.60	1.3%	18.8	4,130	2.380	522.6
LM-C-3	393.20	2.4%	25.4	9,995	0.211	83.0
LM-C-4	280.31	1.7%	50.7	14,208	13.000	3644.0
LM-C-5	112.72	0.7%	126.9	14,304	1.190	134.1
LM-C-6 Avg[a]	1,587.78	9.5%	25.6	40,682	0.428	679.6
LM-C-7	244.75	1.5%	197.9	48,425	1.070	261.9
S1	526.93	3.2%	445.0	234,480	0.341	179.7
S2	394.27	2.4%	818.5	322,690	0.536	211.3
S3	266.43	1.6%	451.0	120,158	0.721	192.1
S4	404.34	2.4%	610.8	246,969	0.697	281.8
S5	358.61	2.2%	663.4	237,900	0.136	48.8
S6	346.13	2.1%	232.4	80,452	0.272	94.1
S7	449.56	2.7%	187.1	84,110	0.443	199.2
S8	504.93	3.0%	402.9	203,459	0.436	220.1
S9	421.36	2.5%	446.8	188,270	0.689	290.3
S10	593.62	3.6%	186.6	110,741	0.122	72.4
S11	436.64	2.6%	126.4	55,176	0.302	131.9
S12	474.17	2.8%	212.4	100,702	0.462	219.1
S13	676.13	4.1%	76.7	51,893	0.116	78.4
S14	682.49	4.1%	84.0	57,312	0.331	225.9
S15	794.21	4.8%	213.2	169,321	0.392	311.3
S16	386.10	2.3%	200.6	77,437	0.546	210.8
S17	491.12	2.9%	347.4	170,635	0.633	310.9
S18	205.68	1.2%	313.4	64,462	0.932	191.7
SQO1	325.19	2.0%	419.8	136,513	0.143	46.5
SQO2	761.63	4.6%	132.8	101,144	0.496	377.8
SQO3	681.52	4.1%	148.2	101,002	0.680	463.4
SQO4	481.16	2.9%	306.9	147,667	0.692	333.0
SQO5	899.33	5.4%	42.8	38,491	0.133	119.6
Totals	**16,666.1**	**100.0%**		**4,048,795.9**		**11,036.9**
SWAC			**242.9**		**0.662**	
Target Level [b]			**84.0**		**0.570**	
Ratio SWAC/Target Level			**2.89**		**1.16**	

[a] Duplicate results averaged

[b] Established bulk sediment cleanup levels from CAO

Table 3. Alternative 2 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PR PCBs (µg/kg)	Current Hg (mg/kg)	[Hg] x Area Product
Sand Cover Area						
C1	181.79	1.09%	294.9	73.7	0.231	10.5
C2	639.19	3.84%	804.6	201.2	0.116	18.5
C3	557.24	3.34%	268.1	67.0	0.129	18.0
LM1	102.78	0.62%	268.9	67.2	0.807	20.7
LM2 Avga	97.54	0.59%	192.0	48.0	1.660	40.5
LM3	64.27	0.39%	123.3	30.8	0.946	15.2
LM-C-1	394.58	2.37%	41.2	10.3	0.485	47.8
LM-C-2	208.09	1.25%	18.8	4.7	2.380	123.8
LM-C-3	152.34	0.91%	25.4	6.4	0.211	8.0
LM-C-4	280.31	1.68%	50.7	12.7	13.000	911.0
LM-C-5	112.68	0.68%	126.9	31.7	1.190	33.5
LM-C-6 Avga	0.00	0.00%	25.6	6.4	0.428	0.0
LM-C-7	189.74	1.14%	197.9	49.5	1.070	50.8
S1	526.93	3.16%	445.0	111.2	0.341	44.9
S2	394.27	2.37%	818.5	204.6	0.536	52.8
S3	266.43	1.60%	451.0	112.7	0.721	48.0
S4	404.34	2.43%	610.8	152.7	0.697	70.5
S5	358.61	2.15%	663.4	165.8	0.136	12.2
S6	346.13	2.08%	232.4	58.1	0.272	23.5
S7	449.56	2.70%	187.1	46.8	0.443	49.8
S8	504.93	3.03%	402.9	100.7	0.436	55.0
S9	421.37	2.53%	446.8	111.7	0.689	72.6
S10	216.34	1.30%	186.6	46.6	0.122	6.6
S11	22.10	0.13%	126.4	31.6	0.302	1.7
S12	474.17	2.85%	212.4	53.1	0.462	54.8
S13	0.00	0.00%	76.7	19.2	0.116	0.0
S14	0.00	0.00%	84.0	21.0	0.331	0.0
S15	0.00	0.00%	213.2	53.3	0.392	0.0
S16	386.10	2.32%	200.6	50.1	0.546	52.7
S17	491.12	2.95%	347.4	86.9	0.633	77.7
S18	205.68	1.23%	313.4	78.4	0.932	47.9
SQO1	325.19	1.95%	419.8	105.0	0.143	11.6
SQO2	761.62	4.57%	132.8	33.2	0.496	94.4
SQO3	616.31	3.70%	148.2	37.1	0.680	104.8
SQO4	481.16	2.89%	306.9	76.7	0.692	83.2
SQO5	0.00	0.00%	42.8	10.7	0.133	0.0
Sub-total	**10,632.91**					**2,263.2**

Table 3. Alternative 2 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PR PCBs (µg/kg)	Current Hg (mg/kg)	[Hg] x Area Product
Uncovered Area						
C1		0.00%	294.9	294.9	0.231	0.0
C2		0.00%	804.6	804.6	0.116	0.0
C3		0.00%	268.1	268.1	0.129	0.0
LM1		0.00%	268.9	268.9	0.807	0.0
LM2 Avga		0.00%	192.0	192.0	1.660	0.0
LM3	228.83	1.37%	123.3	123.3	0.946	216.5
LM-C-1		0.00%	41.2	41.2	0.485	0.0
LM-C-2	11.51	0.07%	18.8	18.8	2.380	27.4
LM-C-3	240.86	1.45%	25.4	25.4	0.211	50.8
LM-C-4		0.00%	50.7	50.7	13.000	0.0
LM-C-5	0.04	0.00%	126.9	126.9	1.190	0.0
LM-C-6 Avga	1,587.78	9.53%	25.6	25.6	0.428	679.6
LM-C-7	55.01	0.33%	197.9	197.9	1.070	58.9
S1		0.00%	445.0	445.0	0.341	0.0
S2		0.00%	818.5	818.5	0.536	0.0
S3		0.00%	451.0	451.0	0.721	0.0
S4		0.00%	610.8	610.8	0.697	0.0
S5		0.00%	663.4	663.4	0.136	0.0
S6		0.00%	232.4	232.4	0.272	0.0
S7		0.00%	187.1	187.1	0.443	0.0
S8		0.00%	402.9	402.9	0.436	0.0
S9		0.00%	446.8	446.8	0.689	0.0
S10	377.28	2.26%	186.6	186.6	0.122	46.0
S11	414.55	2.49%	126.4	126.4	0.302	125.2
S12		0.00%	212.4	212.4	0.462	0.0
S13	676.14	4.06%	76.7	76.7	0.116	78.4
S14	682.48	4.10%	84.0	84.0	0.331	225.9
S15	794.21	4.77%	213.2	213.2	0.392	311.3
S16		0.00%	200.6	200.6	0.546	0.0
S17		0.00%	347.4	347.4	0.633	0.0
S18		0.00%	313.4	313.4	0.932	0.0

