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SECOND FIVE-YEAR REVIEW REPORT FOR

PALOS VERDES SHELF (OPERABLE UNIT 5 OF THE MONTROSE CHEMICAL CORPORATION SUPERFUND SITE)

LOS ANGELES COUNTY, CALIFORNIA

PREPARED BY

US Army Corps of Engineers, Seattle District

FOR

U.S. Environmental Protection Agency

Region IX

Approved by:

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Date: September 11, 2019

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Executive Summary

This is the second Five-Year Review (FYR) for Palos Verdes Shelf (PV Shelf), Los Angeles County, California. PV Shelf is Operable Unit 5 of the Montrose Chemical Corporation Superfund Site, 20201 Normandie Avenue, Los Angeles, California. Montrose Operable Unit 5 encompasses a deposit of contaminated seafloor sediment about 44 square kilometers in size. The deposit sits on the continental shelf and slope off the coast of the Palos Verdes Peninsula, Los Angeles County, California, at water depths ranging roughly from 40 to 200 meters or greater.

Sediment, ocean water, fish, and other ecological receptors at PV Shelf are contaminated due to discharged wastes from Montrose and other industries that entered the sanitary sewers and were released to the environment at the White Point ocean outfalls. The contaminants at Palos Verdes Shelf are Dichlorodiphenyltrichloroethane (DDT) and its metabolites (referred to as "Total DDT"), and congeners of polychlorinated biphenyls (referred to as "Total PCBs"). The quality of the wastewater discharge from the White Point outfalls has improved over the years – DDTs have not been detected in White Point discharge since 2002, and PCBs have not been detected since 1985.

In the Interim Record of Decision, the United States Environmental Protection Agency (EPA) selected an interim remedy for Palos Verdes Shelf to protect human health and the environment. This interim remedy consists of the following:

- Institutional controls component – Continue and strengthen the institutional controls program for PV Shelf that originated as a non-time-critical removal action.
- Monitored natural recovery component – Monitor the ongoing, naturally occurring processes that contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment.
- Isolation cap component – Place an in-situ isolation cap over portions of the PV Shelf sediment bed that are erosive or are highly contaminated or both.

Currently, the institutional controls component of the remedy is functioning as intended by the decision documents. The institutional controls have been successful in limiting human exposure to contaminated fish through aggressive outreach and education performed by EPA in partnership with other federal, state, local agencies, and community-based organizations. Site-specific processes that support monitored natural recovery are evident and appear to be reducing risk to human health and ecological receptors. In 2018, EPA released the first monitored-natural recovery report which indicated that the concentrations of total DDTs and total PCBs in PV Shelf sediments are lower than historical concentrations. Sediment concentrations were also lower than the post-cap placement cleanup goals. As a result, EPA has postponed implementation of the isolation cap component of the interim remedy. Cap placement, as well as additional response actions that can accelerate recovery, will be assessed as part of the final feasibility study for the Site.

The remedy at Montrose Chemical Corporation Operable Unit 5 (Palos Verdes Shelf) protects human health and the environment. Concentrations of DDTs and PCBs in sediment and fish tissue are decreasing through monitored natural recovery and institutional controls minimize human consumption of impacted fish.

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List of Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeters
DDT	Dichlorodiphenyltrichloroethane
DTSC	California Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
FCEC	Fish Contamination Education Collaborative
FYR	Five-Year Review
IROD	Interim Record of Decision
µg/kg	micrograms per kilogram (parts per billion)
Montrose	Montrose Chemical Corporation
ng/L	nanograms per liter (parts per trillion)
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
OC	organic carbon
OEHHA	Office of Environmental Health Hazard Assessment
OU	operable unit
PCBs	polychlorinated biphenyls
PV Shelf	Palos Verdes Shelf
PVSTIEG	Palos Verdes Shelf Technical Information Exchange Group
RAO	remedial action objective
SAIC	Science Applications International Corporation
Sanitation Districts	Sanitation Districts of Los Angeles County
SCCWRP	Southern California Coastal Water Research Project
SMCA	State Marine Conservation Area
USACE	United States Army Corps of Engineers

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, 40 Code of Federal Regulation Section 300.430(f)(4)(ii) of the National Contingency Plan (NCP) and EPA policy.

This is the second FYR for the Palos Verdes Shelf Superfund Site (Table 1). The triggering action for this Statutory review is the completion and signature of the previous FYR on August 28, 2014. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The Montrose Chemical Corporation (Montrose) Superfund Site consists of seven operable units:

- Operable Unit 1: on and near property soil
- Operable Unit 2: current stormwater pathway
- Operable Unit 3: groundwater and dense non-aqueous phase liquids
- Operable Unit 4: historic stormwater pathway-north
- Operable Unit 5: Palos Verdes Shelf
- Operable Unit 6: historical stormwater pathway-south
- Operable Unit 7: Jones Chemicals Inc.

This FYR only addresses EPA's response actions at Operable Unit 5, Palos Verdes Shelf (PV Shelf); FYRs for the other Montrose operable units are being conducted separately.

The Palos Verdes Shelf Superfund Site Five-Year Review was led by Judy C. Huang, EPA Remedial Project Manager and Cynthia Wetmore, EPA Region IX Superfund Review Coordinator. Participants included William Gardiner (Risk Assessor) and Benino McKenna (Hydrologist) with U.S. Army Corps of Engineers. The review began on November 19, 2018.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Palos Verdes Shelf, Operable Unit 5 of the Montrose Chemical Superfund Site		
EPA ID: CAD008242711		
Region: 9	**State:** CA	**City/County:** Los Angeles, Los Angeles County
SITE STATUS		
NPL Status: Final		
Multiple OUs: Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Judy C. Huang, P.E.		
Author affiliation: EPA		
Review period: 11/19/2018 - 8/29/2019		
Date of site inspection: 4/22/2019		
Type of review: Statutory		
Review number: 2		
Triggering action date: 8/28/2014		
Due date *(five years after triggering action date)*: 8/28/2019		

1.1. Background

Palos Verdes (PV) Shelf is part of the Montrose Site because the former Montrose Chemical plant is the source of the contamination. From 1953 until 1971, Montrose discharged wastes containing DDT from its manufacturing operations at the Normandie Avenue facility to the sanitary sewer collection system operated by the Sanitation Districts. Other industries also sent wastes containing PCBs and metals to the sanitary sewer.

The Sanitation Districts' sewer system carried wastes to the Joint Water Pollution Control Plant at Carson, from which treated wastewater containing contaminants including DDT, PCBs, and metals reached the Pacific Ocean via the Districts' White Point outfall system. The wastes were released through the diffuser portions of the outfall pipes, situated on the seafloor roughly 9 miles from the former Montrose Chemical Plant (see Figure 1). The estimated mass of DDTs discharged from the White Point outfalls from the 1950s through 1971 was 1,000 metric tons. At the time of the IROD, the mass of DDTs and PCBs remaining in sediment at PV Shelf had been estimated at 110 and 10 metric tons, respectively (EPA 2009). Likely sources of contaminants at PV Shelf other than the White Point outfall system include outfalls related to stormwater drains, ocean dumping of sediment from navigational dredging, ocean dumping of waste drums, and uncontrolled runoff from regional manufacturing and storage facilities.

Since Montrose ceased discharges in 1971, the quality of the wastewater discharge from the White Point outfalls improved – DDTs have not been detected in White Point discharge since 2002, and PCBs have not been detected since 1985.

The contaminated sediment bed at PV Shelf is too deep for direct human contact. Fishing activities at portions of PV Shelf have been restricted by the California Department of Fish and Wildlife (CDFW) through its enforcement of the commercial catch ban for white croaker that was initiated in May 1990 (California Fish and Game Code § 7715(a) & (b) and California Code of Regulations Title 14, Section 104). Recently in 2012, under the Marine Life Protection Act, CDFW designated two marine protection areas, the Abalone Cove State Marine Conservation Area (SMCA) and the Point Vicente No-Take SMCA, that are partially within the footprint of the PV Shelf Study Area. CDFW's marine protection areas are intended to protect natural habitats and marine life by protecting or limiting removal of wildlife from within their boundaries.

Other than these restrictions, the area at PV Shelf is open for other commercial and sport fishing. Sport fishermen angle from boats, rocky intertidal areas, and sandy beaches. Sport fishing also includes shellfishing for lobsters and crabs in the near-shore, shallow waters of the Palos Verdes Peninsula. Other activities that occur in this coastal area include boating, swimming, windsurfing, surfing, scuba diving, snorkeling and shell-fishing.

1.2. Physical Characteristics

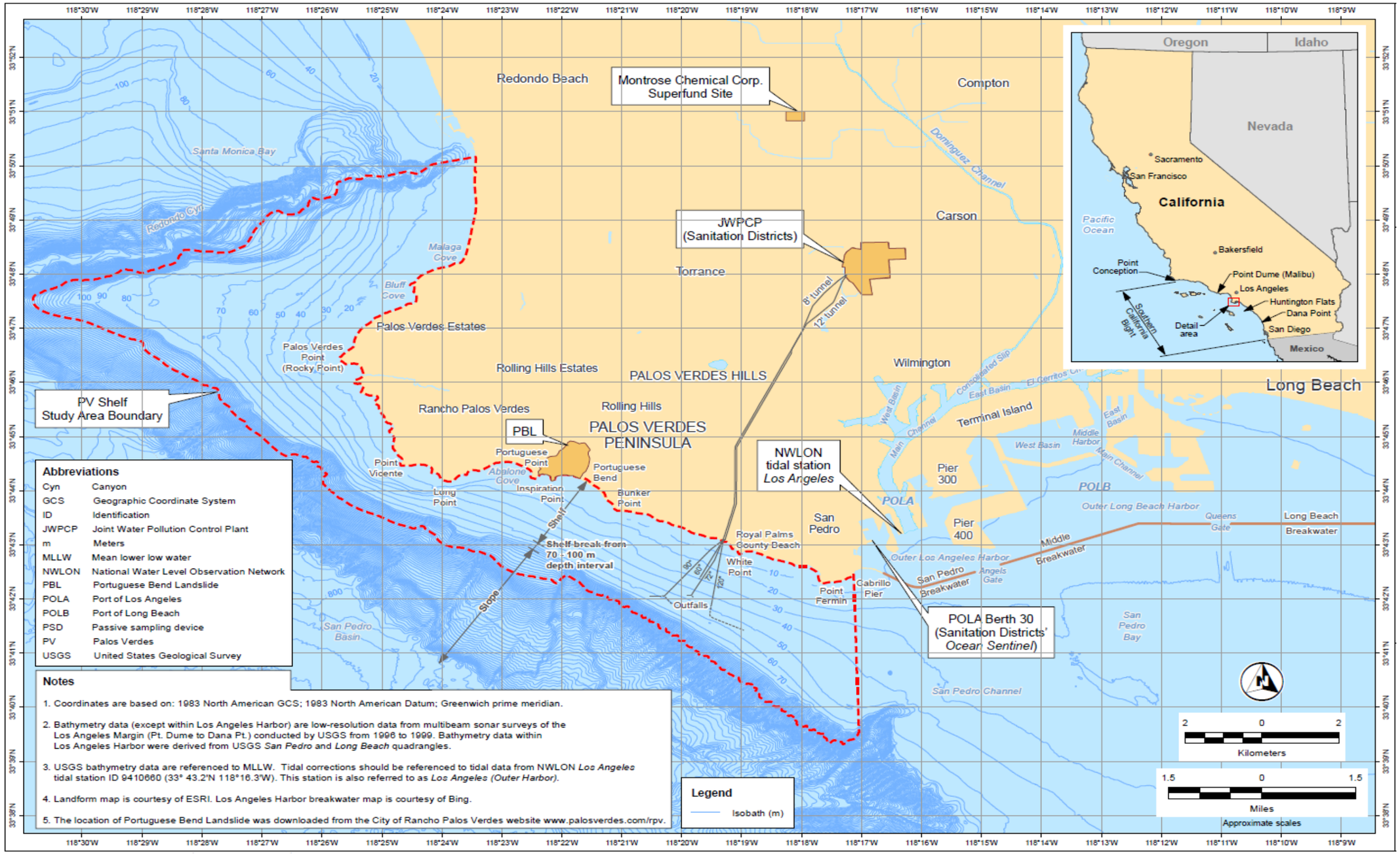
The PV Shelf is a submerged continuation of the Palos Verdes Peninsula extending approximately 4 kilometers offshore to the southwest (EPA, 2009). PV Shelf encompasses a bed of contaminated solids (sediment) that has settled on the seafloor in the Pacific Ocean at water depths varying from about 40 to 200 meters or greater. The bed of contaminated sediment lies within the boundaries of the PV Shelf Study

Area (Figure 1) situated on the western edge of the North American continental shelf off the Palos Verdes Peninsula in southern California. The distance from the shoreline to the inshore edge of the sediment bed (water depth = 40 meters) is about 1.5 kilometers. Catalina Island, one of the Channel Islands, is the closest island to PV Shelf, at a distance of about 42 kilometers.

The PV Shelf sediment bed is about 1.5 to 4 kilometers in width and about 25 kilometers in length. The continental shelf in this area slopes in the seaward direction at about 1 to 4 degrees. A shelf break (i.e., the zone of transition from the relatively flat shelf to the steeper continental slope) occurs at water depths of 70 to 100 meters. The seafloor then drops sharply at a slope of about 13 degrees to a water depth of 800 meters (Lee, 1994).

1.3. Hydrology

The PV Shelf Study Area is entirely within an oceanic, saltwater environment. The predominant currents flow across the Shelf from the southeast to the northwest. At the water's surface, current direction and speed are more variable and are influenced by both prevailing oceanic currents and wind-driven waves. Contaminants in near surface sediments are transported into the water column through an exchange with the near-bottom waters and then generally flow in the water column in a northwesterly direction across the PV Shelf (EPA 2018).



Abbreviations

Cyn	Canyon
GCS	Geographic Coordinate System
ID	Identification
JWPCP	Joint Water Pollution Control Plant
m	Meters
MLLW	Mean lower low water
NWLON	National Water Level Observation Network
PBL	Portuguese Bend Landslide
POLA	Port of Los Angeles
POLB	Port of Long Beach
PSD	Passive sampling device
PV	Palos Verdes
USGS	United States Geological Survey

Notes

1. Coordinates are based on: 1983 North American GCS; 1983 North American Datum; Greenwich prime meridian.
2. Bathymetry data (except within Los Angeles Harbor) are low-resolution data from multibeam sonar surveys of the Los Angeles Margin (Pt. Dume to Dana Pt.) conducted by USGS from 1996 to 1999. Bathymetry data within Los Angeles Harbor were derived from USGS *San Pedro* and *Long Beach* quadrangles.
3. USGS bathymetry data are referenced to MLLW. Tidal corrections should be referenced to tidal data from NWLON *Los Angeles* tidal station ID 9410660 (33° 43.2'N 118°16.3'W). This station is also referred to as *Los Angeles (Outer Harbor)*.
4. Landform map is courtesy of ESRI. Los Angeles Harbor breakwater map is courtesy of Bing.
5. The location of Portuguese Bend Landslide was downloaded from the City of Rancho Palos Verdes website www.palosverdes.com/rpv.

Figure 1. Location Map for the Palos Verdes Shelf Superfund Site

2. Remedial Actions Summary

2.1. Basis for Taking Action

DDTs and PCBs are regarded as probable human carcinogens, and their presence and the associated unacceptable risks posed to human health and the environment at PV Shelf provided the basis for EPA taking action under CERCLA. The primary threat to human health was due to consumption of contaminated fish bought at commercial outlets and caught by local anglers. DDTs and PCBs also were associated with harmful impacts to birds throughout the Southern California Bight and risks to sea lions near PV Shelf and on the Channel Islands.

2.2. Remedy Selection

EPA issued the IROD on September 30, 2009 to select the interim remedy. The remedy consists of institutional controls, monitored natural recovery, and containment by an outfall area cap. The remedial action objectives (RAOs) are listed on Table 2 and are summarized as follows:

- Reduce to acceptable levels the risks to human health from ingestion of fish contaminated with DDTs and PCBs.
- Reduce to acceptable levels the risks from DDTs and PCBs to the ecological community (i.e., benthic invertebrates and fish) at PV Shelf.
- Reduce concentrations of DDTs and PCBs in water at PV Shelf to acceptable levels that meet ambient water quality criteria (AWQC)[1] set by EPA for human health and ecological health.
- Minimize potential adverse impacts to sensitive habitats and biological communities on PV Shelf during remedial action.

Because the potential effects of DDTs and PCBs are affected by the presence of organic materials (such as decaying animal and plant tissues) in sediments, the cleanup goals for sediment are normalized for total organic carbon. This means that the chemical concentrations are divided by the concentration of total organic carbon. Two interim cleanup goals were selected in the IROD. The first interim cleanup goal was to be achieved upon placement of the cap which would decrease immediately the average concentrations of DDTs and PCBs when the highest concentration areas were capped. The second interim cleanup level was set for the first FYR, which assumed the cap would be in place and natural recovery processes would continue to reduce concentrations after cap placement.

[1]Although the term "Ambient Water Quality Criteria" is superseded by the "National Recommended Water Quality Criteria", to ensure consistency with the IROD, this FYR uses the term Ambient Water Quality Criteria. More information on the National Recommended Water Quality Criteria can be found at http://water.epa.gov/scitech/swguidance/criteria/current/index.cfm."

Table 2. Cleanup Levels for PV Shelf

Medium	DDTs	PCBs	Related RAO
White croaker tissue	400 µg/kg	70 µg/kg	Reduce to acceptable levels the risks to human health from ingestion of fish contaminated with DDTs and PCBs.
Surface Sediment – immediate achievement of interim cleanup levels after cap placement	78 mg/kg OC Average Concentration	7 mg/kg OC Average Concentration	
Surface Sediment – interim cleanup levels to be achieved by the first Five-Year Review	46 mg/kg OC Average Concentration	7 mg/kg OC Average Concentration	
Sediment – final cleanup levels by 2039	23 mg/kg OC Average Concentration	-	
Water	0.22 ng/L	0.064 ng/L	Reduce concentrations of DDTs and PCBs in the surface waters over the PV Shelf to acceptable levels that meet ambient water quality criteria (AWQC) for ecological health and human health (human health criteria have been adopted because they are more stringent).

Abbreviations
µg/kg – Micrograms per liter (parts per billion)
mg/kg – Milligrams per liter (parts per million)
ng/L – Nanograms per liter (parts per trillion)
OC – organic carbon

Each of the three components of the interim remedy is described below.

Institutional Controls

Institutional controls are "non-engineering instruments such as administrative and legal controls that minimize the potential for human exposure to contamination and protect the integrity of the remedy" (EPA, 2009). The components of the institutional controls program are:

- **Public outreach and education** – to increase awareness and understanding of the existing fish consumption advisories and fishing restrictions.
- **Monitoring** – to evaluate and track contaminant concentrations in fish (i.e. white croaker) caught at or near PV Shelf, as well as those sold in retail fish markets and served in restaurants,
- **Enforcement** – to prevent commercial catch and sale of contaminated fish caught at and near PV Shelf based on restrictions established by CDFW.

Monitored Natural Recovery

Natural recovery at PV Shelf includes burial and dispersion (for both DDTs and PCBs) and biodegradation (primarily for DDTs), all processes that have been observed by investigators at PV Shelf. Monitoring will be used to evaluate the effectiveness of the cap and the natural recovery processes. The monitored natural recovery (MNR) component of the remedy includes additional studies to improve

modeling of contaminant fate and transport. Studies included under MNR are transformation of DDE, rates of contaminant loss, and a fish tracking study to identify habitat usage by fish species.

Cap

The third component of the selected remedy at PV Shelf is placement of an isolation cap, such as a layer of clean sand, to prevent erosion and reduce exposure to high concentrations of contaminants in sediment. The capping component consists of the following:

- Delineation of the proposed cap area by conducting sampling and analysis to better define horizontal and vertical boundaries of the deposit. This includes the collection of data on sediment characteristics (grain size, bulk density, shear stress) necessary for cap design. Modeling and treatability studies to pilot low-impact techniques are part of the cap placement component.
- Based on conceptual design work conducted by EPA, placement of a 45-centimeter (cm)-thick layer of fine sand/silt over approximately 300 acres of the sediment bed to stop flux (movement of dissolved-phase contaminants from pore water into the open water column) and transport, and to provide a barrier for benthic invertebrates feeding in the most contaminated area of sediment. The cap was estimated to require 864,000 cubic yards of material. Cap construction would follow assessment of modeling and treatability studies. These design criteria would be reassessed during the formal remedial design.
- During cap construction, monitor any plume of resuspended sediment, measure turbidity, and collect samples of sediment and water column.
- Post-construction monitoring of the cap to assess cap thickness and cap movement. To verify effectiveness and stability of the cap, collect samples of cap material and pore water to test for compaction and contaminant flux.

The implementation of the capping component of the remedy was postponed in 2013 for re-evaluation based on the results of the Fall 2009 Sediment Sampling Program (EPA 2013).

2.3. Remedy Implementation

Institutional Controls

Institutional controls were initiated in December 2001, when EPA issued an Implementation Plan (EPA, 2001b). A summary of institutional controls for the PV Shelf is presented in Table 3.

Public outreach and education. EPA coordinates with a variety of federal, state and local agencies, along with community-based organizations, to implement outreach and education activities, including sponsoring the Fish Contamination Education Collaborative (FCEC). EPA also sponsors the Angler Outreach Program, which has been implemented by Heal the Bay and Cabrillo Marine Aquarium. This program targets subsistence fishermen at selected piers, shorelines and bait shops. FCEC meetings are held routinely (usually semi-annually) to update stakeholders on recent developments. EPA issues periodic updates to the FCEC website www.pvsfish.org (offered in English, Spanish, Vietnamese and Chinese).

Market and Restaurant Enforcement, Monitoring and Outreach EPA entered into formal agreements with the City of Long Beach and Los Angeles County Environmental Health to inspect market and restaurants to: 1) evaluate commercial availability of contaminated white croaker, 2) enforce the sale of illegally harvested local white croaker, and 3) provide outreach to business owners. A list of 57 fish retail markets initially was identified based on previous studies, with additional input from community-based organizations and county health departments. The list of markets continues to evolve, and currently includes a rotating list of 76 markets and restaurants in Los Angeles County and the City of Long Beach.

Enforcement. Under a Cooperative Agreement with EPA, the California Department of Fish and Wildlife (CDFW)–Law Enforcement Division (LED) conducts inspections of local wholesalers/distributors and fish landing locations on a monthly basis. CDFW-LED enforces a commercial catch ban for white croaker in the area between Point Vicente and Point Fermin and from the shoreline out approximately 3 miles. CDFW-LED also implements a daily bag limit of 10 white croakers for recreational anglers fishing along the shoreline of the Palos Verdes Peninsula shoreline. CDFW-LED conducts its enforcement patrols monthly. Figure 4 shows the CDFW-LED enforcement areas.

