State of California
Regional Water Quality Control Board
San Diego Region

EXECUTIVE OFFICER SUMMARY REPORT
January 29, 1990

ITEM: 20

SUBJECT: **ENFORCEMENT-ADMINISTRATIVE CIVIL LIABILITY MAURICIO AND SONS, INC. SAN DIEGO COUNTY**

DISCUSSION: On January 5, 1990, the Regional Board Executive Officer issued Complaint No. 90-06 for Administrative Civil Liability to Mauricio and Sons, Inc., for failure to comply with Directive No. 1 of Cleanup and Abatement Order No. 88-86. The Complaint proposes that Administrative Civil Liability be imposed on Mauricio and Sons in the amount of $75,000.

ISSUE: Should Administrative Civil Liability be imposed on Mauricio and Sons for violations of Cleanup and Abatement Order No. 88-86?

RECOMMENDATION: Staff will make a recommendation on this matter at today's meeting.

LKM4/eo900129.20

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

IN THE MATTER OF MAURICIO AND SONS, INC. SAN DIEGO COUNTY	)	COMPLAINT NO. 90-06 FOR ADMINISTRATIVE CIVIL LIABILITY

MAURICIO AND SONS, INC. IS HEREBY GIVEN NOTICE THAT:

1. Mauricio and Sons, Inc. is alleged to have violated provisions of laws and orders of the California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board) for which the Regional Board may impose administrative civil liability under California Water Code Sections 13323 and 13385.

2. Unless waived, a hearing will be held on this matter before the Regional Board at 9:00 a.m. on January 29, 1990, in the Encinitas City Council Chamber, 535 Encinitas Boulevard, Encinitas, California, 92024. Mauricio and Sons, Inc. representatives and other interested persons will have an opportunity to appear and be heard regarding the allegations in this complaint and the imposition of administrative civil liability by the Regional Board. At the hearing the Regional Board will consider whether to affirm, reject, or modify the proposed administrative civil liability.

ALLEGATIONS

3. Mauricio and Sons, Inc. is alleged to have failed to comply with Directive No. 1 of Cleanup and Abatement Order No. 88-86 issued by the Regional Board Executive Officer on July 5, 1988, pursuant to California Water Code Section 13304. The provisions of Directive No. 1 are contained in Attachment A to this complaint.

4. The following facts are the basis for the alleged violations in this matter:

   a) Mauricio and Sons, Inc. was a boat repair and maintenance facility located adjacent to the Commercial Basin portion of San Diego Bay;

   b) Directive No. 1 of Cleanup and Abatement Order No. 88-86, as amended, required Mauricio and Sons, Inc. to submit a report to the Regional Board no later than June 30, 1989, identifying a range of remedial action alternatives to cleanup contaminated bay sediment resulting from the discharge of waste by

Mauricio and Sons, Inc.. The report was to contain, at a minimum, a detailed analysis of the cost, feasibility, and lateral and vertical extent of contaminated sediment associated with cleanup strategies a), b), and c) described in Directive No. 1 of Order No. 88-86. Under the terms and conditions of Directive No. 1 of Order No. 88-86, Mauricio and Sons, Inc. could propose alternate cleanup strategies by evaluating the criteria described in item d) of Directive No. 1 of Cleanup and Abatement Order No. 88-86.

c) Mauricio and Sons, Inc. submitted the Remedial Action Alternatives Analysis Report 69 days late on September 7, 1989, in violation of Directive No. 1 of Cleanup and Abatement Order No. 88-86.

d) Directive No. 1(c) of Cleanup and Abatement Order No. 88-86 directed Mauricio and Sons, Inc. to ascertain the degree of copper, mercury, and tributyltin migration from the sediments to the water column that would occur and to demonstrate that any copper, mercury, or tributyltin migration would not cause the Ocean Plan or the State Water Resources Control Board proposed water quality criteria for the pollutants to be exceeded in either the water column or the interstitial water found within the sediment. However, Mauricio and Sons, Inc. failed to provide information which could be used to determine the degree of migration of pollutants from the sediments to the waters of San Diego Bay and hence allow the Regional Board to identify the concentration of pollutants in the sediment which would be required to achieve the standards contained in the Ocean Plan and other prescribed policies.

e) Mauricio and Sons, Inc.'s Remedial Action Alternatives Analysis Report proposes two alternative cleanup level criteria under Directive No. 1(d) of Cleanup and Abatement Order No. 88-86. The first alternative, **Alternative (D)- Beneficial Uses,** is proposed as "a cost effective alternative strategy for maintenance of the established beneficial uses of Commercial Basin and applicable water quality standards". Under this alternative, Mauricio and Sons, Inc. proposes a sediment cleanup standard of 800 mg/Kg for copper as a means of protecting the beneficial uses of San Diego Bay. Alternative cleanup levels for mercury and tributyltin concentrations are not identified under this proposal. Mauricio and Sons, Inc. failed to comply with Directive No. 1(d) by failing to submit any supporting technical information demonstrating compliance with criteria contained in Directive Nos. 1(d)(1) and 1(d)(3). In particular, Mauricio and Sons, Inc. failed to demonstrate that a copper cleanup level of 800 mg/Kg would protect the beneficial uses of San Diego Bay and would not cause water quality objectives for copper, mercury and tributyltin contained in the Ocean Plan and other State Board policies to be exceeded in San Diego Bay waters. Hence, as explained in the January 5, 1990 report entitled **Rationale for the Determination of Administrative Civil Liability Contained in Complaint No. 90-06, Mauricio and Sons, Inc., San Diego County**, the proposed cleanup standard is based on invalid "interstitial water" data which may not be used to determine whether or not the proposed sediment copper concentration would result in water quality less than prescribed in the Basin Plan, Ocean Plan or other prescribed policies.

f) The second alternative proposed by Mauricio and Sons, Inc. under Directive No. 1(d) of Cleanup and Abatement Order No. 88-86 is **Alternative (E)- No Disturbance of Sediments**, which is discussed on page 7 of the report. Under this alternative, Mauricio and Sons, Inc. proposes to leave the sediments in place and allow "natural capping" to seal the pollutants in place. Mauricio and Sons, Inc. failed to comply with Directive 1(d) by failing to submit any supporting technical information demonstrating that leaving the sediments in place would protect the beneficial uses of San Diego Bay and would not cause water quality objectives for copper, mercury and tributyltin contained in the Ocean Plan and other State Board policies to be exceeded in San Diego Bay waters. Bay City Marine, Inc. also failed to demonstrate that natural capping of sediments would be a reliable means of reducing or eliminating the effect of the contaminated sediments on the beneficial uses of San Diego Bay.

g) Mauricio and Sons, Inc. violated Directive No. 1 of Cleanup and Abatement Order No. 88-86 by:

1) failing to submit a Remedial Action Alternatives Analysis Report with sufficient supporting technical information upon which the Regional Board could rely to make decisions regarding sediment cleanup standards; and

2) failing to submit the Remedial Action Alternatives Analysis Report by the June 30, 1989 due date specified in Cleanup and Abatement Order No. 88-86, as amended, resulting in the delay of the cleanup of San Diego Bay. The report was submitted 69 days late on September 7, 1989.

MAXIMUM CIVIL LIABILITY

5. Under California Water Code Section 13385 (a)(4) and (c)(1), the maximum administrative civil liability which could be imposed by the Regional Board for the violations described in Finding No. 4 of this Complaint is ten thousand dollars ($10,000.00) per day for each of the sixty-nine days of violation for a total of $690,000.00.

PROPOSED CIVIL LIABILITY

6. The Regional Board Executive Officer proposes that administrative civil liability be imposed on Mauricio and Sons, Inc. in the amount of seventy-five thousand dollars ($75,000.00). This proposed administrative civil liability takes into consideration the nature, circumstances, extent, and gravity of the violations and, with respect to Mauricio and Sons, Inc., the ability to pay, any prior history of violations, the degree of culpability, economic benefit or savings, if any, resulting from the violations, and other matters that justice may require in accordance with California Water Code Section 13385 (e). The rationale for determining the proposed administrative civil liability is contained in the Regional Board staff report **Rationale for the Determination of Administrative Civil Liability Contained in Complaint No. 90-06, Mauricio and Sons, Inc., San Diego County**, dated January 5, 1990.

WAIVER OF HEARING

7. Mauricio and Sons, Inc. may waive the right to a hearing. If Mauricio and Sons, Inc. does choose to waive the right to a hearing, the Regional Board will determine whether or not to adopt an order assessing administrative civil liability in the amount of $75,000.00 at its next meeting. If an order is adopted, payment will be due within 30 days of adoption. Regulations of the Environmental Protection

Agency require public notification of any proposed settlement of the civil liability occasioned by violation of either an NPDES permit or laws pertaining to the discharge of waste to navigable waters of the United States. Accordingly interested persons have been given 30 days to comment on the amount of civil liability proposed in this complaint. Based on written comments received, the Regional Board may refuse to adopt the proposed order and may issue a new complaint proposing a different amount of civil liability. If a hearing is not waived, comments from interested parties at the hearing may be considered by the Regional Board in determining the amount of civil liability to assess. At the hearing the Regional Board may impose a different amount of civil liability than that proposed in this complaint or revoke the complaint and refer the matter to the Attorney General. If Mauricio and Sons, Inc. representatives have any questions, please contact the Regional Board Executive Officer at (619) 265-5114 or Regional Board counsel at (916) 322-0215.

Ladin H. Delaney

Ladin H. Delaney
Executive Officer

Date: January 5, 1990

Waiver of Hearing Form
for
Complaint No. 90-06
Mauricio and Sons, Inc.

As the designated administrative officer of Mauricio and Sons, Inc., I agree to waive Mauricio and Sons, Inc.'s right to request a hearing before the Regional Board. I understand that if an administrative civil liability order is adopted at the Regional Board meeting on January 29, 1990, payment will be due by February 28, 1990. I understand that regulations of the United States Environmental Protection Agency require public notification of any proposed settlement of the civil liability occasioned by violation of either an NPDES permit or laws pertaining to the discharge of waste to navigable waters of the United States. Accordingly interested persons have been given 30 days to comment on the amount of civil liability proposed in this complaint. The public comment period began on December 28, 1989, and will end on January 27, 1990. Based on written comments received on or before January 27, 1990, the Regional Board may refuse to adopt the proposed order and may issue a new complaint proposing a different amount of civil liability. If a hearing is held, comments from interested parties may be considered by the Regional Board in determining the amount of civil liability to assess. At the hearing the Regional Board may impose a different amount of civil liability than that proposed in this complaint or revoke the complaint and refer the matter to the Attorney General. In the event the Regional Board accepts this waiver and no hearing is held, I understand that I am giving up Mauricio and Sons, Inc.'s right to be heard.

Signature: ______________________________

Name: ______________________________

Position: ______________________________

Company: ______________________________

Date: ______________________________

LKM4/acl90-06.cmp

1. Mauricio and Sons, Inc. shall submit a report to the Regional Board no later than November 1, 1988 identifying a range of remedial action alternatives to cleanup contaminated bay sediment resulting from the discharge of waste Mauricio and Sons, Inc.. The report shall, at a minimum, contain a detailed analysis of the cost, feasibility, and lateral and vertical extent of contaminated sediment associated with cleanup strategies a), b), and c) described below. In addition to the evaluation of these cleanup strategies Mauricio and Sons, Inc. may propose an alternate cleanup strategy by evaluating the criteria described in item d) below. The Regional Board will evaluate the information submitted in the report and select a cleanup level for the contaminated sediment.

a) Removal and/or treatment of the contaminated sediment to attain the following background concentrations of mercury, copper, and tributyltin in the bay sediment described in Finding 10:

Constituent	Dry Weight Concentration
Mercury	0.81 mg/kg
Copper	63 mg/kg
Tributyltin	193 ng/g

b) Removal and/or treatment of the contaminated sediment to attain the following Apparent Effects Threshold (AET) dry weight sediment concentrations for copper and mercury described in Finding 16 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 19:

Constituent	Concentration
Mercury	0.49 mg/kg
Copper	170 mg/kg
Tributyltin	6 ng/l

Under this alternative it will be necessary to ascertain the degree of tributyltin migration from the sediments to the water column that will occur and to demonstrate that any tributyltin migration will not cause the 6 ng/l water quality criteria to be exceeded in either the water column or the interstitial water found within the sediment.

c) Removal and/or treatment of contaminated sediment to attain the following Ocean Plan water quality objectives for copper and mercury described in Finding 6 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 19 in the water column and interstitial water:

Constituent	Concentration
Mercury	0.14 µg/l
Copper	5 µg/l
Tributyltin	6 ng/l

Under this alternative it will be necessary to ascertain the degree of copper, mercury, and tributyltin migration from the sediments to the water column that will occur and to demonstrate that any copper, mercury, and tributyltin migration will not cause the above concentrations to be exceeded in either the water column or the interstitial water found within the sediment.

d) Any remedial action alternative proposing the attainment of copper, mercury, and tributyltin concentrations in the sediment, water column and interstitial water that would comply with the following criteria:

1. The proposed copper, mercury, and tributyltin concentrations to be attained in the affected San Diego Bay sediment contamination zone will not alter the quality of San Diego Bay waters to a degree which unreasonably affects the beneficial uses of San Diego Bay.

2. The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will be consistent with the maximum benefit to the people of the state.

3. The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will not result in water quality less than prescribed in the Basin Plan, Ocean Plan or other prescribed policies.

2 Mauricio and Sons, Inc. shall no later than May 1, 1989 cleanup the contaminated bay sediment to the level prescribed by the Regional Board under Directive 1 of this order.

3 Mauricio and Sons, Inc. shall no later than March 1, 1989 submit a post-cleanup sampling plan to verify the attainment of the prescribed cleanup standards in the area of sediment contamination defined under Directive 1 of this order. Upon the approval of the sampling plan by the Regional Board Executive Officer, Mauricio and Sons, Inc. shall collect and analyze the samples prescribed in the sampling plan. The post cleanup sampling results shall be submitted to the Regional Board no later than July 1, 1989.

4 Mauricio and Sons, Inc. shall upon implementation of the selected cleanup alternative, submit cleanup progress reports to the Regional Board on a quarterly basis, until in the opinion of the Regional Board Executive Officer, the cleanup of the contaminated sediment has been completed. The reports shall contain information discussing the progress made toward attaining the final selected cleanup criteria for the bay sediment. Specific information to be included in the quarterly progress reports will be determined by the Regional Board Executive Officer upon the selection of the sediment cleanup standard. The reports shall be submitted in accordance with the following reporting schedule:

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT FIELD STATION
Federal Building, 24000 Avila Road
Laguna Niguel, California 92656

In Reply Refer To:
FWS/FWEFS

December 15, 1989

RECEIVED
DEC 19 1989
SAN DIEGO REGIONAL
WATER QUALITY CONTROL BOARD

Ladin H. Delaney
Executive Officer
State Water Quality Control Board
San Diego Region
9771 Clairemont Mesa Blvd., Ste. B
San Diego, CA 92124-1331

Re: Sediment Contamination in Commercial Basin

Dear Mr. Delaney:

We appreciate the opportunity to comment on the investigation currently being conducted in the Commercial Boat Basin, San Diego Bay, San Diego California. The initial investigation was conducted in early 1988 by your Regional Board. As a result of elevated levels of copper, tributyltin, and mercury near several boatyards, a Cleanup and Abatement (C&A) was issued.

In response to the Board's C&A order, the boatyards have hired an environmental consultant to collect additional data and prepare the required evaluation of remediation alternatives. You enclosed a copy of their report for our review.

In order to put our comments in perspective we will provide a brief discussion of the U.S. Fish and Wildlife's (Service) mission. The Service has a general mandate based on many Federal laws to protect fish and wildlife resources of the nation as well as their habitats. One of our specific mandates is to protect Federally listed endangered or threatened species.

There are two federally listed endangered species, the California least tern (Sterna antillarum browni) and the brown pelican (Pelecanus occidentalis), which may be affected by contaminated sediment in the commercial boat basin. There are three colonies of least terns in proximity to the basin which could very likely be feeding there at certain times of the year. Brown pelicans which breed mostly in Mexico disperse between July and November to the southern California coast, including San Diego Bay and the Commercial Boat Basin.

<u>General Comments</u>

We highly commend the Board for undertaking the sediment contaminant study in the Commercial Boat Basin. Results clearly show in a scientifically supportable way that: 1) copper, mercury and tributyltin are highly "enriched" in sediments from the boat basin; 2) sources of these contaminants are coming from specific boatyards, as a result of discharges etc.; 3) transplanted oysters into the Commercial Basin exhibited chambering and reduced tissue weight most likely as a result of tributyltin; and 4) benthic community studies have shown that the Commercial Basin has low species diversity and biomass, and is dominated by serpulid tube worms.

Based on these results we strongly concur with the Regional Board's view that these marinas need to: 1) demonstrate they are following best management practices; 2) insure all illegal discharges are stopped and; 3) initiate an environmentally sound cleanup of contaminated bay sediment. The key issue in this situation is what standards/guidelines to use for the contaminated sediment cleanup.

The first proposed cleanup option is to remove and/or treat contaminated sediment to attain background concentrations. This is normally a good alternative when the "background" itself is uncontaminated or within an environmentally acceptable range. However, it appears that the background concentrations used, (See Table 1) are significantly higher than "unpolluted" marine sediment.

The next option is to use the apparent effects threshold (AET) values establish for Puget Sound. This approach uses toxicological bioassays and abundance of benthic infauna to define sediment contaminant concentrations above which, statistically significant biological effects could always be expected to occur. The value for mercury of 0.49 mg/kg is about 1/2 the basin "background", however, the copper value of 170 is over twice as high as "background". We believe AET values are a very objective and rational approach for establishing sediment cleanup criteria. However, there is enough differences between bay ecosystems in southern California and the State of Washington to have concern about using them in the Commercial Boat Basin.

The last alternative establishes various water quality criteria which must be maintained after the removal and/or treatment of contaminated sediment. This approach has some merit since adequate (long-term) water quality is important. However, this does not sediment address toxicity itself and is very difficult to enforce.

None of these alternatives address bioaccumulation and/or biomagnification of contaminants through the food chain. Through

Table 1

Various Sediment Contaminant Guidelines/Standards[1]

Contaminant	Unpolluted Marine Sediment	Commercial Boat Basin "Background" value	Commercial Boat Basin "Highest" value	Apparent Effects Threshold	Wildlife Protection (In Diet)
Mercury	0.06 mg/kg[2]	0.81 mg/kg	93.3 mg/kg	0.49 mg/kg[4]	<0.1 mg/kg[6]
Copper	<20 mg/kg[2]	63 mg/kg	4,530 mg/kg	170 mg/kg[4]	<60 mg/kg[7]
Tributyltin	0 mg/kg[3]	0.193 mg/kg	22.0 mg/kg	0.000006 mg/L[5]	<50 mg/kg[8]

1. All concentrations in mg/kg dry weight except #5 mg/L wet weight and wildlife protection values which are in mg/kg wet weight
2. Data from toxicity of metals in Aquatic Ecosystems (Moore & Ramanoorthy, 1984)
3. All organotins, except for some methyltin, are anthropogenically manufactured and should not occur in unpolluted waters
4. Values taken from Puget Sound Estuary Program
5. Value in water recommended by California State Water Control Board to protect aquatic life
6. Value in diet to protect birds (Heinz, 1979)
7. Y_{10} the LD_{50} acute value for Canada geese (Henderson & Winterfield, 1974)
8. Chronic LD_{50} value for Mallard ducklings (Eisler, 1989)

these processes contaminants can be transferred from sediment into benthic and epibenthic infauna which are consumed by fish which in turn are consumed by birds. Each transfer between trophic levels can magnify the contaminant concentration until they become toxic. Mercury, which can concentrate over 40,000 times in oysters (Kopfler, 1974), is notorious for biomagnification through the food chain.