Table 3. Alternative 2 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PR PCBs (µg/kg)	Current Hg (mg/kg)	[Hg] x Area Product
SQO1		0.00%	419.8	419.8	0.143	0.0
SQO2		0.00%	132.8	132.8	0.496	0.0
SQO3	65.21	0.39%	148.2	148.2	0.680	44.3
SQO4		0.00%	306.9	306.9	0.692	0.0
SQO5	899.33	5.40%	42.8	42.8	0.133	119.6
Sub-total	**6,033.24**					**1,984.0**
Totals	**16,666.1**	**100.0%**				**4,247.2**
SWAC			**84.8**		**0.25**	
Target Level [b]			**84.0**		**0.57**	
Background mean [c]			**29.6**		**0.31**	
Background median [d]			**22.4**		**0.25**	
Ratio SWAC/Target Level			**1.01**		**0.45**	

[a] Duplicate results averaged
[b] Established bulk sediment cleanup levels from CAO
[c] Reference pool mean from RWQCB 2012b
[d] Reference pool median from RWQCB 2012b

Table 4. Alternative 4 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
Sand Cover Area								
C1	101.39	0.61%	294.9	73.7	7,476	0.231	0.058	5.9
C2	409.61	2.46%	804.6	201.2	82,396	0.116	0.029	11.9
C3	557.24	3.34%	268.1	67.0	37,347	0.129	0.032	18.0
LM1	98.14	0.59%	268.9	67.2	6,598	0.807	0.202	19.8
LM2 Avga		0.00%	192.0	48.0	0	1.660	0.415	0.0
LM3	64.27	0.39%	123.3	30.8	1,981	0.946	0.237	15.2
LM-C-1	82.68	0.50%	41.2	10.3	851	0.485	0.121	10.0
LM-C-2	117.43	0.70%	18.8	4.7	552	2.380	0.595	69.9
LM-C-3	152.34	0.91%	25.4	6.4	968	0.211	0.053	8.0
LM-C-4	0.14	0.00%	50.7	12.7	2	13.000	3.250	0.4
LM-C-5	51.41	0.31%	126.9	31.7	1,631	1.190	0.298	15.3
LM-C-6 Avga		0.00%	25.6	6.4	0	0.428	0.107	0.0
LM-C-7	156.22	0.94%	197.9	49.5	7,727	1.070	0.268	41.8
S1	298.56	1.79%	445.0	111.2	33,214	0.341	0.085	25.5
S2	266.25	1.60%	818.5	204.6	54,479	0.536	0.134	35.7
S3	74.77	0.45%	451.0	112.7	8,431	0.721	0.180	13.5
S4	404.34	2.43%	610.8	152.7	61,742	0.697	0.174	70.5
S5	358.61	2.15%	663.4	165.8	59,475	0.136	0.034	12.2
S6	346.13	2.08%	232.4	58.1	20,113	0.272	0.068	23.5
S7	449.56	2.70%	187.1	46.8	21,028	0.443	0.111	49.8
S8	504.93	3.03%	402.9	100.7	50,865	0.436	0.109	55.0
S9	421.37	2.53%	446.8	111.7	47,068	0.689	0.172	72.6
S10	216.34	1.30%	186.6	46.6	10,090	0.122	0.031	6.6
S11	22.10	0.13%	126.4	31.6	698	0.302	0.076	1.7
S12	474.17	2.85%	212.4	53.1	25,175	0.462	0.116	54.8
S13		0.00%	76.7	19.2	0	0.116	0.029	0.0
S14		0.00%	84.0	21.0	0	0.331	0.083	0.0
S15		0.00%	213.2	53.3	0	0.392	0.098	0.0
S16	386.10	2.32%	200.6	50.1	19,360	0.546	0.137	52.7
S17	491.12	2.95%	347.4	86.9	42,659	0.633	0.158	77.7
S18	44.75	0.27%	313.4	78.4	3,506	0.932	0.233	10.4
SQO1	146.89	0.88%	419.8	105.0	15,416	0.143	0.036	5.3
SQO2	761.62	4.57%	132.8	33.2	25,286	0.496	0.124	94.4
SQO3	616.31	3.70%	148.2	37.1	22,834	0.680	0.170	104.8
SQO4	481.16	2.89%	306.9	76.7	36,917	0.692	0.173	83.2
SQO5		0.00%	42.8	10.7	0	0.133	0.033	0.0
Sub-total	**8,555.96**				**705,884.7**			**1,066.0**

Table 4. Alternative 4 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
Dredge Area (DMMU-2)								
C1	80.40	0.48%	294.9	22.4	1,801	0.231	0.231	18.6
C2	229.57	1.38%	804.6	22.4	5,142	0.116	0.116	26.6
C3		0.00%	268.1	22.4	0	0.129	0.129	0.0
LM1	4.64	0.03%	268.9	22.4	104	0.807	0.250	1.2
LM2 Avg[a]	97.54	0.59%	192.0	22.4	2,185	1.660	0.250	24.4
LM3		0.00%	123.3	22.4	0	0.946	0.250	0.0
LM-C-1	311.91	1.87%	41.2	22.4	6,987	0.485	0.250	78.0
LM-C-2	90.66	0.54%	18.8	18.8	1,705	2.380	0.250	22.7
LM-C-3		0.00%	25.4	22.4	0	0.211	0.211	0.0
LM-C-4	280.17	1.68%	50.7	22.4	6,276	13.000	0.250	70.0
LM-C-5	61.27	0.37%	126.9	22.4	1,372	1.190	0.250	15.3
LM-C-6 Avg[a]		0.00%	25.6	22.4	0	0.428	0.250	0.0
LM-C-7	33.52	0.20%	197.9	22.4	751	1.070	0.250	8.4
S1	228.38	1.37%	445.0	22.4	5,116	0.341	0.250	57.1
S2	128.01	0.77%	818.5	22.4	2,867	0.536	0.250	32.0
S3	191.65	1.15%	451.0	22.4	4,293	0.721	0.250	47.9
S4		0.00%	610.8	22.4	0	0.697	0.250	0.0
S5		0.00%	663.4	22.4	0	0.136	0.136	0.0
S6		0.00%	232.4	22.4	0	0.272	0.250	0.0
S7		0.00%	187.1	22.4	0	0.443	0.250	0.0
S9		0.00%	446.8	22.4	0	0.689	0.250	0.0
S10		0.00%	186.6	22.4	0	0.122	0.122	0.0
S11		0.00%	126.4	22.4	0	0.302	0.250	0.0
S12		0.00%	212.4	22.4	0	0.462	0.250	0.0
S13		0.00%	76.7	22.4	0	0.116	0.116	0.0
S14		0.00%	84.0	22.4	0	0.331	0.250	0.0
S15		0.00%	213.2	22.4	0	0.392	0.250	0.0
S16		0.00%	200.6	22.4	0	0.546	0.250	0.0
S17		0.00%	347.4	22.4	0	0.633	0.250	0.0
S18	160.93	0.97%	313.4	22.4	3,605	0.932	0.250	40.2
SQO1	178.30	1.07%	419.8	22.4	3,994	0.143	0.143	25.5
SQO2		0.00%	132.8	22.4	0	0.496	0.250	0.0
SQO3		0.00%	148.2	22.4	0	0.680	0.250	0.0
SQO4		0.00%	306.9	22.4	0	0.692	0.250	0.0
SQO5		0.00%	42.8	22.4	0	0.133	0.133	0.0
Sub-total	**2,076.95**				**46,197.7**			**467.9**