Table 3. Summary of Planned and/or Implemented Institutional Controls

Media, engineered controls, and areas that do not support unlimited use and unrestricted exposure based on current conditions	Institutional Controls Needed	Institutional Controls Called for in the Decision Documents	Impacted Parcel(s)	Institutional Control Objective	Title of IC Instrument Implemented and Date (or planned)
Marine Sediments	Yes	Yes	Palos Verdes Shelf/OU5	To increase awareness and understanding of the existing fish consumption advisories and fishing restrictions.	Public Outreach and Education
				To evaluate and track contaminant concentrations in fish (i.e. white croaker) caught at or near PV Shelf, as well as those sold in retail fish markets and served in restaurants.	Monitoring
				To prevent commercial catch and sale of contaminated fish caught at and near PV Shelf based on restrictions established by CDFW.	Enforcement

The following reports were generated over the past five-year period in support of the IC program:

Final Enforcement Reports (2016, 2017, 2018) documenting institutional controls implemented to address existing white croaker regulations for commercial and recreational anglers, along with inspections of retail food facilities and enforcement of market protocol under the California Health and Safety Code. Community outreach extends to English, Spanish, Chinese and Vietnamese communities.

Final Annual Angler Outreach Reports (2016, 2017, 2018) documenting implementation of institutional controls designed to reduce risk of exposure posed by contaminated fish through outreach and education to anglers. Efforts also include dissemination of educational material concerning consumption of contaminated fish as well as monitoring and enforcing the daily catch limit and the commercial no-take zone for white croaker.

Monitored Natural Recovery

The remedy includes monitoring to evaluate the effectiveness of the natural recovery processes, and additional studies to improve modeling of contaminant fate and transport. These studies address the biotransformation of DDT, rates of contaminant loss in the sediment bed, and movement patterns of white croakers and barred sand bass.

In 2009, EPA conducted a sediment sampling program including a baseline event related to the natural recovery processes, and an outfall sampling event related to possible design of the isolation cap. EPA conducted subsequent sediment sampling in 2013 to assess changes in contaminant concentrations. EPA also conducted a water column sampling event in 2010 to assess contaminant concentrations in open water at PV Shelf, and a flux study event in 2011 to assess movement of contaminants from the pore water in the sediment bed to the open water column above. As a part of the ongoing natural recovery monitoring, EPA also collected and analyzed water column, and fish tissue samples for DDTs and PCBs between 2013 through 2016. The results of these analysis along with the 2013 sediment analysis results are documented in the 2018, First Monitored Natural Recovery Report and are summarized in Section 4 of this report.

EPA intends to conduct sediment, water, and fish tissue collection and analysis every five years in support of the Monitored Natural Recovery and the FYR processes.

Cap

Currently, the cap component of the interim remedy has been postponed. EPA is in the process of preparing a Feasibility Study in support of the final remedy selection for PV Shelf and will evaluate the capping/containment component as a part of this process.

2.4. Operation and Maintenance (O&M)

The selected interim remedy, consisting of institutional controls, monitored natural recovery, and outfall area cap (postponed), currently has no operation and maintenance requirements. Monitoring related to the remedy were described in Section 2.3 above.

3. Progress since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2014 FYR for the Palos Verdes Shelf Site stated the following:

> *The interim remedy at Montrose Chemical Corporation Operable Unit 5 (Palos Verde Shelf) is protective of human health and the environment. Institutional controls are in place and are effective in protecting users of PV Shelf. Results of sampling programs and research by EPA and others indicate that natural recovery processes are occurring. The combination of institutional controls and monitored natural recovery is effective and is progressing towards attaining the specific interim cleanup goals and timelines set forth in the Interim Record of Decision.*

The 2014 FYR identified no issues for PV Shelf that affect protectiveness.

In addition to the long-term monitoring studies conducted under the operations and maintenance program, EPA conducted the following studies since the First Five Year Review Report.

2014 Water Sampling using Passive Sampler Devices: In situ, passive samplers deployed at locations along the shelf to establish the distribution of dissolved PCBs and DDTs in the water column.

2014 Palos Verdes Seafood Consumption Study Technical Report: To the extent possible replicates the 1994 Santa Monica Bay Seafood Consumption Study to provide data to conduct trend analysis; to determine the fish species that are being caught and consumed and the associated consumption rate; and to determine the demographic and ethnic subgroups to improve outreach efforts.

2016 Synthesis Report for Factors Controlling DDE Degradation on the PV Shelf: Field and laboratory studies conducted to understand the physicochemical factors of shelf sediments controlling degradation of DDE to support the potential for natural recovery of DDTs in PV Shelf sediments.

2017 Technical Memorandum: Human Health Risk Evaluation of 2011-2012 Fish Collection Data, Palos Verdes Shelf Institutional Controls (ICs) Program, Los Angeles County, California: Human health risk assessment using white croaker fillets collected by the local health agencies from anglers fishing at four near-shore locations, namely Pier J, Rainbow Harbor, Cabrillo Pier, and Santa Monica Pier from August 2011 to October 2012.

4. Five-Year Review Process

4.1. Community Notification, Involvement and Site Interviews

A public notice, entitled "*EPA Begins Second Five-Year Review of the Interim Cleanup for the Palos Verdes Shelf Superfund Site*", was made available to the public by newspaper in the Torrance Daily Breeze of El Segundo, California on April 12, 2019. The press release states that there was a Five-Year Review being conducted and invites the public to submit any comments to the U.S. EPA. The results of the review and the report will be made available at the Site information repository located at four repositories, as follows:

San Pedro Regional Library
931 South Gaffey Street
San Pedro, California 90731

Redondo Beach Public Library
303 North Pacific Coast Highway
Redondo Beach, California 90277

Palos Verdes Library District
701 Silver Spur Road
Rolling Hills Estates, California 90274

EPA Regional Superfund Record Center
75 Hawthorne Street, Room 3110
San Francisco, California 94105

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date**.** The results of these interviews are summarized below.

Interview requests were made to numerous state and federal agencies, local municipalities and community groups. Responses were received from the Boat People SOS Community Group, DTSC, CDFW, HDR Engineering, Heal the Bay Community Group, Sanitation Districts NOAA and U.S. Fish and Wildlife.

Overall the responses contained very positive remarks for the program management and the effectiveness of institutional controls. Several groups questioned whether the 2013 sediment data should be used as a baseline rather than the 2009 sediment data. Additional comments were made regarding using the white croaker as an indicator species in regard to site fidelity. The completed interview forms are included in Appendix F.

4.2. Data Review

This FYR included a review of relevant, site-related documents including the IROD and recent monitoring data reports. A complete list of the documents reviewed can be found in Appendix A. The following sections provide an overview of data collected since the previous Five-Year Review. Supporting information and data analysis are provided in Appendices B and E.

4.2.1. Sediment

The first long-term monitoring event for sediments was conducted in 2013. Sediment cores were collected using sampling approaches and techniques similar to the 2009 baseline sediment assessment. EPA sampled 34 locations from the greater PV Shelf and 35 locations from the outfall area (OA) near the Sanitation Districts outfall diffusers (Figure 1). Concentrations of DDTs and PCBs were measured in sediments from the 0- to-8-centimeter (cm) bed depth interval and core intervals below 8 cm. The point of compliance for the IROD was the upper 8 cm of the sediment layer, where most biological interaction with bottom sediments occurs.

As in previous investigations, total DDT and PCBs were found throughout the PV Shelf, with lower concentrations generally occurring in the nearshore portions of the Site (water depths shallower than 40 m) and higher concentrations found along the shelf edge and near the White Point outfall diffusers (Figures 2 and 3). Throughout much of the PV Shelf, contaminant concentrations were lower in the shallow sediments (the 0-8 cm interval) than in deeper sediments (Table 4). This depth gradient was less apparent in sediments near the outfall diffusers, with similar total DDT and PCB concentrations throughout the sediment column.

Sediment concentrations in 2013 remained below the interim cleanup levels targeted for achievement after placement of a cap (Table 4). The average concentration of total DDT in the 0-8 cm depth interval for the entire study area was 77 milligrams per kilogram (mg/kg) OC, with higher concentrations found in the OA. Average concentrations of total PCBs (a total of 29 congeners) for the 0-8 cm interval were 5 mg/kg OC across the study area and 7.1 mg/kg OC within the OA. Relative to the baseline sediment surveys conducted in 2009, concentrations of total DDT and PCBs increased in 2013. However, there is some uncertainty in the dataset comparisons due to heterogeneity of sediment across the shelf, accuracy in target reacquisition, and analytical methods and tolerances.

Investigations that preceded the IROD indicated that natural processes, including sediment transport, biological mixing, desorption from sediment to water, and biodegradation (dechlorination of DDTs) are contributing to lower concentrations of contaminants in surface sediment at PV Shelf (Drake, et al., 1994; Eganhouse, et al, 2008). Based on results of additional studies by Eganhouse, et al. (2017), the breakdown of DDT isomers to forms that are generally thought to be less toxic is continuing to occur, particularly in shallower sediment depths. Unlike DDTs, dechlorination of PCBs does not appear to be occurring in PV Shelf sediments (EPA 2018).

The 2013 average concentrations of DDTs and PCBs in surface sediment were less than the cleanup levels for cap placement (Table 5); however, the interim cleanup levels for total DDTs set to be achieved by the time of the first Five-Year Review were not achieved. The remedy relied on two components, a cap and natural recovery processes, and as of this second Five-Year Review, the cap has not been installed as was anticipated in selecting the interim cleanup levels. Early indication is that the natural processes may be able to achieve final cleanup goals without implementation of the interim cap component. The average concentration of total DDTs is 1 mg/kg OC below the post-capping objective.

Table 4. Average Concentrations of Total DDTs and PCBs in Sediment

Location	Total DDTs[a] 2013		Total DDTs 2009		Total PCBs[b] 2013		Total PCBs 2009	
	µg/kg dw	mg/kg OC	µg/kg dw	mg/kg OC	µg/kg dw	mg/kg OC	µg/kg dw	mg/kg OC
PV Shelf Site								
Total Bed	3,300	98	1,600	58	200	6.5	120	4.5
0-8 cm Interval	1,800	77	1,300	56	120	5.0	86	3.0
Outfall Area								
Total Bed	5,600	160	2,800	98	300	9.9	160	6.5
0-8 cm Interval	2,500	120	1,900	83	160	7.1	110	4.7

[a]Total DDTs includes *o,p'*-DDT, *o,p'*-DDE, *o,p'*-DDD, *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD

[b]Total PCBs is a sum of 29 congeners

[c]dw: dry weight

[d]OC: organic carbon normalized

Table 5. Site-Wide Average Contaminant Concentrations in Sediment with Cleanup Goals

Parameter	2013 Sitewide Value	IROD Post-Capping Goal	IROD Interim Cleanup Level	IROD Final Cleanup Level
Sediment (mg/kg OC)				
Total DDTs	77	78	46	23
Total PCBs	5	7	7	--
Surface Water (ng/L)				
Human health				
p,p'-DDE	1.1		0.22	
Total PCBs	0.19		0.064	
Ecological				
Total DDTs	1.6		1	
Total PCBs	0.19		30	
Fish Tissue (µg/kg)				
Zone 1				
Total DDTs	1,000		400	
Total PCBs	98		70	
Zone 2				
Total DDTs	940		400	
Total PCBs	130		70	
Zone 3				
Total DDTs	520		400	
Total PCBs	60		70	

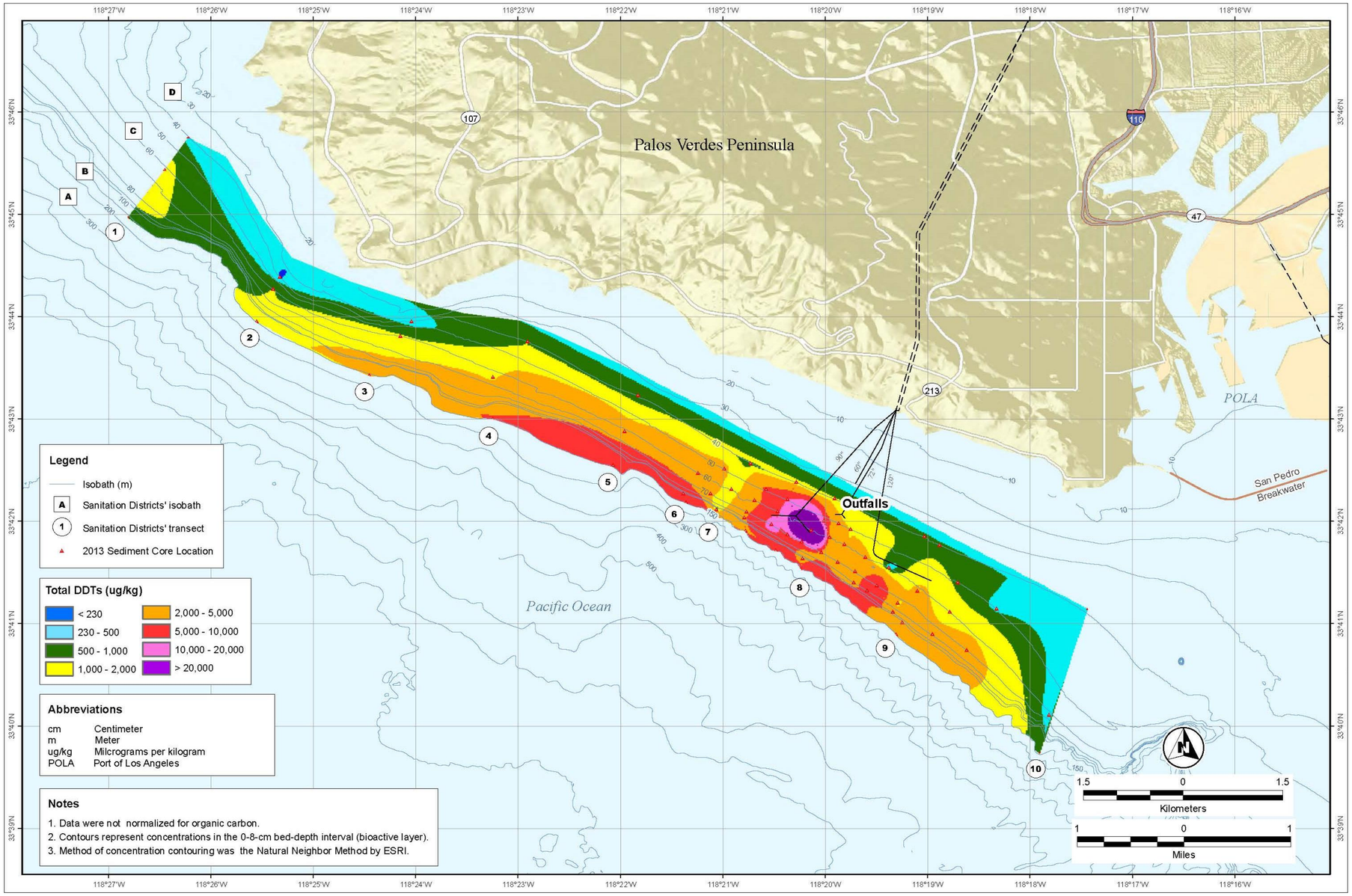


Figure 2. Concentrations of Total DDTs (µg/kg dw) in PV Shelf Sediments collected in 2013

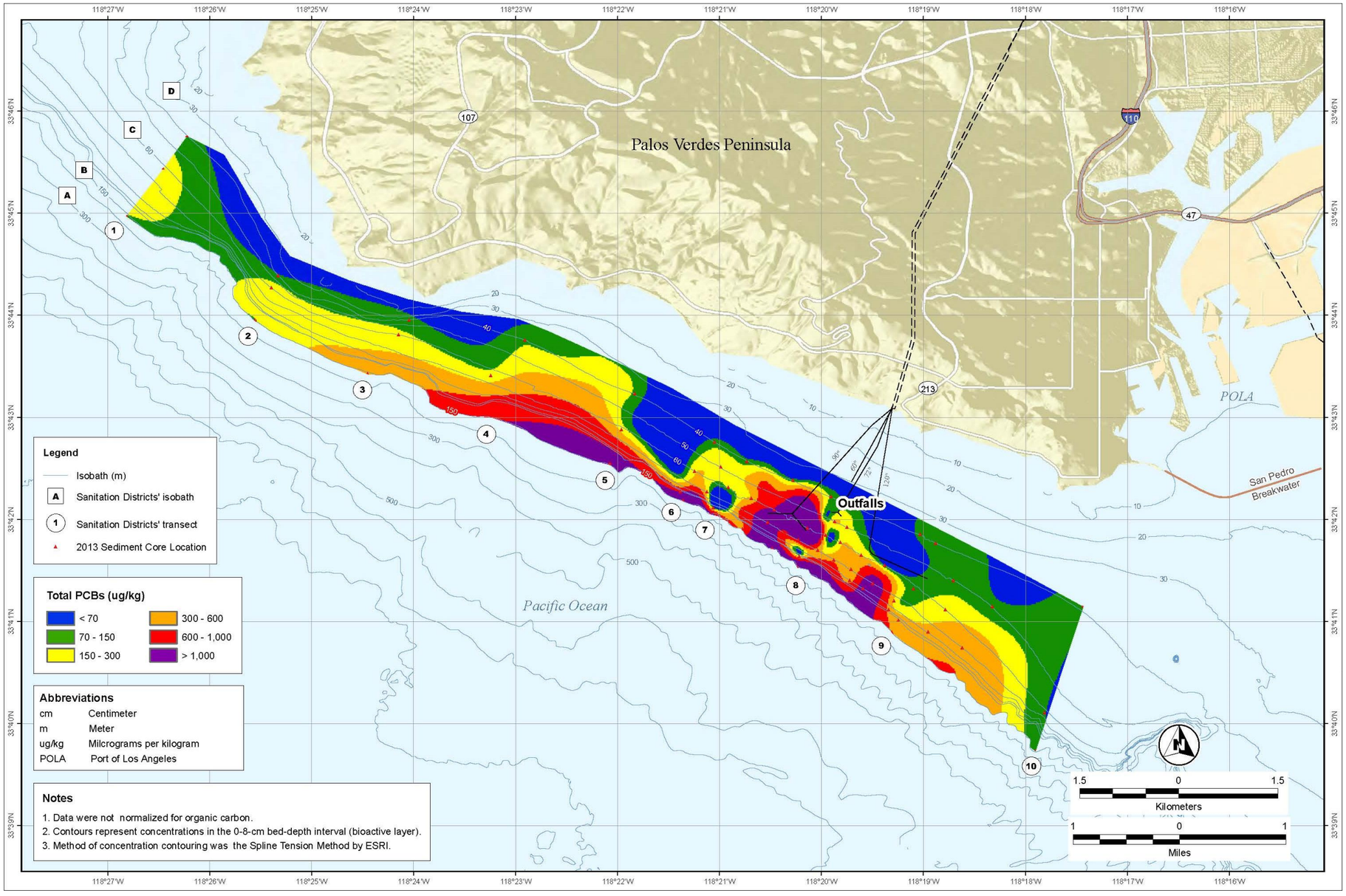


Figure 3. Concentrations of Total PCBs (µg/kg dw) in PV Shelf Sediments collected in in 2013

4.2.2. Water Column

In September and November 2015, EPA collected bulk water samples for high-resolution chemical analysis. The maximum water column concentrations exceeded the human health interim cleanup goal set by the ambient water quality criteria (AWQC) for both DDTs and PCBs (Table 5). For ecological risk, only near-bottom samples in the vicinity of the outfalls exceeded the ecological AWQC of 1ng/L total DDT and none of the samples exceeded the ecological AWQC for PCBs

Throughout the PV Shelf, the average concentrations of total DDTs and total PCBs were generally highest in the bottom and near bottom samples, with generally decreasing concentrations in the mid-water column samples. In some stations downstream of the diffusers on the 60 m depth contour, the highest concentrations were observed in the mid-water column sample. All near surface samples had relatively low concentrations of total DDTs and total PCBs. Across the PV Shelf, the highest concentrations were observed down-current of the outfalls, while upcurrent concentrations were relatively low.

4.2.3. Fish Tissue

Two fish species common to the Palos Verdes Shelf and popular with anglers were collected for tissue analysis between 2014 and 2016. White croaker and barred sand bass were collected from three zones of Sanitation Districts' NPDES bioaccumulation monitoring program: Zone 1, (outfall zone); Zone 2 (intermediate zone) and; Zone 3 (distant zone). In addition, EPA selected the Breakwater Zone and three spawning grounds: Ventura Flats, Redondo Flats, Huntington Flats as reference sites (Figure 4).

Concentrations of total DDT in white croaker collected from Zones 1, 2, and 3 were above the risk-based tissue goal of 400 µg/kg in the IROD (Table 5). Tissue concentrations of total PCBs were above the interim cleanup goal of 70 µg/kg for fish collected from Zones 1 and 2. Based on white croaker sampled regularly as part of the Sanitation Districts' NPDES monitoring (Sanitation Districts 2017), there has been a significant declining trend (Mann-Kendall analysis, Appendix B) in total DDT concentrations between 1999 to 2016 (Figure 5). Decreases are less dramatic for PCBs, with significant decreases in Zones 1 and 2 (Mann-Kendall analysis, Appendix B). The trend for PCBs in Zone 3 over the entire sampling period was considered "stable"; however, there is a consistent decrease in concentrations for PCBs in white croaker collected between 2004 and 2016. While these decreases have not achieved the interim tissue goals, they have resulted in decreased risk from seafood consumption (Appendix E).

The data set for barred sand bass is more limited; however, concentrations of total DDT and total PCBs observed in 2013 were lower than those observed during the baseline assessment (EPA 2009).

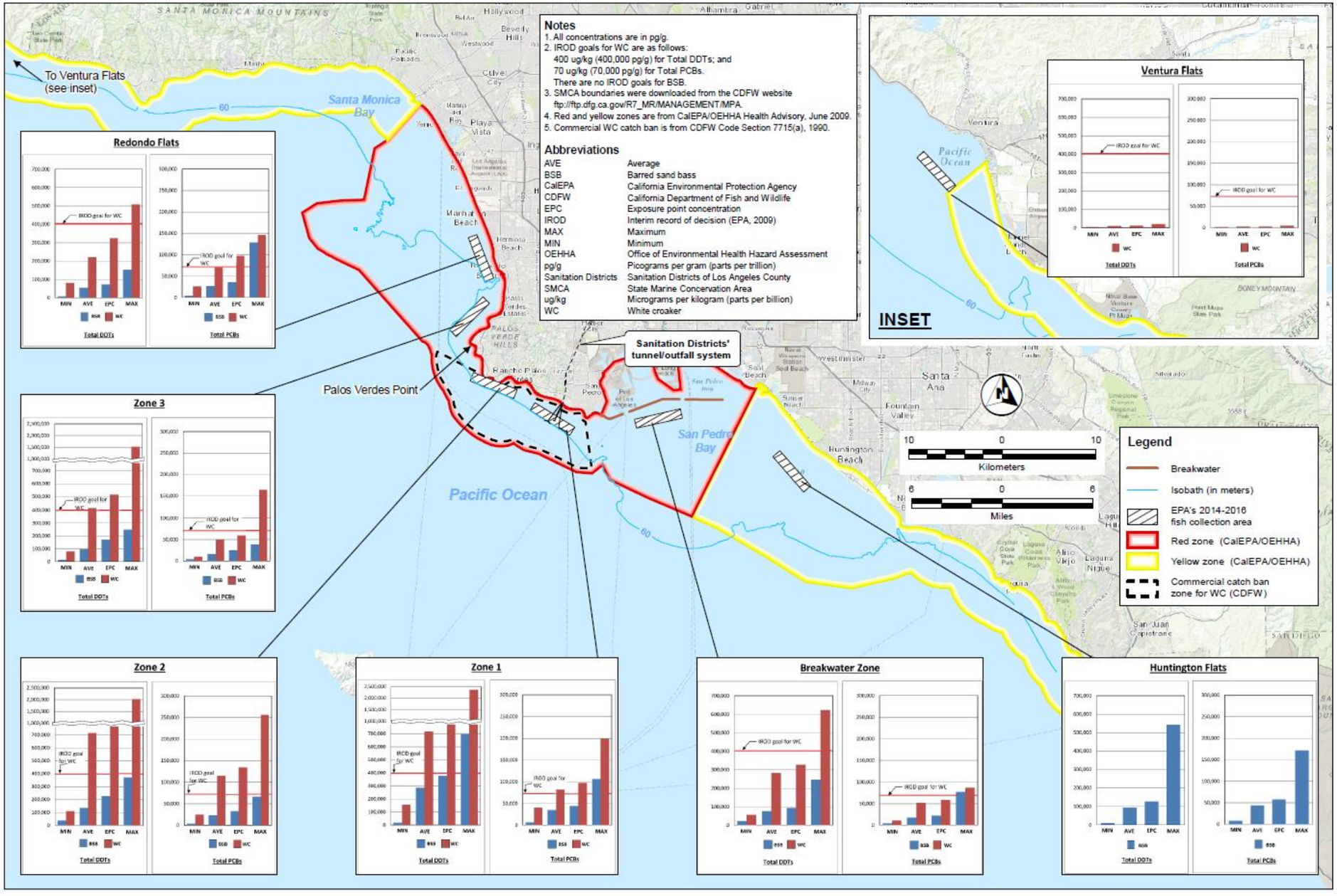


Figure 4. Concentrations of Total DDT and PCBs in Fish Tissues.