Evaluating the various cleanup alternatives in relation to how they would protect wildlife, including the endangered brown pelican and California least tern, mercury appears to pose the most significant problem. Even the lowest cleanup alternative of 0.49 mg/kg is almost 500% above the 0.1 mg/kg value to protect birds. With the additional factor of biomagnification we are concerned about the impacts of mercury to wildlife.

The best way to assess if mercury is a problem would be to have some limited bioaccumulation sampling. We would suggest analyzing 5 composite samples of two species of fish and two species of invertebrates. The fish sample should include one forage species like the topsmelt (Atherinops affinis) which is fed on by the California least tern and one predator species.

Specific Comments

We have reviewed the report entitled " Commercial Basin Boatyards: Sediment Characterization and Evaluation of Remedial Action Alternatives" and offer the following comments:

1. We agree with the Regional Board that this report is woefully lacking and does not provide sufficient scientifically defensible arguments that a cleanup of contaminated sediment should not be done.

2. Page 4: The report does not provide any documentation to preclude other cleanup alternatives in addition to dredging and no action. In particular capping the contaminated area with clean sediment could be economically attractive as well as environmentlly sound. It appears that throughout the report that a rational is continually developed to justify a no action alternative.

3. Page 6: Interstitial water sample 5 were said to have been analyzed. Apparently only free standing water at the top of the core was sampled as interstitial. We do not agree that this is interstitial water. A standardized elutriate test such as the one used by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers (Ludwig et al. 1988) would be appropriate.

4. Page 7. We take strong exception to the 800 mg/kg proposed action threshold for copper. This value is 40 times

greater than unpolluted marine sediments. Copper residue in marine invertebrates inhabiting polluted sediment can get as high as 6480 mg/kg as found in soft parts of the Pacific oyster (Crassostrea gigas) by Boyden & Romeril (1974). Bioaccumulation data for marine invertebrates from various sediment copper concentrations within the Commercial Boat Basin would aid in the evaluation of this potential problem.

5. Page 8: The statement made to explain the distribution of contaminants through normal hydrology and sediment deposition within Commercial Basin is not supported in any way. A competent hydraulic oceanographer or sedimentologist should be consulted to substantiate or refute this hypothesis.

6. Page 9: Since higher concentrations of contaminants were found in sediment as opposed to "interstitial" water, metals were stated to be not available to benthic biota. The availability of sediment-associated metals to marine biota depends upon the physical and chemical nature of the sediment and water at the locale in question (Olsen, 1984). Information on particle size, pH, redox potential, presence of chelating agents, and total organic carbon are needed to assess the situation in the Commercial Basin. However, we believe the most direct way to demonstrate if metals are bioavailable or not is to conduct a limited bioaccumulation study through a caged study similar to the California mussel watch program or collecting resident biota and determine their metal burdens.

7. Page 11. In the section about natural remedial processes a discussion was included about benthic biota transferring contaminated surface sediment to deeper layers making it unavailable. It is just as likely that biota will transfer contaminants from the deeper layers to the surface. Deposit feeding worms and clams can easily borrow down to 10 cm and beyond where they rework sediment and either incorporate contaminants within their tissue or excrete contaminant laden sediment at the surface of the borrow.

8. Page 12: The conclusions drawn from this report are based on the assumption that levels of contaminants in the Commercial Basin sediments are insignificant with respect to bioavailability and toxicity as indicated by interstitial water sample results.

In fact the "interstitial" water analytical results presented on page A4 show that indeed toxicity does exist. For Copper, 13 out of 15 samples were above EPA's acute and chronic marine water quality criteria of 0.0029 mg/L. For mercury, the three samples above detection limits were above EPA's chronic marine water quality criteria of 0.000025 mg/L. Unfortunately, the detection limit used in the study of 0.0005 mg/L is 20 times higher than EPA's chronic criteria.

Summary

The preponderance of data gathered at the Commercial Boat Basin by both the Regional Board and the consultants to the boatyards show that significant enrichment of copper, mercury and tributyltin has occurred in the sediment. Standing water ("interstitial") in the sediment cores shows copper and mercury to be above EPA's marine water quality criteria and hence toxic. There are no data that show if bioaccumulation is occurring through the food chain and ultimately, if endangered birds are being impacted.

In order to better evaluate this situation we recommend that:

1. Some limited sediment toxicity test be performed (either whole sediment or elutriate tests) for use to define cleanup standards in addition to chemical criteria.

2. A limited bioaccumulation study be conducted using benthic invertebrates and resident fish (including a forage fish) to determine if contaminants are bioavailable and if they are being transferred through the food chain.

3. Using information from recommendation 2, a simple risk assessment should be performed to evaluate if any endangered birds could be impacted by contaminants within the Commercial Basin.

4. In the absence of any additional data we strongly recommend that at a minimum the most contaminated sediments be removed down to background concentrations and further cleanup be considered based on additional bioaccumulation and toxicity.

5. Any sediment cleanup option should insure that contaminant concentrations do not bioaccumulate in food for endangered wildlife that would cause injury or harm.

We appreciate the opportunity to provide comments on this issue and would like to be kept informed of any future developments. Any clarifications or questions should be forwarded to Steve Goodbred of my staff at (714) 643-4270.

Sincerely,

Brooks Harper

Brooks Harper
Acting Field Supervisor

Literature Cited

Boyden, C.R., and M.G. Romeril. 1974. A trace metal problem in pond oyster culture. Marine Pollution Bulletin 5:74-78.

Eisler, R. 1989. Tin hazards to fish, wildlife and invertebrates: A synoptic review. U.S. Fish and Wildlife Service Biological Report. 85(1.15). 83 pp.

Heinz, G.H. 1979. Methymercury: Reproductive and behavioral effects on three generations of mallard ducks. Journal of Wildlife Management. 43:394-401.

Henderson, B.M., and R.W. Winterfield. 1975. Acute Copper toxicosis in the Canada goose. Avian Diseases vol 19, No. 2 pp. 385-387.

Kopfler, F.C. 1974. The accumulation of organic and inorganic mercury compounds by the eastern oyster (Crassostrea virginica). Bulletin of Environmental Contaminants and Toxicology. 11:275.

Ludwig, D.D., J.H. Sherrad, and R.A. Amende. 1988. An evaluation of the standard elutriate test as an estimator of contaminant release at the point of dredging. Contract Report HL-88-1, prepared by Virginia polytechnic Institute, for the U.S. Army Engineer Waterway Experiment Station, Vicksburg, MS.

Moore, J.W., and S. Ramamoorthy. 1984. Toxicity of metals in aquatic ecosystems. Academic Press, 261 pp.

Olsen, L.A. 1984. Effects of contaminated sediment on fish and wildlife: review and annotated Bibliography. U.S. Fish and Wildlife Service. FWS/OBS-82166, 103 pp.

STATE OF CALIFORNIA

REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

In the matter of MAURICIO & SONS, INC. San Diego County	))))))	STIPULATION AND ORDER No. 90-06

Mauricio & Sons, Inc., San Diego County ("Mauricio & Sons") and the Regional Water Quality Control Board, San Diego Region ("Regional Board"), based upon the facts recited below, hereby stipulate as follows:

RECITALS

1. The Executive Officer issued Complaint No. 90-06 on January 5, 1990 pursuant to Water Code Section 13323, alleging that Mauricio & Sons failed to submit a Remedial Action Alternatives Analysis Report by June 30, 1989, as required by Directive No. 3 of Cleanup and Abatement Order No. 88-86 and addenda thereto. The Executive Officer further alleges that an incomplete report was submitted by Mauricio & Sons on September 7, 1989.

2. A hearing on this matter was scheduled before the Regional Board for January 29, 1990 in Encinitas, California. Mauricio & Sons elects to waive a hearing on the matter.

3. Mauricio & Sons denies that it failed to submit a Remedial Action Alternatives Analysis Report as required by Directive No. 3 of the Cleanup and Abatement Order No. 88-86 and addenda thereto or that the report was incomplete. Mauricio & Sons further alleges that it received no notice that the report was incomplete prior to January 5, 1990. Furthermore, Mauricio & Sons denies liability for any of the violations alleged in the complaint.

4. The parties desire to enter into this Stipulation and Order for the purpose of avoiding the time, expense and uncertainty associated with protracted administrative and judicial proceedings and for the purpose of focusing their respective resources on identifying,

analyzing, and resolving problems concerning contamination in the Commercial Basin of San Diego Bay.

5. This enforcement action is taken for the protection of the environment and, as such, is exempt from provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) in accordance with Section 15321, Chapter 2, Title 14, of the California Administrative Code.

6. The Regional Board has considered the factors specified in Water Code section 13327 of the California Water Code in agreeing to this Stipulation and Order and has concluded that it is in the public interest to accept payment of the Settlement amount.

7. The Regional Board will consider imposition of an administrative civil liability if the following dates are not met:

   A. Mauricio & Sons shall submit a plan of study, including a time schedule, for completion of the Remedial Action Alternatives Analysis Report required by Directive No. 3 of Cleanup and Abatement Order No. 88-86, as modified by addenda thereto, by February 2, 1990.

   B. Mauricio & Sons shall submit a Remedial Action Alternatives Analysis Report required by Directive No. 3 of Cleanup and Abatement Order No. 88-86, as modified by addenda thereto, by June 1, 1990.

STIPULATION

IT IS ACCORDINGLY STIPULATED as follows:

1. Upon execution of this Stipulation and Order by the Regional Board Executive Officer, Mauricio & Sons agrees to pay a settlement of $3,750.00 to the State Cleanup and Abatement Account. A check made payable to the State Water Resources Control Board in the amount of $3,750.00 shall be submitted to the Regional Board office within 30 days following execution of this Stipulation and Order by the Regional Board Executive Officer.

2. Mauricio & Sons is released from any and all claims for civil or criminal penalties arising out of the matters alleged in Complaint No. 90-06.

3. This Stipulation and Order is entered into and made without adjudication of any fact or law, without determination of any liability or violation of law, and

without constituting any evidence against or admission by Mauricio & Sons in connection with any of the matters set forth or alleged in said Complaint No. 90-06.

Dated: January 24, 1990

Mauricio & Sons, Inc.
San Diego County

By: *Anthony Mauricio*

Its *President*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION

Ladin H. Delaney 1-25

LADIN H. DELANEY
Executive Officer

ORDER

GOOD CAUSE APPEARING THEREFOR, it is so ordered this _____ day of ____________________, 1990.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION

____

LADIN H. DELANEY
Executive Officer

RECEIVED
JAN 24 1990
SAN DIEGO REGION
WATER QUALITY CONTROL

Show Opens Feb. 2 in Los Angeles

N DIEGO LOG

Southern California's Boating Newspaper Combined Circulation 53,800

LOS ANGELES—More than 1,100 sail and power-boats will be on display at the Southern California Boat Show, slated to begin a 10-day run Friday, Feb. 2, in the Los Angeles Convention Center.

The show will be open to the public from 2 to 10 p.m. weekdays, 11 a.m. to 10 p.m. Saturdays, and 11 a.m. to 7 p.m. Sundays. Admission will be $6 for adults, $3 for children 6 to 12. See page 15.

Photo courtesy of Knight and Carver [illegible]

d Sportfisher

Boat-Yard Owners Mystified By Water Board Tactics

By Larry Edwards
San Diego Bureau Manager

SAN DIEGO—The attorney representing three San Diego boat yards is saying his clients are mystified by the recent tactics of the San Diego Regional Water Quality Control Board.

The water board on Jan. 5 issued complaints specifying heavy fines for Eichenlaub Marine, Kettenburg Marine Corp., Bay City Marine, Inc., and Mauricio & Sons, Inc., for failure to comply with directives contained in cleanup and abatement orders issued by the board in 1988.

"We are mystified by the board's actions," said Alan [illegible] of the San Diego office of Latham & Watkins, speaking for Kettenburg, Bay City and Mauricio & Sons. "We thought we had a definite understanding on a revised schedule for submitting our reports. Without an inkling they dropped this complaint on us."

The complaints, signed by Laden H. Delaney, executive officer of the regional water board, specified fines of $75,000 each for Kettenburg, Bay City and Mauricio & Sons and $100,000 for Eichenlaub Marine.

Though the Mauricio & Sons boat yard was sold to Tom Nielsen and Don Beaumont about two years ago, Anthony Mauricio is being held responsible for cleaning up the adjacent waters.

The complaints charge that Kettenburg, Bay City and Mauricio & Sons failed to submit Remediation Alternatives Analysis Reports to the board by the June 30, 1989, deadline, submitting them instead on Sept. 7, 69 days late. In addition, the [illegible]

Turn to Page 22

S.D. Trade Group Benefits From Int'l Boat Show

►Fines

from page 1

reports were incomplete, the complaint said.

But Haney maintains he had been assured by Delaney that they could delay the submission of their reports in order to include additional test results, improving the reports, and that he had correspondence from Delaney specifying the revised deadline.

In any event, Haney wonders why, if there were questions about the validity of the reports, no one received a simple phone call. There was no communication from the board, prior to receiving the actual complaints, indicating the reports were unsatisfactory or that fines would be levied, Haney said.

At press time, Haney and the boat-yard owners he represents were involved in discussions with Delaney and board staff members in an effort to resolve the matter prior to the scheduled public hearing Monday, Jan. 29.

The board is offering to substantially reduce the fines in exchange for additional data, but the specific terms had not yet been worked out, Haney said.

Carl Eichenlaub, owner of Eichenlaub Marine, is dealing with the board independently. He said he, too, is hopeful of an equitable resolution to the matter and of a similar reduction of the fine.

Eichenlaub failed to meet an Aug. 7 deadline and as of Jan. 5 had not yet submitted sediment sampling results, the complaint said.

The maximum amount the boat yards could have been fined is $690,000 each for Kettenburg, Bay City and Maurfole & Sons and $1.47 million for Eichenlaub Marine. The water board is allowed by law to assess up to $10,000 a day for each day a firm is in violation of the board's directives.

►SDMTA

from page 1

"We've already gained not only the smaller shops which make up the backbone of the marine trades in San Diego, but many corporate members, as well," Shakespeare noted.

The association's 1990 priorities include increasing membership, environmental issues, developing an apprenticeship program, and promoting recreational boating in San Diego.

CUT 00766

CUT 00i

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone (619) 265-5114

January 22, 1990

Mr. Allen Haynie
Attorney
Latham & Watkins
Attorneys at Law
701 B Street, Suite 2100
San Diego, California 92101-8197

Dear Mr. Haynie:

This is to confirm our telephone conversation of this morning regarding settlement of the administrative civil liability complaints for Kettenburg Marine, Bay City Marine, and Mauricio and Sons, Inc.

As we discussed, the deadline date for submission of written testimony and witnesses concerning the allegations contained in the civil liability complaints is extended to 5:00 pm, January 24, 1990. You indicated that you would submit by 5:00 pm on January 24 either the written testimony and list of witnesses for the scheduled hearing on January 29, 1990 or a signed stipulation and order, containing terms agreeable to the Regional Board Executive Officer, for each boatyard wishing to waive the right to a hearing on January 29.

If you have any questions regarding this matter please contact me at the above number.

Very truly yours,

David Barker
Senior Engineer

1550 Hotel Circle North
San Diego, California 92108
(619) 294-9400
Fax: (619) 293-7920

Woodward-Clyde Consultants

September 8, 1989
Project No. 8853235T-COM3

Latham & Watkins
701 B Street, Suite 2100
San Diego, California 92101

Attention: Mr. Allen D. Haynie

COMMERCIAL BASIN BOATYARDS:
SEDIMENT CHARACTERIZATION AND
EVALUATION OF REMEDIAL ACTION ALTERNATIVES

Dear Mr. Haynie:

Woodward-Clyde Consultants (WCC) is pleased to provide this report, entitled Commercial Basin Boatyards: Sediment Characterization Study and Remedial Action Alternatives Evaluation. This report satisfies the reporting requirements of Directive 3 of Cleanup and Abatement Orders issued to Bay City Marine, Inc. (Order No. 88-79), Kettenburg Marine (Order No. 88-78), and Mauricio and Sons, Inc. (Order No. 88-86).

Analytical laboratory reports will be sent under separate cover.

Please contact us with your questions or comments.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

Barry D. Graham
Project Scientist

BDG/hal (a/bdg2)

Enclosures

(1) Mauricio & Sons, Inc.
(1) Bay City Marine, Inc.
(1) Kettenburg Marine

Copy of the original report filed in
Kettenburg Marine
Copy of cover letter filed in
Bay City Marine & Mauricio

Hotel Circle North
Diego, California 92108
(619) 294-9400
Fax: (619) 293-7920

Woodward-Clyde Consultants

September 7, 1989
Project No. 8853235T-COM3

ECEIVED
- 7 1989
SAN DIEGO REGIONAL
WATER QUALITY CONTROL BOARD

Latham & Watkins
701 B Street, Suite 2100
San Diego, California 92101

Attention: Mr. Allen D. Haynie

COMMERCIAL BASIN BOATYARDS:
SEDIMENT CHARACTERIZATION AND
EVALUATION OF REMEDIAL ACTION ALTERNATIVES

Dear Mr. Haynie:

Woodward-Clyde Consultants (WCC) is pleased to provide this report, entitled Commercial Basin Boatyards: Sediment Characterization Study and Remedial Action Alternatives Evaluation. This report satisfies the reporting requirements of Directive 3 of Cleanup and Abatement Orders issued to Bay City Marine, Inc. (Order No. 88-79), Kettenburg Marine (Order No. 88-78), and Mauricio and Sons, Inc. (Order No. 88-86).

Please contact us with your questions or comments.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

Barry D. Graham
Project Scientist

BDG/hal (a/bdg2)

(1) Mauricio & Sons, Inc.
(1) Bay City Marine, Inc.
(1) Kettenburg Marine

Enclosures

ORIGINAL REPORT FILED IN KETTENBURG MARINE
COPY OF THE COVER LETTER FILED IN
BAY CITY MARINE
MAURICIO & SONS

CUT 007670

Recommendations for PCB Action Levels in Sediments: Convair Lagoon, San Diego Bay

Technical Report

Prepared for:
Teledyne Ryan Aeronautical

for submittal to:
California Regional Water Quality Control Board

March 1988

ERC
Environmental
and Energy
Services Co.