Table 4. Alternative 4 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
Uncovered Area								
C1		0.00%	294.9	294.9	0	0.231	0.231	0.0
C2		0.00%	804.6	804.6	0	0.116	0.116	0.0
C3		0.00%	268.1	268.1	0	0.129	0.129	0.0
LM1		0.00%	268.9	268.9	0	0.807	0.807	0.0
LM2 Avg[a]		0.00%	192.0	192.0	0	1.660	1.660	0.0
LM3	228.83	1.37%	123.3	123.3	28,208	0.946	0.946	216.5
LM-C-1		0.00%	41.2	41.2	0	0.485	0.485	0.0
LM-C-2	11.51	0.07%	18.8	18.8	216	2.380	2.380	27.4
LM-C-3	240.86	1.45%	25.4	25.4	6,122	0.211	0.211	50.8
LM-C-4		0.00%	50.7	50.7	0	13.000	13.000	0.0
LM-C-5	0.04	0.00%	126.9	126.9	5	1.190	1.190	0.0
LM-C-6 Avg[a]	1,587.78	9.53%	25.6	25.6	40,682	0.428	0.428	679.6
LM-C-7	55.01	0.33%	197.9	197.9	10,885	1.070	1.070	58.9
S1		0.00%	445.0	445.0	0	0.341	0.341	0.0
S2		0.00%	818.5	818.5	0	0.536	0.536	0.0
S3		0.00%	451.0	451.0	0	0.721	0.721	0.0
S4		0.00%	610.8	610.8	0	0.697	0.697	0.0
S5		0.00%	663.4	663.4	0	0.136	0.136	0.0
S6		0.00%	232.4	232.4	0	0.272	0.272	0.0
S7		0.00%	187.1	187.1	0	0.443	0.443	0.0
S8		0.00%	402.9	402.9	0	0.436	0.436	0.0
S9		0.00%	446.8	446.8	0	0.689	0.689	0.0
S10	377.28	2.26%	186.6	186.6	70,382	0.122	0.122	46.0
S11	414.55	2.49%	126.4	126.4	52,383	0.302	0.302	125.2
S12		0.00%	212.4	212.4	0	0.462	0.462	0.0
S13	676.14	4.06%	76.7	76.7	51,893	0.116	0.116	78.4
S14	682.48	4.10%	84.0	84.0	57,311	0.331	0.331	225.9
S15	794.21	4.77%	213.2	213.2	169,321	0.392	0.392	311.3
S16		0.00%	200.6	200.6	0	0.546	0.546	0.0
S17		0.00%	347.4	347.4	0	0.633	0.633	0.0
S18		0.00%	313.4	313.4	0	0.932	0.932	0.0

Table 4. Alternative 4 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
SQO1		0.00%	419.8	419.8	0	0.143	0.143	0.0
SQO2		0.00%	132.8	132.8	0	0.496	0.496	0.0
SQO3	65.21	0.39%	148.2	148.2	9,664	0.680	0.680	44.3
SQO4		0.00%	306.9	306.9	0	0.692	0.692	0.0
SQO5	899.33	5.40%	42.8	42.8	38,491	0.133	0.133	119.6
Sub-total	**6,033.24**				**535,565.6**			**1,984.0**
Totals	**16,666.1**	**100.0%**			**1,287,647.9**			**3,517.8**
SWAC			**77.3**			**0.21**		
Target Level [b]			**84.0**			**0.57**		
Background mean [c]			**29.6**			**0.31**		
Background median [d]			**22.4**			**0.25**		
Ratio SWAC/Target Level			**0.92**			**0.37**		

[a] Duplicate results averaged
[b] Established bulk sediment cleanup levels from CAO
[c] Reference pool mean from RWQCB 2012b
[d] Reference pool median from RWQCB 2012b