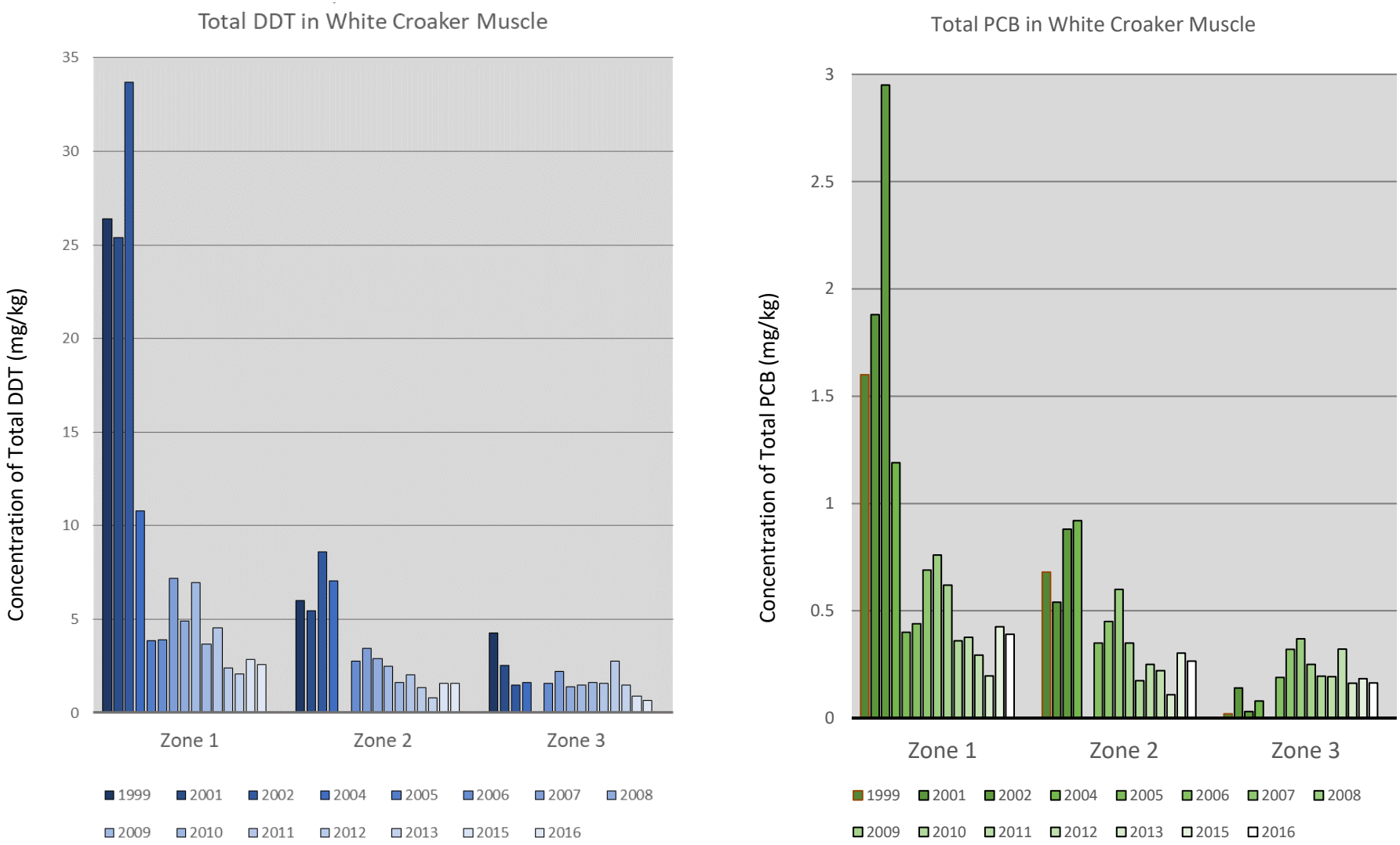


Figure 5. Concentrations of Total DDT and Total PCBs in White Croaker Muscle Tissue (1999-2016). Data from LACSD*

*Prior to 2006, individual fish was used for analysis. Starting in 2016, per the NPDES permit requirement 10 composited fish sample for each zone was used for analysis.

4.2.4. Institutional Controls – Monitoring Component

EPA conducts inspections at retail and wholesale markets, and at in-water, dockside, and shoreline locations. Prior to the IROD, EPA purchased 30 white croakers from six Los Angeles fish markets between July 2004 and January 2005, and analyzed fish tissue samples (skin-off filets) for DDTs and PCBs. Results from the study indicated that concentrations of total DDTs ranged from 58 µg/kg to 12,000 µg/kg, and concentrations of total PCBs ranged from 27 µg/kg to 1,000 µg/kg (CH2M Hill, 2003). Since November 2010, no locally sourced white croaker caught in violation of the white croaker catch ban have been observed for sale in any of the local markets, including markets where white croakers had been previously identified. In markets where white croaker was observed, the markets were able to provide paperwork to verify that they were not caught off the coast of Southern California and were legally harvested.

4.2.5. Institutional Controls – Enforcement and Outreach Components

The Community Involvement Program was designed to reduce risk posed by exposure to contaminated fish through outreach and education. The program has three main activities: Angler Outreach, Community Outreach, and Enforcement. In support of these activities, EA Engineering, Science, and Technology, Inc. (EA) coordinated meetings with the Fish Contamination Education Collaborative (FCEC) during the reporting period. The FCEC is a forum for the agencies, outreach groups, and other entities involved to share ideas, get updates on the project's progress, and maintain momentum for continued outreach work.

The purpose of the Community Involvement Program is the dissemination of educational material concerning consumption of contaminated fish focusing on specifically vulnerable ethnic communities. To better communicate with these vulnerable ethnic communities, outreach/education material are provided in multiple languages, in addition to English. The extent of the outreach components includes the following.

1. Angler outreach conducted between March 2015 and July 2018.
2. Bait shop outreach conducted between October/November 2015 and May 2018.
3. Electronic outreach on the FCEC website and Facebook page conducted between January 2015 and July 2018.
4. Community events attendance between April 2015 and July 2018.

EA subcontracted Heal the Bay (HTB) and Cabrillo Marine Aquarium (Cabrillo) to perform angler outreach; team subcontractor, HDR, Inc. (HDR), to complete the bait shop outreach and attend community events; and Chinese Christian Herald Crusade (CCHC) and Boat People SOS (BPSOS) to conduct outreach during community events for the Chinese and Vietnamese communities, respectively. Electronic outreach through the FCEC website and Facebook page was maintained by EA. Multiple FCEC partners meetings were held during the review period and were coordinated and facilitated by EA.

The California Department of Fish and Wildlife (CDFW) – Law Enforcement Division (LED) conducts inspections of in-water commercial and recreational anglers, and shoreline recreational and subsistence anglers in an effort to enforce the daily catch limit and the commercial no-take zone for white croaker. Enforcement and pier sign monitoring activities were also performed as part of the Community Involvement Program. Enforcement activities were performed by the CDFW between January 2015 and July 2018. Additionally, the City of Long Beach Department of Health and Human Services, Bureau of Environmental Health (City of Long Beach) and the Los Angeles County Department of Public Health (LACDPH) inspected and enforced the catch ban at markets and restaurants on behalf of the EPA from 2015 to 2018. The pier signs were monitored by Heal the Bay, Cabrillo, and City of Long Beach during the reporting period to assess the need for replacement or repair. EA facilitated multiple fish identification training workshops for LACDPH and City of Long Beach during the reporting period.

While markets and restaurants are still allowed to sell white croaker, they must demonstrate that the fish were obtained legally and not sourced from the local off shore areas under enforcement. Educational materials are designed to reach anglers who inadvertently catch white croaker to inform them of the ban and issues associated with consuming contaminated fish. Overall, data collected between February 2015 and August 2018 have demonstrated the absence of white croakers in local markets, restaurants, and commercial fishing facilities. Of the 243 market inspections conducted during that time period, white croakers were observed on only one instance. During one market inspection conducted by LACDPH, 50 pounds of white croaker were observed in the establishment. The market provided an invoice for the croaker which confirmed that they were sourced from a reputable vendor, and not caught off the coast of Southern California. White croakers have not been observed in any local markets or restaurants since 2011. In the past, the Orange County Health Care Agency, Environmental Health Division conducted the inspections of markets and restaurants in Orange County. Based on the data collected prior to EA's involvement in the project, Orange County determined that white croaker was not being sold in markets and declined to continue involvement in this program.

Data suggest that white croaker still are commonly caught (and released) by recreational anglers fishing along the shoreline of the Palos Verdes Peninsula. Of the recreational anglers contacted since 2015, up to 82 percent of them reported being aware of existing fish contamination issues (EA 2016, 2017, 2018). Other Do Not Consume (DNC) fish, such as barred sand bass, also were commonly caught during enforcement and monitoring efforts.

The most recent data suggest a moderate awareness level of the fish contamination issue among market operators and employees; 33 percent of the market/restaurant employees surveyed for Los Angeles County and 55 percent for Long Beach demonstrated awareness (EA, 2018), although the most commonly reported sources of information varied between different jurisdictions. In Los Angeles County (including Long Beach), health inspectors were reported as the most common sources of information.

The data demonstrate that contaminated fish are not reaching the local markets and also validate the continued effectiveness of the institutional controls in reducing the presence of contaminated fish in local markets.

4.3. Site Inspection

The inspection of the Site was conducted on April 22, 2019. Judy C. Huang, EPA Project Manager, conducted the inspection (Appendix G). Ms. Huang selected two piers to inspect: Rainbow Harbor and Belmont Pier. The key inspection item was to verify that the presence and condition of the required signage containing Do Not Consume (DNC) fish messaging are posted on piers to help anglers identify which fish are on the DNC list and therefore should not be eaten. All inspected signs shown evidence of aging and minor vandalism such as graffiti and/or placement of stickers but are generally well maintained, visible, and readable. Ms. Huang also noted that one of the five required signs was missing from the Rainbow Harbor. She followed up with the City of Long Beach, which plans on replacing the missing sign.

5. Technical Assessment

5.1. Question A: Is the remedy functioning as intended by the decision documents?

Yes, the interim remedy is functioning as intended by the IROD.

The institutional controls are well established and remain effective in protecting human health. The physical, chemical, and biological mechanisms of MNR appear to be effective in reducing contaminant levels in the sediment bed. The isolation cap as described in the IROD is postponed pending alternatives development and evaluation in the final Feasibility Study.

The institutional controls component of the remedy is functioning as intended by the decision documents. The institutional controls have been successful in limiting human exposure to contaminated fish through aggressive outreach and education performed by EPA in partnership with other federal, state, and local agencies, and community-based organizations. Based on data from the review period, the institutional controls have been effective in preventing contaminated fish from reaching local markets and restaurants. Given this trend, the frequency of the market monitoring for the City of Long Beach and Los Angeles County could be optimized (frequency of monitoring of Los Angeles markets is already semi-annual) and focus more efforts on the outreach efforts in the pier areas.

Concentrations of contaminants detected in sediment samples at PV Shelf derived from cores collected in 2013 confirmed observations from 2009 - that current concentrations are significantly lower than those observed during pre-remedy sediment sampling events (Appendix B, Data Review). Based on the decrease in concentrations of DDTs and PCBs detected in sediment samples, the design and installation of a clean sediment cap were suspended. Additional sediment monitoring will be conducted to confirm that sediment concentrations are continuing to decrease and to determine if remedial action objectives can be achieved without the cap.

Fish tissues collected from the PV Shelf by the Sanitation Districts since the 1990s show a declining trend for both total DDT and total PCBs. White croaker and barred sand bass collected by EPA in 2014 to 2016 confirmed the decrease in DDT and PCB concentrations in PV Shelf fish tissues. While white croaker tissue concentrations remain above the target tissue levels, decreasing trends indicate that tissue goals are

achievable across the shelf. PCBs may require a longer period of time to reach the target tissue levels and are now the greater contributor to human health risk.

As previously described, the cap component of the interim remedy for PV Shelf has been postponed pending analysis of data sets for sediment, ocean water, and ecological receptors (fish).

5.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs in the IROD are still valid and support the interim remedy. However, subsequent to releasing the IROD, fish tracking studies have indicated that the food web model which forms the basis of the risk-based cleanup levels for sediment and tissues may need to be refined prior to establishing cleanup levels for the final ROD.

There have been no changes to the standards that would affect protectiveness, but there has been a change in the surface water *p,p'*-DDE AWQC for human health from 0.22 to 0.018 ng/kg, increasing the number of samples exceeding the criteria. However, there is no change in the protectiveness of the remedy since bottom and mid-column water samples from a number of stations exceeded both standards.

There have been no changes to the toxicity factors for DDT isomers or PCBs that would affect protectiveness.

There have been no changes in the risk assessment methods since the completion of the baseline risk assessments that would call into question the protectiveness of the remedy. While there have been some changes in the recommended exposure factors for human health risk assessments (OSWER 2014), many of the exposure factors used in the baseline human health risk assessments were site-specific and the risk-based threshold concentrations would be unaffected.

Uses of the area at or near PV Shelf have not and are not expected to change. There are no new human health or ecological routes of exposure or receptors that have been identified, and none of those previously identified have changed. The baseline relationship between sediment and water column contaminant concentrations has been confirmed by the field investigations summarized in the first long-term monitoring report (EPA 2018). However, fish tracking studies have indicated that the amount of time that white croaker are exposed to site sediments may not be as high as previously assumed. In that case, the food web model which forms the basis of the risk-based cleanup levels for sediment and tissues may need to be refined prior to establishing cleanup levels for the final ROD. While this change may affect the final cleanup goals, the continued decrease in both sediment and tissue concentrations indicate that the interim remedy is functioning as intended.

Sediment concentrations of total DDT and PCBs have met post-capping goals and the IROD interim cleanup goal has been met for total PCBs. While total DDTs in sediment remain above the interim cleanup goal of 46 mg/kg OC, there has been a decrease in total DDTs in both 2009 and 2013, relative to pre-IROD levels in sediment, showing progress towards the RAOs. Likewise, despite not meeting the interim cleanup goals for fish tissues, the decreasing trend in tissue concentrations indicates progress towards meeting the RAOs.

5.3. *Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?*

No, there are no additional considerations that may affect protectiveness of the remedy.

6. Issues/Recommendations

Table 6. Issues and Recommendations Identified in the Five-Year Review

OU(s):	**Issue Category:** Other *Interim* ***cleanup level for sediment may not be appropriate.***			
	Issue: The interim sediment cleanup level is based on a food web model that assumes that PV Shelf white croaker are closely associated with the PV Shelf sediments and that tissue concentrations in white croaker are primarily due to exposure to PV Shelf sediments. However, fish tracking studies have indicated that PV Shelf white croaker spend less time on the Shelf than previously thought. Since the risk-based interim cleanup levels are based on the white croaker-to-sediment relationship, the interim goals may not be appropriate.			
	Recommendation: Reevaluate the fish-sediment relationship for the PV Shelf and revise the sediment cleanup levels as part of the Feasibility Study.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	8/28/2024

6.1. *Other Findings*

In addition, the following are recommendations that improve management of O&M but do not affect current and/or future protectiveness and were identified during the FYR.

- Although total DDT and PCB concentrations and contaminant mass have decreased since pre-IROD sampling, there was an increase since the 2009 baseline survey. Additional rounds of sediment sampling should be conducted to confirm that concentrations and bedload mass continue to decline. This is particularly true for concentrations and mass of PCBs which appear to be decreasing more slowly than total DDT. It may also be useful to evaluate changes in congener distributions over time as an indication of degradation. A 5-year frequency for sediment sampling is appropriate for PV Shelf, as the shape and thickness of the contaminated sediment bed does not appear to undergo rapid change, there are no significant ongoing sources of contaminants and the rates of contaminant biodegradation are low.

- Continue to monitor barred sand bass as a second indicator species of fish (in addition to white croaker). This would allow trends over time to be evaluated for both white croaker and barred sand bass.

7. Protectiveness Statement

Table 7. Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: OU-5	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at Montrose Chemical Corporation Operable Unit 5 (Palos Verdes Shelf) is protective in the short-term; however, in order for the remedy to be protective in the long-term, follow up actions need to be taken. Concentrations of DDTs and PCBs in sediment and fish tissue are decreasing through monitored natural recovery and Institutional Controls minimize human consumption of impacted fish. Sediment cleanup levels should be revised based on revised fish-sediment relationships.	

8. Next Review

The next Five-Year Review report for the Palos Verdes Shelf Superfund Site is required five years from the completion date of this review.

Appendix A: List of Documents Reviewed

CH2M Hill, 2005. *Final Ecological Risk Assessment for the Palos Verdes Shelf*, CH2M Hill. November.

CH2M Hill, 2007. *Final Palos Verdes Shelf Superfund Site Remedial Investigation Report*. October.

Drake, D.E., C.R. Sherwood, and P.L. Wiberg, 1994. *Predictive Modeling of the Natural Recovery of the Contaminated Effluent-Affected Sediment, Palos Verdes Margin, Southern California*, expert report for U.S. vs. Montrose.

EA Engineering, Science and Technology Inc., 2016a *Fish Contamination Education Collaborative. Final Annual Angler Outreach Report, February 2015-July 2016, Palos Verdes Shelf Superfund Site, Los Angeles, California.* August.

EA Engineering, Science and Technology Inc., 2016b *Fish Contamination Education Collaborative. Final Enforcement Report, February 2015-July 2016, Palos Verdes Shelf Superfund Site, Los Angeles, California.* August.

EA Engineering, Science and Technology Inc., 2017a *Fish Contamination Education Collaborative. Final Annual Angler Outreach Report, July 2016-July 2017, Palos Verdes Shelf Superfund Site, Los Angeles, California.* November.

EA Engineering, Science and Technology Inc., 2017b *Fish Contamination Education Collaborative. Final Enforcement Report, February 2016-July 2017, Palos Verdes Shelf Superfund Site, Los Angeles, California.* July.

EA Engineering, Science and Technology Inc., 2018a *Fish Contamination Education Collaborative. Final Annual Angler Outreach Report, August 2017-July 2018, Palos Verdes Shelf Superfund Site, Los Angeles, California.* November.

EA Engineering, Science and Technology Inc., 2018b *Fish Contamination Education Collaborative. Final Enforcement Report, August 2017-July 2018, Palos Verdes Shelf Superfund Site, Los Angeles, California.* November.

Eganhouse, Robert, and J. Pontolillo, 2008. DDE in Sediments of the Palos Verdes Shelf, California: *In Situ* Transformation Rates and Geochemical Fate, *Environmental Science & Technology*, Vol. 42, No. 17, 2008, pp. 6392-6398.

Eganhouse, R, W Orem, M Reinhard. 2017. *Final Synthesis Report for Factors Controlling DDE Dechlorination Rates on the Palos Verdes Shelf: A Field and Laboratory Investigation*. Report prepared for US Environmental Protection Agency Region 9. Report prepared by US Geological Survey, Reston VA and Civil and Environmental Engineering, Stanford University, Stanford, CA.

EPA. 2001. *Action Memorandum for Palos Verdes Shelf*. 28 September.

EPA. 2001b. *Draft Institutional Controls Implementation Plan for Palos Verdes Shelf.* December.

EPA, 2003. *Ecological Risk Assessment for the Palos Verdes Shelf*. December.

EPA. 2009. *Interim Record of Decision, Palos Verdes Shelf, Operable Unit 5 of Montrose Chemical Corporation Superfund Site*. September.

EPA. 2013. *Revised Final Data Report for the Fall 2009 Sediment Sampling Program. Palos Verdes Shelf (OU5 of the Montrose Chemical Corporation Superfund Site). Los Angeles County, California*. EPA Contract No. EP-S9-08-03. Task Order 0029. Report Prepared by ITSI Gilbane Company, Walnut Creek, CA for USEPA Region IX, San Francisco CA.

Lowe, 2013. *Revised Final Data Report for the Fish Movement Study Palos Verdes Shelf (OU5 of the Montrose Chemical Corporation Superfund Site, Los Angeles County, California*. Report Prepared by Dr. Christopher Lowe for ITSI Gilbane Company, Long Beach California

EPA. 2014. *First Five-Year Review Report for Palos Verdes Shelf (Operable Unit 5 of the Montrose Chemical Corporation Superfund Site) Los Angeles, California.* Prepared by Gilbane Federal. August.

EPA 2014. *Palos Verdes Seafood Consumption Study Technical Report*. Prepared by S. Groner Associates.

EPA 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, Office of Superfund Remediation and Technology Innovation. Feb 2014, OSWER Directive 9200.1-120

EPA, 2018. *First Monitored Natural Recovery Report Data Collections 2013-2016. Palos Verdes Shelf (OU 5 of the Montrose Chemical Corporation Superfund Site), Los Angeles County, California*. May.

Gilbane Federal. 2017. Technical Memorandum: *Human Health Risk Evaluation of 2011-2012 Fish Collection Data, Palos Verdes Shelf Institutional Controls (ICs) Program, Los Angeles County, California*. Contract No. EP-S9-08-03/Task Order 05. Report Prepared by Gilbane Federal, Walnut Creek, CA for USEPA Region IX, San Francisco CA.

Gilbane Federal, 2016. *Risk Evaluation of Fish Monitoring Results and Lobster Data – Palos Verdes Shelf Technical Memorandum*. January.
Heal the Bay, 2018. *Angler Outreach Program, Year 15, April 2017-December 2017*. January.

Los Angeles County Sanitation Districts. 2017. 2016-2017 JWPCP Biennial Receiving Water Monitoring Report. Sanitation Districts. Whittier, California.

Lee, H.J., 1994. *The Distribution and Character of Contaminated Effluent-Affected Sediment, Palos Verdes Margin, Southern California, Expert Report*, U.S. Geological Survey.
October.

Science Applications International Corporation (SAIC), 1999. *Human Health Risk Evaluation for Palos Verdes Shelf*. April.