Recommendations for PCB Action Levels in Sediments: Convair Lagoon, San Diego Bay

Technical Report

Prepared for:
Teledyne Ryan Aeronautical

for submittal to:
California Regional Water Quality Control Board
San Diego Region
9771 Clairemont Mesa Blvd., Suite B
San Diego, CA 92124

Prepared by:
Ebasco Environmental
10900 N.E. 8th Street
Bellevue, WA 98004
and
ERC Environmental and Energy Services Co.
5510 Morehouse Drive

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF APPENDICES

SECTION 1
INTRODUCTION

1.1 Background

Convair Lagoon is a small embayment (less than 10 acres) within San Diego Bay, located northeast of Harbor Island and immediately west of the U.S. Coast Guard Station. The adjacent shore property uses are primarily industrial, with General Dynamics, Port of San Diego, Teledyne Ryan Aeronautical, and the Coast Guard all maintaining facilities in the area. Over 24 drains and pipes terminate in the lagoon, including four large storm drains (a 54-inch drain to the west, a 60-inch drain off a central pier, a 48-inch drain from the airfield, and a 30-inch drain near Teledyne Ryan Aeronautical property). Smaller drains also come from the Coast Guard Station and the General Dynamics facility. For years the embayment was used as a dumping ground and retrieval area for derelict vessels. Over time, more than 500 vessels have been scuttled in a portion of the lagoon. The drains, industrial activities, and vessel disposal practices are all potential sources of contamination.

In the late 1970s and early 1980s, the state mussel watch program and subsequent California Regional Water Quality Control Board (RWQCB) investigations identified the presence of PCBs (polychlorinated biphenyls) in the sediments of Convair Lagoon. In response to RWQCB Cleanup and Abatement Order No. 86-92 and amendments, Teledyne Ryan Aeronautical has undertaken a number of corrective actions and sponsored further investigations regarding PCB contamination as summarized below.

1.2 Summary of Previous Investigations

Initial RWQCB investigations in the mid-1980s identified PCBs at several storm drain locations, including locations at TRA. As a result, TRA has implemented storm drain cleanup and replacement actions. In conjunction with these actions, in early 1987 TRA submitted a plan of study to evaluate the magnitude and extent of PCB contamination in Convair Lagoon. This plan subsequently went through three revisions after RWQCB response/comments and was adopted in February 1988.

This plan called for a two-phased investigation of sediments in Convair Lagoon to determine vertical and lateral extent of contamination. After initial sampling and analysis of sediments (Phase I) in 1988, a refined Phase II sampling plan was developed and executed in mid-1989. Results from the Phase II investigation were presented to the board in October 1989. Key findings of this investigation are:

- PCB sediment contamination exists in Convair Lagoon, but is confined primarily to the upper northwest quadrant.

- Contamination levels are patchy, ranging from below detection to 100 ppm with occasional hot spots (100 ppm-1,800 ppm). Highest levels are generally in the 2- to 5-foot depth interval. Typical levels are less than 10.

- There is a clear correlation of contaminants with the 60-inch storm drain. Vessel disposal may also have contributed to some hot spots.

Based on further meetings with RWQCB, TRA proposed a two-phase study of remedial alternatives in December 1989 and January 1990. The RWQCB subsequently requested TRA to perform Phase I of that study in a letter from L. H. Delaney of the RWQCB to D. J. Wilkins, General Counsel, TRA, dated January 31, 1990. This report is submitted in response to that request. Recommendations were developed for appropriate cleanup levels based on:

- Remedial information on other national sites which have PCB contaminated sediments, including the Hudson River, New York; New Bedford Harbor, Massachusetts; and Waukegan Harbor, Illinois sites. To the extent possible, this information incorporated the proposed cleanup levels and remedial strategies under consideration for the above locations.

- An evaluation of the existing data regarding PCB levels throughout San Diego Bay and an identification of a range of values representing PCB levels in areas of San Diego Bay other than Convair Lagoon. This evaluation also considered information on the potential storm drain inputs of PCBs at other San Diego Bay locations where PCBs are present.

- A compilation and description of proposed sediment quality criteria for PCBs as developed from several approaches, including Equilibrium Partitioning (EP), Apparent Effects Threshold (AET), Screening Level Concentrations (SLC), Sediment Quality Triad (SQT), and sediment bioassay data.

From the evaluation steps outlined above, a range of potential action levels was developed for protection of aquatic biota in contact with sediments. It should be emphasized here that this investigation is not intended to be a formal ecological risk assessment, but rather a summary presentation of applicable sediment quality criteria which may be used to support cleanup divisions for Convair Lagoon. It should also be noted that these recommended action levels are under no statutory authority, but can be considered only as advisories recognizing the limitations of the scientific approaches used to arrive at these values. Finally, the action levels were developed independent of any engineering or economic considerations and, hence, may not be practically achievable.

SECTION 2
NATIONWIDE PERSPECTIVE ON PCB SEDIMENT CONTAMINATION AND REMEDIAL EFFORTS

This section presents remedial information on three major national sites with PCB sediment contamination: Hudson River, New York; New Bedford Harbor, Massachusetts; Waukegan Harbor, Illinois. Also presented is the Duwamish River site in the State of Washington where a PCB spill of smaller magnitude occurred. A brief description of the problem, remedial technologies evaluated, and selected alternatives is provided together with proposed action levels. A more detailed discussion on site characteristics, regulatory action, remedial considerations, and action levels is provided in the appendices.

2.1 HUDSON RIVER, NEW YORK

2.1.1 Description of the Problem

Over a 30-year period ending in 1977, two General Electric (G.E.) capacitor manufacturing plants near Fort Edward and Hudson Falls discharged PCBs to the Hudson River. The PCBs in the discharges were trapped in sediments behind a 100-year-old dam at Fort Edward. After the removal of the dam in 1973, large spring floods scoured an estimated 1.5 million cubic yards of material from the former dam pool. Subsequent studies revealed that the discharges, in combination with the removal of the Fort Edward Dam, resulted in the dispersal of approximately one million pounds of PCBs throughout the entire Hudson River system south of Fort Edward. Much of this PCB-contaminated material was either dredged or washed out to sea. An estimated 498,000 to 656,000 pounds remain in the river. Sediment PCB concentrations average 5 to 30 ppm throughout the contaminated area, while hot spots average over 100 ppm. The overall range is from less than 1 ppm to over 10,000 ppm. Figure 2-1 illustrate the Upper Hudson River Basin.

2.1.2 Remedial Alternatives Evaluated

The remedial alternatives evaluated were: no action, in-situ treatment, chemical/biological treatment, and dredging (USEPA/NYSDEC 1987).

Under the no-action alternative, PCB-contaminated sediment in the upper Hudson River would remain in place except as removed by routine maintenance dredging. The alternative was judged unacceptable because it did nothing to reduce continued losses of PCBs from the Hudson River sediments to the water column and surrounding environment.

The in-situ treatment and chemical/biological treatment alternatives were rejected, primarily based upon lack of a full-scale demonstration of feasibility and cost considerations.

Of the dredging alternatives evaluated, clam shell dredging was eliminated due to required excess dredge volumes to provide access to shallow areas, greater PCB losses, and projected greater air and noise impacts. The other two hydraulic dredging alternatives were judged roughly equivalent, both with site-specific advantages and disadvantages. At present, the proposed remediation is removal by hydraulic dredging of over 40 PCB hot spots (50-500 ppm) with disposal of spoils in an upland controlled containment site (site 10).

2.1.3 Action Levels

Due to the magnitude and extent of the contamination, the project focus has been on dredged volumes, and no action levels have ever been established or a formal RI/FS initiated (Berger 1990). However, NYSDEC scientists are now considering the feasibility of using a TSCA level of 50 ppm or perhaps 10 ppm as the action level (Berger 1990).

2.2 NEW BEDFORD HARBOR

2.2.1 Description of the Problem

New Bedford, Massachusetts is a port city located at the head of Buzzards Bay, approximately 55 miles south of Boston (Figure 2-2). Historically, New Bedford is nationally known for its role in the development of the whaling industry in the early 1800s. Today, the harbor is home port to one of the largest commercial fishing fleets in the U.S.

Two local electronic component manufacturers, Cornell-Dubilier Electronics, Inc. and Aerovox Corp. used PCBs in the manufacture of capacitors from the 1940s to

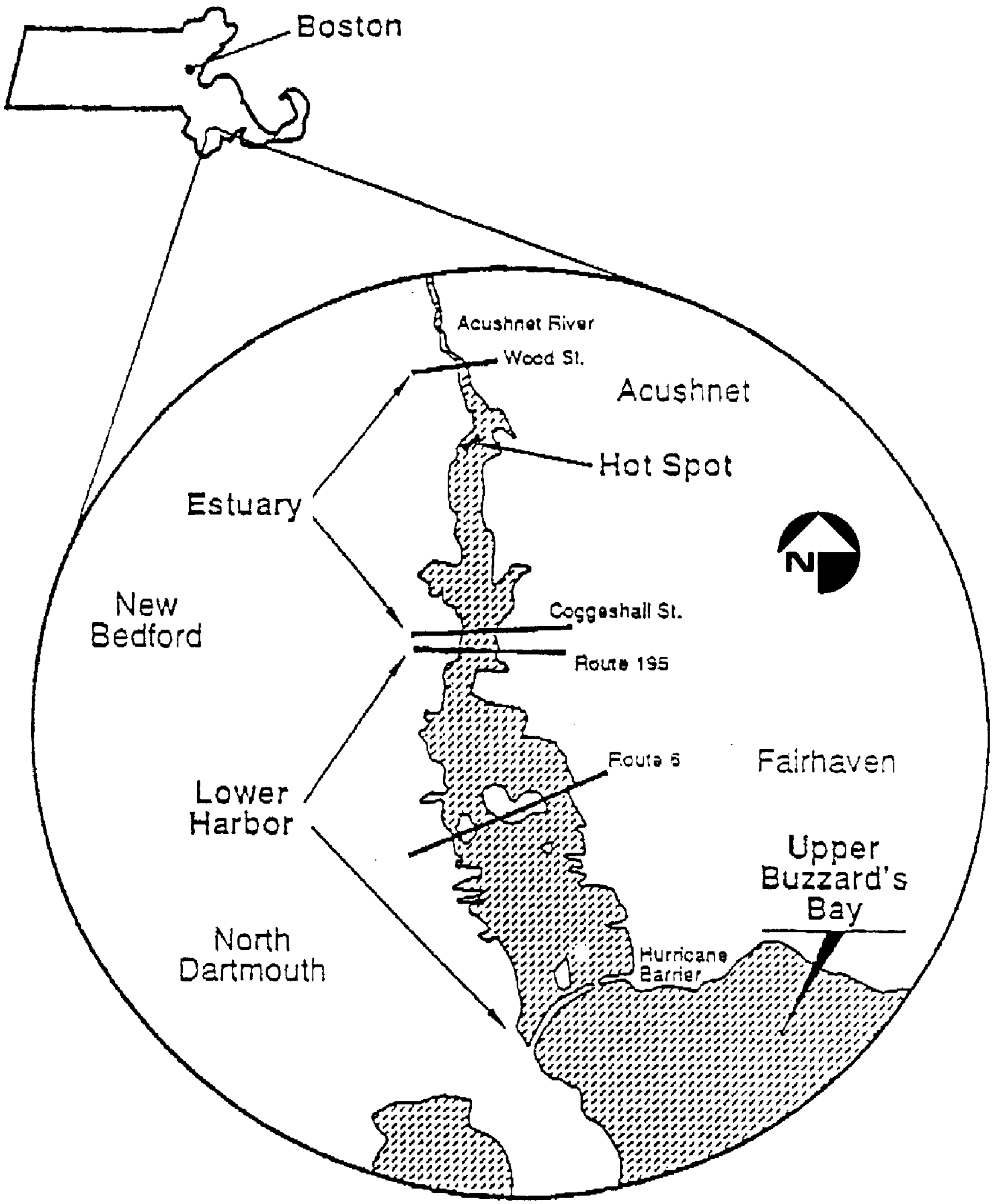


FIGURE 2-2

New Bedford Harbor Descriptive Areas

approximately 1978. Wastewater contaminated with PCBs was discharged by these and possibly other industries to the estuary and municipal sewage system for at least 30 years.

In 1976, the U.S. Environmental Protection Agency (EPA) conducted a New England-wide survey for PCBs. During this survey, elevated levels of PCB contamination were discovered in the marine sediments over a widespread area of New Bedford Harbor. Fish and shellfish concentrations were found in excess of the U.S. Food and Drug administration (FDA) tolerance limit (i.e., 2 ppm) for edible tissue. Subsequent investigations characterized the extent of contamination. Hot spots in the upper estuary (approximately 5 acres) range from 4,000 to 200,000 ppm PCBs (including visible product) in the sediments. The balance of the estuary (225 acres) ranges from below detection limits to 4000 ppm PCBs. The lower harbor and upper Buzzards Bay area (approximately 17,000 acres) ranges from below detection up to 100 ppm PCBs in the sediment.

As a result, the Massachusetts Department of Public Health established three fishing closure areas in New Bedford Harbor in September 1979. These closures are still in effect and resulted in the loss of approximately 18,000 acres of productive lobstering ground.

2.2.2 Remedial Alternatives Evaluated

Under the guidance of the U.S. EPA, Ebasco Environmental has managed a number of studies which incorporate the evaluation of remedial alternatives for this site. The response actions can be broadly categorized into removal, containment, and no action. Initially, over 20 technologies and 100 process options were identified for possible consideration. The figures in Appendix B illustrate the various alternatives that were retained for detailed evaluation during feasibility studies. Alternative evaluations are still ongoing. At present, it appears that separate responses will be selected for the hot spot areas and the other areas. Hot spot areas (>4,000 ppm PCBs) will likely be removed and incinerated prior to disposal. For the lower estuary, containment or selected removal may be viable, while no action/institutional controls may be viable for the Upper Bay. No decisions, however, have yet been made.

2.2.3 Action Levels

Action levels have not yet been established for the three major locations (Upper Estuary, Lower Harbor, and Upper Buzzards Bay). However, Ebasco Environmental, EPA REM III managing contractor for this site, is currently preparing a technical memorandum for agency consideration. Based on preliminary engineering cost/benefit evaluations it appears that levels much below 10 ppm may not be achievable in any area. Hot spots, which will evidently be removed (dredged), are defined as >4,000 ppm.

2.3 WAUKEGAN HARBOR, ILLINOIS

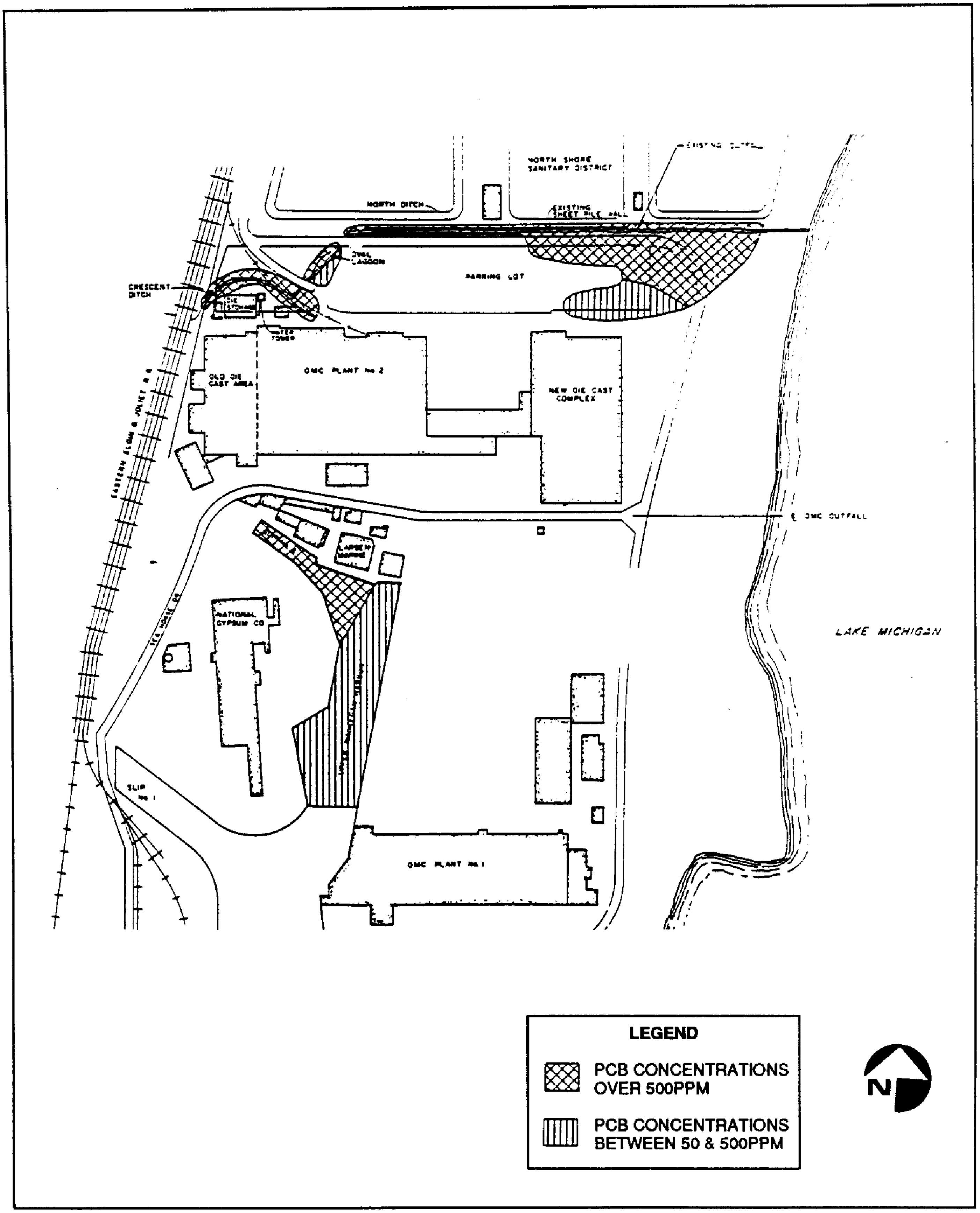
2.3.1 Description of the Problem

Outboard Marine Corporation (OMC) operates a recreational marine products manufacturing plant located on the west shore of Lake Michigan in Waukegan, Illinois, about 37 miles north of Chicago and 10 miles south of the Wisconsin state border (Figure 2-3). From approximately 1961 to 1972, OMC purchased a PCB-containing hydraulic fluid used in the diecasting works. Some of these fluids escaped through floor drains which discharged to an oil interceptor system which, in turn, discharged to the North Ditch. Some of these PCBs were released into the harbor. The harbor area discharge was located in the western end of Slip 3 and the north property discharge was in the Crescent Ditch. The discharge pipe to the harbor was sealed in 1975 (USEPA 1988h).

As a result of these discharges, large quantities of PCBs are in Waukegan Harbor and on OMC property in the North Ditch/Oval Lagoon/Crescent Ditch area and in the parking lot and Slip 3. It is estimated that there are over 700,000 pounds of PCBs on OMC property and approximately 300,000 pounds of PCBs in Waukegan Harbor. The range of PCB concentrations is a few parts per million in the harbor channel to over 10,000 ppm in selected hot spots.