Table 5. Alternative 3 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
Sand Cover Area								
C1	101.39	0.61%	294.9	73.7	7,476	0.231	0.058	5.9
C2	369.06	2.21%	804.6	201.2	74,239	0.116	0.029	10.7
C3	543.59	3.26%	268.1	67.0	36,432	0.129	0.032	17.5
LM1		0.00%	268.9	67.2	0	0.807	0.202	0.0
LM2 Avga		0.00%	192.0	48.0	0	1.660	0.415	0.0
LM3		0.00%	123.3	30.8	0	0.946	0.237	0.0
LM-C-1	82.68	0.50%	41.2	10.3	851	0.485	0.121	10.0
LM-C-2	117.55	0.71%	18.8	4.7	553	2.380	0.595	69.9
LM-C-3	152.34	0.91%	25.4	6.4	968	0.211	0.053	8.0
LM-C-4		0.00%	50.7	12.7	0	13.000	3.250	0.0
LM-C-5	51.41	0.31%	126.9	31.7	1,631	1.190	0.298	15.3
LM-C-6 Avga		0.00%	25.6	6.4	0	0.428	0.107	0.0
LM-C-7	20.38	0.12%	197.9	49.5	1,008	1.070	0.268	5.5
S1	298.56	1.79%	445.0	111.2	33,214	0.341	0.085	25.5
S2		0.00%	818.5	204.6	0	0.536	0.134	0.0
S3		0.00%	451.0	112.7	0	0.721	0.180	0.0
S4		0.00%	610.8	152.7	0	0.697	0.174	0.0
S5	358.61	2.15%	663.4	165.8	59,475	0.136	0.034	12.2
S6	68.59	0.41%	232.4	58.1	3,986	0.272	0.068	4.7
S7		0.00%	187.1	46.8	0	0.443	0.111	0.0
S8		0.00%	402.9	100.7	0	0.436	0.109	0.0
S9		0.00%	446.8	111.7	0	0.689	0.172	0.0
S10	197.20	1.18%	186.6	46.6	9,197	0.122	0.031	6.0
S11		0.00%	126.4	31.6	0	0.302	0.076	0.0
S12		0.00%	212.4	53.1	0	0.462	0.116	0.0
S13		0.00%	76.7	19.2	0	0.116	0.029	0.0
S14		0.00%	84.0	21.0	0	0.331	0.083	0.0
S15		0.00%	213.2	53.3	0	0.392	0.098	0.0
S16		0.00%	200.6	50.1	0	0.546	0.137	0.0
S17		0.00%	347.4	86.9	0	0.633	0.158	0.0
S18	45.47	0.27%	313.4	78.4	3,562	0.932	0.233	10.6
SQO1	146.89	0.88%	419.8	105.0	15,416	0.143	0.036	5.3
SQO2	11.73	0.07%	132.8	33.2	389	0.496	0.124	1.5
SQO3		0.00%	148.2	37.1	0	0.680	0.170	0.0
SQO4	24.21	0.15%	306.9	76.7	1,857	0.692	0.173	4.2
SQO5		0.00%	42.8	10.7	0	0.133	0.033	0.0
Sub-total	**2,589.66**				**250,254.7**			**212.7**

Table 5. Alternative 3 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
Dredge Area (DMMU-2)								
C1	80.40	0.48%	294.9	22.4	1,801	0.231	0.231	18.6
C2	270.12	1.62%	804.6	22.4	6,051	0.116	0.116	31.3
C3	13.66	0.08%	268.1	22.4	306	0.129	0.129	1.8
LM1	102.78	0.62%	268.9	22.4	2,302	0.807	0.250	25.7
LM2 Avga	97.54	0.59%	192.0	22.4	2,185	1.660	0.250	24.4
LM3	64.27	0.39%	123.3	22.4	1,440	0.946	0.250	16.1
LM-C-1	311.91	1.87%	41.2	22.4	6,987	0.485	0.250	78.0
LM-C-2	90.54	0.54%	18.8	18.8	1,703	2.380	0.250	22.6
LM-C-3		0.00%	25.4	22.4	0	0.211	0.211	0.0
LM-C-4	280.31	1.68%	50.7	22.4	6,279	13.000	0.250	70.1
LM-C-5	61.27	0.37%	126.9	22.4	1,372	1.190	0.250	15.3
LM-C-6 Avga		0.00%	25.6	22.4	0	0.428	0.250	0.0
LM-C-7	169.36	1.02%	197.9	22.4	3,794	1.070	0.250	42.3
S1	228.38	1.37%	445.0	22.4	5,116	0.341	0.250	57.1
S2	394.26	2.37%	818.5	22.4	8,831	0.536	0.250	98.6
S3	266.43	1.60%	451.0	22.4	5,968	0.721	0.250	66.6
S4	404.34	2.43%	610.8	22.4	9,057	0.697	0.250	101.1
S5		0.00%	663.4	22.4	0	0.136	0.136	0.0
S6	277.54	1.67%	232.4	22.4	6,217	0.272	0.250	69.4
S7	449.56	2.70%	187.1	22.4	10,070	0.443	0.250	112.4
S8	504.93	3.03%	402.9	22.4	11,310	0.436	0.250	126.2
S9	421.37	2.53%	446.8	22.4	9,439	0.689	0.250	105.3
S10	19.14	0.11%	186.6	22.4	429	0.122	0.122	2.3
S11	22.10	0.13%	126.4	22.4	495	0.302	0.250	5.5
S12	474.17	2.85%	212.4	22.4	10,621	0.462	0.250	118.5
S13		0.00%	76.7	22.4	0	0.116	0.116	0.0
S14		0.00%	84.0	22.4	0	0.331	0.250	0.0
S15		0.00%	213.2	22.4	0	0.392	0.250	0.0
S16	386.10	2.32%	200.6	22.4	8,649	0.546	0.250	96.5
S17	491.12	2.95%	347.4	22.4	11,001	0.633	0.250	122.8
S18	160.21	0.96%	313.4	22.4	3,589	0.932	0.250	40.1
SQO1	178.29	1.07%	419.8	22.4	3,994	0.143	0.143	25.5
SQO2	749.89	4.50%	132.8	22.4	16,798	0.496	0.250	187.5
SQO3	616.31	3.70%	148.2	22.4	13,805	0.680	0.250	154.1
SQO4	456.95	2.74%	306.9	22.4	10,236	0.692	0.250	114.2
SQO5		0.00%	42.8	22.4	0	0.133	0.133	0.0
Sub-total	**8,043.24**				**179,843.0**			**1,949.9**

Table 5. Alternative 3 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
Uncovered Area								
C1		0.00%	294.9	294.9	0	0.231	0.231	0.0
C2	0.01	0.00%	804.6	804.6	6	0.116	0.116	0.0
C3		0.00%	268.1	268.1	0	0.129	0.129	0.0
LM1		0.00%	268.9	268.9	0	0.807	0.807	0.0
LM2 Avga		0.00%	192.0	192.0	0	1.660	1.660	0.0
LM3	228.83	1.37%	123.3	123.3	28,208	0.946	0.946	216.5
LM-C-1	0.00	0.00%	41.2	41.2	0	0.485	0.485	0.0
LM-C-2	11.51	0.07%	18.8	18.8	216	2.380	2.380	27.4
LM-C-3	240.86	1.45%	25.4	25.4	6,122	0.211	0.211	50.8
LM-C-4		0.00%	50.7	50.7	0	13.000	13.000	0.0
LM-C-5	0.04	0.00%	126.9	126.9	5	1.190	1.190	0.0
LM-C-6 Avga	1,587.78	9.53%	25.6	25.6	40,682	0.428	0.428	679.6
LM-C-7	55.01	0.33%	197.9	197.9	10,885	1.070	1.070	58.9
S1		0.00%	445.0	445.0	0	0.341	0.341	0.0
S2	0.01	0.00%	818.5	818.5	4	0.536	0.536	0.0
S3		0.00%	451.0	451.0	0	0.721	0.721	0.0
S4		0.00%	610.8	610.8	0	0.697	0.697	0.0
S5		0.00%	663.4	663.4	0	0.136	0.136	0.0
S6		0.00%	232.4	232.4	0	0.272	0.272	0.0
S7		0.00%	187.1	187.1	0	0.443	0.443	0.0
S8		0.00%	402.9	402.9	0	0.436	0.436	0.0
S9		0.00%	446.8	446.8	0	0.689	0.689	0.0
S10	377.28	2.26%	186.6	186.6	70,382	0.122	0.122	46.0
S11	414.55	2.49%	126.4	126.4	52,383	0.302	0.302	125.2
S12		0.00%	212.4	212.4	0	0.462	0.462	0.0
S13	676.14	4.06%	76.7	76.7	51,893	0.116	0.116	78.4
S14	682.48	4.10%	84.0	84.0	57,311	0.331	0.331	225.9
S15	794.21	4.77%	213.2	213.2	169,321	0.392	0.392	311.3
S16		0.00%	200.6	200.6	0	0.546	0.546	0.0
S17		0.00%	347.4	347.4	0	0.633	0.633	0.0
S18	0.00	0.00%	313.4	313.4	1	0.932	0.932	0.0