Appendix B: Data Review

The following section summarizes data collected since the previous Five-Year Review. This includes concentrations of DDTs and PCBs measured in sediment, water and tissues, changes in concentrations over time, and comparisons to cleanup goals presented in the IROD (EPA 2009). Literature citations are presented in Appendix A.

Sediment

The first long-term monitoring event was conducted in 2013. Sediment cores were collected using sampling approaches and techniques similar to the 2009 baseline sediment assessment. EPA sampled 34 locations from the greater PV Shelf and 35 locations from the outfall area (OA) near the Sanitation Districts outfall diffusers. Ten additional OA cores were collected from "hot spot" areas that were not sampled in 2009. Data analysis included sediment COCs from the 0- to-8-centimeter (cm) bed depth interval and core intervals below 8 cm. The upper 8 cm of the sediment profile was the point of compliance in the IROD.

As in previous investigations, total DDT and PCBs were found throughout the PV Shelf, with lower concentrations generally occurring in shallower portions of the site (water depths shallower than 40 m) and higher concentrations found along the shelf edge and near the White Point outfall diffusers (Figures 2 and 3 in Section 4.2.1). Based on vertical profiles for sediments along the 60 m depth contour, concentrations of total DDTs and PCBs were lower in the 0-8 cm interval than those in deeper sediments (Figures B1 and B2; Table B1). This depth gradient was less apparent in sediments near the outfall diffusers, with similar total DDT and PCB concentrations throughout the sediment column.

In 2013, the average concentration of total DDT in the 0-8 cm depth interval for the entire study area was 77 milligrams per kilogram (mg/kg) OC. The average total DDT concentration for 0-8 cm interval in the OA was 120 mg/kg OC (Table B1). Concentrations across the PV shelf were variable, with coefficients of variation (CV) greater than 100% for averages based on individual cores. Variability within the OA was considerably lower, with a CV for total DDTs of 52%. Within-station variability was also relatively high, with relative percent differences greater than 50% for primary-replicate sample pairs.

The total DDT compounds in shelf sediments were comprised primarily of two isomers, *p,p'*-DDE and an associated breakdown product, *p,p'*-DDMU. The increasing proportion of DDMU in shelf sediments, particularly in the uppermost sample interval (0-2 cm), provides an indication that degradation is occurring in shelf sediments.

In 2013, average concentrations of total PCBs from 29 congeners for the 0-8 cm interval were 5 mg/kg OC across the study area and 7.1 mg/kg OC within the OA (Table B1). Similar to total DDT, across-shelf and within-station variability was high.

Relative to the baseline sediment surveys conducted in 2009, concentrations of total DDT and PCBs increased in 2013, but are still below interim cleanup levels targeted for achievement after placement of a cap (Table B2). For total DDTs in the upper 8 cm of the sediment bed, average concentrations (based on output from the geostatistical model) were 56 mg/kg OC in 2009 and 77 mg/kg OC in 2013. The

respective mass estimates of total DDTs for the upper 8-cm interval were 1.7 metric tons and 3.6 metric tons. For total PCBs in the upper 8 cm of the sediment bed, the respective average concentrations were 3 mg/kg OC and 5 mg/kg OC. The respective mass estimates of total $PCBs_{27}$ for the upper 8-cm interval were 0.11 metric tons and 0.28 metric tons.

While there is an apparent increase in the modeled average concentrations of total DDT and PCBs from 2009 to 2013, it is difficult to determine whether the average values are statistically significantly different. In addition to the high cross-shelf and within station variability, there was uncertainty associated with the geospatial model used to predict the average concentrations and the ability to accurately recapture station locations in the open-water environment. As part of the MNR evaluation, a second model was used to confirm the output from the primary geospatial model. The relative percent differences in average concentrations and total mass were as high as 39% and with the secondary model output being more similar to those of 2009. Regardless of whether the differences between 2009 and 2013 are significant, the concentrations and mass of total DDT and PCBs are considerably lower than estimates observed prior to the IROD (150 mg/kg OC and 110 metric tons for total DDT; 10 metric tons for total PCBs; EPA 2018).

Table B1: Average Concentrations of Total DDTs and PCBs in Sediment

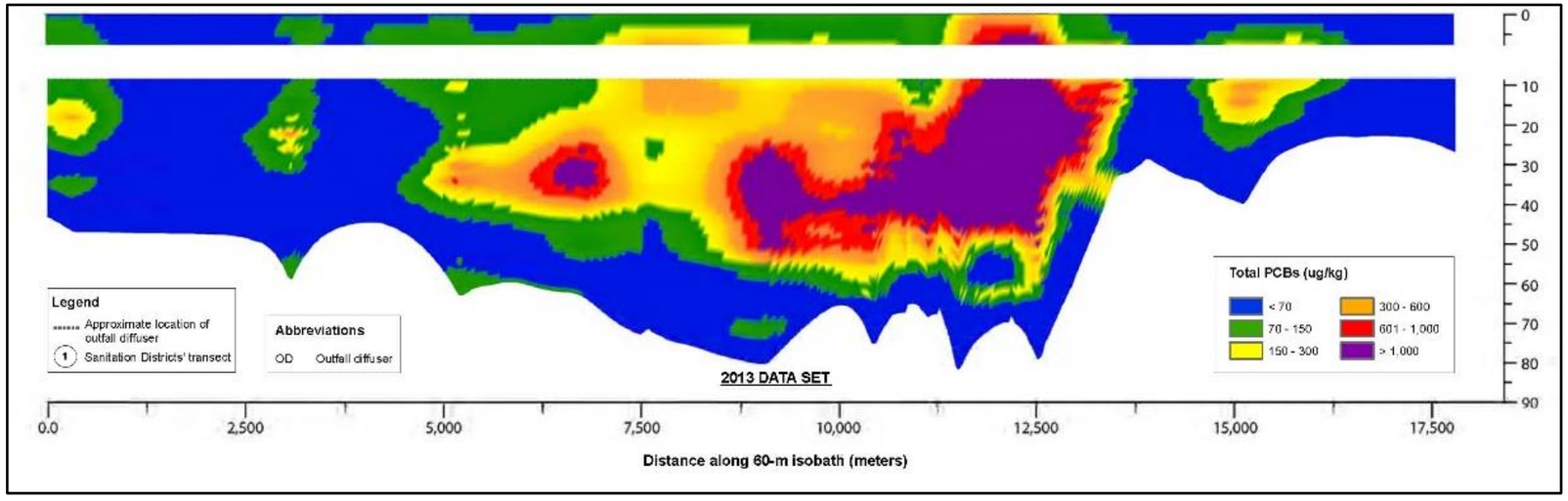
Location	Total DDTs[a] 2013		Total DDTs 2009		Total PCBs[b] 2013		Total PCBs 2009	
	µg/kg dw	mg/kg OC	µg/kg dw	mg/kg OC	µg/kg dw	mg/kg OC	µg/kg dw	mg/kg OC
PV Shelf Site								
Total Bed	3,300	98	1,600	58	200	6.5	120	4.5
0-8 cm Interval	1,800	77	1,300	56	120	5.0	86	3.0
Outfall Area								
Total Bed	5,600	160	2,800	98	300	9.9	160	6.5
0-8 cm Interval	2,500	120	1,900	83	160	7.1	110	4.7

[a]Total DDTs includes *o,p'*-DDT, *o,p'*-DDE, *o,p'*-DDD, *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD

[b]Total PCBs is a sum of 29 congeners

[c]dw: dry weight

[d]OC: organic carbon normalized



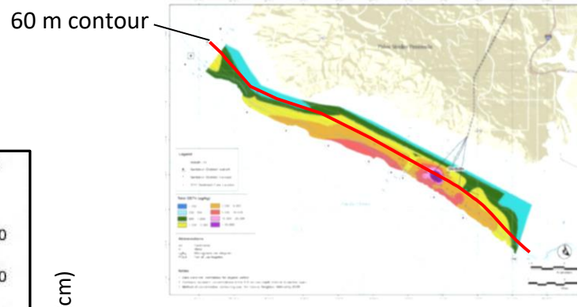


Figure B1. Concentrations of total DDT (µg/kg dw) in the Sediment Bed along the 60 m Depth Contour.

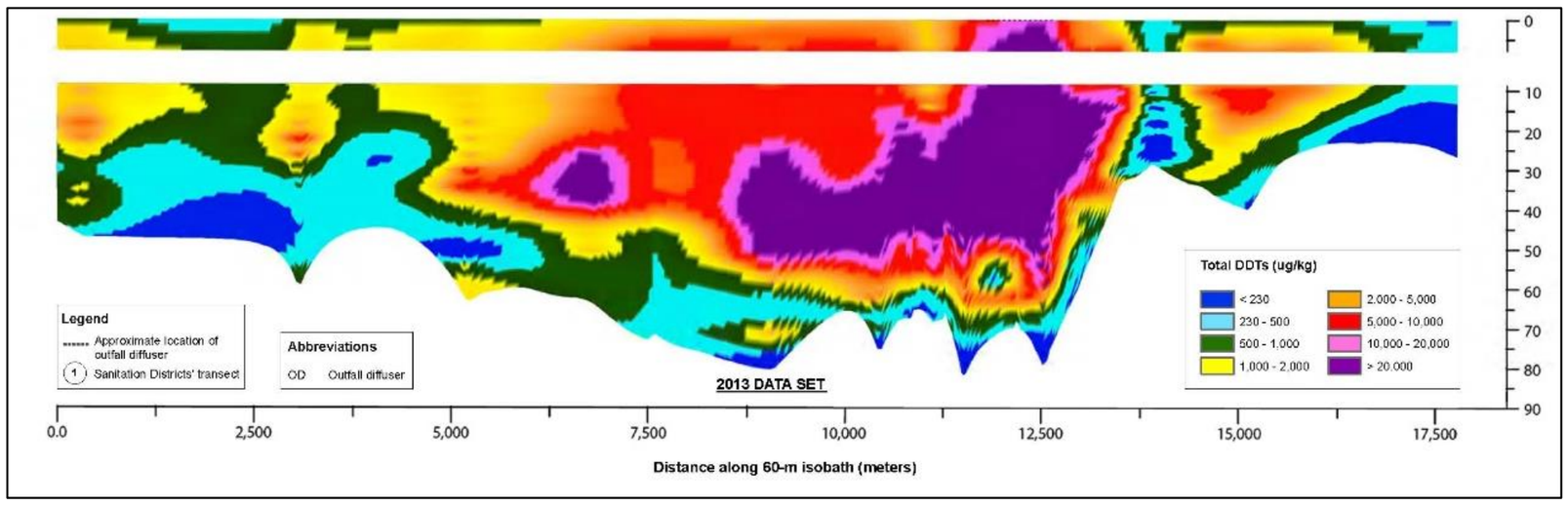


Figure B2. Concentrations of total PCBs (µg/kg dw) in the Sediment Bed along the 60 m Depth Contour.

Investigations that preceded the IROD indicated that natural processes, including sediment transport, biological mixing, desorption from sediment to water, and biodegradation (dechlorination of DDTs) are contributing to lower concentrations of contaminants in surface sediment at PV Shelf (Drake, et al., 1994; Eganhouse, et al, 2008). Based on results of additional studies by Eganhouse et al. (2017), the dechlorination of DDT isomers to forms that are generally thought to be less toxic is continuing to occur, particularly in shallower sediment depths. Unlike DDTs, dechlorination of PCBs does not appear to be occurring in PV Shelf sediments (EPA 2018).

The 2013 average concentrations of DDTs and PCBs in surface sediment were less than the cleanup levels for cap placement (Table B2); however, total DDTs did not achieve the interim cleanup levels for total DDTs set to be achieved by the first Five-Year Review. The remedy relied on two components, a cap and natural recovery processes, and as of this second Five-Year Review, the cap has not been installed as was anticipated in selecting the interim cleanup levels. Early indication is that the natural processes may be able to achieve final cleanup goals without implementation of the interim cap component.

Table B2: Site-Wide Average Contaminant Concentrations in Sediment with Cleanup Goals

Parameter	2013 Sitewide Value	IROD Post-Capping Goal	IROD Interim Cleanup Level	IROD Final Cleanup Level
Sediment (mg/kg dw)				
Total DDTs	77	78	46	23
Total PCBs	5	7	7	--
Surface Water (ng/L)				
Human health				
p,p'-DDE	1.1		0.22	
Total PCBs	0.19		0.064	
Ecological				
Total DDTs	1.6		1	
Total PCBs	0.19		30	
Fish Tissue (µg/kg)				
Zone 1				
Total DDTs	1,000		400	
Total PCBs	98		70	
Zone 2				
Total DDTs	940		400	
Total PCBs	130		70	
Zone 3				
Total DDTs	520		400	
Total PCBs	60		70	

Water Column

In September and November 2015, EPA collected bulk water samples for high-resolution chemical analysis. Throughout the PV Shelf, the average concentrations of *p,p'*-DDE, total DDTs and total PCBs were generally highest in the bottom and near bottom samples (Figures B3 through B8), with generally decreasing concentrations in the mid-water column samples. In some stations, particularly stations downstream of the diffusers on the 60 m depth contour, the highest concentrations were observed in the mid-water column sample. All near surface samples had relatively low concentrations of total DDTs and total PCBs. Total DDTs in water samples were dominated by the *p,p'*-DDE and DDMU isomers, with very little *o,p*'- or *p,p'*-DDT detected in any sample. Across the PV Shelf, the highest concentrations were observed down-current of the outfalls, while upcurrent concentrations were relatively low.

Water column concentrations have been evaluated over time, with sampling events in 1997, 2010, 2013, and 2015. However, the sampling methods have varied and have included both passive samplers and grab samples. While the passive samplers deployed in 2010 and 2013 show generally similar trends in both the vertical and horizontal distribution of contaminants, it is difficult to discern temporal trends. Where 2015 grab sample locations overlap with 1997 dissolved phase samples, concentrations were generally lower in 2015. Near bottom water concentrations showed similar spatial trends to the uppermost sediment (to a depth of 2 cm; Figure B9).

Relative to the IROD, the maximum water column concentrations exceeded the human health and ecological criteria, set by the AWQC for both DDTs and PCBs (Table B2). For assessing human health impacts related to DDTs in the water, EPA used the AWQC for *p,p'*-DDE (0.22 ng/L). Use of the *p,p*'-DDE criterion is appropriate since this isomer is the most prevalent form in the water column. Concentrations of *p,p'*-DDE exceeded the human health AWQC (for salt water) at all stations. It should be noted that the AWQC for *p,p'*-DDE has since been reduced to 0.018 ng/L (EPA 2015) increasing the number of samples exceeding the criteria. Only near-bottom samples in the vicinity of the outfalls exceeded the ecological AWQC of 1ng/L total DDT.

For total PCBs, a total of 38 of 146 water samples exceeded the IROD cleanup goal for human health and none of the samples exceeded the ecological AWQC (Table B2).

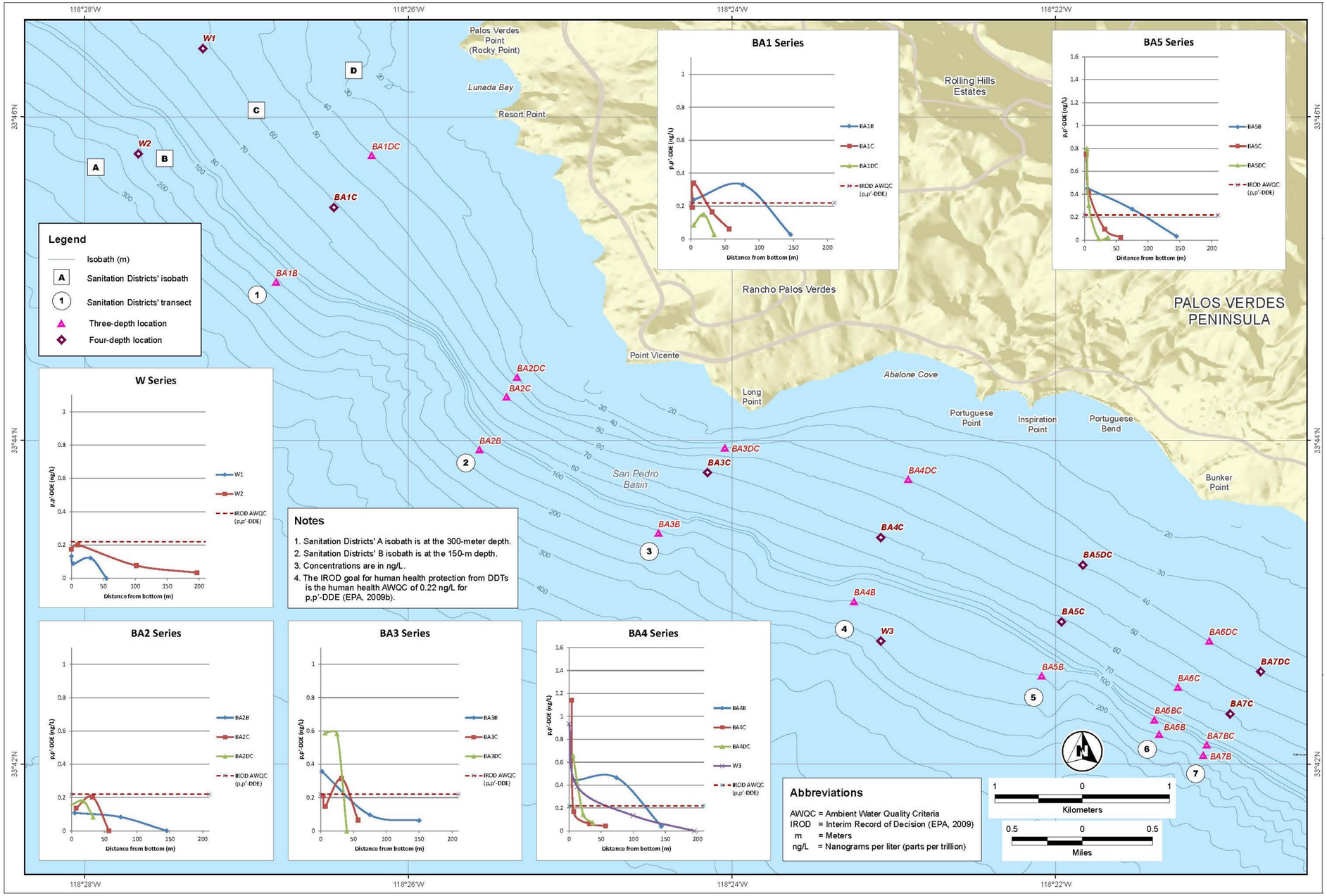


Figure B3. Concentrations of p,p'-DDE (ng/L) in the Water Column, Western and Central PV Shelf.

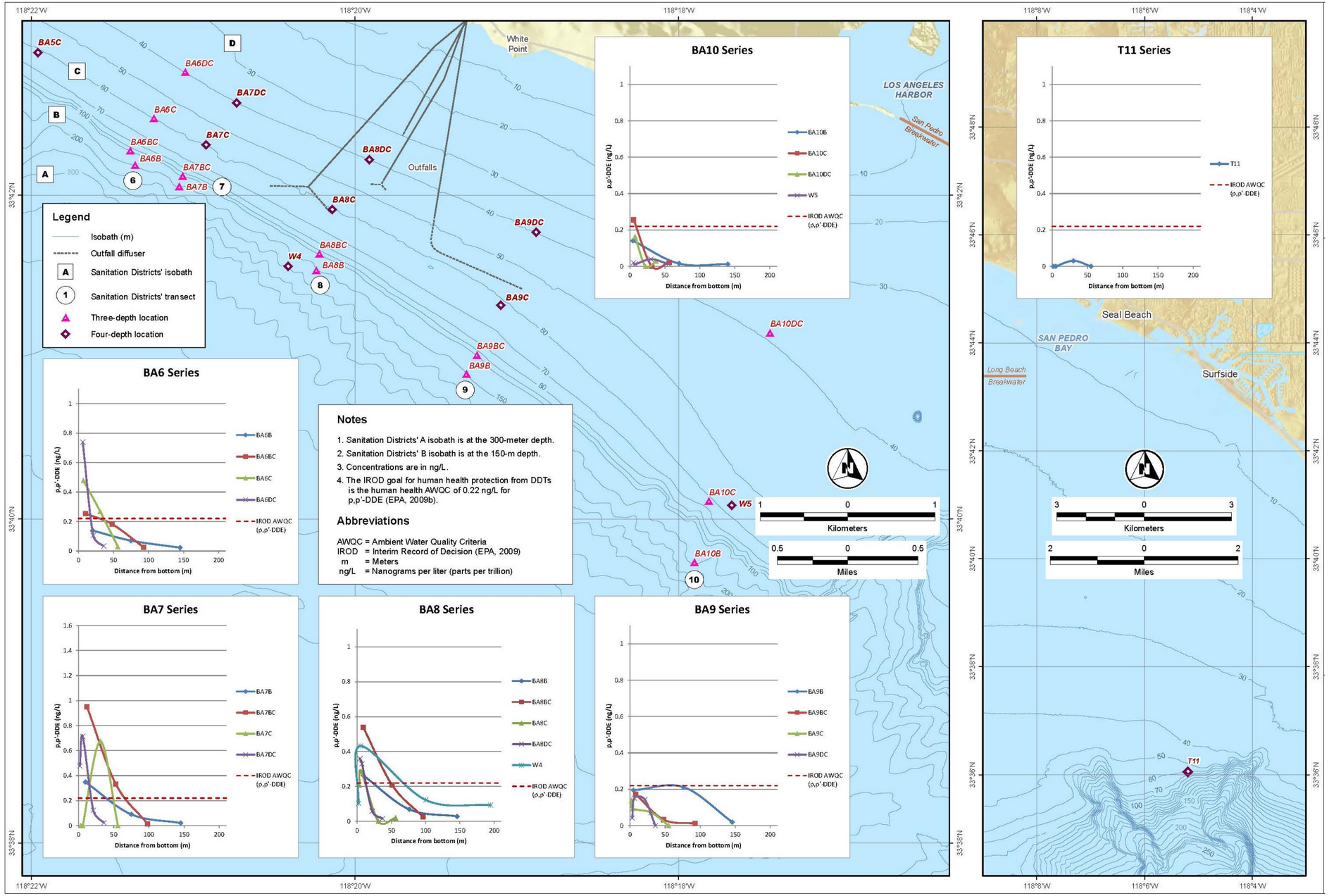


Figure B4. Concentrations of p,p'-DDE (ng/L) in the Water Column, Eastern PV Shelf.