2.3.2 Remedial Alternatives Evaluated

Two treatment technologies were evaluated by OMC, the TACIUK Process and the BEST Process. The TACIUK Process is a thermal process based on recovering oil from oil shale and tar sands in Canada. The BEST Process is a chemical extraction process employing



FIGURE

2-3

OMC Site- Before Remedial Action

triethylamine (TEA) as a solvent. Both were deemed to be technologically equivalent, but the TACIUK Process was chosen because of lower cost. There were additional reasons for rejecting the BEST Process: (1) the EPA oversight contractor revealed that there were questions regarding the financial solvency of the vendors of the BEST technology: (2) OMC was not convinced that the technology would work because there are no commercial systems currently operating with this process; and (3) control of solvent emissions in the air was not considered adequate.

2.3.3 Action Levels

The objective of the 1984 Record of Decision (ROD) was to clean up general areas within the site which contained PCB contamination of 50 ppm or greater, and remove hot spots (defined as greater than 10,000 ppm) and encapsulate the removed material. The 1988 ROD has refined the action levels such that hot spots are now defined as those areas with PCB contamination greater than 500 ppm. No action will be taken on sediments of less than 50 ppm PCBs. Evidently treatment will not occur on removed sediments of less than 500 ppm.

2.4 DUWAMISH RIVER ESTUARY, WASHINGTON

On September 13, 1974, an electric transformer destined for arctic service was dropped and broken on the north pier of Slip 1 of the Duwamish River, Seattle, Washington. As a result, approximately 255 gallons of PCB transformer fluid containing Aroclor 1242 was spilled onto the pier and into the water. After becoming aware of the type and quantity of fluid spilled, EPA acted to determine the extent of pollution. Being denser than water, this liquid settled onto the sediments.

Results from EPA Region X Laboratory's monitoring of this cleanup operation indicated the EPA initially removed 80 of the estimated 255 gallons of PCB through hand dredging and suction pumping of the pooled liquid. The remaining fluid spread throughout the slip and into the river channel. Recognizing the seriousness of this problem, DOD and the Army Corps of Engineers conducted a second recovery operation to remove the remaining PCB using a Pneuma Model 600 dredge. Sediment PCB concentrations ranged from 112 to 2,400 ppm in the impact area during the first phase of this removal opreation (60 percent of sediment). The remaining 40 percent of sediments removed ranged in the second phase of the removal operation from 0.8 to 43 ppm when tested (prior to treatment).

The second recovery effort resulted in the removal of most of the spilled Aroclor from Slip 1 without evidence of significant PCB translocation. Estimates of the amount of PCB recovered range between 220 and 250 gallons. The average estimated value of PCB removed, 235 gallons, represents a 92% recovery of the total amount of PCB spilled. It follows that approximately 20 of the 255 gallons of PCB spilled are assumed to still be on the river bottom or unaccounted for at this time. Substantially reduced levels of PCB were detected in the impact area and only trace amounts of the substance were found to be present in the remaining portion of the slip. The river channel remained free of the spilled Aroclor indicating that less than a detectable amount of the pollutant was transported out of the spill site during the final cleanup operation.

In comparison, analysis of survey data obtained during the first three-month period after the spill indicates that some translocation of Aroclor 1242 into the river channel occurred during the first cleanup operation. Apparently, divers with hand-held dredges disturbed the pollutant, allowing transport of the material to occur. This situation was further aggravated by natural disposal forces acting on the transformer oil which lay unprotected on the river bottom. Prop wash from vessel traffic also appears to have played a significant role in the dispersal of the contaminants.

Subsequent surveys during the months that followed demonstrated that normal river sediments tended to cover the contaminated sediments and that the spread of PCB occurred mainly toward the back portion of the slip. Also, the force of a "20-year flood" experienced in the Duwamish Estuary during the winter of 1976 either diluted or scoured the contaminated river channel sediments such that no detectable amount of PCB remained in the channel. However, no significant changes attributable to the flood were noted in sediment concentrations within the slip proper. A continual migration of Aroclor 1242 towards the back of the slip appears to have occurred, attributed to docking and embarking activities of ships in the area and other factors such as tidal action.

A slow but persistent movement of transformer fluid could have eventually contaminated the entire slip and polluted much of the Duwamish River if the spilled PCB were allowed to remain on the slip bottom. A relatively rapid response and successful completion of the removal operation terminated that migration.

SECTION 3
EXISTING DATA REGARDING SAN DIEGO BAY PCB CONTAMINATION LEVELS

This section summarizes information on PCB levels in San Diego Bay based on existing literature and information obtained from other investigators. Although the focus is on areas of San Diego Bay other than Convair Lagoon, we have included recent data from Convair Lagoon for completeness. This evaluation also considers information on potential storm drain inputs of PCBs where appropriate.

3.1 CONVAIR LAGOON

Information on the concentrations of PCBs in the sediments of Convair Lagoon and in storm drains which discharge to Convair Lagoon were first developed and summarized by the Regional Water Quality Control Board (Barker 1986). Subsequently, TRA conducted a comprehensive two phased investigation to document the vertical and horizontal distribution of PCBs in the sediments of Convair Lagoon. This involved collection of samples at 26 sites to a sediment depth of up to 10 feet below the bay bottom (Figure 3-1). Study results and interpretations are presented in TRA 1988 and TRA 1989. Chemical results of the comprehensive Phase 2 study (TRA 1989) are presented in Table 3-1. PCB concentrations ranged from below the chemical limits of detection to 1,800 mg/kg dry weight (ppm) based on all samples from all depths. PCB concentrations in surface samples (i.e., the upper 1 ft) ranged from less than 1 to 96 mg/kg. Surface samples from Phase 1 ranged from less than 1 to 960 mg/kg and contained a greater proportion of high values. This is probably due to more samples being taken near the terminus of the 60 inch storm drain. A frequency distribution of all surface samples from both phases is presented in Figure 3-2. This will allow a general comparison with data from other areas of the bay.

3.2 AREAS OUTSIDE CONVAIR LAGOON

Recent information on PCBs in San Diego Bay was grouped into the following categories

- PCBs in bay sediments,
- PCBs in bay sediments removed by dredging; and
- PCBs in tissue.

TABLE 3-1. PCB AND TOC ANALYTICAL RESULTS (DRY WEIGHT BASIS).

Transect Number	Distance (feet)	Sample Depth (feet)	Percent Moisture (%)	Aroclor 1016 mg/kg	Aroclor 1221 mg/kg	Aroclor 1232 mg/kg	Aroclor 1242 mg/kg	Aroclor 1248 mg/kg	Aroclor 1254 mg/kg	Aroclor 1260 mg/kg	TOTAL PCB* mg/kg	PCB Detection Limit	TOC dry %
1	50	1	50.6	N.D.	N.D.	N.D.	N.D.	4.4	1.0	1.5	6.9	1.0	2.6
1	50	2	54.2	N.D.	N.D.	N.D.	N.D.	64	N.D.	6.0	70	5.0	3.7
1	50	3	52.0	N.D.	N.D.	N.D.	N.D.	35	6.4	5.1	47	2.5	5.9
1	50	4	52.1	N.D.	N.D.	N.D.	N.D.	N.D.	8.2	N.D.	8.2	1.0	6.7
1	50	5	40.3	N.D.	N.D.	N.D.	N.D.	N.D.	1.1	0.26	1.4	0.25	2.6
1	50	6	42.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.26	0.26	0.05	2.4
1	50	7	27.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.099	0.099	0.05	0.76
1	50	8	23.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.20
1	50	9	24.0	-	-	-	-	-	-	-	-	-	-
1	50	10	26.7	-	-	-	-	-	-	-	-	-	-
1	100	1	54.2	N.D.	N.D.	N.D.	N.D.	2.3	1.2	1.3	4.8	0.5	2.9
1	100	2	65.7	N.D.	N.D.	N.D.	N.D.	24	8.2	4.6	37	2.5	3.6
1	100	3	49.4	N.D.	N.D.	N.D.	N.D.	14	1.8	1.9	18	1.0	4.2
1	100	4	45.7	N.D.	N.D.	N.D.	N.D.	2.4	5.6	N.D.	8.0	1.0	2.9
1	100	5	31.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.81
1	100	6	22.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.25
1	100	7	24.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.52
1	100	8	24.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.29
1	100	9	27.5	-	-	-	-	-	-	-	-	-	-
1	100	10	34.9	-	-	-	-	-	-	-	-	-	-
1	150	1	57.6	N.D.	N.D.	N.D.	N.D.	0.19	1.3	0.11	1.6	0.10	3.6
1	150	2	49.3	N.D.	N.D.	N.D.	N.D.	N.D.	0.40	0.20	0.60	0.05	3.2
1	150	3	22.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.27
1	150	4	22.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.29
1	150	5	21.8	-	-	-	-	-	-	-	-	-	-
1	150	6	22.5	-	-	-	-	-	-	-	-	-	-
1	150	7	22.0	-	-	-	-	-	-	-	-	-	-
1	150	8	28.0	-	-	-	-	-	-	-	-	-	-
1	150	9	-	-	-	-	-	-	-	-	-	-	-
1	150	10	-	-	-	-	-	-	-	-	-	-	-
1	200	1	44.6	N.D.	N.D.	N.D.	N.D.	2.3	5.4	0.81	8.5	0.75	2.6
1	200	2	46.7	N.D.	N.D.	N.D.	N.D.	0.23	0.22	0.45	0.90	0.05	2.8
1	200	3	30.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.40
1	200	4	24.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.16
1	200	5	24.8	-	-	-	-	-	-	-	-	-	-
1	200	6	26.3	-	-	-	-	-	-	-	-	-	-
1	200	7	30.9	-	-	-	-	-	-	-	-	-	-
1	200	8	29.7	-	-	-	-	-	-	-	-	-	-
1	200	9	-	-	-	-	-	-	-	-	-	-	-
1	200	10	-	-	-	-	-	-	-	-	-	-	-
2	0	1	20.7	N.D.	N.D.	N.D.	N.D.	17	7.8	N.D.	25	5.0	0.96
2	0	2	15.7	N.D.	N.D.	N.D.	N.D.	2.0	N.D.	N.D.	2.0	0.75	0.50
2	0	3	19.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.38
2	0	4	18.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.24
2	0	5	22.3	-	-	-	-	-	-	-	-	-	-
2	0	6	23.4	-	-	-	-	-	-	-	-	-	-
2	0	7	19.3	-	-	-	-	-	-	-	-	-	-
2	0	8	21.1	-	-	-	-	-	-	-	-	-	-
2	0	9	-	-	-	-	-	-	-	-	-	-	-
2	0	10	-	-	-	-	-	-	-	-	-	-	-
2	50	1	50.0	N.D.	N.D.	N.D.	N.D.	64	12	15	91	10	4.2

TABLE 3-1. PCB AND TOC ANALYTICAL RESULTS (DRY WEIGHT BASIS).

Transect Number	Distance (feet)	Sample Depth (feet)	Percent Moisture (%)	Aroclor 1016 mg/kg	Aroclor 1221 mg/kg	Aroclor 1232 mg/kg	Aroclor 1242 mg/kg	Aroclor 1248 mg/kg	Aroclor 1254 mg/kg	Aroclor 1260 mg/kg	TOTAL PCB* mg/kg	PCB Detection Limit	TOC dry %
2	50	2	50.0	N.D.	N.D.	N.D.	N.D.	75	9.3	12	96	7.5	3.8
2	50	3	73.2	N.D.	N.D.	N.D.	N.D.	70	9.5	11	91	5.0	4.1
2	50	4	54.7	N.D.	N.D.	N.D.	N.D.	420	N.D.	51	471	50	6.0
2	50	5	56.1	N.D.	N.D.	N.D.	N.D.	1800	N.D.	N.D.	1800	250	11.6
2	50	6	53.2	N.D.	N.D.	N.D.	N.D.	16	80	N.D.	96	5.0	13.5
2	50	7	51.4	N.D.	N.D.	N.D.	N.D.	1000	270	140	1410	130	8.2
2	50	8	55.3	N.D.	N.D.	N.D.	N.D.	N.D.	38.0	7.6	45.6	5.0	8.6
2	50	9	45.9	N.D.	N.D.	N.D.	N.D.	N.D.	1.4	1.8	3.2	0.50	5.7
2	50	10	55.2	N.D.	N.D.	N.D.	N.D.	N.D.	0.39	0.43	0.82	0.05	5.8
2	100	1	46.0	N.D.	N.D.	N.D.	50	N.D.	12	11	73	10	3.2
2	100	2	54.4	N.D.	N.D.	N.D.	N.D.	78	8.3	23	109	5.0	3.9
2	100	3	51.2	N.D.	N.D.	N.D.	880	N.D.	N.D.	N.D.	880	130	3.7
2	100	4	46.6	N.D.	N.D.	N.D.	N.D.	270	N.D.	34	304	25	5.4
2	100	5	51.7	N.D.	N.D.	N.D.	N.D.	63	19	18	100	10	5.9
2	100	6	42.7	N.D.	N.D.	N.D.	N.D.	N.D.	21.0	2.8	23.8	2.5	4.5
2	100	7	42.5	N.D.	N.D.	N.D.	0.15	N.D.	N.D.	1.2	1.4	0.15	3.4
2	100	8	35.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.38	0.38	0.05	1.8
2	100	9	26.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.33
2	100	10	35.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.66
2	150	1	55.7	N.D.	N.D.	N.D.	N.D.	30	5.8	14	50	5.0	5.6
2	150	2	51.0	N.D.	N.D.	N.D.	630	N.D.	N.D.	N.D.	630	130	5.3
2	150	3	47.5	N.D.	N.D.	N.D.	N.D.	N.D.	25	N.D.	25	5.0	5.6
2	150	4	49.0	N.D.	N.D.	N.D.	N.D.	N.D.	18	N.D.	18	5.0	3.9
2	150	5	50.1	N.D.	N.D.	N.D.	N.D.	N.D.	0.44	0.98	1.42	0.05	3.8
2	150	6	36.5	N.D.	N.D.	N.D.	N.D.	N.D.	0.063	0.28	0.34	0.05	2.1
2	150	7	39.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	1.4
2	150	8	26.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.64
2	150	9	22.7	-	-	-	-	-	-	-	-	-	-
2	150	10	23.9	-	-	-	-	-	-	-	-	-	-
2	250	1	46.9	N.D.	N.D.	N.D.	N.D.	47	N.D.	6.6	54	5.0	2.7
2	250	2	48.4	N.D.	N.D.	N.D.	1.3	N.D.	9.8	2.5	13.6	1.0	3.8
2	250	3	48.6	N.D.	N.D.	N.D.	N.D.	N.D.	4.0	0.68	4.7	0.5	3.5
2	250	4	48.7	N.D.	N.D.	N.D.	N.D.	0.11	N.D.	0.25	0.36	0.05	3.2
2	250	5	35.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.17	0.17	0.050	1.4
2	250	6	23.2	N.D.	N.D.	N.D.	N.D.	0.058	N.D.	N.D.	0.058	0.050	0.40
2	250	7	23.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.25
2	250	8	23.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.24
2	250	9	-	-	-	-	-	-	-	-	-	-	-
2	250	10	-	-	-	-	-	-	-	-	-	-	-
3	0	1	28.7	N.D.	N.D.	N.D.	75	N.D.	N.D.	N.D.	75	10	1.7
3	0	2	25.4	N.D.	N.D.	N.D.	21	N.D.	N.D.	N.D.	21	10	1.9
3	0	3	24.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	9.6	9.6	2.5	0.49
3	0	4	21.2	N.D.	N.D.	N.D.	0.15	N.D.	N.D.	N.D.	0.15	0.05	0.10
3	0	5	21.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.056	0.056	0.050	0.26
3	0	6	21.9	N.D.	N.D.	N.D.	N.D.	N.D.	0.068	0.068	0.136	0.050	0.40
3	0	7	19.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.12
3	0	8	20.6	N.D.	N.D.	N.D.	N.D.	0.081	N.D.	N.D.	0.081	0.050	0.37
3	0	9	28.3	-	-	-	-	-	-	-	-	-	-
3	0	10	30.2	-	-	-	-	-	-	-	-	-	-
3	50	1	28.4	N.D.	N.D.	N.D.	89	N.D.	N.D.	N.D.	89	25	2.31
3	50	2	21.7	N.D.	N.D.	N.D.	1600	N.D.	N.D.	N.D.	1600	500	3.89

TABLE 3-1. PCB AND TOC ANALYTICAL RESULTS (DRY WEIGHT BASIS).