Table 5. Alternative 3 Predicted Post-Remedial SWAC Calculations

Station	Polygon Area (m2)	Fraction of Total Area	Current PCBs (µg/kg)	Projected PCBs (µg/kg)	[PCBs] x Area Product	Current Hg (mg/kg)	Projected Hg (mg/kg)	[Hg] x Area Product
SQO1	0.00	0.00%	419.8	419.8	1	0.143	0.143	0.0
SQO2		0.00%	132.8	132.8	0	0.496	0.496	0.0
SQO3	65.21	0.39%	148.2	148.2	9,664	0.680	0.680	44.3
SQO4		0.00%	306.9	306.9	0	0.692	0.692	0.0
SQO5	899.33	5.40%	42.8	42.8	38,491	0.133	0.133	119.6
Sub-total	**6,033.25**				**535,577.6**			**1,984.0**
Totals	**16,666.1**	**100.0%**			**965,675.3**			**4,146.6**
SWAC			**57.9**			**0.25**		
Target Level [b]			**84.0**			**0.57**		
Background mean [c]			**29.6**			**0.31**		
Background median [d]			**22.4**			**0.25**		
Ratio SWAC/Target Level			**0.69**			**0.44**		

[a] Duplicate results averaged
[b] Established bulk sediment cleanup levels from CAO
[c] Reference pool mean from RWQCB 2012b
[d] Reference pool median from RWQCB 2012b

APPENDIX C: REMEDIAL ALTERNATIVE COST ESTIMATES

Table C-1
Remedial Alternative 2: Clean Sand Cover Placement
Feasibility Level Cost Estimate

Description	Quantity	Units	Unit Costs	Probable Cost
Construction Costs				
Mobilization/Demobilization	10%	PERCENT		$60,000
Water Handling System Installation and Operation[1]	0	LS	$100,000	$0
Debris Removal and Disposal[2]	1	LS	$20,000	$20,000
Sediment Offloading Facility Improvements/Lease[3]	0	LS	$200,000	$0
Dredge, Transport, and Upland Disposal[4]	0	CY	$200	$0
Clean Sand Cover Purchase and Delivery[5]	6000	TON	$30	$180,000
Post-dredging Sand Cover Purchase and Delivery[6]	0	TON	$30	$0
Clean Sand Cover Placement [9]	6000	TON	$30	$180,000
Environmental Protection[10]	1	LS	$50,000	$50,000
Surveys[11]	6	SURVEY	$10,000	$60,000
Outfall Erosion Protection[12]	2	EA	$20,000	$40,000
Total - Construction Costs[13]				**$590,000**
Non-Construction Costs				
Pre-design Submittals (Revised RAP)	1	LS	$75,000	$75,000
Geotechnical Evaluations - Slope Protection[14]	0	LS	$30,000	$0
Sediment Suitability Determination for Upland Disposal[15]	0	LS	$40,000	$0
Project Management and Permitting[16]	6%	PERCENT		$40,000
Remedial Design[17]	12%	PERCENT		$80,000
Construction Management and Inspection[18]	8%	PERCENT		$50,000
Environmental Monitoring[19]	6	EVENT	$7,500	$45,000
Long-Term Monitoring[20]	1	LS	$570,000	$570,000
Total - Non-Construction Costs				**$860,000**
Total Costs, excluding contingency				$1,450,000
Project Contingency	30%	PERCENT		$440,000
Total Costs, including contingency				**$1,890,000**
Total Cost Accuracy Range[21]	**-30%**			**$1,323,000**
	50%			**$2,835,000**

In providing opinions of probable construction cost, the Client understands that the Consultant has no control over the cost or availability of labor, equipment, or materials, or over market condition or the Contractor's method of pricing, and the Consultant's opinions of probable construction costs are made on the basis of the Consultant's professional judgment and experience. The Consultant makes no warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the Consultant's opinion of probable construction cost.

Notes:

1. Based on our experience, any water generated through dredging operations will need to be treated, and discharged into the City of San Diego Sewer System under an Individual User Discharge Permit. For the San Diego North Shipyard Project, this included a series of weir tanks to allow sediment to settle, and sampling of the discharge water to confirm the City limits are met. The water would likely need to be sampled in the final discharge tank prior to discharge.

2. Assumed quantity of debris will need to be removed prior to dredging (as identified by pre-design surveys). Any additional debris found during dredging is assumed to be incidental to the contract, and included in the Contractors dredging rate.

3. Prior to work, an offloading facility will need to be located and mobilized to move sediment from material barges into trucks. Depending on the method of sediment stabilization (if any), a stockpile area will need to be constructed to dewater the sediment to allow for transportation to an upland landfill.

4. Dredging to be conducted adjacent to the historical submerged railways and pier structure at the Lockheed Marine Terminal facility (assuming to be demolished prior to dredging), wrapping to the north to Outfall No. 2. The volume shown includes structural offsets to the existing revetments, neatline dredging elevation of -10 feet Mean Lower Low Water. The remaining portion of the dredge prism below -10 feet Mean Lower Low Water will receive 2 foot cut. A two foot allowable overdredge, of which only one foot will be payable will be provided to the Contractor, which is typical, and will be necessary with the thin cuts being proposed. We assumed 1.5 tons per CY and a land fill tipping fee of $24 per ton. Cost is based on dredging, transport to offloading facility, offloading, handling, transport to landfill and disposal at Otay Landfill. Rate is assumed to be similar to those utilized for the San Diego Shipyards, North Shipyard Project (for dredging, handling, transportation, and disposal), with additional allowances for transportation to the selected offloading facility.

5. Material specifics will be determined during design (mix of sand and gravely sand) and will address potential for erosion due to propeller action, tides, waves, etc.

6. Assumes that a layer of clean material cover will be placed over the dredge prism following dredging to control residuals.