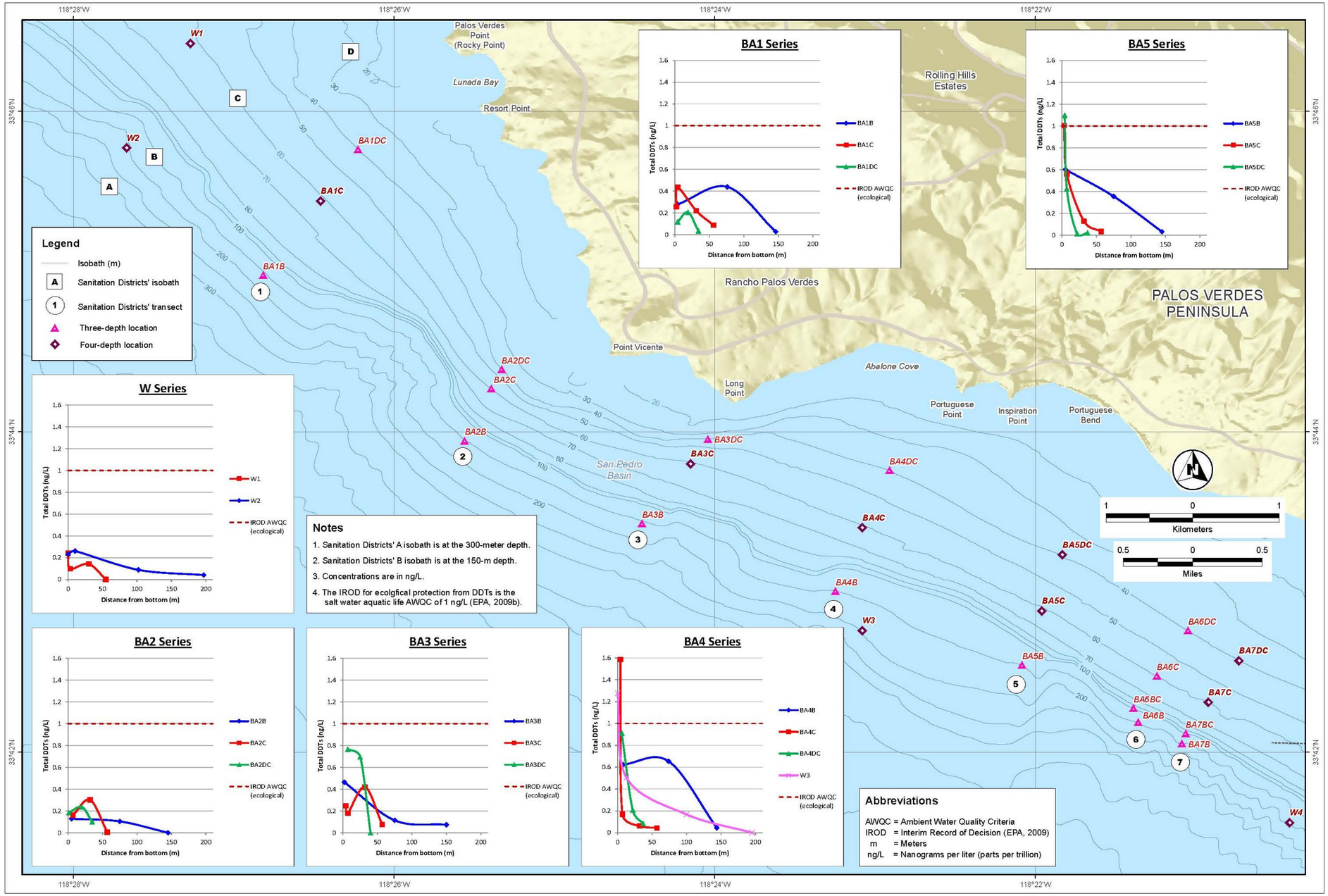


Figure B5. Concentrations of Total DDT (ng/L) in the Water Column, Western and Central PV Shelf.

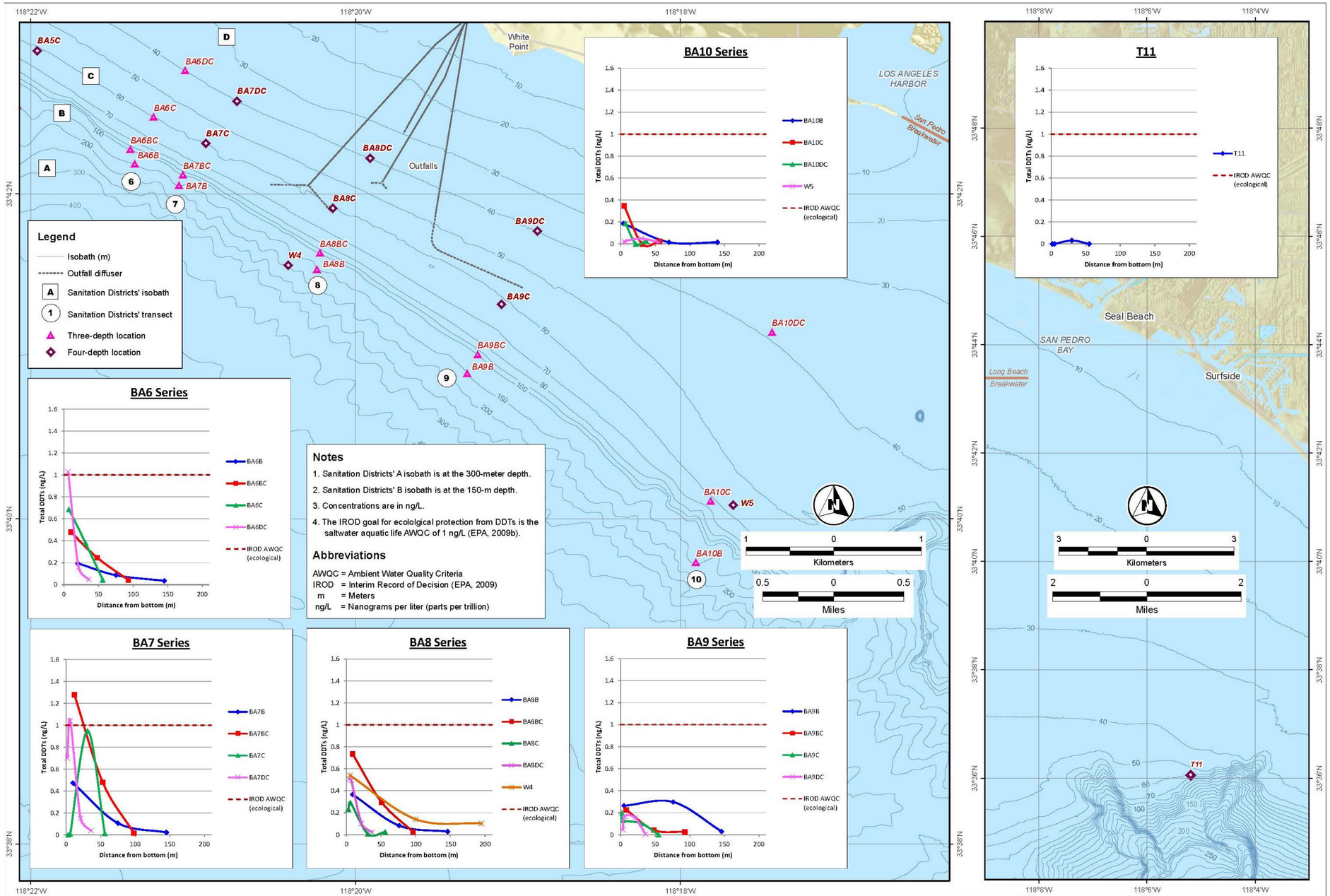


Figure B6. Concentrations of Total DDT (ng/L) in the Water Column, Eastern PV Shelf.

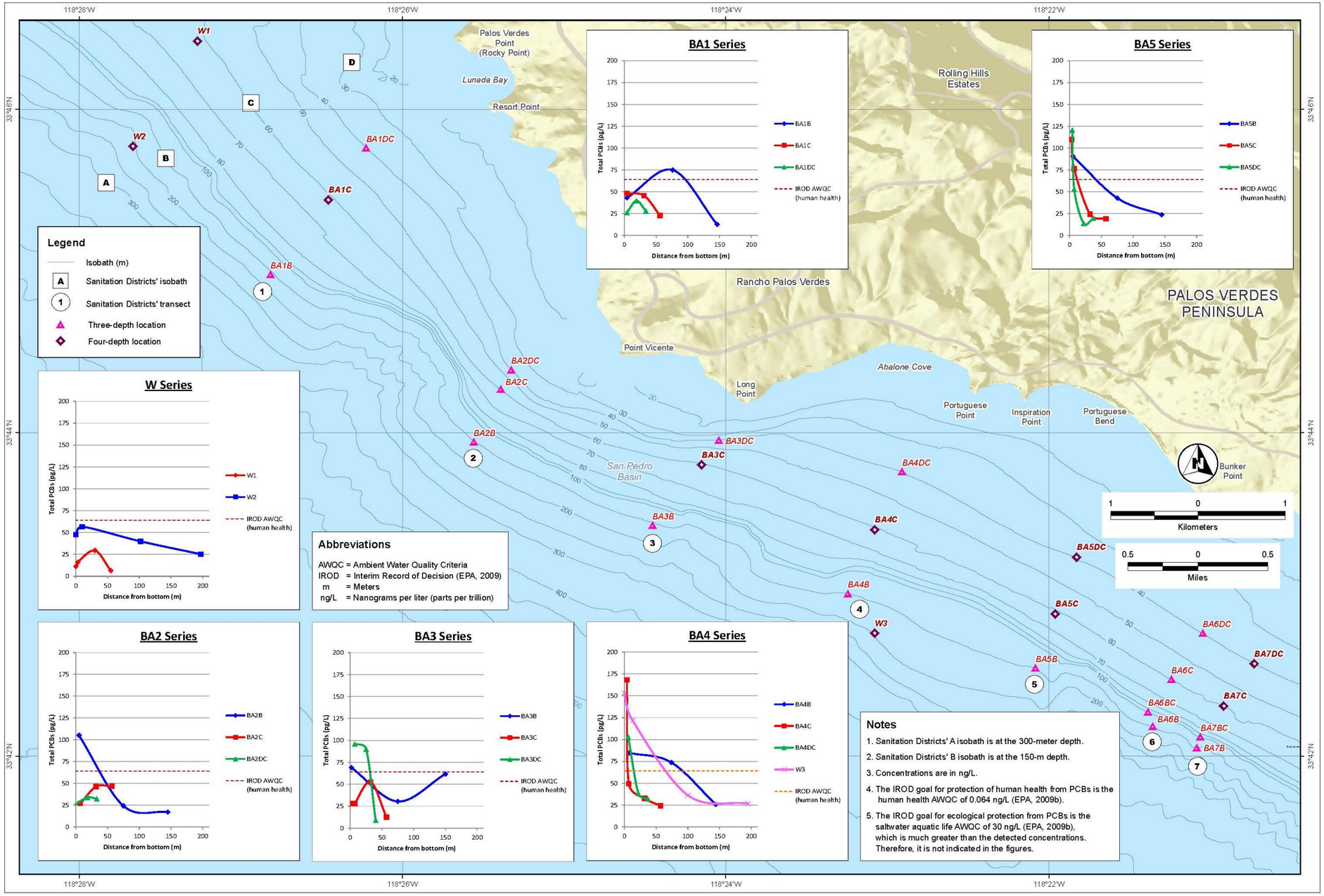


Figure B7. Concentrations of Total PCBs (ng/L) in the Water Column, Western and Central PV Shelf.

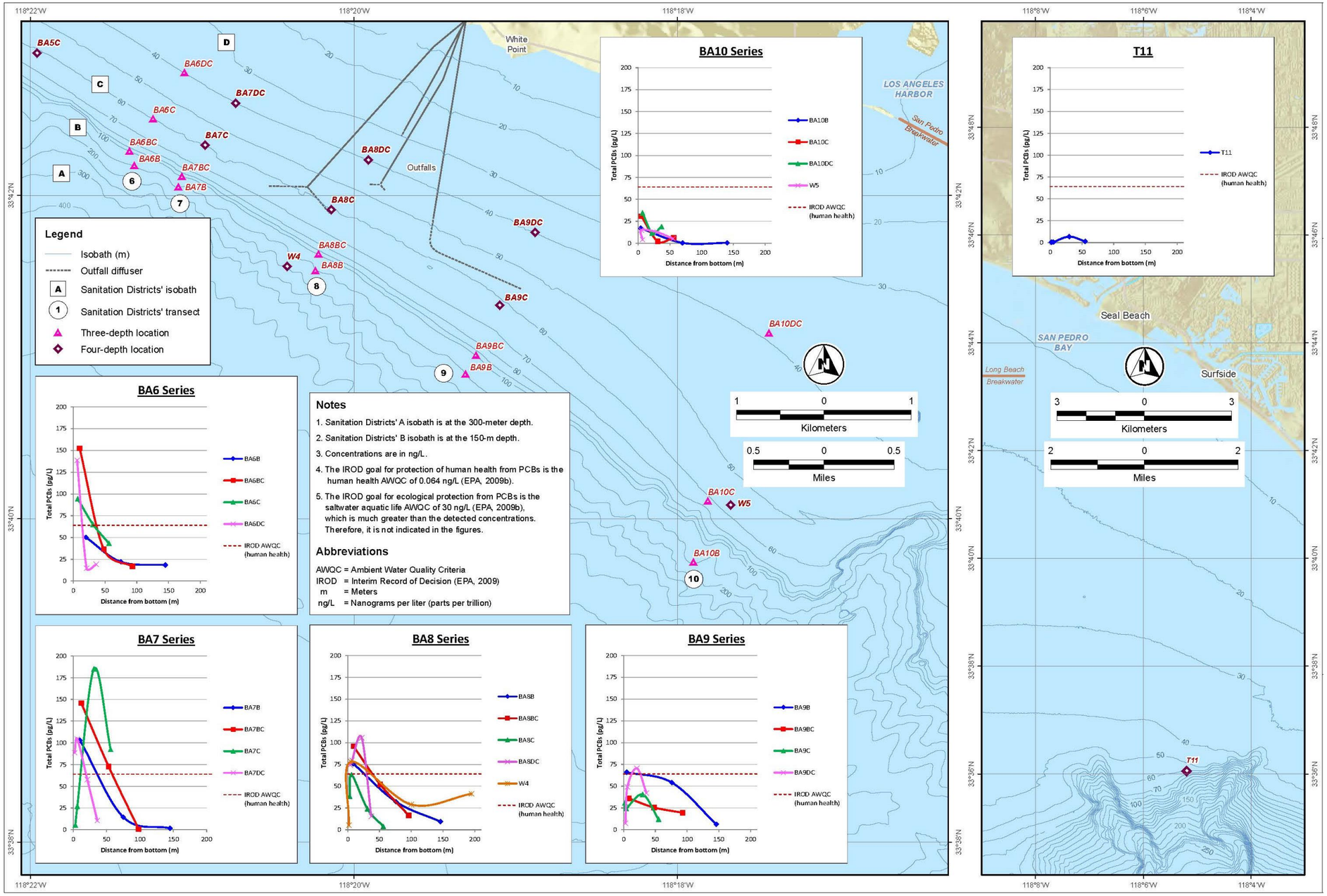


Figure B8. Concentrations of Total PCBs (ng/L) in the Water Column, Eastern PV Shelf.

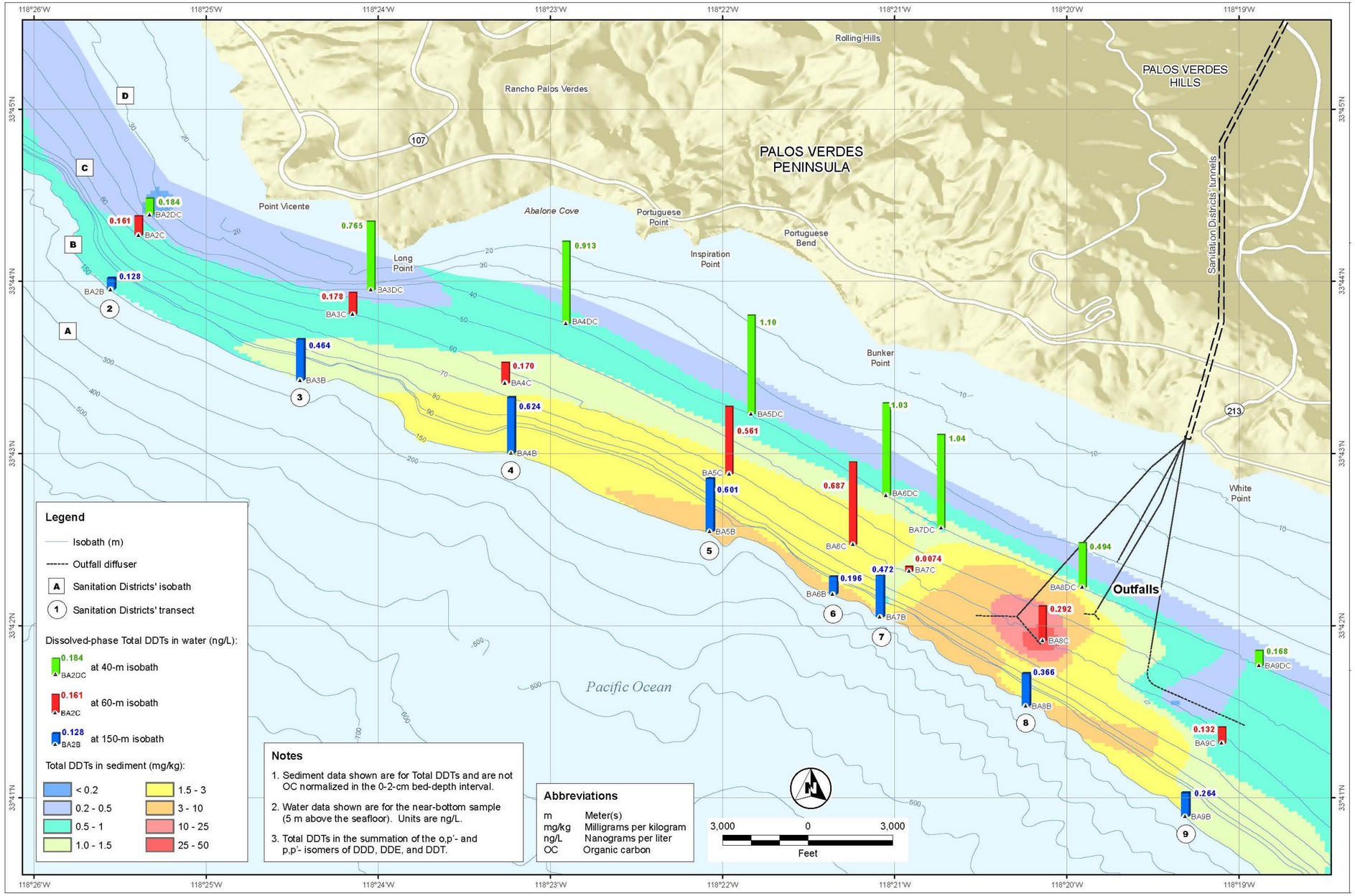


Figure B9. Comparison of Concentrations of Total DDT (µg/L) in the Surface Sediment (0 - 2 cm) and Near-Bottom Water Column, PV Shelf.

Fish Tissue

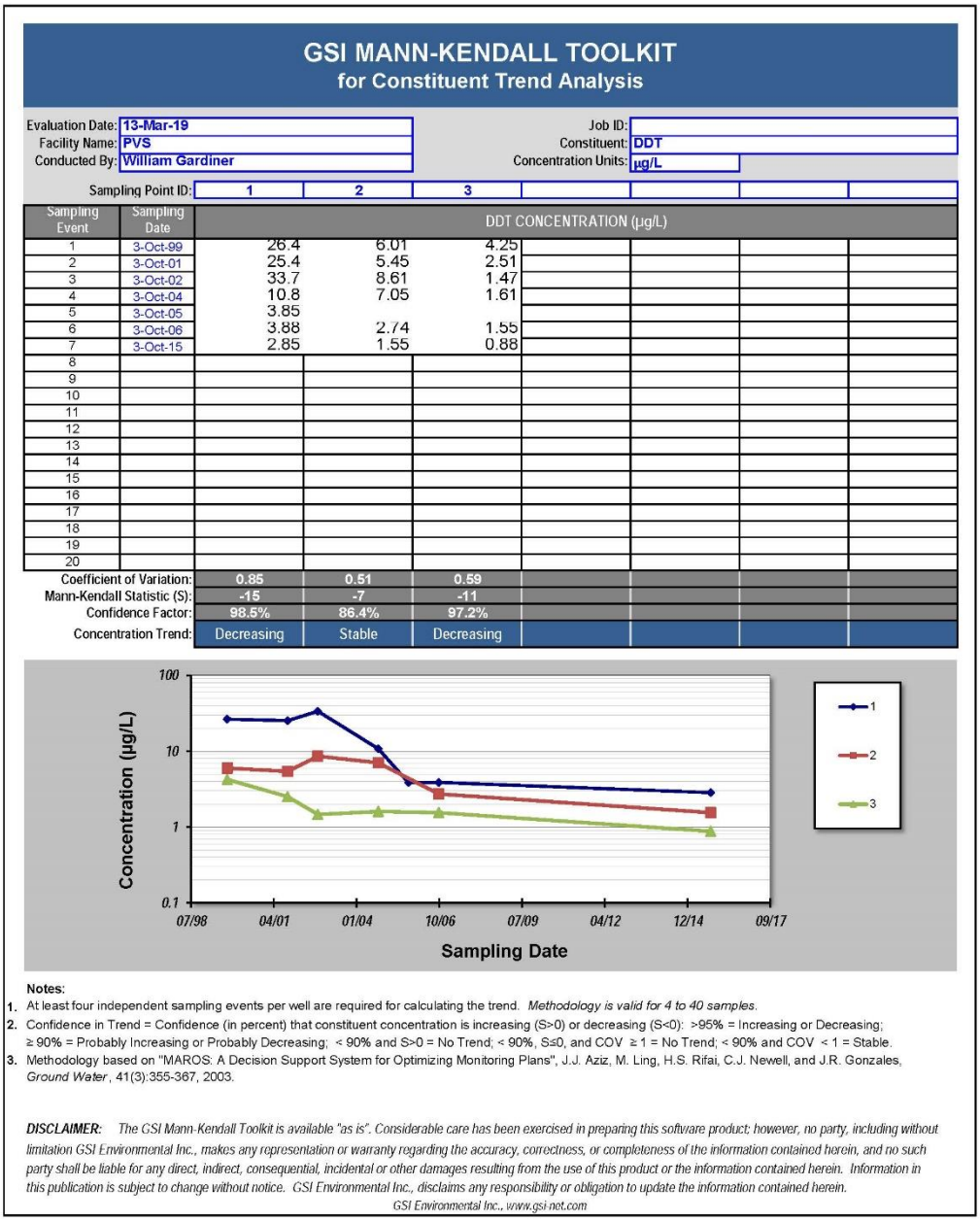
Two fish species common to the Palos Verdes Shelf and popular with anglers were collected for tissue analysis between 2014 and 2016. White croaker and barred sand bass were collected from three zones: Zone 1, near the White Point outfall diffuser; Zone 2, down-current of the OA; and Zone 3, which consists of north of Palos Verdes Point, Redondo Flats, the Breakwater Zone, and a reference area at Ventura Flats and Huntington Flats (Section 4.2.3 Figure 4).

Concentrations of total DDTs were highest in white croaker collected in Zones 1, 2, and 3, with notable concentrations also found in white croaker from both the Breakwater Zone and Redondo Flats (Figure B9). Concentrations in each of the collection areas were greater than those in the Ventura Flats reference area. Concentrations of total PCBs in white croaker were highest in Zones 1 and 2, with notably lower concentrations in white croaker from the other study sites. Concentrations of PCBs were very low in the Ventura Flats reference area.

Total DDT concentrations for barred sand bass were highest in Zones 1 and 2. Concentrations of total PCBs in barred sand bass collected from each of the PV Shelf study areas were similar to or below those of Huntington Flats.