Transect Number	Distance (feet)	Sample Depth (feet)	Percent Moisture (%)	Aroclor 1016 mg/kg	Aroclor 1221 mg/kg	Aroclor 1232 mg/kg	Aroclor 1242 mg/kg	Aroclor 1248 mg/kg	Aroclor 1254 mg/kg	Aroclor 1260 mg/kg	TOTAL PCB* mg/kg	PCB Detection Limit	TOC dry %
3	50	3	20.5	N.D.	N.D.	N.D.	400	N.D.	N.D.	N.D.	400	100	1.93
3	50	4	19.2	N.D.	N.D.	N.D.	1.7	N.D.	1.8	0.75	4.3	0.50	0.39
3	50	5	18.8	N.D.	N.D.	N.D.	N.D.	N.D.	1.0	1.7	2.7	0.50	1.4
3	50	6	21.7	N.D.	N.D.	N.D.	0.45	N.D.	N.D.	0.40	0.85	0.25	0.51
3	50	7	30.3	N.D.	N.D.	N.D.	0.18	N.D.	N.D.	0.87	1.05	0.10	2.3
3	50	8	30.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.49	0.49	0.050	2.2
3	50	9	27.2	N.D.	N.D.	N.D.	N.D.	0.067	N.D.	0.13	0.197	0.050	0.89
3	50	10	29.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.074	0.074	0.050	1.8
3	100	1	36.2	N.D.	N.D.	N.D.	94	N.D.	N.D.	N.D.	94	25	3.1
3	100	2	28.6	570	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	570	130	3.5
3	100	3	39.6	N.D.	N.D.	N.D.	N.D.	180	N.D.	N.D.	180	50	3.9
3	100	4	26.9	N.D.	N.D.	N.D.	60	N.D.	N.D.	N.D.	60	10	1.8
3	100	5	29.1	N.D.	N.D.	N.D.	N.D.	N.D.	11	N.D.	11	1.0	2.4
3	100	6	30.2	N.D.	N.D.	N.D.	N.D.	N.D.	0.28	0.45	0.73	0.15	1.7
3	100	7	28.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.3	1.3	0.20	1.6
3	100	8	29.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.31	0.31	0.10	1.8
3	100	9	20.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.064	0.050	0.43
3	100	10	29.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.28	0.050	0.32
3	150	1	51.1	N.D.	N.D.	N.D.	N.D.	29	N.D.	6.7	36	5.0	3.4
3	150	2	58.7	N.D.	N.D.	N.D.	32	N.D.	9.6	13	55	5.0	2.7
3	150	3	38.9	N.D.	N.D.	N.D.	N.D.	44	20	14	78	5.0	4.1
3	150	4	37.1	N.D.	N.D.	N.D.	N.D.	N.D.	6.7	2.7	9.4	2.5	3.4
3	150	5	39.7	N.D.	N.D.	N.D.	N.D.	N.D.	17	8.0	25	5.0	3.5
3	150	6	36.7	N.D.	N.D.	N.D.	N.D.	N.D.	6.1	N.D.	6.1	1.0	3.3
3	150	7	38.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.8	1.8	0.15	2.8
3	150	8	32.7	N.D.	N.D.	N.D.	N.D.	N.D.	0.14	0.052	0.19	0.050	1.7
3	150	9	36.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.096	0.050	1.4
3	150	10	38.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	1.7
4	0	1	25.8	N.D.	N.D.	N.D.	N.D.	0.42	N.D.	N.D.	0.42	0.25	0.48
4	0	2	22.8	N.D.	N.D.	N.D.	N.D.	0.28	0.17	0.14	0.59	0.05	0.44
4	0	3	21.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.32
4	0	4	64.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.77
4	0	5	27.1	-	-	-	-	-	-	-	-	-	-
4	0	6	22.9	-	-	-	-	-	-	-	-	-	-
4	0	7	30.9	-	-	-	-	-	-	-	-	-	-
4	0	8	34.3	-	-	-	-	-	-	-	-	-	-
4	0	9	31.7	-	-	-	-	-	-	-	-	-	-
4	0	10	42.4	-	-	-	-	-	-	-	-	-	-
4	50	1	58.8	N.D.	N.D.	N.D.	N.D.	37	13	7.5	58	2.5	5.4
4	50	2	72.1	N.D.	N.D.	N.D.	N.D.	30	N.D.	6.9	37	5.0	8.0
4	50	3	79.4	N.D.	N.D.	N.D.	N.D.	22	4.6	7.2	34	2.0	5.4
4	50	4	70.1	N.D.	N.D.	N.D.	N.D.	58	20	19	97	5.0	4.6
4	50	5	65.2	N.D.	N.D.	N.D.	N.D.	270	N.D.	N.D.	270	25	5.5
4	50	6	54.1	N.D.	N.D.	N.D.	N.D.	85	N.D.	N.D.	85	25	7.7
4	50	7	53.0	N.D.	N.D.	N.D.	N.D.	N.D.	11	N.D.	11	2.5	5.5
4	50	8	47.7	N.D.	N.D.	N.D.	N.D.	N.D.	0.11	0.33	0.44	0.05	4.0
4	50	9	32.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.36	0.36	0.050	1.6
4	50	10	23.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.16	0.16	0.050	1.6
4	100	1	52.5	N.D.	N.D.	N.D.	N.D.	30	7.8	5.0	43	5.0	4.6
4	100	2	61.2	N.D.	N.D.	N.D.	N.D.	52	8.9	10	71	5.0	5.0
4	100	3	61.1	N.D.	N.D.	N.D.	N.D.	56	10	17	83	5.0	3.1

TABLE 3-1. PCB AND TOC ANALYTICAL RESULTS (DRY WEIGHT BASIS).

Transect Number	Distance (feet)	Sample Depth (feet)	Percent Moisture (%)	Aroclor 1016 mg/kg	Aroclor 1221 mg/kg	Aroclor 1232 mg/kg	Aroclor 1242 mg/kg	Aroclor 1248 mg/kg	Aroclor 1254 mg/kg	Aroclor 1260 mg/kg	TOTAL PCB* mg/kg	PCB Detection Limit	TOC dry %
4	100	4	64.4	N.D.	N.D.	N.D.	160	N.D.	N.D.	N.D.	160	50	4.5
4	100	5	48.9	N.D.	N.D.	N.D.	230	N.D.	N.D.	N.D.	230	50	6.9
4	100	6	47.5	N.D.	N.D.	N.D.	N.D.	N.D.	18	2.8	21	2.5	4.8
4	100	7	40.0	N.D.	N.D.	N.D.	N.D.	N.D.	0.62	1.0	1.6	0.25	2.6
4	100	8	38.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.55	0.55	0.10	2.2
4	100	9	31.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.16	0.16	0.050	1.7
4	100	10	34.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.096	0.096	0.050	1.6
4	150	1	53.7	N.D.	N.D.	N.D.	N.D.	44	7.6	5.4	57	5.0	3.6
4	150	2	63.6	N.D.	N.D.	N.D.	N.D.	14	5.7	5.5	25	1.0	3.1
4	150	3	54.0	160	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	160	50	4.9
4	150	4	42.1	N.D.	N.D.	N.D.	N.D.	N.D.	13	5.2	18	2.5	5.0
4	150	5	38.6	N.D.	N.D.	N.D.	N.D.	N.D.	0.15	0.53	0.68	0.050	3.6
4	150	6	47.0	N.D.	N.D.	N.D.	N.D.	N.D.	10	1.3	11	1.0	3.5
4	150	7	38.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.28	0.28	0.050	2.1
4	150	8	42.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	2.2
4	150	9	24.4	-	-	-	-	-	-	-	-	-	-
4	150	10	22.9	-	-	-	-	-	-	-	-	-	-
4	250	1	54.8	N.D.	N.D.	N.D.	N.D.	18	1.6	3.6	23	1.0	3.2
4	250	2	50.6	N.D.	N.D.	N.D.	44	N.D.	7.1	5.6	57	5.0	4.9
4	250	3	49.3	N.D.	N.D.	N.D.	N.D.	N.D.	11	3.9	15	1.0	3.9
4	250	4	47.9	N.D.	N.D.	N.D.	N.D.	N.D.	3.7	0.67	4.4	0.5	3.7
4	250	5	42.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.24	0.24	0.050	2.9
4	250	6	34.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.063	0.063	0.050	1.2
4	250	7	24.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.21
4	250	8	22.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.15
4	250	9	22.9	-	-	-	-	-	-	-	-	-	-
4	250	10	22.4	-	-	-	-	-	-	-	-	-	-
5	0	1	38.0	N.D.	N.D.	N.D.	N.D.	6.8	N.D.	N.D.	6.8	2.5	2.4
5	0	2	19.8	N.D.	N.D.	N.D.	6.5	N.D.	N.D.	N.D.	6.5	2.5	0.81
5	0	3	21.8	N.D.	N.D.	N.D.	15	N.D.	N.D.	N.D.	15	5.0	1.2
5	0	4	29.2	N.D.	N.D.	N.D.	0.091	N.D.	N.D.	N.D.	0.091	0.05	0.97
5	0	5	19.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.23
5	0	6	20.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.29
5	0	7	20.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.20
5	0	8	23.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.055	0.055	0.050	0.26
5	0	9	33.9	-	-	-	-	-	-	-	-	-	-
5	0	10	35.4	-	-	-	-	-	-	-	-	-	-
5	50	1	46.5	N.D.	N.D.	N.D.	N.D.	19	5.4	4.3	29	2.5	3.7
5	50	2	58.3	N.D.	N.D.	N.D.	N.D.	32	6.3	6.3	45	5.0	4.0
5	50	3	47.9	N.D.	N.D.	N.D.	N.D.	24	5.6	5.3	35	2.5	1.6
5	50	4	19.9	N.D.	N.D.	N.D.	N.D.	1.8	0.58	0.40	2.8	0.25	0.31
5	50	5	54.2	N.D.	N.D.	N.D.	N.D.	150	N.D.	N.D.	150	50	5.5
5	50	6	46.0	N.D.	N.D.	N.D.	N.D.	3.0	8.5	4.5	16.0	1.0	6.1
5	50	7	48.5	N.D.	N.D.	N.D.	N.D.	2.2	1.1	1.7	5.0	0.50	5.8
5	50	8	45.0	N.D.	N.D.	N.D.	N.D.	0.22	N.D.	0.20	0.42	0.050	3.2
5	50	9	29.1	N.D.	N.D.	N.D.	N.D.	N.D.	0.055	N.D.	0.055	0.050	0.50
5	50	10	26.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.45
5	100	1	68.5	N.D.	N.D.	N.D.	N.D.	35	11	6.7	53	5.0	4.2
5	100	2	74.7	N.D.	N.D.	N.D.	N.D.	32	10	8.5	51	3.5	4.0
5	100	3	64.2	N.D.	N.D.	N.D.	N.D.	40	9.4	15	64	5.0	3.8
5	100	4	67.4	N.D.	N.D.	N.D.	N.D.	1800	N.D.	N.D.	1800	130	1.2

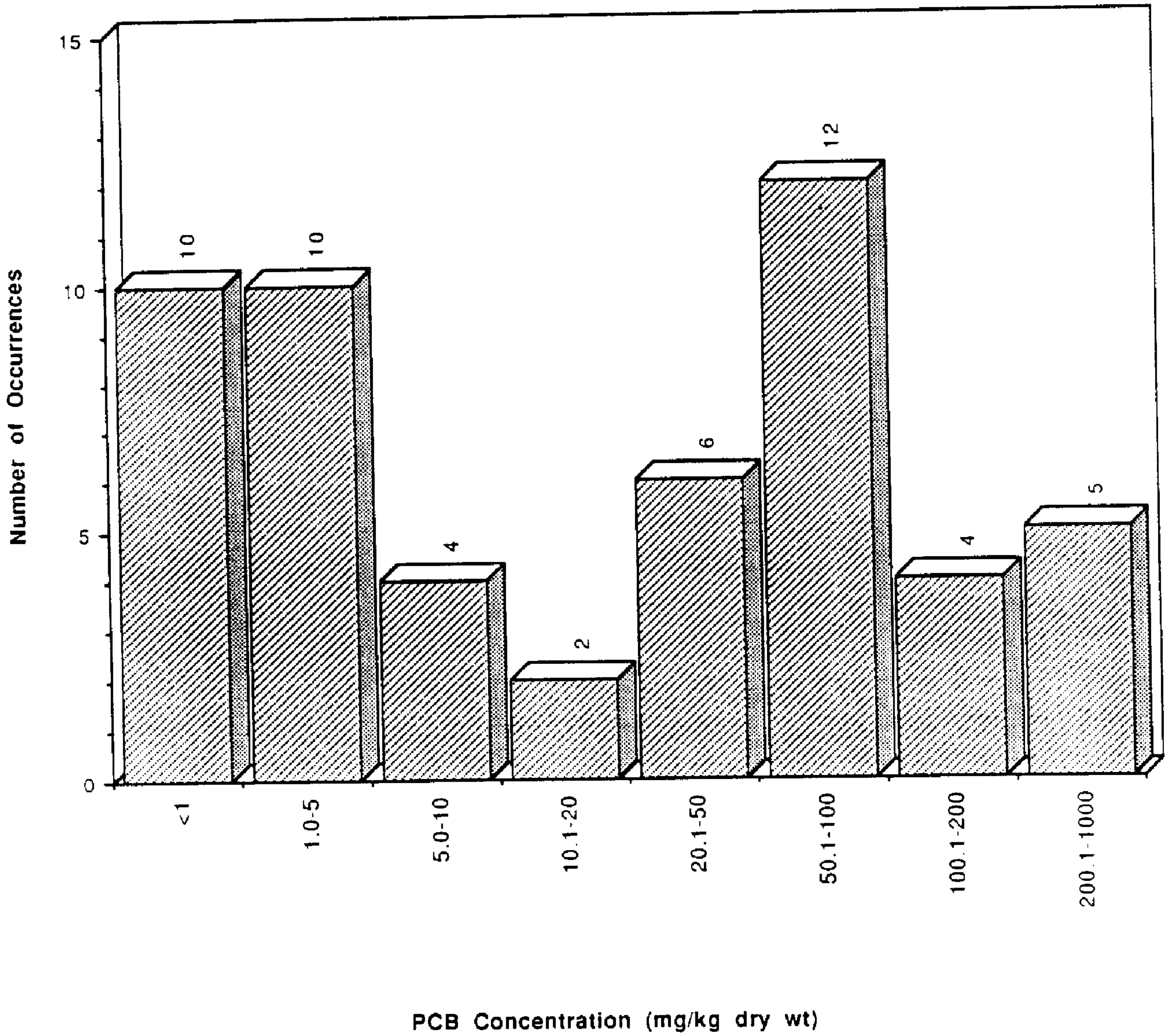
TABLE 3-1. PCB AND TOC ANALYTICAL RESULTS (DRY WEIGHT BASIS).

Transect Number	Distance (feet)	Sample Depth (feet)	Percent Moisture (%)	Aroclor 1016 mg/kg	Aroclor 1221 mg/kg	Aroclor 1232 mg/kg	Aroclor 1242 mg/kg	Aroclor 1248 mg/kg	Aroclor 1254 mg/kg	Aroclor 1260 mg/kg	TOTAL PCB* mg/kg	PCB Detection Limit	TOC dry %
5	100	5	51.1	N.D.	N.D.	N.D.	N.D.	N.D.	10	1.6	12	1.0	5.2
5	100	6	50.5	N.D.	N.D.	N.D.	N.D.	31	N.D.	N.D.	31	5.0	3.9
5	100	7	41.2	N.D.	N.D.	N.D.	N.D.	0.39	N.D.	0.34	0.73	0.10	2.5
5	100	8	45.6	N.D.	N.D.	N.D.	N.D.	0.073	N.D.	N.D.	0.073	0.050	1.0
5	100	9	36.7	-	-	-	-	-	-	-	-	-	-
5	100	10	28.9	-	-	-	-	-	-	-	-	-	-
6	0	1	22.4	N.D.	N.D.	N.D.	N.D.	4.6	N.D.	N.D.	4.6	1.0	1.5
6	0	2	16.8	N.D.	N.D.	N.D.	5.7	5.3	N.D.	N.D.	11.0	2.5	0.42
6	0	3	18.2	N.D.	N.D.	N.D.	N.D.	0.30	N.D.	N.D.	0.30	0.10	0.32
6	0	4	19.8	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	0.12
6	0	5	21.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.12
6	0	6	20.6	-	-	-	-	-	-	-	-	-	-
6	0	7	19.4	-	-	-	-	-	-	-	-	-	-
6	0	8	20.9	-	-	-	-	-	-	-	-	-	-
6	0	9	-	-	-	-	-	-	-	-	-	-	-
6	0	10	-	-	-	-	-	-	-	-	-	-	-
6	50	1	33.1	N.D.	N.D.	N.D.	N.D.	2.6	0.87	0.61	4.1	0.50	0.87
6	50	2	20.7	N.D.	N.D.	N.D.	N.D.	2.5	0.62	0.54	3.7	0.50	0.92
6	50	3	15.8	N.D.	N.D.	N.D.	N.D.	4.5	N.D.	N.D.	4.5	1.0	0.89
6	50	4	37.1	N.D.	N.D.	N.D.	N.D.	15	N.D.	2.5	18	2.5	2.2
6	50	5	29.7	N.D.	N.D.	N.D.	N.D.	160	N.D.	N.D.	160	25	1.9
6	50	6	37.9	N.D.	N.D.	N.D.	N.D.	1.6	3.2	1.6	6.4	0.50	5.5
6	50	7	38.0	N.D.	N.D.	N.D.	N.D.	N.D.	2.4	0.38	2.8	0.25	4.4
6	50	8	34.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.64	0.64	0.050	2.8
6	50	9	32.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.17	0.17	0.050	1.3
6	50	10	30.0	N.D.	N.D.	N.D.	N.D.	N.D.	0.053	0.10	0.15	0.050	1.1
6	100	1	64.0	N.D.	N.D.	N.D.	N.D.	12	5.8	3.1	21	2.5	3.5
6	100	2	72.0	N.D.	N.D.	N.D.	N.D.	8.7	2.5	2.1	13.3	1.0	4.6
6	100	3	62.2	N.D.	N.D.	N.D.	N.D.	79	8.7	7.7	95	5.0	5.6
6	100	4	48.0	N.D.	N.D.	N.D.	N.D.	N.D.	8.6	1.6	10.2	1.0	3.8
6	100	5	51.2	N.D.	N.D.	N.D.	N.D.	N.D.	1.7	0.62	2.3	0.15	4.2
6	100	6	41.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.16	0.16	0.050	2.0
6	100	7	41.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	1.5
6	100	8	37.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	1.2
6	100	9	24.6	-	-	-	-	-	-	-	-	-	-
6	100	10	22.4	-	-	-	-	-	-	-	-	-	-
6	150	1	66.9	N.D.	N.D.	N.D.	N.D.	7.7	1.1	2.5	11.3	1.0	3.9
6	150	2	63.7	N.D.	N.D.	N.D.	N.D.	67	11	11	89	5.0	3.9
6	150	3	58.2	N.D.	N.D.	N.D.	N.D.	180	19	12	211	10	5.2
6	150	4	45.3	N.D.	N.D.	N.D.	N.D.	N.D.	7.5	N.D.	7.5	1.0	3.3
6	150	5	45.8	N.D.	N.D.	N.D.	N.D.	N.D.	1.8	0.27	2.1	0.15	3.8
6	150	6	42.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.47	0.47	0.050	3.0
6	150	7	39.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	1.8
6	150	8	24.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.32
6	150	9	22.3	-	-	-	-	-	-	-	-	-	-
6	150	10	22.7	-	-	-	-	-	-	-	-	-	-
6	250	1	56.6	N.D.	N.D.	N.D.	N.D.	10	4.3	2.8	17	2.5	3.7
6	250	2	62.7	N.D.	N.D.	N.D.	N.D.	43	8.8	7.7	60	2.5	3.5
6	250	3	48.8	N.D.	N.D.	N.D.	N.D.	16	9.3	5.3	31	5.0	4.3
6	250	4	46.4	N.D.	N.D.	N.D.	N.D.	N.D.	3.3	0.65	4.0	0.5	3.2
6	250	5	46.5	N.D.	N.D.	N.D.	N.D.	N.D.	0.23	0.38	0.61	0.050	1.1

TABLE 3-1. PCB AND TOC ANALYTICAL RESULTS (DRY WEIGHT BASIS).

Transect Number	Distance (feet)	Sample Depth (feet)	Percent Moisture (%)	Aroclor 1016 mg/kg	Aroclor 1221 mg/kg	Aroclor 1232 mg/kg	Aroclor 1242 mg/kg	Aroclor 1248 mg/kg	Aroclor 1254 mg/kg	Aroclor 1260 mg/kg	TOTAL PCB* mg/kg	PCB Detection Limit	TOC dry %
6	250	6	45.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	2.4
6	250	7	25.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.32
6	250	8	21.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.050	0.24
6	250	9	-	-	-	-	-	-	-	-	-	-	-
6	250	10	-	-	-	-	-	-	-	-	-	-	-

* Total PCB = sum of detected PCB species.



ERC
Environmental and Energy Services Co.

Frequency Distribution of PCBs in the Upper 1 ft of Sediment of Convair Lagoon Based on TRA 1988,1989

FIGURE **3-2**

PCBs in sediments was the main focus of this evaluation because of the desire to compare the PCB concentrations in Convair lagoon with baywide conditions. These comparisons should be made cautiously however, since Convair Lagoon has been studied more extensively than other areas of San Diego Bay, and initial PCB concentrations detected in Convair Lapoon were much lower than those discovered later during more intensive (and deeper) sampling. Information on PCBs in tissue was presented for completeness and because this data indicates areas where PCBs are bioavailable.