9. Costs for placement of clean sand cover are assumed to be equivalent (utilizing same equipment). Assumes continuous access to site without interruptions caused by marina or other uses. Some work can be done from shoreline but due to shoreline structures, we have assumed that work will be done from the water. We have also assumed that no eelgrass is present (survey required) and no mitigation process is required.

10. Additional environmental protection will be required during dredging operations when compared to clean sand placement, such as the use of a double silt curtain and having spill control equipment on hand.

11. Assume four multibeam bathymetric surveys (pre-construction, post-dredge, post-sand cover, and as-built), two debris surveys (side-scan sonar and magnetometer), and an eelgrass survey. Though debris surveys will be less expensive then a bathymetric survey, an average survey cost of $10,000 per survey is assumed. An eelgrass survey is assumed to be required as part of California Environmental Quality Act (CEQA) and prior to construction.

12. Assumes that source control is documented (will be summarized in Remedial Action Plan) and that erosion control will be constructed at terminus of two outfalls (20 by 20 foot area of max 1 foot of rip rap). Outfall location based on Google Maps and estimated erosion area at terminus. No source control evaluation or monitoring included.

13. The construction costs include Contractor Overhead and Profit.

14. Assume a limited geotechnical investigation required due to limited depth of cut (subject to change upon the dredge design characterization). Geotechnical investigation may include in-situ testing (vane shear), piston core sampling, and geotechnical laboratory analysis. Information would be utilized to generate stable dredge slopes of avoid sloughing of adjacent material.

15. In our experience, the material is unlikely to be approved for Open Ocean Disposal due to the elevated PCB and Mercury concentrations. Upland disposal testing and frequency will be determined by the landfill selected for disposal. If Open Water Disposal testing was requested, the budget should be increased to $80,000.

16. The Project Management cost (percentage of construction) is based on EPA 540. This item includes CAO negotiation support, and quarterly progress letters for 1 year. Permitting assumes no categorical exemption under CEQA, public comment, Coastal Development Permit process, and will require a negative declaration or a mitigated negative declaration (likely not a full Environmental Impact Report).

17. The remedial design cost (percentage of construction) is based on EPA 540. The design will include a summary of the existing information and pre-design geotechnical and dredge prism characterization, and generation of construction drawings and specifications. Finally, we have assumed that sources are controlled and we have not included any source control evaluations.

18. The construction management cost (percentage of construction) is based on EPA 540.

19. Weekly water quality monitoring will be required during both dredging and sand cover activities. It is assumed that intensive water quality monitoring (3 consecutive days) will be required at the start of both dredging and sand cover operations, as well as if any exceedances are measured. Finally, from our experience on the San Diego Shipyards North Shipyard project, water quality chemistry is assumed not be required. This estimate includes 1 pre-construction event, 2 intensive water quality events (6 total), 6 additional weekly water quality events, and the associated reporting.

20. Assumption is that monitoring will include 2 events of chemical testing of the 0-10 cm surface interval at 36 stations (TOC, total solids, total PCBs, and Hg), 2 events of porewater sampling using SPME (PCBs) and peepers (Hg)at 12 stations, 2 events of benthic community sampling and visual observations at 2 locations in the NW corner of the site, 2 bathmetry surveys in the NW corner of the site, 2 full site-wide bathymetry surveys, and 2 site-wide benthic community sampling events.

21. Expected accuracy range for Feasibility Study cost estimates are -30% to +50% for the detailed analysis of alternatives, based on EPA 540.

Table C-2
Remedial Alternative 3: Removal
Feasibility Level Cost Estimate

Description	Quantity	Units	Unit Costs	Probable Cost
Construction Costs				
Mobilization/Demobilization	10%	PERCENT		$310,000
Water Handling System Installation and Operation[1]	1	LS	$100,000	$100,000
Debris Removal and Disposal[2]	1	LS	$20,000	$20,000
Sediment Offloading Facility Improvements/Lease[3]	1	LS	$200,000	$200,000
Dredge, Transport, and Upland Disposal[4]	11100	CY	$200	$2,220,000
Clean Sand Cover Purchase and Delivery[5]	1500	TON	$30	$45,000
Post-dredging Sand Cover Purchase and Delivery[6]	4500	TON	$30	$135,000
Clean Sand Cover Placement[9]	6000	TON	$30	$180,000
Environmental Protection[10]	1	LS	$50,000	$50,000
Surveys[11]	7	SURVEY	$10,000	$70,000
Outfall Erosion Protection[12]	2	EA	$20,000	$40,000
Total - Construction Costs[13]				**$3,370,000**
Non-Construction Costs				
Pre-design Submittals (Revised RAP)	1	LS	$75,000	$75,000
Geotechnical Evaluations - Slope Protection[14]	1	LS	$30,000	$30,000
Sediment Suitability Determination for Upland Disposal[15]	1	LS	$50,000	$50,000
Project Management and Permitting[16]	6%	PERCENT		$210,000
Remedial Design[17]	12%	PERCENT		$410,000
Construction Management and Inspection[18]	8%	PERCENT		$270,000
Environmental Monitoring[19]	13	EVENT	$7,500	$98,000
Long-Term Monitoring[20]	1	LS	$570,000	$570,000
Total - Non-Construction Costs				**$1,713,000**
Total Costs, excluding contingency				$5,083,000
Project Contingency	30%	PERCENT		$1,520,000
Total Costs, including contingency				**$6,603,000**
Total Cost Accuracy Range[21]	**-30%**			**$4,622,100**
	50%			**$9,904,500**

In providing opinions of probable construction cost, the Client understands that the Consultant has no control over the cost or availability of labor, equipment, or materials, or over market condition or the Contractor's method of pricing, and the Consultant's opinions of probable construction costs are made on the basis of the Consultant's professional judgment and experience. The Consultant makes no warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the Consultant's opinion of probable construction cost.

Notes:

1. Based on our experience, any water generated through dredging operations will need to be treated, and discharged into the City of San Diego Sewer System under an Individual User Discharge Permit. For the San Diego North Shipyard Project, this included a series of weir tanks to allow sediment to settle, and sampling of the discharge water to confirm the City limits are met. The water would likely need to be sampled in the final discharge tank prior to discharge.

2. Assumed quantity of debris will need to be removed prior to dredging (as identified by pre-design surveys). Any additional debris found during dredging is assumed to be incidental to the contract, and included in the Contractors dredging rate.

3. Prior to work, an offloading facility will need to be located and mobilized to move sediment from material barges into trucks. Depending on the method of sediment stabilization (if any), a stockpile area will need to be constructed to dewater the sediment to allow for transportation to an upland landfill.