Temporal trends show a gradual decrease in white croaker tissue concentrations for each of Zones 1, 2, and 3. Based on white croaker regularly sampled as part of the Sanitation Districts' NPDES monitoring programs (Sanitation Districts 2017), concentrations of both total DDT and total PCBs have shown a steady decrease from 1999 to 2016 (Section 4.2.3 Figure 5). Based on Mann-Kendall analysis, the declining trend is significant for Zones 1, 2, and 3 for total DDTs (Figure B10). Decreases are less dramatic for PCBs, with significant decreases in Zones 1 and 2 (Figure B11). The trend for Zone 3 over the entire sampling period was considered "stable"; however, there is a consistent decrease in concentrations for PCBs in white croaker collected between 2004 and 2016.

Relative to the tissue clean up levels in the IROD, the exposure point concentration (EPC; the 95% upper confidence limit of the average) of total DDT is above the risk-based tissue goal of 400 µg/kg for Zones 1, 2, and 3 (Table B2). The EPCs of total DDT in white croaker tissues were below the tissue goal for both Redondo Flats and the Breakwater Area. Concentrations of total PCBs in white croaker were above the IROD interim cleanup level for fish collected in Zones 1 and 2. The EPC for all other study areas were below the cleanup level. Comparisons of barred sand bass tissue concentrations with the cleanup goal are made on Figure B9; however, the target tissue level was developed for white croaker and is not appropriate for barred sand bass.



GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 13-Mar-19
Facility Name: PVS
Conducted By: William Gardiner
Job ID:
Constituent: DDT
Concentration Units: µg/L

Sampling Point ID:	1	2	3				
Sampling Event	Sampling Date	DDT CONCENTRATION (µg/L)						
1	3-Oct-99	26.4	6.01	4.25				
2	3-Oct-01	25.4	5.45	2.51				
3	3-Oct-02	33.7	8.61	1.47				
4	3-Oct-04	10.8	7.05	1.61				
5	3-Oct-05	3.85						
6	3-Oct-06	3.88	2.74	1.55				
7	3-Oct-15	2.85	1.55	0.88				
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.85	0.51	0.59				
Mann-Kendall Statistic (S):		-15	-7	-11				
Confidence Factor:		98.5%	86.4%	97.2%				
Concentration Trend:		Decreasing	Stable	Decreasing				

Notes:
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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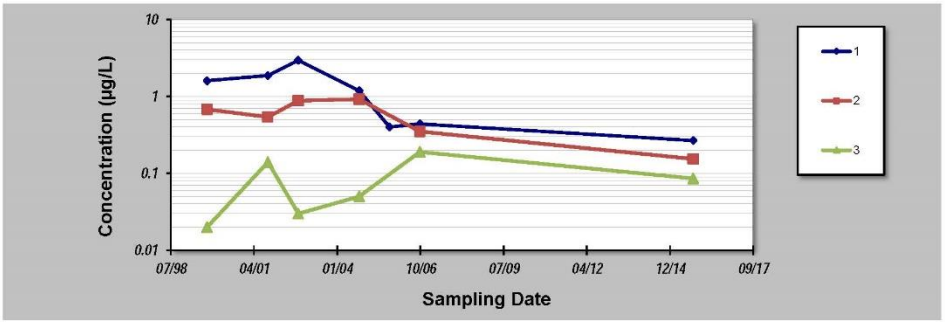
Figure B10. Mann-Kendall Trend Analysis for Total DDT (µg/kg dw) in White Croaker Tissue between 1999 and 2016, PV Shelf. Trends are presented for Zone 1 (blue lines), Zone 2 (red lines), and Zone 3 (green lines).

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 13-Mar-19
Facility Name: PVS
Conducted By: William Gardiner
Job ID:
Constituent: PCB
Concentration Units: µg/L

Sampling Point ID:		1	2	3				
Sampling Event	Sampling Date	PCB CONCENTRATION (µg/L)						
1	3-Oct-99	1.6	0.68	0.02				
2	3-Oct-01	1.88	0.54	0.14				
3	3-Oct-02	2.95	0.88	0.03				
4	3-Oct-04	1.19	0.92	0.05				
5	3-Oct-05	0.4						
6	3-Oct-06	0.44	0.35	0.19				
7	3-Oct-15	0.267	0.154	0.086				
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.79	0.51	0.78				
Mann-Kendall Statistic (S):		-13	-5	7				
Confidence Factor:		96.5%	76.5%	86.4%				
Concentration Trend:		Decreasing	Stable	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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Figure B11. Mann-Kendall Trend Analysis for Total PCBs (µg/kg dw) in White Croaker Tissue, between 1999 and 2016, PV Shelf. Trends are presented for Zone 1 (blue lines), Zone 2 (red lines), and Zone 3 (green lines).

Fish Tracking Studies

EPA conducted a fish movement study at PV Shelf from 2010 to 2012 using acoustic telemetry methods (Lowe 2013). Objectives of the study included assessment of movement patterns, degree of site fidelity, habitat use, and migration patterns of white croaker and barred sand bass. Arrays of acoustic receivers (including a finescale array covering the White Point outfalls) were deployed at PV Shelf, and small arrays were installed at the breakwater gates to Los Angeles Harbor (Angels Gate and Queens Gate). Ninety-seven white croaker and 55 barred sand bass were caught using hook and line, transmitters were surgically implanted, and the "tagged" fish were released and tracked using the receiver arrays.

Results of the study showed that there are two general subpopulations of white croaker. The first subpopulation is considered to be "transient", spending about 1 percent of their time in the vicinity of the White Point outfalls. The second subpopulation of white croaker exhibited foraging/refuging behavior, spending about 10 percent of their time near the White Point outfalls. The study concluded that these behavioral patterns could be a reason for wide-ranging COC concentrations historically detected in tissue samples of white croaker. Furthermore, the lack of site-fidelity indicates that sediment-fish tissue relationships developed during the baseline risk assessments may not be appropriate for developing risk-based threshold concentrations for PV Shelf sediments. Another conclusion of the study was that barred sand bass do exhibit site fidelity for PV Shelf, and returned there after seasonal spawning migrations (Lowe 2013). However, barred sand bass may have a greater association with hard substrate rather than the contaminated sediments at the site.

While this study was conducted prior to the time window for this Five-Year Review, it has implications on the risk-based cleanup levels and should be considered as part of the revised feasibility study.

Appendix C: ARAR Assessment

Section 121(d)(2)(A) of CERCLA, 42 USC §9621(d)(2)(A), specifies that remedial actions conducted under EPA's Superfund program must meet any federal and State standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Superfund site (applicable) or that address problems or pertain to circumstances similar to those encountered at a Superfund site (relevant and appropriate).

Table C-1 lists the ARARs from the IROD. Also included are the regulatory basis, current status, and regulatory changes, if any. In summary, there were no changes to any of the ARARs. There have been no revisions to laws and regulations that affect the protectiveness of the remedy.

Table C-1. Summary of ARARs

Type of Requirement	Citation	Document	Description	Amendment Date	Comments	Effect on Protectiveness
Protection of aquatic life and human health	Clean Water Act Section 304, 33 USC. §1314 (National Surface Water Quality Criteria	2009 IROD	Establishes surface water criteria for protection of fish-eating birds, birds feeding at higher tropic levels, and marine aquatic life. Establishes surface water criteria for human health (based on the consumption of water and organisms and organisms only); these criteria were revised in 2015 for total DDTs.	2015	Revised surface water criteria values for Human Health: *p,p'*-DDD: 0.012 ng/L *p,p'*-DDE: 0.018 ng/L *p,p'*-DDT: 0.030 ng/L Protective of sensitive aquatic species and achievement of the Food and Drug Administration's tolerance of 5,000 µg/kg in fish after bioaccumulation (protection of human health)	There have been no changes to this law that affect protectiveness
Any response action should not jeopardize listed species or adversely modify critical habitat at PV Shelf	Endangered Species Act of 1973, 16 USC. §1531-1544	2009 IROD	Conservation and recovery of species of fish, wildlife and plants that are threatened with extinction	Green Sea Turtle Listing: April 2016 Humpback Whale Listing Revision: September 2016	Endangered/threatened species are present at PV Shelf; Listing of Green Sea Turtle eastern pacific DPS Humpback whale	There have been no changes to this law that affect protectiveness
Selected remedy must be consistent with substantive requirements of the Coastal Zone Management Plan	Section 307(c)(1) of the Coastal Zone Management Act	2009 IROD	Filling of surface waters is allowable only when (a) public benefits exceed public detriment from the loss of water areas, (b) the filling is for a water-oriented use, and (c) no alternative upland location is available	N/A	On-site activities are not subject to administrative review or permitting processes related to the Coastal Zone Management Act.	There have been no changes to this law that affect protectiveness

Type of Requirement	Citation		Document	Description	Amendment Date	Comments	Effect on Protectiveness
For the purpose of constructing a cap, placement of material on the PV Shelf will comply with substantive requirement of these Sections.	Marine Protection, Research and Sanctuaries Act of 1972 and the Ocean Dumping regulations, 33 USC §§1411-1414, 40 CFR Parts 220-238	Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, 33 USC. §1344, 33 SUC P401, 40 CFR Part 230.	2009 IROD	Dredged material must meet federal testing guidelines to meet approval for disposal of material in the ocean.	N/A	Establish dredge material reuse standards. Applies to capping material selection.	There have been no changes to this law that affect protectiveness
Taking of fish species	California Ocean Fishing regulations. CCR Title 14 §§28.05, 28.10		2009 IROD	Forbids the taking of garibaldi and giant (black) sea bass from California ocean waters.	N/A	Applies to fish sampling activities undertaken under monitoring	There have been no changes to this law that affect protectiveness
California Fish and Game (CDFG) Requirements	California Endangered Species Act California Fish and Came Code §2080		2009 IROD	Conserves, protects, restores, and enhances any endangered or threatened species and its habitat	N/A	Requirements of the Act may be applicable due to the presence of endangered/threatened species on the PV Shelf	There have been no changes to this law that affect protectiveness
Protection of mammals	California Fish and Game Code §4700		2009 IROD	Prohibits the take of any of the listed fully protected mammals, including Northern elephant seal, Guadalupe fur seal	N/A	Area of the PV Shelf that will be impacted by the remedy are within the population range for the Northern elephant seal and the Guadalupe fur seal.	There have been no changes to this law that affect protectiveness

Appendix D. Toxicity Assessment

Review of Human Health Risk Assessments

Risks to human health from PV Shelf sediments are primarily associated with the consumption of seafood. Given the depth of the Site, there is little potential for direct contact with contaminated sediments. Site-specific risk assessments were used to evaluate potential human health risks associated with the consumption of seafood from the PV Shelf. Risks from fish consumption were calculated based on the amount of total DDT or total PCBs in the fish tissues, toxicity values specific to each contaminant, and the amount of contaminant ingested by people that consume fish that may be from the PV Shelf. The following section discusses any changes in fish tissue concentrations, toxicity values, and chemical intake estimates that may affect protectiveness.

Fish Tissue Concentrations

The human health risk evaluation conducted in 1999 addressed potential health risks due to consumption of various species of fish by recreational anglers. The results indicated that the fish species presenting the highest estimated cancer risk and non-cancer health hazard (due to ingestion) was the white croaker (SAIC, 1999). The human health risk evaluation updated in the PV Shelf Feasibility Study (EPA 2007 using data collected in 2002) indicated that DDTs were the primary contributors to the cumulative cancer risk estimates, while PCBs were the primary contributors to the cumulative non-cancer health hazard estimates.

As another line of evidence to evaluate the changes in site conditions over time, human health risks were recalculated based on fish tissues collected during the 2014-2016. Current tissue concentrations (the 95 UCL for all white croaker collected from zones 1, 2, and 3 of the PV Shelf) were used with the reasonable maximum exposure ingestion rates included in the baseline risk assessment (Table E1; CH2MHill 2006) to estimate both cancer and non-cancer risks associated with total DDT and total PCB.

Cancer risks for total DDT are an order of magnitude lower in 2016, relative to those of the baseline risk assessment (Table E2). Similarly, non-cancer risks are considerably lower in 2016, with HQ values that are close to 1. Cancer and non-cancer risks for total PCBs are also lower than for the baseline risk estimates; however, decreases in risks associated with total PCBs are less than those of total DDTs. Consequently, the relative contribution of PCBs to total risk is now greater than that of DDT for both cancer and non-cancer risks (Figure E1).

Table D1. Risk Calculation Worksheet for Cancer and Non-cancer Risk Estimates for PV Shelf White Croaker.

Risk Calculation Worksheet	White croaker from PV Shelf Zones 1, 2, and 3 - Fish Collected in 2014 - 2016

Exposure Parameter	Abbreviation	Units	RME Scenarios	
			All Anglers	Asian Anglers
Fish Ingestion Rate	IRfish	kg/day	0.1071	0.1157
Exposure Freqency	EF	days/year	365	365
Exposure Duration	ED	years	30	30
Body Weight	BW	kg/day	70	70
Averaging Time - Carcinogens	ATc	days	25550	25550
Averaging Time - Non-carcinogens	ATnc	days	10950	10950

Subpopulation	Chemical	EPC Value	Intake Concentration	Cancer Slope Factor	Cancer Risk	Intake	RfD	Noncancer HQ
All Anglers	DDT 2002	1.92E+01	1.26E-02	3.40E-01	4.28E-03	2.94E-02	5.00E-04	5.88E+01
	DDT 2016	7.45E-01	4.89E-04	3.40E-01	1.66E-04	1.14E-03	5.00E-04	2.28E+00
Asian Anglers	DDT 2002	1.92E+01	1.36E-02	3.40E-01	4.62E-03	3.17E-02	5.00E-04	6.35E+01
	DDT 2016	7.45E-01	5.28E-04	3.40E-01	1.79E-04	1.23E-03	5.00E-04	2.46E+00
All Anglers	PCB 2002	1.62E+00	1.06E-03	2.00E+00	2.13E-03	2.48E-03	2.00E-05	1.24E+02
	PCB 2016	9.36E-01	6.13E-04	2.00E+00	1.23E-03	1.43E-03	2.00E-05	7.16E+01
Asian Anglers	PCB 2002	1.62E+00	1.15E-03	2.00E+00	2.30E-03	2.68E-03	2.00E-05	1.34E+02
	PCB 2016	9.36E-01	6.63E-04	2.00E+00	1.33E-03	1.55E-03	2.00E-05	7.73E+01

Table D2: Summary of Health Risks due to Consumption of White Croaker

Subpopulation	Cancer Risk Estimate				Non-Cancer Hazard Quotient			
	DDTs		PCBs		DDTs		PCBs	
	2002	2016	2002	2016	2002	2016	2002	2016
All Anglers	4.3×10^{-3}	1.7×10^{-4}	2.1×10^{-3}	1.2×10^{-3}	58.8	2.3	124	71.6
Asian Anglers	4.6×10^{-3}	1.8×10^{-4}	2.3×10^{-3}	1.3×10^{-3}	63.5	2.5	134	77.3

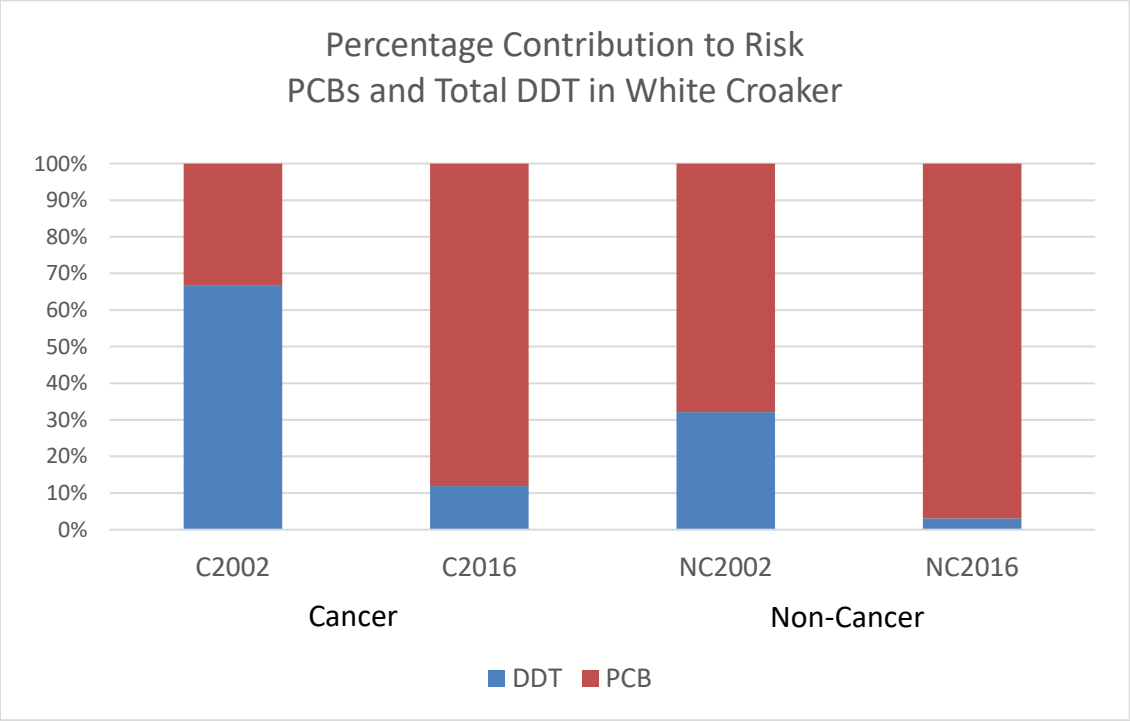

Figure E1. A Comparison of the Relative Contribution of PCBs and Total DDT in White Croaker to Risks for Asian American Anglers, 2002 and 2016.

Additional human health risk assessments associated with the institutional control program evaluated risks associated with white croaker obtained from local markets or collected from anglers at various docks and piers in the vicinity of the PV Shelf (SAIC 1999; CH2MHill 2007; ITSI Gilbane, 2014). While these risk estimates are not specific to the PV Shelf, they provide an indication of risks to local area fishers and residents consuming white croaker. In 2017, the human health risk evaluation was again updated to assess risk due to consumption of skin-off filets from white croaker (Gilbane Federal, 2017).

Fish were collected at near-shore locations from Santa Monica Bay to the Port of Long Beach from August 2011 to October 2012. Risk and hazard index estimates in 2017 were similar to those of 2014 and were lower than the risk and hazard index estimates in 2007 (Table E3). Similar to risk estimated for white croaker from the PV Shelf presented above, PCBs are now the primary contributor to cumulative cancer risks for anglers. In 2007, DDTs were the primary contributors to the increased likelihood of cancer and PCBs were the primary contributors to non-cancer health effects, the both the 2014 and 2017 evaluations show that PCBs are the primary contributors to the increased likelihood of both cancer and non-cancer effects in the consumption of white croaker.

Table E3: Summary of Health Risks due to Consumption of White Croaker

Exposure Scenario and Pathway	Cumulative Cancer Risk Estimate	Primary COC	Non-Cancer Hazard Index	Primary COC
Consumption of white croaker by recreational boaters (SAIC, 1999)	1.6×10^{-3}	DDT	49	PCBs
Consumption of white croaker by recreational Asian anglers (CH2M Hill, 2007)	6.9×10^{-3}	DDT	197	PCBs
Consumption of white croaker by recreational Asian anglers (ITSI Gilbane, 2014)	2.8×10^{-4}	PCBs	14	PCBs
Consumption of white croaker by recreational Asian anglers; all piers without Santa Monica pier (Gilbane Federal 2017)	3×10^{-4}	PCBs	14	PCBs

In 2014-2016, EPA collected barred sand bass for tissue analysis (EPA 2018). As with white croaker, average concentrations of total DDTs in barred sand bass (206 µg/kg dw across the Site) were notably lower than those observed during the baseline surveys (744 µg/kg dw) and risks associated with the consumption of barred sand bass from the PV Shelf would be expected to decrease.

In 2010, the monitoring program was expanded to include the collection of lobsters from four areas near PV Shelf, namely White Point, Rocky Point, Long Point, and the Los Angeles Breakwater. The Los Angeles Breakwater is considered the non-impacted reference location. While DDTs and PCBs were detected in lobster tail (edible tissue) and the tomalley, the risk of cancer due to consumption of lobsters was below EPA's normal range of concern.

Based on the concentrations of total DDT and total PCBs in white croaker collected from zones 1, 2, and 3 of the PV Shelf site, as well as concentrations in fish collected from anglers, the cumulative human health risks from fish consumption are decreasing. The majority of the decrease is associated with lower total DDT tissue concentrations. This is consistent with observations of the dechlorination of DDT isomers and the increase in less toxic breakdown products (e.g. DDMU) in sediments and seawater. Risks associated with PCBs are decreasing at a slower rate, and total PCBs are becoming the limiting factor to a reduction in risks as a result of MNR.

Toxicity Values

Toxicity values are a measure of a chemical's likelihood to cause cancer or non-cancer effects in humans. The toxicity factor for cancer-related effects is called a slope factor. For non-cancer related effects, the toxicity factor is called a reference dose. EPA's Integrated Risk Information System is a program that provides updated toxicity values (when newer scientific information becomes available) to be used in risk assessments. In the past five years, there have been no changes to the toxicity values for either DDT isomers or PCBs.

Chemical Intake and Exposure Factors

As part of the human health risk assessment, exposure to site-related contaminants through the fish ingestion pathway were estimated by identifying human populations that may be exposed to total DDT and total PCBs in fish fillets and then estimating the chemical intake for each population. Chemical intake was estimated using exposure factors that represent the magnitude, frequency, and duration of potential exposures. The PV Shelf baseline human health risk assessment used exposure factors published in the EPA Exposure Factors Handbook (EPA 1989), as well as site-specific exposure factors to account for the non-standard exposures associated with marine sediments (as opposed to soils) and the regional subpopulations.

In 2014, the EPA Office of Solid Waste and Emergency Response (OSWER) released revised risk factors for use in human health risk assessments (OSWER 2014). Exposure factors that pertain to the fish consumption pathway include ingestion rates, exposure duration, and sediment adhesion rates. However, most exposure factors used in the baseline risk assessments are considered to be site specific. A summary of exposure factors used in the baseline risk assessment and the impact of any changes in exposure factors over the past five-year period are presented in Table E4.

Table E4: Summary of Exposure Factors used to Estimate Risk

Formula for Chemical Intake	$Intake = \frac{C_{fish} * IR_{fish} * EF * ED}{BW * AT}$				
Exposure Factor	**Units**	**Source**	**Value**		**Impact on Estimated Risk**
			Baseline	**Updated**	
C_{fish}: fish concentration	mg/kg	Site specific	NA	NA	NA
IR_{fish}: ingestion rate	kg/day	Site specific	All anglers: 0.1071 Asian anglers: 0.1157	No change	NA
EF: exposure frequency	days/year	Site specific	365	No change	NA
ED: exposure duration	years	Site specific	All anglers: 30 Asian anglers: 30	No change	NA
BW: body weight	kg	EPA 1989	70	80[a]	Reduction of chemical intake for "all angler" scenario, resulting in reduced risk for "all angler" scenario
AT: averaging time cancer	days	EPA 1998	25550	No change	NA
AT: averaging time non- cancer	days	Site specific	10950	No change	NA

[a] In 2014, USEPA updated the default body weight to be used in health risk assessment from 70 kg to 80 kg based upon recent population studies (USEPA, 2014). The risk evaluation reported here relied upon the previous value of 70 kg primarily to allow comparability with previous PV Shelf assessments. Because this evaluation also addressed high end Asian consumers, a brief literature review was conducted to determine if there was a meaningful body weight difference from the default weight that warranted further consideration. One study of note was located, Carpenter et al., 2013. This study examined the body weights of several college age ethnic groups in Southern California including Asians. The average body weight for Asians was approximately 62 kg. Given that age-related body weights generally increase to some degree with age (USEPA, 2011), a value of 70 kg is considered sufficiently conservative for use in this evaluation.