The major source of PCBs in sediment data was the RWQCB San Diego Bay Study Database, sediment studies conducted by the California Department of Fish and Game, the California State Mussel Watch Program, and the National Oceanic and Atmospheric Administration (NOAA) Status and Trends Program (Table 3-2). Additional sediment data was obtained from results of bioassay studies conducted to obtain permits to dredge and ocean dispose San Diego Bay sediments for a variety of projects (Table 3-3). Although the sediments investigated in these studies have been (or will be) removed from the bay the data indicates the levels of PCBs that were present and that could be present in adjacent areas. Data for PCBs in tissue were obtained from the California State Mussel Watch Program, the NOAA Status and Trends Program and a variety of special investigations oriented at development projects (Table 3-4).

The data presented in Table 3-2 allow general comparisons of total PCB concentrations in San Diego Bay. The data, however are limited in their present form. For example none of the studies presented data for the complete suite of PCB species (i.e., Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260). Consequently, the total PCB values may not reflect the actual total PCBs present because it was not possible to determine if other species were evaluated or if they were evaluated and not found. For example the data on page 1 of Table 3-2 are primarily PCB 1254 and 1260, consequently total PCBs is based on these numbers. Inspection of the data on line one of Table 3-1 shows the composition of all aroclor species. In this case the total PCBs would be 2.5 (sum of 1254 and 1260), not the 6.9 mg/kg which results from adding information from additional aroclors. The second line of Table 3-1 is even more dramatic where the total is different by 64 mg/kg. Therefore we have inserted a ">" symbol into the total column of the summary tables to indicate that this value is probably greater than indicated.

In some cases PCB values were reported as "<". In totaling these data we have assumed a worst case scenario in which the value is assumed to be the greater value (e.g. <5 was

TABLE 3-2
HISTORICAL INFORMATION ON PCBs IN SEDIMENT FROM SAN DIEGO BAY. CONCENTRATIONS IN PARTS PER MILLION (PPM)

STATION NAMES	STATION LOCATION	REPORT	LABORATORY	COLLECTION DATE	SAMPLING METHOD	STATE PLANE COORDINATES		COORDINATE SOURCE	AROCLOR 1242	1248	1254	1260	TOTAL	N	WET/DRY	% MOISTURE	TOC mg/kg
NOAA STATUS AND TRENDS																	
SDF	San Diego Bay, outside	NOAA (1988)		1984-85	Benthic Grab								0.01834	?	Dry		4000
SDHI	Harbor Island	NOAA (1988)		1984-85	Benthic Grab								0.33202	?	Dry		14000
SDA	South Bay	NOAA (1988)		1984-85	Benthic Grab								0.78855	?	Dry		27000
RWQCB SAN DIEGO BAY STUDY																	
B	Commercial Basin	San Diego Bay Study	QA	2/2/88		1701605	202680	RWQCB				< 0.07	? 0.07	1	Dry		
B dup	Commercial Basin	San Diego Bay Study	QA	2/2/88		1701605	202680	RWQCB				< 0.07	? 0.07	1	Dry		
D	Commercial Basin	San Diego Bay Study	QA	2/2/88		1701055	202565	RWQCB				< 0.11	? 0.11	1	Dry		
AG	Commercial Basin	San Diego Bay Study	QA	2/2/88		1700310	202885	RWQCB				0.16	> 0.16	1	Dry		
AZ	Commercial Basin	San Diego Bay Study	QA	2/2/88		1699780	203320	RWQCB				< 0.1	? 0.1	1	Dry		
BE	Commercial Basin	San Diego Bay Study	QA	2/2/88		1699750	203625	RWQCB				< 0.08	? 0.08	1	Dry		
BH	Commercial Basin	San Diego Bay Study	QA	2/2/88		1700030	204015	RWQCB				< 0.08	? 0.08	1	Dry		
BY	Commercial Basin	San Diego Bay Study	QA	2/2/88		1700810	204060	RWQCB				< 0.14	? 0.14	1	Dry		
CB	Commercial Basin	San Diego Bay Study	QA	2/2/88		1701350	203590	RWQCB				< 0.08	? 0.08	1	Dry		
CE	Commercial Basin	San Diego Bay Study	QA	2/2/88		1700890	202950	RWQCB				< 0.12	? 0.12	1	Dry		
SMWA	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1699655	203605	RWQCB			0.23		> 0.23	1	Dry		
SMWA	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1699655	203605	RWQCB			0.17		> 0.17	1	Dry		
SMWA	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1699655	203605	RWQCB			0.13		> 0.13	1	Dry		
WA dup	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1699655	203605	RWQCB			0.13		> 0.13	1	Dry		
SMWB	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1700950	204180	RWQCB			0.94		> 0.94	1	Dry		
SMWB	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1700950	204180	RWQCB			0.71		> 0.71	1	Dry		
SMWB	Commercial Basin SMW	San Diego Bay Study	QA	3/8/88		1700950	204180	RWQCB			0.71		> 0.71	1	Dry		
CA	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720210	196545	RWQCB	0.04		0.37		> 0.41	2	Dry		
CB	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720095	196600	RWQCB	0.18		0.46		> 0.64	2	Dry		
CB dup	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720095	196600	RWQCB	0.2		0.46		> 0.66	2	Dry		
CC	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720095	196400	RWQCB	0.37		2.97		> 3.34	2	Dry		
CD	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1719980	196250	RWQCB		0.67			> 0.67	1	Dry		
CE	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1719830	196280	RWQCB	0.01		0.16		> 0.17	2	Dry		
CF	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720035	196600	RWQCB			0.23		> 0.23	1	Dry		
CF dup	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720035	196600	RWQCB			0.201		> 0.201	1	Dry		
CJ	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720240	196095	RWQCB	0.13		0.81		> 0.94	2	Dry		
CL	Shipyards Yr 2	San Diego Bay Study	QA	2/22/89		1720925	195915	RWQCB		0.79			> 0.79	1	Dry		
CN	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723210	193400	RWQCB	0.12		0.45		> 0.57	2	Dry		
CP	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723350	193555	RWQCB	0.06		0.34		> 0.4	2	Dry		
CR	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723480	193465	RWQCB	0.03		0.24		> 0.27	2	Dry		
CS	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723605	193365	RWQCB			5.88		> 5.88	1	Dry		
CT	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723325	192990	RWQCB			0.25		> 0.25	1	Dry		
dup	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723325	192990	RWQCB			0.18		> 0.18	1	Dry		
CV	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723550	193100	RWQCB	0.07		0.63		> 0.7	2	Dry		
CW	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723690	193165	RWQCB	0.45		3.25		> 3.7	2	Dry		
CX	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723835	193090	RWQCB	0.36		2.48		> 2.84	2	Dry		
CY	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723760	192885	RWQCB	0.07		0.58		> 0.65	2	Dry		
CZ	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723850	192970	RWQCB	0.05		0.47		> 0.52	2	Dry		
DA	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1724020	193000	RWQCB	0.13		1.17		> 1.3	2	Dry		
DB	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723820	192525	RWQCB	0.02		0.46		> 0.48	2	Dry		
DC	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723440	193165	RWQCB			0.37		> 0.37	1	Dry		
DD	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723260	193275	RWQCB	0.51		0.81		> 1.32	2	Dry		
DD dup	Shipyards Yr 2	San Diego Bay Study	QA	2/23/89		1723260	193275	RWQCB	0.53		0.81		> 1.34	2	Dry		
DE	Shipyards Yr 2	San Diego Bay Study	QA	2/24/89		1724230	192785	RWQCB	0.15		1.39		> 1.54	2	Dry		
DF	Shipyards Yr 2	San Diego Bay Study	QA	2/24/89		1724365	192755	RWQCB	0.02		0.26		> 0.28	2	Dry		
DG	Shipyards Yr 2	San Diego Bay Study	QA	2/24/89		1724180	192465	RWQCB	0.03		0.56		> 0.59	2	Dry		
DJ	Shipyards Yr 2	San Diego Bay Study	QA	2/24/89		1724500	192615	RWQCB	0.06		0.64		> 0.7	2	Dry		
DK	Shipyards Yr 2	San Diego Bay Study	QA	2/24/89		1724530	192555	RWQCB	0.16		1.28		> 1.44	2	Dry		
DL	Shipyards Yr 2	San Diego Bay Study	QA	2/24/89		1724670	192625	RWQCB	0.15		1.18		> 1.33	2	Dry		

TABLE 3-2
HISTORICAL INFORMATION ON PCBs IN SEDIMENT FROM SAN DIEGO BAY. CONCENTRATIONS IN PARTS PER MILLION (PPM)

STATION NAMES	STATION LOCATION	REPORT	LABORATORY	COLLECTION DATE	SAMPLING METHOD	STATE PLANE COORDINATES		COORDINATE SOURCE	AROCLOR 1242	1248	1254	1260	TOTAL	N	WET/DRY	% MOISTURE	TOC mg/kg
EX	Storm Drains Run 1	San Diego Bay Study	QA	3/16/89							0.07		> 0.07	1	Dry		10900
EZ	Storm Drains Run 1	San Diego Bay Study	QA	3/21/89							0.39		> 0.39	1	Dry		12500
FB	Storm Drains Run 1	San Diego Bay Study	QA	3/22/89									< 0.07		Dry		6360
FC	Storm Drains Run 1	San Diego Bay Study	QA	3/22/89							0.09		> 0.09	1	Dry		6370
FC dup	Storm Drains Run 1	San Diego Bay Study	QA	3/22/89							0.07		> 0.07	1	Dry		
GA	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1728815	190785	RWQCB			0.2		> 0.2	1	Dry	41	264407
GB	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1729120	190785	RWQCB			0.4		> 0.4	1	Dry	40	31167
GB dup	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1729120	190785	RWQCB							Dry		27333
GC	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1728600	190225	RWQCB			< 0.07		? 0.07	1	Dry	29	12845
GD	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1733145	185310	RWQCB			0.3		> 0.3	1	Dry	44	49643
GE	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1733335	185450	RWQCB			0.26		> 0.26	1	Dry	42	39310
GF	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1733640	185170	RWQCB			0.28		> 0.28	1	Dry	42	30862
GF dup	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1733640	185170	RWQCB			0.31		> 0.31	1	Dry		
GG	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1733280	184920	RWQCB			0.26		> 0.26	1	Dry	53	26383
GH	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1732930	184690	RWQCB			0.28		> 0.28	1	Dry	57	32326
GJ	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1732730	184555	RWQCB					trace		Dry	54	27147
GJ dup	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1732730	184555	RWQCB					trace		Dry		
GK	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/17/89		1732305	184260	RWQCB			0.17		> 0.17	1	Dry	52	25625
GL	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1732540	183740	RWQCB			< 0.12		? 0.12	1	Dry	58	34524
GM	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1732600	183795	RWQCB			< 0.14		? 0.14	1	Dry	63	48378
GN	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1732545	183660	RWQCB			< 0.15		? 0.15	1	Dry	66	37941
GP	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1732415	183630	RWQCB			< 0.14		? 0.14	1	Dry	65	48000
GQ	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1731950	183650	RWQCB			< 0.16		? 0.16	1	Dry	69	50323
GR	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1731055	187650	RWQCB					trace		Dry	65	57714
GS	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1731130	187590	RWQCB			< 0.09		? 0.09	1	Dry	46	28889
GT	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1730610	187365	RWQCB			0.22		> 0.22	1	Dry	64	48889
GU	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1731285	187350	RWQCB			0.18		> 0.18	1	Dry	51	18612
GV	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1730830	186700	RWQCB			< 0.14		? 0.14	1	Dry	63	75135
GW	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1730340	186320	RWQCB			0.18		> 0.18	1	Dry	67	69091
GX	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1730000	186990	RWQCB			< 0.31		? 0.31	1	Dry	68	35938
GY	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/18/89		1730965	187785	RWQCB			0.3		> 0.3	1	Dry	67	37576
GZ	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1732775	182685	RWQCB			0.28		> 0.28	1	Dry	60	39000
GZ dup	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1732775	182685	RWQCB			0.28		> 0.28	1	Dry		
HA	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1728205	189640	RWQCB			< 1.03		? 1.03	1	Dry	60	67000
HA dup	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1728205	189640	RWQCB							Dry		68500
HB	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1728000	189500	RWQCB			0.26		> 0.26	1	Dry	62	27105
HC	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1729920	189310	RWQCB			0.4		> 0.4	1	Dry	55	26444
HD	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/1/99		1730110	189005	RWQCB			0.4		> 0.4	1	Dry	52	22500
HE	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1730110	188875	RWQCB			0.53		> 0.53	1	Dry	53	31915
HF	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1730560	188395	RWQCB				0.43	> 0.43	1	Dry	65	46857
HG	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1730795	188080	RWQCB				0.39	> 0.39	1	Dry	64	42500
HH	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1732865	185175	RWQCB				0.29	> 0.29	1	Dry	59	17561
HJ	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/19/89		1731445	184090	RWQCB				< 0.13	? 0.13	1	Dry	60	32500
HK	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1736110	169860	RWQCB				3.5	> 3.5	1	Dry	17	3578
HL	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1736140	169975	RWQCB				< 0.3	? 0.3	1	Dry	67	4879
HP	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1736335	170040	RWQCB					0.065		Dry	56	23409
HQ	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1736520	170695	RWQCB				1.13	> 1.13	1	Dry	31	12609
HR	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1731865	171780	RWQCB				< 0.09	? 0.09	1	Dry	44	16946
HS	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1733985	172780	RWQCB				< 0.08	? 0.08	1	Dry	38	15774
HT	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1735570	171880	RWQCB				< 0.06	? 0.06	1	Dry	20	7663
HT dup	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1735570	171880	RWQCB				< 0.06	? 0.06	1	Dry		
HU	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1726335	175235	RWQCB				< 0.09	? 0.09	1	Dry	43	7825
HV	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1726200	175500	RWQCB				< 0.1	? 0.1	1	Dry	50	13766
HW	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1719665	191000	RWQCB				< 0.1	? 0.1	1	Dry	49	13306
HX	Shipyards Yr 2 Run 2	San Diego Bay Study	QA	4/20/89		1719635	191265	RWQCB				< 0.08	? 0.08	1	Dry	41	6373

TABLE 3-3
HISTORICAL INFORMATION ON PCBs IN SEDIMENT FROM SAN DIEGO BAY; BASED ON BIOASSAY STUDIES. CONCENTRATION IN PARTS PER MILLION (PPM)

STATION NAMES	STATION LOCATION	REPORT	LABORATORY	COLLECTION DATE	SAMPLING METHOD	STATE PLANE COORDINATES		COORDINATE SOURCE	AROCLOR 1242	1248	1254	1260	TOTAL	Wet/Dry	% MOISTURE	TOC mg/kg
MAIN HARBOR CHANNEL													0.028	Wet ?		
Section #1	Channel South of the Coronado Bridge	U. S. Navy (1984)		7/84		1723600	191602	M. Salazar, pers com					0.039	Wet ?		
Section #2	Channel South of Section #1	U. S. Navy (1984)		7/84		1724615	190380	M. Salazar, pers com					0.059	Wet ?		
Section #3	Channel South of Section #2	U. S. Navy (1984)		7/84		1725107	187950	M. Salazar, pers com					0.003	Wet ?		
Section #4	Channel South of Section #3	U. S. Navy (1984)		7/84		1728682	186101	M. Salazar, pers com					0.027	Wet ?		
Section #5	Near Pier 2	U. S. Navy (1984)		7/84		1728702	188526	M. Salazar, pers com					0.036	Wet ?		
Section #6	Near Pier 8	U. S. Navy (1984)		7/84		1731236	184866	M. Salazar, pers com					< 0.038	Wet ?		
CONTINENTAL MARITIME																
Test Site A	Continental Maritime Shipyard	WESTEC (1985b)		8/30/85		1723103	193425	Report Map (est.)					0.066	Wet ?		
Test Site B	Continental Maritime Shipyard	WESTEC (1985b)		8/30/85		1723103	193425	Report Map (est.)					0.079	Wet ?		
#1	Continental Maritime Shipyard	WESTEC (1987f)	QA	12/23/86	Corer	1723611	192815	Report Map (est.)	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0064	Wet		11800
#5	Continental Maritime Shipyard	WESTEC (1987f)	QA	12/23/86	Corer	1723611	192815	Report Map (est.)	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0064	Wet		10000
#9	Continental Maritime Shipyard	WESTEC (1987f)	QA	12/23/86	Corer	1723611	192815	Report Map (est.)	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0064	Wet		20000
Test Site #1	Inshore, south of Coronado Bridge	ERCE (1989)	QA	5/10-12/89	Vibracorer				< 0.05	< 0.05	0.43	< 0.05	< 0.58	Dry	30	17458
Test Site #2	Inshore, south of Site #1	ERCE (1989)	QA	5/10-12/89	Vibracorer				< 0.05	< 0.05	0.4	< 0.05	? 0.55	Dry	41	20169
Test Site #3	Offshore of Site #1	ERCE (1989)	QA	5/10-12/89	Vibracorer				< 0.05	< 0.05	0.27	< 0.05	? 0.42	Dry	50	10678
#3 dup	Offshore of Site #1	ERCE (1989)	QA	5/10-12/89	Vibracorer				< 0.05	< 0.05	0.28	< 0.05	? 0.43	Dry		
Test Site #4	Offshore of Site #3	ERCE (1989)	QA	5/10-12/89	Vibracorer				< 0.05	< 0.05	0.059	< 0.05	? 0.209	Dry	29	12563
SOUTHWEST MARINE																
Southwest Site	Southwest Marine Drydock	Lockheed (1983b)		1/12-13/83	Vibracorer							0.024	0.024			
Northeast Site	Southwest Marine Drydock	Lockheed (1983b)		1/12-13/83	Vibracorer							0.016	0.016			
NASSCO FLOATING DRYDOCK																
Southwest drydock	NASSCO Shipyard	Lockheed (1983c)				1726159	190973	Report Map (est.)				0.19	0.19	Wet ?		
Northeast Drydock	NASSCO Shipyard	Lockheed (1983c)				1726677	191575	Report Map (est.)				0.19	0.19	Wet ?		
Berths 3 & 4	NASSCO Shipyard	Lockheed (1983c)				1727179	190358	Report Map (est.)				0.17	0.17	Wet ?		
Test Site	NASSCO Shipyard	WESTEC (1985a)		1/12/85	VanVeen Grab								0.006			
CHOLLAS CREEK																
Test Site	Chollas Creek	U. S. Navy (1984)		2/84		1729231	190341	M. Salazar, pers com					0.06	Wet ?		
NATIONAL CITY NAVAL FACILITY																
Site#1	South of Pier 12	WESTEC (1987b)	QA	2/24-26/87	Vibracorer/Grab								0.045	Wet ?		
Site #2	North of Pier 13	WESTEC (1987b)	QA	2/24-26/87	Vibracorer/Grab								0.19	Wet ?		
Site #3	Offshore of Piers 12 and 13	WESTEC (1987b)	QA	2/24-26/87	Vibracorer/Grab								0.19	Wet ?		
Site #4	Offshore of Piers 10 and 11	WESTEC (1987b)	QA	2/24-26/87	Vibracorer/Grab								0.073	Wet ?		
NATIONAL CITY MARINE TERMINAL															50.4	13900
Test Site	Sweetwater Channel	WESTEC (1987a)	QA	4/24-25/87	Hammer Corer								ND			
NAVY MED MOOR																
Test Site	Navy Med Moor Pier	U. S. Navy (1983)		Jul-83		1696434	193060	M. Salazar, pers com					0.02	Wet ?		
NAVY DE-PERMING PIER																
Test Site	Next to Sub Base	U. S. Navy (1984)		5/84		1697425	189412	M. Salazar, pers com					0.007	Wet ?		