4. Dredging to be conducted adjacent to the historical submerged railways and pier structure at the Lockheed Marine Terminal facility (assuming to be demolished prior to dredging), wrapping to the north to Outfall No. 2. The volume shown includes structural offsets to the existing revetments, neatline dredging elevation of -10 feet Mean Lower Low Water. The remaining portion of the dredge prism below -10 feet Mean Lower Low Water will receive 2 foot cut. A two foot allowable overdredge, of which only one foot will be payable will be provided to the Contractor, which is typical, and will be necessary with the thin cuts being proposed. We assumed 1.5 tons per CY and a land fill tipping fee of $24 per ton. Cost is based on dredging, transport to offloading facility, offloading, handling, transport to landfill and disposal at Otay Landfill. Rate is assumed to be similar to those utilized for the San Diego Shipyards, North Shipyard Project (for dredging, handling, transportation, and disposal), with additional allowances for transportation to the selected offloading facility.

5. Material specifics will be determined during design (mix of sand and gravely sand) and will address potential for erosion due to propeller action, tides, waves, etc.

6. Assumes that a layer of clean material cover will be placed over the dredge prism following dredging to control residuals.

9. Costs for placement of clean sand cover are assumed to be equivalent (utilizing same equipment). Assumes continuous access to site without interruptions caused by marina or other uses. Some work can be done from shoreline but due to shoreline structures, we have assumed that work will be done from the water. We have also assumed that no eelgrass is present (survey required) and no mitigation process is required.

10. Additional environmental protection will be required during dredging operations when compared to clean sand placement, such as the use of a double silt curtain and having spill control equipment on hand.

11. Assume four multibeam bathymetric surveys (pre-construction, post-dredge, post-sand cover, and as-built), two debris surveys (side-scan sonar and magnetometer), and an eelgrass survey. Though debris surveys will be less expensive then a bathymetric survey, an average survey cost of $10,000 per survey is assumed. An eelgrass survey is assumed to be required as part of California Environmental Quality Act (CEQA) and prior to construction.

12. Assumes that source control is documented (will be summarized in Remedial Action Plan) and that erosion control will be constructed at terminus of two outfalls (20 by 20 foot area of max 1 foot of rip rap). Outfall location based on Google Maps and estimated erosion area at terminus. No source control evaluation or monitoring included.

13. The construction costs include Contractor Overhead and Profit.

14. Assume a limited geotechnical investigation required due to limited depth of cut (subject to change upon the dredge design characterization). Geotechnical investigation may include in-situ testing (vane shear), piston core sampling, and geotechnical laboratory analysis. Information would be utilized to generate stable dredge slopes of avoid sloughing of adjacent material.

15. In our experience, the material is unlikely to be approved for Open Ocean Disposal due to the elevated PCB and Mercury concentrations. Upland disposal testing and frequency will be determined by the landfill selected for disposal. If Open Water Disposal testing was requested, the budget should be increased to $80,000.

16. The Project Management cost (percentage of construction) is based on EPA 540. This item includes CAO negotiation support, and quarterly progress letters for 1 year. Permitting assumes no categorical exemption under CEQA, public comment, Coastal Development Permit process, and will require a negative declaration or a mitigated negative declaration (likely not a full Environmental Impact Report).

17. The remedial design cost (percentage of construction) is based on EPA 540. The design will include a summary of the existing information and pre-design geotechnical and dredge prism characterization, and generation of construction drawings and specifications. Finally, we have assumed that sources are controlled and we have not included any source control evaluations.

18. The construction management cost (percentage of construction) is based on EPA 540.

19. Weekly water quality monitoring will be required during both dredging and sand cover activities. It is assumed that intensive water quality monitoring (3 consecutive days) will be required at the start of both dredging and sand cover operations, as well as if any exceedances are measured. Finally, from our experience on the San Diego Shipyards North Shipyard project, water quality chemistry is assumed not be required. This estimate includes 1 pre-construction event, 2 intensive water quality events (6 total), 6 additional weekly water quality events, and the associated reporting.

20. Assumption is that monitoring will include 2 events of chemical testing of the 0-10 cm surface interval at 36 stations (TOC, total solids, total PCBs, and Hg), 2 events of porewater sampling using SPME (PCBs) and peepers (Hg)at 12 stations, 2 events of benthic community sampling and visual observations at 2 locations in the NW corner of the site, 2 bathmetry surveys in the NW corner of the site, 2 full site-wide bathymetry surveys, and 2 site-wide benthic community sampling events.

21. Expected accuracy range for Feasibility Study cost estimates are -30% to +50% for the detailed analysis of alternatives, based on EPA 540.

Table C-3
Remedial Alternative 4: Combination
Feasibility Level Cost Estimate

Description	Quantity	Units	Unit Costs	Probable Cost
Construction Costs				
Mobilization/Demobilization	10%	PERCENT		$170,000
Water Handling System Installation and Operation[1]	1	LS	$100,000	$100,000
Debris Removal and Disposal[2]	1	LS	$20,000	$20,000
Sediment Offloading Facility Improvements/Lease[3]	1	LS	$200,000	$200,000
Dredge, Transport, and Upland Disposal[4]	4000	CY	$200	$800,000
Clean Sand Cover Purchase and Delivery[5]	5900	TON	$30	$177,000
Post-dredging Sand Cover Purchase and Delivery[6]	0	TON	$30	$0
Clean Sand Cover Placement[9]	5900	TON	$30	$177,000
Environmental Protection[10]	1	LS	$50,000	$50,000
Surveys[11]	7	SURVEY	$10,000	$70,000
Outfall Erosion Protection[12]	2	EA	$20,000	$40,000
Total - Construction Costs[13]				**$1,810,000**
Non-Construction Costs				
Pre-design Submittals (Revised RAP)	1	LS	$75,000	$75,000
Geotechnical Evaluations - Slope Protection[14]	1	LS	$30,000	$30,000
Sediment Suitability Determination for Upland Disposal[15]	1	LS	$40,000	$40,000
Project Management and Permitting[16]	6%	PERCENT		$110,000
Remedial Design[17]	12%	PERCENT		$220,000
Construction Management and Inspection[18]	8%	PERCENT		$150,000
Environmental Monitoring[19]	10	EVENT	$7,500	$75,000
Long-Term Monitoring[20]	1	LS	$570,000	$570,000
Total - Non-Construction Costs				**$1,270,000**
Total Costs, excluding contingency				$3,080,000
Project Contingency	30%	PERCENT		$920,000
Total Costs, including contingency				**$4,000,000**
Total Cost Accuracy Range[21]	**-30%**			**$2,800,000**
	50%			**$6,000,000**

In providing opinions of probable construction cost, the Client understands that the Consultant has no control over the cost or availability of labor, equipment, or materials, or over market condition or the Contractor's method of pricing, and the Consultant's opinions of probable construction costs are made on the basis of the Consultant's professional judgment and experience. The Consultant makes no warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the Consultant's opinion of probable construction cost.