Fish Movement

The cleanup levels for the PV Shelf are based on risk-based threshold concentrations in sediment, that are in turn based on risk-based threshold concentrations for white croaker fish tissue determined by the human health risk assessments (Appendix C of the FS, EPA 2007). This process of using tissue thresholds for establishing sediment cleanup levels assumes that the majority of the chemical contamination in fish tissues comes from the PV Shelf sediments. To evaluate that assumption, EPA conducted a fish movement study at PV Shelf from 2010 to 2012 using acoustic telemetry (Lowe 2013). Objectives of the study included assessment of movement patterns, degree of site fidelity, habitat use, and migration patterns of white croaker and barred sand bass. Arrays of acoustic receivers (including a finescale array covering the White Point outfalls) were deployed at PV Shelf, and small arrays were installed at the breakwater gates to Los Angeles Harbor (Angels Gate and Queens Gate). Ninety-seven white croaker and 55 barred sand bass were caught using hook and line, transmitters were surgically implanted, and the "tagged" fish were released and tracked using the receiver arrays.

Results of the study showed that there are two general subpopulations of white croaker. The first subpopulation exhibits "transient" behavior, spending about 1 percent of their time in the vicinity of the White Point outfalls. The second subpopulation of white croaker exhibited foraging/refuging behavior, spending about 10 percent of their time near the White Point outfalls. The study concluded that these behavioral patterns could be a reason for wide-ranging DDT and PCB concentrations historically detected in tissue samples of white croaker. Another conclusion of the study was that barred sand bass do exhibit site fidelity for PV Shelf, and returned there after seasonal spawning migrations (Lowe 2013). However, barred sand bass may have a greater association with hard substrate rather than the contaminated sediments at the site.

The limited site-fidelity in some white croaker indicates that there is greater uncertainty in the sediment-fish tissue relationships developed during the baseline risk assessments than previously thought. As a result, the long-term protectiveness of the risk-based sediment cleanup levels is uncertain.

Review of Ecological Assessments

A baseline ecological risk assessment (BERA) was completed for PV Shelf in November 2003 to evaluate the likelihood of adverse effects on marine biota that are present on the PV Shelf (EPA, 2003). The assessment indicated that primary exposure pathways are from the sediment to resident invertebrates and bottom-dwelling fish. Benthic and water-column invertebrates, water-column fish, and fish-eating ecological receptors are potentially exposed through the food web due to bioaccumulation of chemicals of potential ecological concern. Bald eagles were assessed for exposure and risk through consumption of sea lion carcasses, and bald eagles and peregrine falcons were assessed for exposure through consumption of seabirds.

The 2003 assessment concluded that there was a gradient of ecological risk with the greatest risk in the vicinity of the PV Shelf outfalls and along a band extending up the coast to the northwest. Intermediate risks were found in the immediate PV Shelf vicinity and the lowest risks were estimated for the more distant locations. DDTs posed greater risks to fish and invertebrates than PCBs, and the immediate area of the outfalls posed the highest risks to fish and invertebrates. Birds were also shown to have higher risk due to DDTs than to PCBs.

Since the 2003 BERA, there has been a decrease of total DDT and PCBs concentrations in PV Shelf sediments, particularly those most likely to be encountered by resident invertebrates and bottom-dwelling fish (the 0-8 cm interval). A decrease of total DDT concentrations coupled with an increase in concentrations of known breakdown ("daughter") products of DDT (e.g. DDMU) provides an indication that DDT isomers are undergoing dechlorination. The breakdown of DDT isomers to less toxic metabolites represents a reduction in hazards to ecological receptors, particularly the fish-eating birds that are sensitive to DDT compounds. PCBs in PV Shelf sediments have not shown a similar decrease in concentration, indicating that ecological risks due to PCBs may persist longer than those for DDTs.

There has also been an improvement in the condition of the benthic communities of the PV Shelf. Based on annual surveys conducted by the Los Angeles County Sanitation Districts, the invertebrate communities living in and on sediments are gradually improving. Important metrics of community

health (e.g. abundance, density, species composition) measured in 2016-17 more closely resemble the reference condition than in previous years (Figure E2; supporting metrics shown in Figure E3).While there has been measurable improvement in benthic community structure, it is important to note that the benthic surveys still show areas that have not returned to "reference" conditions.

Additionally, tissue concentrations of total DDT and PCBs in white croaker and barred sand bass are lower than those used in the BERA, indicating a decreased potential for transfer of PV Shelf contaminants through the food web. While tissue concentrations remain above the human-health-based project cleanup levels, the ecological risks associated with tissue residues appear to be reduced, relative to baseline conditions, particularly risks from total DDTs. However, the risks are still elevated for fish eating birds and benthic invertebrate communities.

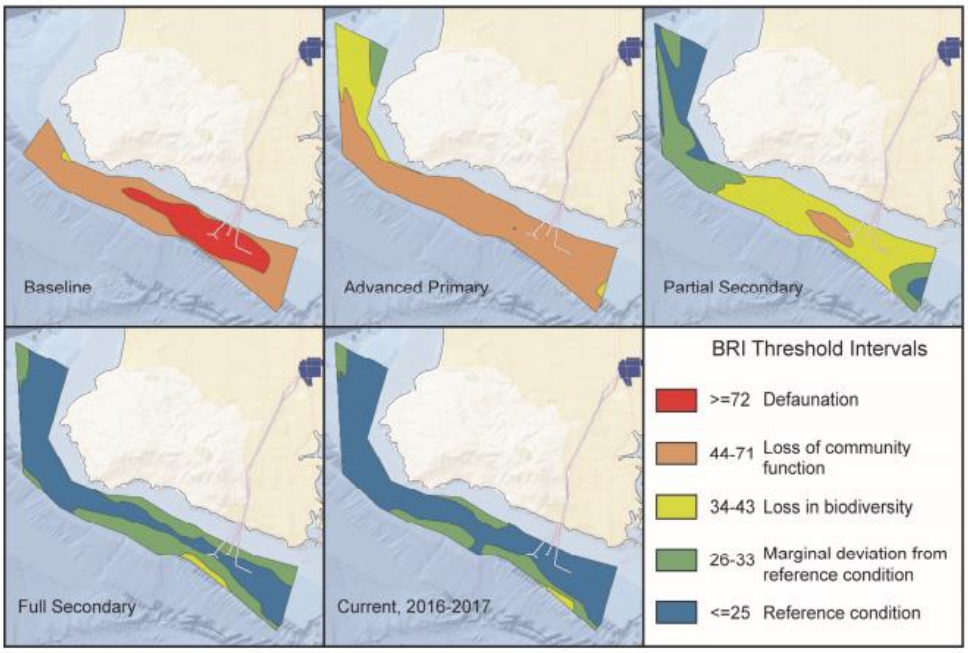

Figure E2. Biointegrity of Palos Verdes Benthos 1972-2017 (LACSD 2017). Time periods represent baseline conditions (1972-1973), following advanced primary treatment (1974-1983), following partial secondary treatment (1984-2002), full secondary treatment (2003-2015), and current conditions (2016-2017). Biointegrity index based on measures of density, abundance, and species assemblage.

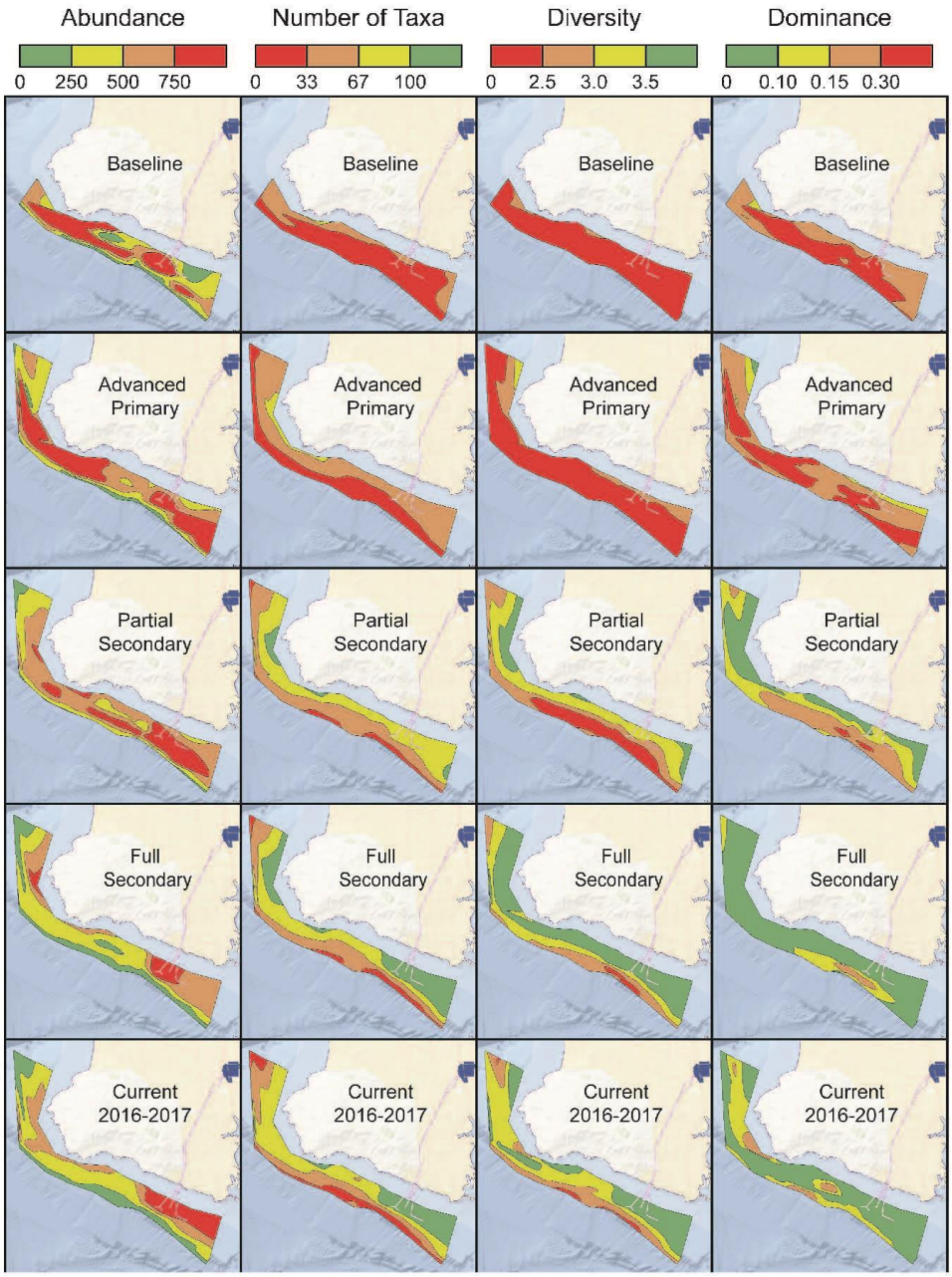

Figure E3. Benthic Community Measurements used to Estimate Biointegrity, 1972 – 2017 (Sanitation Districts, 2017). Time periods represent baseline conditions (1972-1973), following advanced primary treatment (1974-1983), following partial secondary treatment (1984-2002), full secondary treatment (2003-2015), and current conditions (2016-2017).

Appendix E: Press Notice

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STATE OF CALIFORNIA
County of Los Angeles

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above-entitled matter. I am the principal clerk of the printer of THE DAILY BREEZE, a newspaper of general circulation, printed and published in the City of Torrance*, County of Los Angeles, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of County of Los Angeles, State of California, under the date of June 10, 1974, Case Number SWC7146. The notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

04/12/2019

I certify (or declare) under the penalty of perjury that the foregoing is true and correct.

Dated at Torrance, California
On this 16th day of April, 2019.

Pauline Fernandez

Signature

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PUBLIC NOTICE
EPA BEGINS SECOND FIVE-YEAR REVIEW OF THE INTERIM CLEANUP AT THE PALOS VERDES SHELF SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) is doing a second Five-Year Review cleanup actions completed at the Palos Verdes Shelf Superfund site, located in Lo California. The purpose of this Five-Year Review is to ensure that the remedy is fun intended and continues to protect public health and the environment.

The Palos Verdes Shelf site is one part of the larger Montrose Chemical Corporation

According to the Superfund law, if a cleanup takes more than five years to complete, or if plan (called a "Record of Decision" [ROD]) includes hazardous waste remaining on t cleanup will be reviewed every five years. The last Five-Year Review, done in 2014, re effectiveness of:

- the fish contamination-related outreach;
- public education;
- enforcement activities;
- updated information on DDT (insecticide) and PCBs (a type of chemical) in the on the bottom of the ocean; and
- if the cleanup levels in the interim ROD still protect human health and the envir

EPA invites the community to learn more about this upcoming review and welcomes Information is available at EPA's website: www.epa.gov/superfund/montrose, and EP three information repositories (listed below) that have site documents, factsheets and ot about the site. All material EPA used to make its cleanup decision and evaluate its perfor the repositories.

To get more information or if you would like to be interviewed for the Five-Year Review, c Huang, the site's Project Manager, at (415) 972-3681 or huang.judy@epa.gov.

The results of the review and the report will be final in September 2019 and available t online and at the information repositories.

To be added to the site's mailing and email list, contact Carlin Hafiz, Community I Coordinator, at (213) 244-1814 or hafiz.carlin@epa.gov.

INFORMATION REPOSITORY LOCATIONS:

San Pedro Regional Library
931 South Gaffey St.
San Pedro, CA 90731
Phone: (310) 548-7779

Redondo Beach Public Library
303 North Pacific Coast Highway
Redondo Beach, CA 90277
Phone: (310) 318-0675

Palos Verdes Library District
701 Silver Spur Rd.
Rolling Hills Estates, CA 90274
Phone: (310) 377-0674

EPA Regional Superfund Record Center
75 Hawthorne St. Room 3110
San Francisco, CA 94105
Phone: (415) 947-8717

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Appendix F: Interview Forms

Five-Year Review Interview Record				
Site:	Palos Verdes Shelf Interim Record of Decision		**EPA ID No:**	CAD008242711
Interview Type: *Written* Date: February 26, 2019 Time: 1:35 PM				
Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Chi-Li Tang	Sanitation Districts of	Environmental Scientist	562-908-4288	ctang@lacsd.org
	Los Angeles County		X 2819	

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)

The EPA published the interim Record of Decision (IROD) in September 2009. Over the past decade, EPA conducted a series of projects to investigate the contamination off the Palos Verdes Shelf (PVS) Superfund Site. The Sanitation Districts of Los Angeles County (Sanitation Districts) collaborated with EPA for sampling in sediment, water column and fish tissue, participating in QA/QC for the sediment analyses, attending technical/strategic planning meetings and outreaching the members of Fish Contamination Education Collaborative (FCEC). Overall, EPA is moving forward to the right direction in implementation of the Institutional Controls (ICs) and Monitored Natural Recovery (MNR) components. It is anticipated that the Final Record of Decision (FROD) for PVS Superfund site can be released as scheduled.

2. Do you feel well informed about the site's activities and progress?
Yes. As the collaborator of EPA, staff of the Sanitation Districts attended all meetings, workshops, public hearing hosted by EPA. These meetings always provided ample information to communicate with members of the technical group, Palos Verdes Shelf Technical Information Exchange Group (PVSTIEG) as well as the members of the FCEC for the activities and progress of PVS Superfund site remediation.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?
Yes. Staff of the Sanitation Districts participated in sediment sample collections in both 2009 and 2013 and provided comments during the draft report review period. The Sanitation Districts is aware of the significantly lower than history results of DDT and PCBs in 2009 and suggest using results of 2013 to serve as the baseline for future remediation. Currently, EPA still plans to use results of 2009 as the baseline, which may be problematic due to lower than historical results.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?
Yes. The Sanitation Districts collected White Croaker and Barred Sand Bass per EPA's request during 2014 to 2016. The concentrations of DDT and PCB in White Croaker muscle tissue are significantly decreasing since the 1990s. However, White Croaker collected in Zones 1, 2 and 3 have the average concentrations of total DDT and PCBs exceed their IROD goals: 400 ppb and 70 ppb, respectively. Given that collection of White Croaker via night trawl becomes very challenging in the past 10 years and the Fish Tracking study suggested that nearly 47% White Croaker moved back to the Harbors, it is suggested that EPA to consider selecting additional fish species, such as Barred Sand Bass, Kelp Bass for the tissue study.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

Yes. Staff of the Sanitation Districts continues to participate in institutional controls ' semiannual meeting and provided a demonstration on Districts' research vessel for the FCEC members in May 2018.

4b. In your opinion, is the institutional controls component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals?

Yes. The institutional controls program appears to be functioning as expected. FCEC members continue to conduct inspection, enforcement at the piers, markets and restaurants. The outreach/education program

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

Yes. Staff of the Sanitation Districts participated in the field sampling of sediments, water column (passive sampler) and fish tissue; and reviewed the First MNR report in draft as well as provided comments. We received the final report in June 2018. It is anticipated that the First MNR report will be available at EPA's website for general public.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

For PVS remediation, MNR component appears to be the most adequate approach at this time although the degradation processes of DDT to DDMU or DDNU do take time. The processes were clearly observed at certain stations in the past decades and the reduction in contaminants transfer is evidently occurring.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Yes. Besides actively participating in the MNR and completed three Special Studies at the PVS Superfund site over the years, the Sanitation Districts routinely monitor the water column, microbiology, sediment condition, benthic infauna and fish/invertebrate communities, and fish tissue contamination at the site for the Joint Water Pollution Control Plant's NPDES permit. The datasets are compiled as a Data Summary Report and submitted annually. The Sanitation Districts also submit the Biennial Receiving Water monitoring report in discussion of the impacts (spatial distribution/temporal trends) from our discharge and the annual Outfall Inspection Report to the California Regional Water Quality Control Board, Los Angeles Region. These reports are available at Sanitation Districts' website.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

No.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

Yes. The Feasibility Study may re-evaluate the model currently used and the boundary of PVS Superfund site.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?
Two comments:

1. Some of the PVSTIEG and FCEC members retired from their jobs in the past years, it is suggested that EPA should consider to backfill these vacancies.
2. The Sanitation Districts will continue to support of EPA for the PVS Superfund site remediation.

Five-Year Review Interview Record			
Site:	Palos Verdes Shelf Interim Record of Decision	**EPA ID No:**	CAD008242711

Interview Type: *Written*
Date: 3/12/19
Time: 15:28

Interviewees

Name	Organization	Title	Telephone	Email
David Witting	NOAA/RC	Fish Biologist – Montrose Program	562-980-3235	David.witting@noaa.gov
Jennifer Boyce	NOAA/RC	Acting Supervisor/Montrose Program	562-980-4086	Jennifer.boyce@noaa.gov

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)

EPA has conducted a thorough investigation and characterization of the Palos Verdes Superfund site over the last 19 years since the case settlement in 2000. NOAA has been an active partner during the entire period and EPA has consistently encouraged our participation and incorporated our comments into their process. The Institutional Controls Program has effectively increase awareness of the risks associated with consuming contaminated seafood in the Southern California Bight. We feel that the time is right and sufficient data exists for EPA to make remedy decision for the PV site and we encourage EPA to move forward with this process as soon as possible.

2. Do you feel well informed about the site's activities and progress?

Yes, we have played an integral role in the process and are therefore well informed.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?

Yes, we are generally aware of all site survey data collected by EPA over the past two decades and are aware that these data indicate an overall decrease in sediment and fish contamination. We realize that there is spatial and temporal variation in the contamination on the shelf that can create results that appear counter intuitive (e.g., higher levels in 2013 than those 2009). This should not distract for the overall result that both of these surveys indicate a decrease in contamination at the site. The results of our restoration projects and associated monitoring also indicate lower levels of contamination and suggest natural recovery is occurring in the Southern California Bight. The best example of this is the successful breeding of Bald Eagles on five of the eight Channel Islands, something that was not possible two decades ago due to the higher exposure to DDTs and PCBs in the ecosystem at that time.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?

We are aware of fish contamination studies that have been conducted over the past several decades, including those mentioned above, collaborative studies conducted by NOAA and EPA in 2002-2003 and ongoing monitoring conducted by the Sanitation Districts. All of these studies indicate a consistent drop in fish tissue concentration over time. While concentrations may not be below target levels, the ongoing decrease in concentrations suggest that no further action is needed (beyond monitoring) to achieve target concentrations in the future. EPA has exhaustively examined options for accelerating this decrease in fish contamination and has not found a viable option

beyond monitoring natural recovery and managing risk of exposure through the institutional controls program.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

Yes, see comments above.

4b. In your opinion, is the ICs component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals?

Yes, see response to question 1 above. Regarding enforcement, we feel that the EPA institutional controls program has sufficiently confirmed that seafood that originates from the PV site is rare or absent in the local markets. The current enforcement monitoring program is sufficient for ensuring that no increase in contaminated seafood occurs in the markets.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

Yes

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

Yes, see responses to questions 3a and 3b

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Not to our knowledge beyond collaborating with EPA on Fish Contamination surveys and updating each other on the activities of our respective programs on the PV shelf.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

No

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

As stated in our responses to 3a and 3b, we do not feel like additional surveys are needed to make a final determination regarding the site remedy.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

In conclusion, we further stress our recommendation that the time is right and sufficient data exists for EPA to make remedy decision for the PV site and we encourage EPA to move forward with this process as soon as possible.

Five-Year Review Interview Record			
Site:	Palos Verdes Shelf Interim Record of Decision	**EPA ID No:**	CAD008242711

Interview Type: *Written*
Date: 2/25/19
Time: 8:30am

Interviewees

Name	Organization	Title	Telephone	Email
Hang Nguyen	BPSOS Center for Community Advancement	Executive Director	714-463-6358	hang.nguyen@bpsos.org

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion) I believe this is a great project, as many community members we met did not know about the contaminations and has family members and friends who fishes along the contaminated areas. Even to this day, we are still encountering people who are not aware of the contaminated areas and think it is safe eat all the fishes they catch.

2. Do you feel well informed about the site's activities and progress? No, we do not meet frequently enough to discuss the activities and progress.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this? No, we are not aware of the sediment monitoring data collected in 2009 and 2013. Nevertheless, we believe there is a sampling error with the result of 2009 and 2013 data. There should be no reason why 2013 contamination level is higher than 2009 unless 1) there is a sampling error or 2) there are new contamination that we are not aware of.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this? We did not know about the fish tissue studies being conducted in 2014-2016. Although is a good thing that that contaminated level in tissues are going down, it is still not safe to eat the fishes if the contamination level is above target tissue levels. Consequently, we feel this information should be disseminated to the community.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)? Yes.