TABLE 3-4
HISTORICAL PCB TISSUE INFORMATION FROM SAN DIEGO BAY. CONCENTRATIONS IN PARTS PER BILLION (PPB) DRY WEIGHT.

STATION NUMBER	LOCATION	REPORT	COLLECTION DATE	SAMPLING METHOD	AROCLOR 1242	AROCLOR 1248	AROCLOR 1254	AROCLOR 1260	TOTAL PCBs	WEIGHT	COMMENTS
STATE MUSSEL WATCH 1977-87 10-YEAR DATA SUMMARY											
880	NATIONAL CITY	Phillips (1988)	12/13/80	RBM		ND	1,500	-	1,500	Dry	[1]
881	SWEETWATER MARSH	Phillips (1988)	12/29/82	RBM		ND	540	-	540	Dry	[2]
882	SD BAY 24th ST. TERM	Phillips (1988)	1/7/82	TCM		ND	700	-	700	Dry	[3]
882.6	SAMPSON ST. EXT.	Phillips (1988)	1/3/86	TCM		ND	1,100	-	1,100	Dry	
882.7	SAMPSON ST. PIER	Phillips (1988)	12/22/86	TCM		ND	3,100	-	3,100	Dry	[4]
882.8	KELP PIER	Phillips (1988)	12/22/86	TCM		ND	1,500	-	1,500	Dry	
882.9	CORONADO BR. EAST	Phillips (1988)	12/22/86	TCM		ND	1,100	-	1,100	Dry	
883	NAVY AMPHIB. BASE	Phillips (1988)	12/13/80	RBM		ND	3,400	-	3,400	Dry	
883	NAVY AMPHIB. BASE	Phillips (1988)	1/7/82	TCM		ND	950	-	950	Dry	
883.5	TUNA DOCKS	Phillips (1988)	12/22/86	TCM		ND	1,300	-	1,300	Dry	
884	GLORIETTA BAY	Phillips (1988)	1/7/82	TCM		ND	840	-	840	Dry	
885	BUOY 30	Phillips (1988)	1/7/82	RBM		ND	490	-	490	Dry	
887	EVANS STREET	Phillips (1988)	1/7/82	TCM		ND	1,100	-	1,100	Dry	
887	EVANS STREET	Phillips (1988)	12/29/82	TCM		ND	1,900	-	1,900	Dry	
888	CORONADO BRIDGE	Phillips (1988)	6/16/80	TCM		ND	2,800	-	2,800	Dry	
888	CORONADO BRIDGE	Phillips (1988)	11/13/80	TCM		ND	2,700	-	2,700	Dry	
889	CORONADO ISLAND	Phillips (1988)	1/7/82	TCM		ND	800	-	800	Dry	
890	8TH AVENUE	Phillips (1988)	1/7/82	TCM		ND	790	-	790	Dry	
890	8TH AVENUE	Phillips (1988)	12/29/82	TCM		ND	1,300	-	1,300	Dry	
891	G STREET PIER	Phillips (1988)	11/13/80	TCM		ND	1,200	-	1,200	Dry	
891	G STREET PIER	Phillips (1988)	1/7/82	TCM		ND	1,000	-	1,000	Dry	
891	G STREET PIER	Phillips (1988)	12/29/82	TCM		ND	2,400	-	2,400	Dry	
892	SD BAY NI BOATHOUSE	Phillips (1988)	2/19/85	TCM		74	890	-	964	Dry	
893	SD BAY LAUREL ST.	Phillips (1988)	2/19/85	TCM		260	2,000	-	2,260	Dry	
894	SD BAY E. COMM. BASI	Phillips (1988)	1/7/82	TCM		ND	7,300	-	7,300	Dry	
894	SD BAY E. COMM. BASI	Phillips (1988)	12/29/82	TCM		11,000	13,000	-	24,000	Dry	[5]
894	SD BAY E. COMM. BASI	Phillips (1988)	2/19/85	TCM		4,300	7,700	-	12,000	Dry	
894	SD BAY E. COMM. BASI	Phillips (1988)	1/3/86	TCM		4,200	8,000	-	12,200	Dry	
894.1	E. BASIN SOFT.BOT	Phillips (1988)	1/4/84	TCM		7,000	12,000	-	19,000	Dry	
894.5	E. BASIN DOCKS	Phillips (1988)	12/29/82	TCM		ND	4,400	-	4,400	Dry	
894.5	E. BASIN DOCKS	Phillips (1988)	1/4/84	TCM		1,000	4,300	-	5,300	Dry	
894.6	E. COM BAS. WEST END	Phillips (1988)	12/22/86	TCM		ND	3,000	-	3,000	Dry	
895	E. HARBOR ISLAND DR.	Phillips (1988)	12/29/82	TCM		ND	1,700	-	1,700	Dry	
896	SD BAY NI RUNWAY 36	Phillips (1988)	2/19/85	TCM		56	940	-	996	Dry	
896.2	SD BAY NI DPDO	Phillips (1988)	2/19/85	TCM		ND	480	-	480	Dry	
896.2	SD BAY NI DPDO	Phillips (1988)	1/3/86	TCM		ND	420	-	420	Dry	
897	E.SHELTER ISLAND	Phillips (1988)	1/26/83	TCM		ND	1,100	-	1,100	Dry	
897.5	COM BASIN N HAROR DR	Phillips (1988)	12/29/82	TCM		ND	4,800	-	4,800	Dry	
897.5	COMM BASIN N HARB DR	Phillips (1988)	1/3/86	TCM		ND	3,000	-	3,000	Dry	

TABLE 3-3

HISTORICAL INFORMATION ON PCBs IN SEDIMENT FROM SAN DIEGO BAY; BASED ON BIOASSAY STUDIES. CONCENTRATION IN PARTS PER MILLION (PPM)

STATION NAMES	STATION LOCATION	REPORT	LABORATORY	COLLECTION DATE	SAMPLING METHOD	STATE PLANE COORDINATES		COORDINATE SOURCE	AROCLOR 1242	1248	1254	1260	TOTAL	Wet/Dry	% MOISTURE	TOC mg/kg
24TH STREET TERMINAL																
Test Site	North of the 24th Street Terminal	Lockheed (1982)		6/29/82	Van Veen Grab	1732221	180007	Report Map (est.)				< 0.01	**< 0.01**	Wet ?		
CHULA VISTA																
Test Site	G St, Chula Vista	WESTEC (1984)				1735732	170275	Report Map (est.)					**0.043**	Wet ?		
Test Site #1	Chula Vista Yacht Basin	WESTEC (1987c)		4/24-25/87	Hammer Corer	1737760	167226	Report (est.)					**0.0091**	Wet ?		
Test Site #2	Chula Vista Yacht Basin	WESTEC (1987c)		4/24-25/87	Hammer Corer	1737760	167226	Report (est.)					**0.0061**	Wet ?		
Test Site #3	Chula Vista Yacht Basin	WESTEC (1988)		12/10/87	Hammer Corer	1737760	167226	Report (est.)					**ND**	Wet ?		

[1]: No Chemical Data
[2]: Total not available
[3]: Chemical Interference
ND: Not Detectable
ATI: Analytical Technologies, Inc., San Diego, CA
QA: Quality Assurance Laboratory, San Diego, CA
CDFG Long: California Dept. Fish & Game, Long Marine Lab, Santa Cruz, CA
CDFG ML: California Dept. Fish and Game Laboratory, Moss Landing, CA
EEL: Environmental Engineering Laboratory, San Diego, CA
N: Number of Aroclors used to obtain the total PCB concentration
QC: analytical replicates
RP: replicate injection
PD: partially degraded
UD: undegraded
ND: not detected
dup: duplicate
Blank: no information reported

TABLE 3-4

HISTORICAL PCB TISSUE INFORMATION FROM SAN DIEGO BAY. CONCENTRATIONS IN PARTS PER BILLION (PPB) DRY WEIGHT.

STATION NUMBER	LOCATION	REPORT	COLLECTION DATE	SAMPLING METHOD	AROCLOR 1242	1248	1254	1260	TOTAL PCBs	WEIGHT	COMMENTS
897.5	COM BASIN N. HAR. DR	Phillips (1988)	12/22/86	TCM		ND	5,400	-	5,400	Dry	
898	COM BASIN CARLTON ST	Phillips (1988)	1/7/82	TCM		ND	6,100	-	6,100	Dry	
898	COM BASIN CARLTON ST	Phillips (1988)	12/29/82	TCM		ND	9,300	-	9,300	Dry	
898.2	N.I.LAUNCH DOCKS	Phillips (1988)	1/4/84	TCM		66	820	-	886	Dry	
899	SHELTER ISLAND DOCKS	Phillips (1988)	3/3/79	RBM		NA	1,700	-	1,700	Dry	
899	SHELTER ISLAND DOCKS	Phillips (1988)	5/16/80	TCM		ND	1,800	-	1,800	Dry	
899	SHELTER ISLAND DOCKS	Phillips (1988)	5/16/80	RBM		ND	1,400	-	1,400	Dry	
899	SHELTER ISLAND DOCKS	Phillips (1988)	11/13/80	TCM		ND	1,000	-	1,000	Dry	
899.4	SHELTER IS. FUEL DK	Phillips (1988)	12/22/86	TCM		ND	NA	-	NA	Dry	
901	DEGAUSING STATION	Phillips (1988)	1/7/82	TCM		ND	180	-	180	Dry	
901	DEGAUSING STATION	Phillips (1988)	1/6/83	TCM		ND	430	-	430	Dry	
901.2	SD BAY NI AMMO PIER	Phillips (1988)	2/19/85	TCM		ND	440	-	440	Dry	
902	ZUNIGA JETTY BUOY	Phillips (1988)	12/13/80	RBM		ND	770	-	770	Dry	
903	SD BAY ZUNIGA JETTY	Phillips (1988)	1/4/84	TCM		ND	150	-	150	Dry	
903	SD BAY ZUNIGA JETTY	Phillips (1988)	1/3/86	TCM		ND	94	-	94	Dry	
STATE MUSSEL WATCH 1987-88 PRELIMINARY DATA											[6]
882.7	Sampson Street Pier	SWRCB (1988)	12/22/87	TCM		ND	740	ND	740	Dry	
883.6	Seventh Street Channel	SWRCB (1988)	12/22/87	TCM		ND	780	ND	730	Dry	
894	E. Basin Storm Drain	SWRCB (1988)	12/22/87	TCM		7,500	4,400	ND	11,900	Dry	
897.5	Com Basin N. Har. Dr	SWRCB (1988)	12/22/87	TCM		ND	2,200	ND	2,200	Dry	
STATE MUSSEL WATCH 1988-89 PRELIMINARY DATA											[7]
882.7	Sampson St Pier	SWRCB (1989)	12/21/88	TCM		ND	1,500	ND	1,500	Dry	
882.8	Kelco Pier	SWRCB (1989)	12/21/88	TCM		ND	1,100	ND	1,100	Dry	
882.9	E. Coronado Bridge	SWRCB (1989)	12/21/88	TCM		ND	1,100	ND	1,100	Dry	
883.1	Chollas Creek	SWRCB (1989)	12/21/88	TCM		ND	820	ND	820	Dry	
883.6	7th St Channel	SWRCB (1989)	12/21/88	TCM		ND	1,300	ND	1,300	Dry	
885.2	28th St Pier	SWRCB (1989)	12/21/88	TCM		ND	860	ND	860	Dry	
885.4	32nd St	SWRCB (1989)	12/21/88	TCM		ND	880	ND	880	Dry	
886.2	SDGE Silvergate	SWRCB (1989)	12/21/88	TCM		ND	1,400	ND	1,400	Dry	
894	E. Basin Storm Drain	SWRCB (1989)	12/21/88	TCM		8,800	9,700	ND	18,500	Dry	
894.1	E. Basin Soft Bottom	SWRCB (1989)	12/21/88	TCM		320	2,700	ND	3,020	Dry	
894.2	Convair Lagoon Dock	SWRCB (1989)	12/21/88	TCM		1,100	4,400	ND	5,500	Dry	
894.3	Convair Lagoon Mid Channel	SWRCB (1989)	12/21/88	TCM		3,900	9,200	ND	13,100	Dry	
894.8	Laurel St Storm Drain	SWRCB (1989)	12/21/88	TCM		ND	1,400	ND	1,400	Dry	
898	Commercial Basin, Carlton St.	SWRCB (1989)	12/21/88	TCM		ND	3,600	ND	3,600	Dry	

TABLE 3-4
HISTORICAL PCB TISSUE INFORMATION FROM SAN DIEGO BAY. CONCENTRATIONS IN PARTS PER BILLION (PPB) DRY WEIGHT.

STATION NUMBER	LOCATION	REPORT	COLLECTION DATE	SAMPLING METHOD	AROCLOR 1242	AROCLOR 1248	AROCLOR 1254	AROCLOR 1260	TOTAL PCBs	WEIGHT	COMMENTS
NOAA STATUS AND TRENDS											
Mussel (Mytilus edulis) Tissue											
SDHI	SD Bay Harbor Island	NOAA 1987	1986	Resident		-	-	-	2,052	Dry	5 of 137
Fish Liver Tissue											
SDA	SD Bay South Bay	NOAA 1987	1984	Barred Sand Bass		-	-	-	19,722	Dry	1 of 49
SDA	SD Bay South Bay	NOAA 1987	1984	Diamond turbot		-	-	-	8,178	Dry	4 of 49
SDF	SD Bay outside	NOAA 1987	1984	Horneyhead turbot		-	-	-	1,977	Dry	19 of 49
COUNTY DEPARTMENT OF HEALTH SERVICES											
Fish Liver Tissue											
	West Shelter Island	County of San Diego (1987)	1987	Diamond turbot		-	-	1,200			
	West-side Coronado Bridge					-	-	1,300			
	Ballast Point			Sand Bass		-	-	840			
	West Shelter Island			Spotted Sand Bass		-	-	1,600			
	West-side Coronado Bridge			Spotted Sand Bass		-	-	1,000			
	5th Street Pier			Spotted turbot		-	-	NA			
	West-side Coronado Bridge			Spotted turbot		-	-	NA			
Fish Muscle Tissue											
	West Shelter Island					-	-	44			
	West-side Coronado Bridge					-	-	64			
	Ballast Point					-	-	63			
	West Shelter Island					-	-	140			
	West-side Coronado Bridge					-	-	160			
	5th Street Pier					-	-	78			
	West-side Coronado Bridge					-	-	54			

TABLE 3-4

HISTORICAL PCB TISSUE INFORMATION FROM SAN DIEGO BAY. CONCENTRATIONS IN PARTS PER BILLION (PPB) DRY WEIGHT.

STATION NUMBER	LOCATION	REPORT	COLLECTION DATE	SAMPLING METHOD	AROCLOR 1242	1248	1254	1260	TOTAL PCBs	WEIGHT	COMMENTS
CROSBY STREET PARK STUDY		ERCE (1988)									
Liver Tissue	Crosby Street										
				Diamond turbot (Composite 3 fish)		-	-	-	3,800	Dry	
				Spotted Sand Bass (1 fish)		-	-	-	2,500	Dry	
				Spotted turbot (Composite 2 fish)		-	-	-	2,300	Dry	
Edible Tissue	Crosby Street										
				Diamond turbot		-	-	-	300	Dry	
				Diamond turbot		-	-	-	ND	Dry	
				Diamond turbot		-	-	-	ND	Dry	
				Spotted Sand Bass		-	-	-	ND	Dry	
				Spotted turbot		-	-	-	ND	Dry	
				Spotted turbot		-	-	-	ND	Dry	

[1] Bold values indicate that the concentrations of Total PCBs in mussel tissue exceeded 85 percent of all measurements of this contaminant in organisms of the sampe species and expose condition at all other sites in the state between 1977 and 1987. EDL 85

[2] RBM - Resident Bay Mussel

[3] TCM - Transplanted California Mussell

[4] Bold and boxed values indicate that the concentrations of Total PCBs in mussel tissue exceeded 95 percent of all measurements of this contaminant in organisms of the sampe species and expose condition at all other sites in the state between 1977 and 1987. EDL 95

[5] Shaded values indicate the the wet weight counterpart of this value exceeded the FDA tolerance level for fish and shellfish tissue.

[6] EDL designations based on data from SWRCB 1988. See footnote 4.

[7] EDL values based on the wet weight counterpart of these values presented in SWRCB 1989 Attachment 15.