Notes:

1. Based on our experience, any water generated through dredging operations will need to be treated, and discharged into the City of San Diego Sewer System under an Individual User Discharge Permit. For the San Diego North Shipyard Project, this included a series of weir tanks to allow sediment to settle, and sampling of the discharge water to confirm the City limits are met. The water would likely need to be sampled in the final discharge tank prior to discharge.

2. Assumed quantity of debris will need to be removed prior to dredging (as identified by pre-design surveys). Any additional debris found during dredging is assumed to be incidental to the contract, and included in the Contractors dredging rate.

3. Prior to work, an offloading facility will need to be located and mobilized to move sediment from material barges into trucks. Depending on the method of sediment stabilization (if any), a stockpile area will need to be constructed to dewater the sediment to allow for transportation to an upland landfill.

4. Dredging to be conducted adjacent to the historical submerged railways and pier structure at the Lockheed Marine Terminal facility (assuming to be demolished prior to dredging), wrapping to the north to Outfall No. 2. The volume shown includes structural offsets to the existing revetments, neatline dredging elevation of -10 feet Mean Lower Low Water. The remaining portion of the dredge prism below -10 feet Mean Lower Low Water will receive 2 foot cut. A two foot allowable overdredge, of which only one foot will be payable will be provided to the Contractor, which is typical, and will be necessary with the thin cuts being proposed. We assumed 1.5 tons per CY and a land fill tipping fee of $24 per ton. Cost is based on dredging, transport to offloading facility, offloading, handling, transport to landfill and disposal at Otay Landfill. Rate is assumed to be similar to those utilized for the San Diego Shipyards, North Shipyard Project (for dredging, handling, transportation, and disposal), with additional allowances for transportation to the selected offloading facility.

5. Material specifics will be determined during design (mix of sand and gravely sand) and will address potential for erosion due to propeller action, tides, waves, etc.

6. Assumes that a layer of clean material cover will be placed over the dredge prism following dredging to control residuals.

9. Costs for placement of clean sand cover are assumed to be equivalent (utilizing same equipment). Assumes continuous access to site without interruptions caused by marina or other uses. Some work can be done from shoreline but due to shoreline structures, we have assumed that work will be done from the water. We have also assumed that no eelgrass is present (survey required) and no mitigation process is required.

10. Additional environmental protection will be required during dredging operations when compared to clean sand placement, such as the use of a double silt curtain and having spill control equipment on hand.

11. Assume four multibeam bathymetric surveys (pre-construction, post-dredge, post-sand cover, and as-built), two debris surveys (side-scan sonar and magnetometer), and an eelgrass survey. Though debris surveys will be less expensive then a bathymetric survey, an average survey cost of $10,000 per survey is assumed. An eelgrass survey is assumed to be required as part of California Environmental Quality Act (CEQA) and prior to construction.

12. Assumes that source control is documented (will be summarized in Remedial Action Plan) and that erosion control will be constructed at terminus of two outfalls (20 by 20 foot area of max 1 foot of rip rap). Outfall location based on Google Maps and estimated erosion area at terminus. No source control evaluation or monitoring included.

13. The construction costs include Contractor Overhead and Profit.

14. Assume a limited geotechnical investigation required due to limited depth of cut (subject to change upon the dredge design characterization). Geotechnical investigation may include in-situ testing (vane shear), piston core sampling, and geotechnical laboratory analysis. Information would be utilized to generate stable dredge slopes of avoid sloughing of adjacent material.

15. In our experience, the material is unlikely to be approved for Open Ocean Disposal due to the elevated PCB and Mercury concentrations. Upland disposal testing and frequency will be determined by the landfill selected for disposal. If Open Water Disposal testing was requested, the budget should be increased to $80,000.

16. The Project Management cost (percentage of construction) is based on EPA 540. This item includes CAO negotiation support, and quarterly progress letters for 1 year. Permitting assumes no categorical exemption under CEQA, public comment, Coastal Development Permit process, and will require a negative declaration or a mitigated negative declaration (likely not a full Environmental Impact Report).

17. The remedial design cost (percentage of construction) is based on EPA 540. The design will include a summary of the existing information and pre-design geotechnical and dredge prism characterization, and generation of construction drawings and specifications. Finally, we have assumed that sources are controlled and we have not included any source control evaluations.

18. The construction management cost (percentage of construction) is based on EPA 540.

19. Weekly water quality monitoring will be required during both dredging and sand cover activities. It is assumed that intensive water quality monitoring (3 consecutive days) will be required at the start of both dredging and sand cover operations, as well as if any exceedances are measured. Finally, from our experience on the San Diego Shipyards North Shipyard project, water quality chemistry is assumed not be required. This estimate includes 1 pre-construction event, 2 intensive water quality events (6 total), 6 additional weekly water quality events, and the associated reporting.

20. Assumption is that monitoring will include 2 events of chemical testing of the 0-10 cm surface interval at 36 stations (TOC, total solids, total PCBs, and Hg), 2 events of porewater sampling using SPME (PCBs) and peepers (Hg)at 12 stations, 2 events of benthic community sampling and visual observations at 2 locations in the NW corner of the site, 2 bathmetry surveys in the NW corner of the site, 2 full site-wide bathymetry surveys, and 2 site-wide benthic community sampling events.

21. Expected accuracy range for Feasibility Study cost estimates are -30% to +50% for the detailed analysis of alternatives, based on EPA 540.

APPENDIX D: COST-BENEFIT ANALYSIS

Cleanup Alternative	Post-Remedial SWAC (per Exponent 2018, Appendix B) for PCBs	for Hg	Cost (Appendix C)
Alternative 1 - No Action (Current conditions)	**242.9**	**0.662**	**$0**
Alternative 2 - Clean Sand Cover	**84.8**	**0.25**	**$1,890,000**
Alternative 3 - Removal	**77.3**	**0.21**	**$6,603,000**
Alternative 4 - Combination	**57.9**	**0.25**	**$4,000,000**
Target level, per CAO	84	0.57	
Background, mean	29.6	0.31	
Background, median	22.4	0.25	

Cleanup Alternative	Percentage exposure reduction Normalized to median background levels for PCBs	for Hg	**Average of both**
Alternative 1 - No Action (Current conditions)	0.0%	0.0%	**0.0%**
Alternative 2 - Clean Sand Cover	71.7%	100.0%	**85.9%**
Alternative 3 - Removal	75.1%	109.7%	**92.4%**
Alternative 4 - Combination	83.9%	100.0%	**92.0%**

Cost (Appendix C)	Percent exposure reduction Average of both
$0	0.0%
$1,890,000	85.9%
$6,603,000	92.4%
$4,000,000	92.0%