4b. In your opinion, is the institutional controls component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals? Yes, I believe the institutional controls program is reaching its outreach and education goals. While BPSOS-CCA outreaches to mainly the Vietnamese community, we were able to reach out to the Spanish speaking community as well at the community events we are invited to.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018? No, I was not aware of the MNR components of the remedy.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf? N/A. We are not familiar with this process and therefore cannot comment.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. We have not done many activities in the last few months. The majority of our community events are in in the Springtime.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses. No.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study? No, I was not aware.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

The sign in sheet that we were asked to use was not effective. It was difficult for community members to answer these questions during outreach events. For the Vietnamese community, the most effective way to find out what the community knows is to do it in a survey format and have the questions translated. The Vietnamese community shies away from responding to questions they do not have any knowledge about. They feel they may not answer the question correctly, even when it's just an opinion we are asking for.

Five-Year Review Interview Record			
Site:	Palos Verdes Shelf Interim Record of Decision	**EPA ID No:**	CAD008242711

Interview Type: *Written*
Date: February 25, 2019
Time: 1:35 pm

Interviewees

Name	Organization	Title	Telephone	Email
Daniel Cordero Jr	DTSC	Senior Hazardous Substances Eng.	714-484-5428	Daniel.cordero@dtsc.ca.gov

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)
   My overall impression of the PV Shelf project is that a tremendous amount of work has been accomplished. Specifically, in outreach to the public. Generations of people have been protected from DDT and PCB contaminated fish, crabs and lobster. On the study end of it, I admire the efforts made to get so many groups together and working toward an understanding of what is occurring in the sediments at the site. The current DTSC project team came into the project very late but has tried to contribute. DTSC still does not have comfort with the data and believes that some effort should be made around the highest concentration locations.
2. Do you feel well informed about the site's activities and progress?
   There is plenty of information available and Judy Huang the EPA Project Manager has been great about answering any questions DTSC has developed. DTSC feels well informed.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?

I am aware about the differences between the 2009 and 2013 sampling event. I believe that utilizing the 2009 sampling event as the baseline is a mistake. The 2013 sampling data should be the baseline data set and another round of sampling needs to be taken. The Los Angeles County Sanitation Districts (Sanitation Districts) has data at a much smaller range of stations over a long period of time that utilized the same sampling techniques and analytical methods (although different from EPA). That data should also be analyzed to extract information that can lead to a better understand of what is occurring out in the field.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?

I am aware of the fish tissue studies for 2014-2016 that indicate contaminant levels in tissues are decreasing but remain above target levels. It is for this reason that DTSC supports doing some sort of remedial activity at the highest concentration areas.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

Yes, I believe these are the most effective part of the interim remedy. Generations of families have been made aware of the contamination issues along our coastline.

4b. In your opinion, is the institutional controls component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals?

I believe the institutional controls component is functioning as expected. I only wish that school programs a little further inland from the coast could be reached. Participation at parent conferences or school fairs would be best. Contact must be made with individual school principals or teachers in order to make any inroads into gaining access.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

I am aware of the MNR components of the remedy and participated by submitting comments about the report.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

Not sure, the selection of 2009 as the baseline sampling event is still an issue. MNR doesn't reduce contaminant levels, it monitors what is occurring at specific locations over time. I believe most of the contaminants are just being dispersed. This is why some locations indicate contaminant concentrations are decreasing while other locations indicate contaminant concentrations are increasing. Again, I believe the Sanitation Districts sediment/fish tissue data should be analyzed on a separate track. It is much more consistent with the sampling methodologies, locations and analytical methods. Good information can be garnered from the Sanitation Districts data that will either support or deny EPA data.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

DTSC has not conducted routine communications or activities of the Site. DTSC has done periodic examination of data and cleanup technologies.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

There have been no complaints, violations or other incidents related to PV Shelf that required a response by DTSC.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

I am aware that the EPA is preparing a Feasibility Study for a final remedy selection at PV Shelf. I would like EPA to study the addition of iron to the highest contaminant concentration areas to promote degradation of the contaminants. If done properly, little disturbance of sediments will occur and if the iron settles into the sediments that would be conducive to the degradation of the contaminants.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

DTSC understands the difficulty of conducting any remedy at this Site, but DTSC hopes serious consideration be put into hot spot treatment. A small disturbance during a remedial activity would do far less harm than one big storm coming through the region.

Five-Year Review Interview Record			
Site:	Palos Verdes Shelf Interim Record of Decision	**EPA ID No:**	CAD008242711

Interview Type: *Written*
Date:
Time:

Interviewees

Name	Organization	Title	Telephone	Email
Mark Gold	UCLA	Associate vice chancellor for environment	310-825-5324	mgold@conet.ucla.edu

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion) I have been extremely disappointed in the remedial action efforts. I've been active on the project since the litigation phase and I'm disappointed that, other than a pilot capping effort, there hasn't been much done on the remediation side. Also, the studies on sediment contamination, and the errors surrounding analysis, meant that human health and ecological harm was allowed to continue with little action. This is why I no longer participate in the effort. I've become too frustrated after 25 years. However, I do feel like the education efforts to reduce the public health risks of vulnerable populations consuming DDT and PCB contaminated fish has been effective. As such, the risk to human health has been managed well. The ecological risk has not.

2. Do you feel well informed about the site's activities and progress? Yes.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this? My thoughts are the same as when I first saw the 2009 data. There was a screw up in the analysis. PCBs don't just disappear. See my comments above. This episode in the effort was about the last straw for me on the lack of progress on remediation.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? Yes. What are your thoughts about this? That there should have been some remediation of the worst hotspots on the site about a decade earlier!! These results confirm that institutional controls and public education of vulnerable fishing populations are still a priority. However, the effort has done nothing to reduce ecological risks over time. Nature is taking its course over time and things are getting better, but they are still problematic. Again, I'm frustrated and disappointed.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)? Yes. These have been the highlight of the effort. Believe me, when Heal the Bay created the Pier outreach program, no one thought it would go on for nearly two decades.

4b. In your opinion, is the institutional controls component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals? Overall yes. I'm ignorant about how well enforcement is working on eliminating landing of contaminated croakers.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018? No. I had largely checked out by then.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf? NMNR doesn't reduce DDT and PCB concentrations or loads. There have been some strong projects that have come out of the effort. There also have been some that aren't truly mitigating the substantial ecological harm.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. No. It is just me and I dropped out about 2 years ago.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses. Not applicable.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study? I don't even know where to begin. After all of this time, all of these missteps, and numerous fits and starts, it is hard for me to take that statement seriously.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

I hope there's money left to actually cap the hotspots in an ecologically sensitive manner. After a quarter century, this globally known DDT/PCB hotspot and natural resources damages case has not been remediated at all. That's nearly as long as the polluters discharged DDT and PCBs to receiving waters.

Five-Year Review Interview Record			
Site:	Palos Verdes Shelf Interim Record of Decision	**EPA ID No:**	CAD008242711

Interview Type: *Written*
Date: 01 March 2019
Time:

Interviewees

Name	Organization	Title	Telephone	Email
Carol Roberts	US Fish and Wildlife Service	Supervisory F&W Biologist	760-431-9440, x271	carol_a_roberts@fws.gov

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)
It is a huge effort that requires balancing many factors.

2. Do you feel well informed about the site's activities and progress?

Yes, I feel very well-informed thanks to my participation in the Palos Verdes Shelf Technical Information Exchange Group (PVSTIEG).

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?

Yes, I am aware of those results. Assessing sediment contamination in a dynamic system is not an exact science. There are a variety of factors that could be at play in the exact concentrations that were found between those two time frames. I think the bigger picture is the key--overall, the concentrations have dropped from historical levels.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?

Yes, I am also aware of the fish tissue results. It is unfortunate that we are still above the IROD target, but again, the trend is in the right direction. The wildlife is recovering in the area, with several years of unassisted reproduction in Bald Eagles. As a wildlife biologist, this is a key element of success.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

Yes.

4b. In your opinion, is the institutional controls component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals?

I think the institutional controls are an appropriate part of the response to address potential human health impacts, but assessing their efficacy is outside my area of expertise.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

Yes.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

Having concentrations drop more quickly would be desirable, but the MNR component is really the only on-site approach that can be implemented given the depth, extent and distribution of the contaminants involved. I support it continuing.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

In addition to participating in the PVSTIEG, we have also had regular coordination calls between the Ms. Huang and staff involved with the Montrose Settlements Restoration Program (I am on the Trustee Council, and one of my staff works on the many bird projects in the program). The results of the restoration activities have been very positive, including reintroduction of Bald Eagles to the northern Channel Islands.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

I am not aware of any such incidents.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

As indicated above, MNR is the only real, practical approach. That said, there are other things that would benefit bird and fish populations that are outside the scope of the current restoration efforts. These could be considered as part of the broader effort.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

Yes, please keep Ms. Huang on the project, as she has been very good to work with!

Five-Year Review Interview Record				
Site:	Palos Verdes Shelf Interim Record of Decision		**EPA ID No:**	CAD008242711
Interview Type: *Written* Date: 3/8/2019 Time: 10.00AM				

Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Lauren Hillman	HDR Engineering	Community Outreach Manager	213.239.5836	Lauren.hillman@hdrinc.com

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)

Generally speaking, the PV shelf project is a well-organized group of inter connected agencies focused on scientific analysis and community awareness.

2. Do you feel well informed about the site's activities and progress?

Internal partners meet regularly to discuss specifics of yearly reporting and highlighted initiatives. The Program has a transparent website open to the public which hosts a variety of information categorized by year.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?

Yes, I am aware that the sediment monitoring data indicated a lower than expected contaminant level. This information was shared during an internal meeting in January 2018.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?

Yes, the fish tissue study was presented during an internal meeting in January 2018.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

Yes, my firm is associated with the outreach effort.

4b. In your opinion, is the institutional controls component functioning as expected? Is the institutional controls program reaching its outreach and education goals? Its enforcement and monitoring goals?

Yes, other outreach firms report an increase of returning anglers who are educated about consumption effects.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

Yes, the MNR report was presented during an internal meeting in January 2018.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

My office reports on Community outreach events attended, twice yearly bait shop outreach and items related to institutional controls .

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

No complaints, violations or other incidents reports.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

Five-Year Review Interview Record				
Site:	Palos Verdes Shelf Interim Record of Decision		**EPA ID No:**	CAD008242711
Interview Type: *Written* Date: 2/25/2019 Time: 1000				

Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Don Nelson	CDFW	Lieutenant	626-629-9096	don.nelson@wildlife.ca.gov

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)

I believe the PV Shelf project has had a huge impact on the education of sport fishing anglers and commercial fishermen, regarding white croaker issues. From the California Department of Fish and Wildlife view, anglers are becoming more aware of the issues concerning white croaker. The issue I see, is that the area between Santa Monica pier and Seal Beach Pier is a popular fishing area. Anglers come from all over Southern California to fish this area. This creates a high turnover of anglers that may not be aware of the white croaker consumption warning.

2. Do you feel well informed about the site's activities and progress?

I would like to be more informed on the activities and progress. I have recently taken over as the coordinator for CDFW so I may have missed earlier publications on the project. The more information I can receive allows me to pass along to my department personnel.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?

I am not aware of the data collection from 2009 and 2013. I am not aware that the 2013 results were higher than the 2009 results. I think this study shows that there is still a high level of contamination around the Palos Verdes shelf area. Depending on annual weather, swell and ocean currents, this could dictate the contaminant readings.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?

I am not aware of the 2014-2016 fish tissue studies. I believe it will take quite awhile to rid the Palos Verdes shelf area of the contamination. It is a great sign that the tissue contaminant levels are decreasing but the sediment readings are still very concerning.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

I am aware of the institutional controls component of the remedy. CDFW plays a big part in outreach, education and enforcement. The California Department of Fish and Wildlife has dedicated patrols that contact and educate sport fishing anglers, commercial fishermen, markets and restaurants. Informational handouts are given out and the public is educated on the contamination issues. Catch is inspected and enforcement is taken if a violation is found.

4b. In your opinion, is the ICs component functioning as expected? Is the ICs program reaching its outreach and education goals? Its enforcement and monitoring goals?

I believe the institutional controls component is functioning as expected in all of the above areas.

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

I am not aware of the MNR components of the remedy. I am not aware of the MRN report that was released in May 2018. I am recently appointed to be my departments White Croaker coordinator. A lot of this is new information to me.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

I don't know enough about the MRN component to comment.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

CDFW continues to inspect and educate sport fishing anglers, commercial fishermen and fish businesses about the white croaker/ Palos Verdes shelf contamination. 2018 (quarters 3 and 4) results are below:
Shore patrols- 57
Vessel patrols- 16
Fish business inspections- 14
Citations issued- 37
Total contacts- 2250

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

None.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

I am not aware of the Feasibility Study.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?

I would recommend opening up the education of the contaminated area for white croaked directed patrols from Malibu Pier, south to Huntington Beach Pier. Currently, CDFW patrols the areas between Santa Monica Pier, south to Seal Beach Pier. This extra outreach would expand the area of education and inform a new group of anglers about the contamination issues. Anglers tend to travel to different fishing spots quite frequently. If we can reach them prior to fishing in the contaminated zone, this could ensure that they are not keeping fish of concern.

Five-Year Review Interview Record				
Site:	Palos Verdes Shelf Interim Record of Decision		**EPA ID No:**	CAD008242711
Interview Type: *Telephone Interview* Date: 3/18/2019 Time: 1200				
Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Naoko Munakata	Sanitation Districts	Supervising Engineer	562-908-4288 ext. 2830	NMunakata@lacsd.org

Summary of Conversation

1. What is your overall impression of the PV Shelf project? (general opinion)

Overall perception is that the project is going well, that it is managed well, and Ms. Munakata has been impressed with the PVSTIEG. The group is very active and the team members try to find solutions to the project challenges. The meetings are well run, the RPM comes to the group with clear questions to address and guides the group to consensus and solutions.

2. Do you feel well informed about the site's activities and progress?

Yes, Ms. Munakata feels well informed. She receives regular updates from Chi-Li Tang, the Sanitation Districts technical lead for the PVS project. She does wonder if she would be as informed without Chi Li's involvement but currently, she feels well informed.

3a. Are you aware of the sediment monitoring data collected in 2009 and 2013? Are you aware that although the data indicated that contaminant levels are significantly lower than historical levels, the 2013 results are higher than the 2009 results? What are your thoughts about this?

Yes, Sanitation Districts has been involved with data collections for the PVS monitoring program. Ms. Munakata agrees that the long-term trends show decreases in contaminant concentrations at the site. She feels that the dramatic drop observed in 2009 may not have been real – perhaps due to analytical or sampling variability. The 2013 data appears to be more consistent with what Sanitation Districts would expect based on the data that they have seen for the site.

3b. Are you aware of the fish tissue studies that have been conducted in 2014-2016? Are you aware that this data indicates that contaminant levels in tissues are decreasing, but remain above target tissue levels in the interim Record of Decision (ROD)? What are your thoughts about this?

Yes, Ms. Munakata is aware of the fish tissue studies and that they show decreasing levels, but that concentrations remain above target levels. Given the nature of the contamination, and the slow natural attenuation, this trend is expected. She was not sure much can be done about that, beyond what the FCEC/IC folks have been doing to educate people to not eat the contaminated fish. Other remediation options seem to pose the threat of elevating contaminant levels even more, which could actually raise levels in fish tissue, which should be avoided.

4a. Are you aware of the Institutional Controls (ICs) component of the remedy (including outreach, education, and enforcement)?

Yes, Ms. Munakata is aware, but it not involved in the IC component of the PVS program.

4b. In your opinion, is the ICs component functioning as expected? Is the ICs program reaching its outreach and education goals? Its enforcement and monitoring goals?

5a. Are you aware of the monitored natural recovery (MNR) components of the remedy (including sampling of environmental media and reporting)? Are you aware of the First MNR report that was released in May 2018?

Ms. Munakata has seen the First MNR report and is aware of the MNR component of the remedy. Her group has been involved with the sampling of sediment, water, and tissues at the PV Shelf site.

5b. In your opinion, is the MNR component functioning adequately? Is it effectively reducing contamination levels at PV Shelf?

Yes, MNR appears to be a reasonable way to go. It is an effective use of resources to ensure that the site is recovering. The capping pilot study showed that bedded sediment was resuspended and increased bioavailability of contaminants in sediment. It is also a very expensive option. Capping appears to provide very little benefit for the cost. Additional, portions of the cap were lost or were not effective. MNR appears to be a good alternative. Ms. Munakata indicated that she will be interested to see the outcome of the FS evaluation of alternatives.

6. Have there been routine communications or activities (inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Yes, the LACSD conducts annual monitoring. They release data annually and release a monitoring report every other year. They participated in 2013 special studies with the RWQCB including fish tissue sampling, water column sampling, and passive sampler studies. Each of these studies had quarterly progress reports and the results of the special studies were included in the First Monitored Natural Recovery report.

7. Have there been any complaints, violations, or other incidents related to PV Shelf that required a response by your office? If so, please give details of the events and results of the responses.

The Sanitation Districts have been contacted by Mr. Daryl Nolta with concerns about offshore concentrations of contaminants. Sanitation Districts has provided information about the site, that discharges of DDTs and PCBs have been eliminated, that they then cleaned out the lines and that appear to remove the releases, and that routine monitoring is ongoing. Mr. Nolta expressed concerns regarding the effects of DDTs and PCBs on sharks and that it may affect human-shark interactions. The Sanitation Districts referred Mr. Nolta to the EPA for more information.

8. Are you aware that the EPA is in the process of preparing a Feasibility Study in support of final remedy selection at PV Shelf? Is there anything specific you would like EPA to consider as a part of the Feasibility Study?

Yes, Ms. Munakata is aware of the FS but does not have any specific input. MNR seems like a good path forward. It allows for comprehensive monitoring to observe trends over time. Other alternatives may do more damage and would be less preferable. The Sanitation Districts own and operate outfalls in areas that would be proposed for capping and would want to be sure that outfalls would not be damaged during cap placement.

9. Do you have any comments, suggestions, or recommendations regarding the remedy at PV Shelf?
No.

Appendix G: Site Inspection Trip Report and Photos

Trip Report

Montrose Chemical Corporation, Operable Unit 5, Palos Verdes Shelf (PV Shelf), Off the Coast of Palos Verdes Estate, Los Angeles County, California

1. INTRODUCTION

1. Date of Visit: April 22, 2019
2. Locations: Rainbow Harbor and Belmont Pier in Los Angeles County, California
3. Purpose: A Five-Year Review site visit to visually inspect and document the conditions of the one of the Institutional Controls components of the remedy
4. Inspector: Judy C. Huang, US EPA, Remedial Project Manager, 451-972-368
5. General Weather Condition: Sunny with clear blue sky
6. Temperature: Approximately 70 degrees
7. Wind Speed: 10 miles per hour

2. SUMMARY

On September 30, 2009, the EPA selected a three-component interim remedy for PV Shelf which consists of capping, Monitored Natural Recovery (MNR), and Institutional Controls (ICs). Based on data collected post interim remedy selection, EPA suspended the capping component due to cleaner than expected sediment results. This inspection focused on the institutional controls component of the remedy since the cap was not implemented and MNR has no physical structure.

Angler outreach is a part of the institutional controls component of the remedy. As a part of the angler outreach program, pier signs containing Do Not Consume (DNC) fish messaging are posted on piers to help anglers identify which fish are on the DNC list and therefore should not be eaten. The purpose of this site visit is to inspect and document the conditions of the DNC signs.

Judy Huang conducted the site visit. Two locations (Rainbow Harbor and Belmont Pier) were selected for inspection. The Fish Contamination Education Collaborative August 2017 to July 2018 Pier Sign Summary Report and the 2009 Interim Record of Decision were reviewed in preparation of the site visit.

Rainbow Harbor:

Only 4 out of the 5 signs were located. The sign at Pier 5 is missing. All the located signs shown evidence of normal wear and tear and minor vandalism such as graffiti (see photos at the end of the report) but are generally well maintained, visible, and in good readable condition. The inspection at Rainbow Harbor started at 12:35 and ended at 1:15. On April 23rd, Judy Huang followed up on the

missing sign at Pier 5 with the City of Long Beach, who is responsible for maintaining the signs. The City is aware of the missing sign and is in the process of replacing the sign.

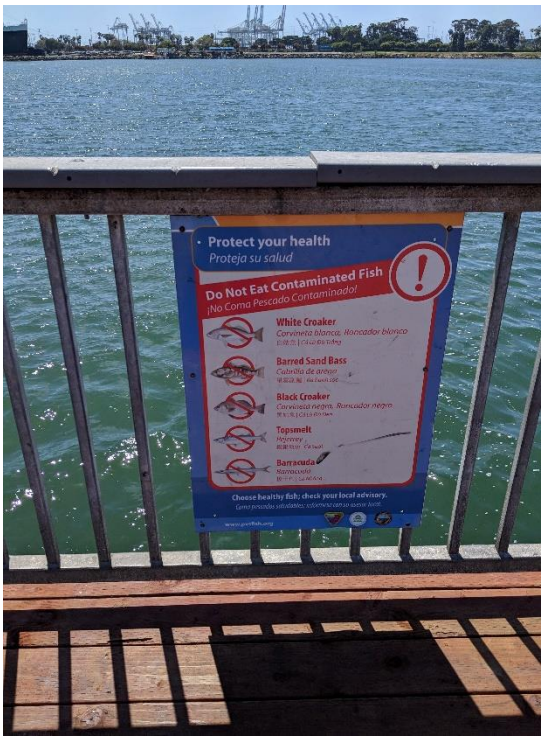
Belmont Pier:

Only 4 out of the 5 signs were inspected. All inspected signs shown evidence of aging and minor vandalism such as graffiti and/or placement of stickers (see photos at the end of the report) but are generally well maintained, visible, and readable. The inspection at Belmont Pier started at 1:40 and ended at 2:00. Inspected signages show signs of aging (cracking paint). No action is required in the currently, but the signs may need to be replaced in the next few years.

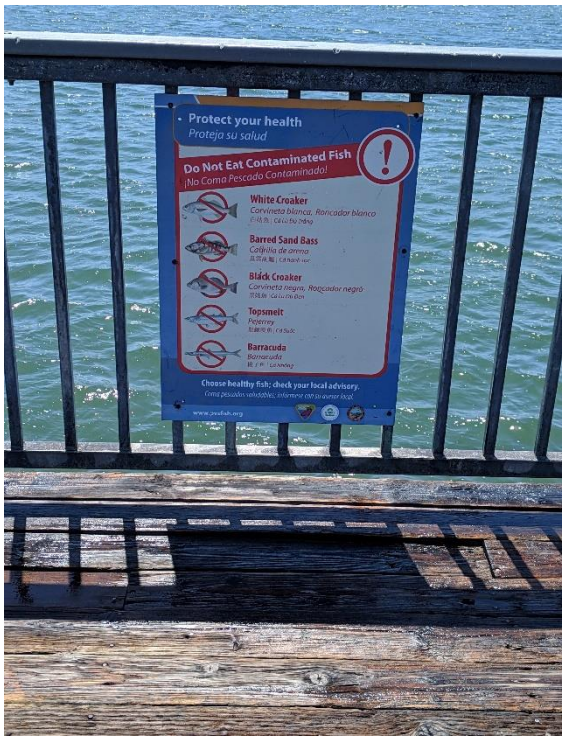
Site Visit Photos

Rainbow Harbor Pier #1

Rainbow Harbor Pier #2



Rainbow Harbor Pier #3



Rainbow Harbor Pier #4

Rainbow Harbor Pier #5 Missing Sign

Belmont Pier Sign #1

Belmont Pier Sign #2

Belmont Pier Sign #3

Belmont Pier Sign #4