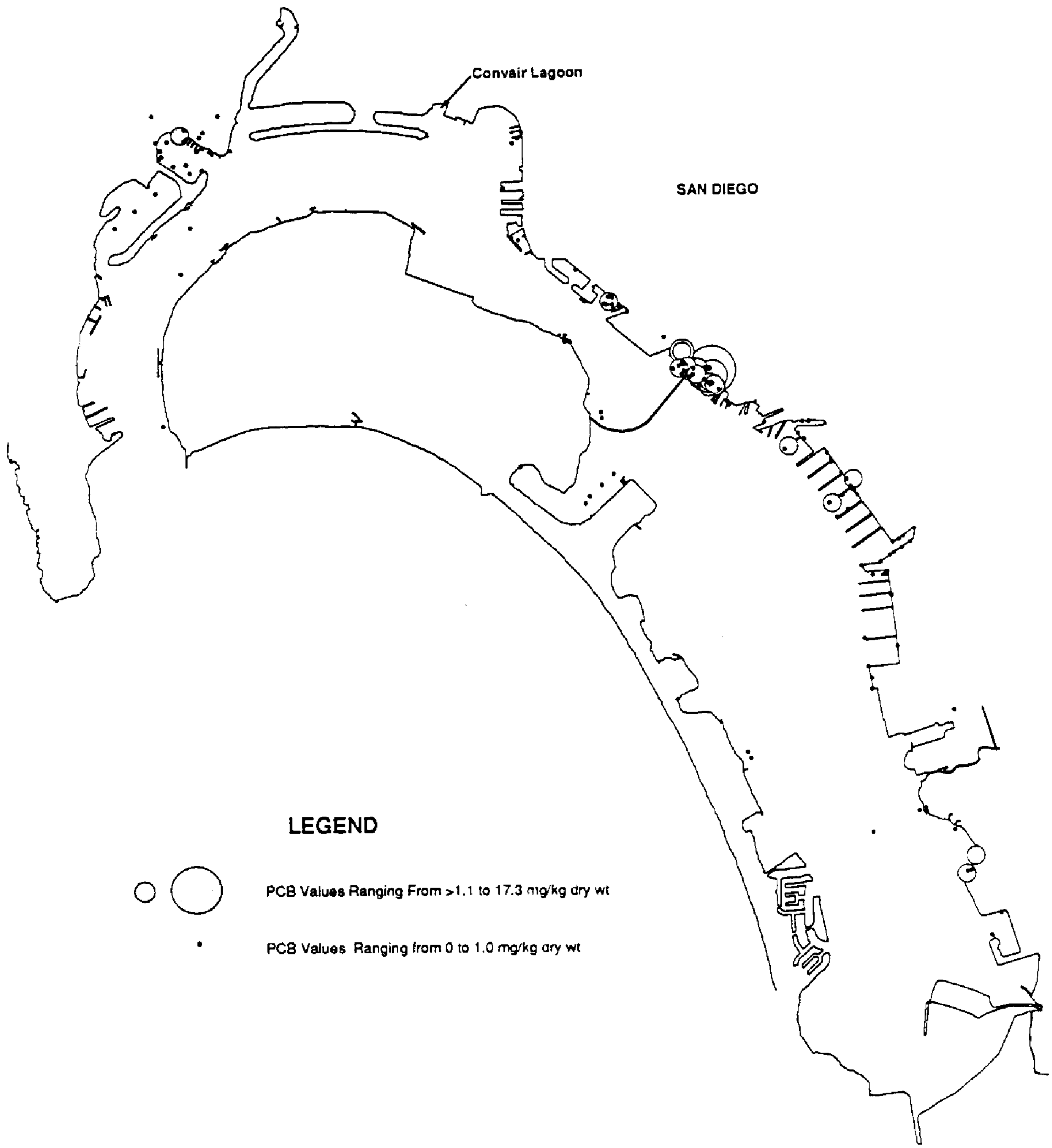
ND - Not Detected
"-" No Sample

assumed to be 5). Some totals are affected by both concerns, i.e., the presence of "<" values and the lack of information on all of the Aroclor species. Totals where this situation exists are preceded by a "?". Although samples may have been obtained with different sampling methods we believe that they generally represent surface samples (i.e., the upper one foot of sediment) and are generally comparable. However, the data obtained from bioassay studies are not directly comparable with the Table 3-2 data, because they represent composites of sediment collected over varying sediment depths and at several locations at a proposed dredge site.

The location and relative concentration of PCBs in the sediment for data presented in Table 3-2 are summarized on a map of San Diego Bay (Figure 3-3). Some data are not plotted on the map because no positioning information was presented in the documents containing the data. There may also be some errors in the positioning information obtained from the various reports because some points plot on land. A frequency distribution of these data showing the number of occurrences of various groups of PCB concentrations are presented in Figure 3-4. Based on these data 83.0 percent of the PCB values were equal to or less than 1 mg/kg and that 97.7 percent were equal to or less than 5.0 mg/kg (ppm). Of the 176 samples, 8 showed PCBs as not detected. However, it should be noted that it was not possible to determine the concentration of all Aroclor species for these samples. Consequently, total PCB values could be greater than those presented.

Sediment data from various bioassay tests were presented as wet or dry weight complicating direct comparisons among data from all studies. However, inspection of all data indicate a range of less than detection to 5.88 mg/kg. Similar to the sediment data previously discussed the majority of values were equal to or less than 5.0 mg/kg.

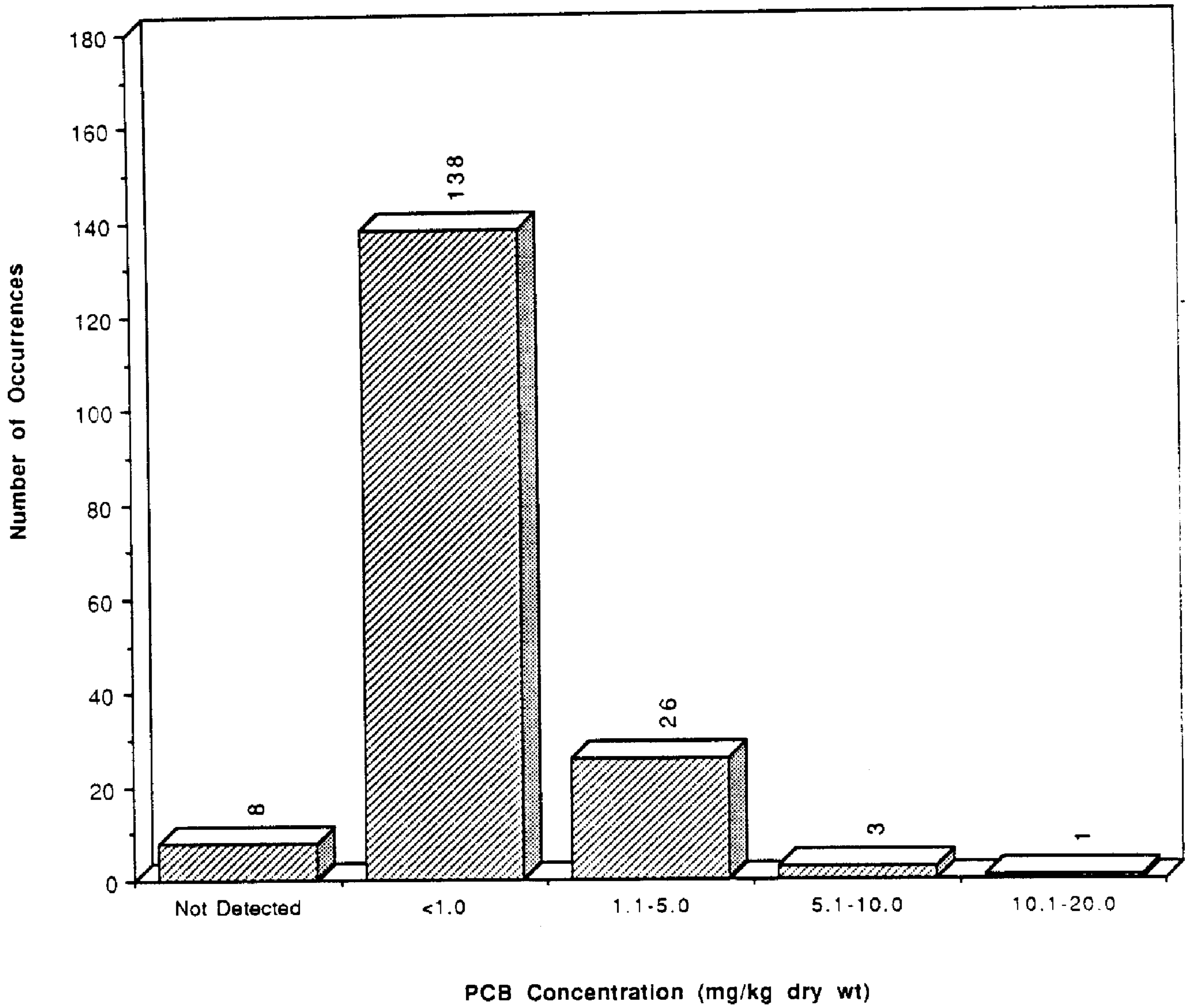
PCB concentrations in several storm drain systems leading to San Diego Bay were investigated by the RWQCB as part of it San Diego Bay Program. Results of these studies are presented in Table 3-2 and labeled as Storm Drain samples in the Station Location column. Values ranged from >0.06 to ?33 mg/kg dry weight. Ninety-five percent of the values were equal to or less than 5.0 mg/kg.



ERC Environmental and Energy Services Co.

General Location of PCBs and Relative Concentration in San Diego Bay Sediment Based on Historical Data

FIGURE 3-3



ERC
Environmental
and Energy
Services Co.

Frequency Distribution of PCBs in San Diego Bay
Excluding Convair Lagoon

FIGURE

3-4

SECTION 4
EXISTING GUIDANCE AND REPORTED EFFECT LEVELS

The development of sediment quality criteria for the protection of aquatic biota has progressed in recent years, with several proposed approaches providing preliminary quantitative limits or ranges (e.g., U.S. EPA, 1989; PTI, 1989; Neff et al., 1986; Neff et al., 1987; Chapman, 1986; Chapman, et al., 1987). Five approaches have been developed: (1) equilibrium partitioning, (2) apparent effects threshold, (3) screening level concentration, (4) sediment quality triad, and (5) biological effects levels. This section summarizes recent information regarding these approaches specific to PCBs.

4.1 Equilibrium Partitioning (EP)

The Equilibrium Partitioning approach has been described by U.S. EPA, 1989 and Pavlou, 1987. It compares interstitial water concentrations of individual sediment contaminants predicted from equilibrium partitioning theory (applied to sediment contaminants) with existing water quality criteria.

In developing EP action levels for PCBs, it is necessary to address the chemistry of the PCB constituents, since action levels for the commercial mixtures are dependent upon an understanding of the environmental chemistry of each constituent. PCBs are a family of synthetic chemicals that have as a base the biphenyl compound (two six-member carbon rings connected by a single bond) with varying numbers of chlorine atoms attached, ranging from one to ten. There are 209 possible individual PCB formulations or congeners, which are determined by the number of chlorine atoms attached to the rings and their location on the rings. These congeners are commonly grouped together by the total number of chlorine atoms they contain, i.e., homologs, mono corresponding to one chlorine atom, di to two chlorine atoms, etc. The different homologs exhibit different physical and chemical properties, and partition between sediment and water to varying degrees depending upon these properties. Distinct Aroclor formulations, the tradename for commercial PCBs, are made up of fixed percentages of various homologs.

Using the equilibrium partitioning theory, acceptable contaminant concentrations or ranges of concentrations can be established for different homologs. Using weighted partitioning factors for Aroclor 1254 homologs and the chronic residue-based marine value for total PCBs, Di Toro, et al. (USEPA, 1989) reported a median (50 percentile) acceptable quality criteria for "total" PCBs of 41.8 µg/goc (goc=grams, organic carbon normalized), with 95 percent confidence interval (CI) of 8.29 to 214 µg/goc for saltwater. Corresponding freshwater values are 19.5 µg/goc with CI ranging from 3.87 - 99.9 µg/goc. To convert these values to site-specific criteria on a dry-weight basis, they must be multiplied by the fraction of total organic carbon (TOC) in the sediment (i.e., percent TOC divided by 100). For example, at 3 percent TOC, these values are 1.3 µg/g for marine and 0.6 µg/g freshwater, respectively. These values are based upon residue (bioconcentration) derived EPA water quality guidelines because chronic toxicity effects based Water Quality guidelines do not exist. Using the freshwater residue-based EPA chronic criteria (0.014 µg/l) and available literature partition coefficients appropriate to freshwater, Pavlou (1987) reported the following homolog levels:

Homolog (# chlorine atoms)	Acceptable Level (µg/goc)	µg/g at 3% TOC
2 PCB	0.06	0.002
3 PCB	1	0.03
4 PCB	2	0.04
5 PCB	5	0.2
6 PCB	7	0.21

These quantities are not applicable to marine environments. If homolog criteria are to be applied in Convair Lagoon, the partition coefficients should be updated to reflect more recent calculations specific to saltwater.

Subsequent to this work, Ebasco has derived ranges of average organic carbon-normalized partition coefficients (K_{OC}) for Aroclor mixtures from several predictive and empirical studies, including Brownawell and Farrington (1986) and Hawker and Connell (1988):

Log_{10} Koc Value (l/koc)

Aroclor	1242	1248	1254	1260
Low mean Koc value	5.5	5.6	6.0	6.9
High mean Koc value	6.6	6.7	7.3	7.9

Applying the saltwater residue-based EPA chronic criteria (0.03 µg/l) to these ranges yields the following range of acceptable sediment levels:

	µg/goc	µg/g at 3% TOC
Aroclor 1242	10 - 109	0.3 - 3.3
Aroclor 1248	12 - 137	0.4 - 4.1
Aroclor 1254	32 - 585	1.0 - 17.6
Aroclor 1260	212 - 2,120	6.4 - 64

4.2 Apparent Effects Threshold (AET)

The Apparent Effects Threshold approach has been described by PTI, 1989. In this method, field data on biological effects are compared with sediment concentrations of individual chemicals. The AET is defined as the concentration above which biological effects are always observed. The following AET values are reported for total PCBs, as developed and updated (1988) for Puget Sound, Washington.

	Amphipod	Oyster	Benthic	Microtox
AET, µg/goc (ppm)	190	>46	65	12
AET, µg/g @ 3% TOC	5.7	>1.4	2.0	0.4
AET, µg/g dw (ppm)	3.1	1.1	1.0	0.13

This approach calculates protective levels based upon groups of species or a particular test (Microtox). It should be noted that the application of AET in a specific marine environment requires substantial site-specific data and carefully selected reference stations to produce reliable results.

4.3 Screening Level Concentrations (SLCs)

The Screening Level Concentration approach has been described by Neff et al., 1986 and Neff et al., 1987. In this method, field data on sediment concentrations of individual chemical are compared with the presence/absence of benthic species. A cumulative frequency distribution of a specific species is plotted against the sediment contaminant concentration and the 90th percentile is termed the species screening level concentration

(SSLC). These SSLC levels, in turn, are plotted for a large number of species as a frequency distribution and the SLC is defined as the concentration above which 95% of these levels are found. The recalculated saltwater SLC value for total PCBs (Neff et al., 1987) is 3.7 µg/goc (range 0.0-4.6). At 3% TOC, the corresponding dry weight normalized value is 0.11 µg/g-dw. Species-specific values (SSLCs) are presented in Table 4-1. In general, the SLC values have proven to be very conservative (i.e., low) in comparison to other criteria approaches. This may be attributable to selection of the 90th percentile as the SSLC level.

4.4 Sediment Quality Triad (SQT)

The Sediment Quality Triad has been described by Chapman (1986). In this method, correspondence between sediment chemistry, toxicity, and biological effects is used to determine sediment concentrations that discriminate conditions of minimal, uncertain, and major biological effects. Using this procedure, Chapman (1986) reported the following sediment quality levels for total PCBs in Puget Sound, Washington:

Criteria Description	Criteria (µg/g-dry weight)
No or minimal effects	≤ 0.1
Major effects	≥ 0.8
Area of uncertainty	> 0.1 - < 0.8

Similar to the AET approach, this method requires the development of site-specific values for each location, based upon local chemical and biological data.

4.5 Biological Effect Levels

In addition to the above approaches, there are studies in the literature which report adverse biological effects associated with specific chemical contaminant concentrations in the sediment. Long (1989) has reviewed the literature for sediment quality criteria and compiled reported biological effects concentration data in Table 4-2 for total PCBs. Some of his reported values (e.g., EP) are based upon older data sets which have been refined; nevertheless his findings are useful. He notes the following:

Table 4-1

SPECIES SCREENING LEVEL CONCENTRATIONS (SSLCs) FOR PCBs

Rank	Cumulative Freq. (%)	SSLC (ug/goc)	No. of Observ.	Organism
1	2.0	2.222	21	Scalibregma inflatum
2	3.9	3.394	21	Spiochaetopterus costarum
3	5.9	3.871	32	Nephtys ferruginea
4	7.8	4.583	24	Harmothoe extenuata
5	9.8	4.634	22	Euchone elegans
6	11.8	4.714	24	Drilonereis longa
7	13.7	4.714	27	Spiophanes bombyx
8	15.7	4.841	30	Euchone incolor
9	17.6	4.841	29	Anobothrus gracilis
10	19.6	4.841	27	Arctica islandica
11	21.6	4.841	20	Paranois cracilis
12	23.5	4.841	26	Ninoe nigripes
13	25.5	6.000	33	Nucula proxima
14	27.5	6.000	23	Cossuro longocirrata
15	29.4	6.000	23	Nephtys incisa
16	31.4	6.000	51	Pholoe minuta
17	33.3	7.500	33	Tharyx acutus
18	35.3	8.000	39	Ariciea catherinae
19	37.3	8.000	24	Unciola irrorata
20	39.2	8.000	22	Caulleriella of killariensis
21	41.2	8.000	24	Coniadella cracilis
22	43.1	8.854	25	Lumbrinereis hebes
23	45.1	10.000	27	Phrusa affinis
24	47.1	10.000	33	Tharyx annulosus
25	49.0	10.000	26	Pyllodoce mucosa
26	51.0	10.625	29	Pital morrhuanus
27	52.9	10.625	30	Lumbrinereis acicularum
28	54.9	10.941	32	Tellina agilis
29	56.9	11.417	24	Glycera dibranchiata

TABLE 4-1 (Continued)

SPECIES SCREENING LEVEL CONCENTRATIONS (SSLCs) FOR PCBs

Rank	Cumulative Freq. (%)	SSLC (ug/goc)	No. of Observ.	Organism
30	58.8	11.731	37	Amphiodia (amphispina) urtica
31	60.8	13.769	2	Heterophoxus oculatus
32	62.7	16.935	55	Euphiomedes carcharodonta
33	64.7	25.000	36	Goniada brunnea
34	66.7	30.118	21	Apelisca brevisimulata
35	68.6	33.103	35	Compsomyax subdiaphana
36	70.6	33.905	20	Ampharete arctica
37	72.5	33.905	20	Stenelanella uniformis
38	74.5	34.194	54	Mediomastus ambiseta
39	76.5	39.683	20	Armandia brevis
40	78.4	40.017	56	Pectinaria californiensis
41	80.4	41.143	28	Prionospio cirrifera
42	82.4	41.143	109	Prionospio steenstrupi
43	84.3	46.025	90	Axinopsida sericata
44	86.3	46.307	20	Chloeia pinnata
45	88.2	47.817	50	Paraprionospio pinnata
46	90.2	47.911	95	Glycera capitata
47	92.2	49.547	64	Capitella capitata
48	94.1	52.058	67	Macoma carlottensis
49	96.1	56.307	89	Parvilucina tenuisculpta
50	98.0	58.774	42	Spiophanes berkeleyorum
51	100.0	71.315	40	Tellina carpenteri

Source: Neff et al., 1987

Table 4-2

PCB CONCENTRATIONS IN SEDIMENTS ASSOCIATED WITH VARIOUS MEASURES OF BIOLOGICAL EFFECTS

Biological Approaches	Concentrations (µg/g-dw)
High 1988 R. abronius mortality (15.7 ± 3.9 out of 20) in Commencement Bay sediments	0.183 ± 0.067
Intermediate R. abronius mortality (5.2 + 1.0 out of 20) in Commencement Bay sediments	0.304 ± .609
Low R. abronius mortality (2.8 ± 0.8 out of 20) in Commencement Bay sediments	0.08 ± .103
1987 screening level concentrations for saltwater benthos (@ 1% TOC)	0.37
Nontoxic (>87% survival of R. abronius) sediments from Puget Sound	0.10 ± 0.12
Intermediate toxicity (<87.5% survival to >95% LPL of R. abronius) Puget Sound sediments	0.3 ± 0.4
Highly toxic (>95% LPL to R. abronius) sediments from Puget Sound	0.28 ± 0.37
EPA chronic marine EP threshold value (@ 4% TOC)(hexachloro-PCB)	0.28
San Francisco Bay amphipod AET	0.26
1988 Puget Sound Microtox AET	0.13
1988 Puget Sound benthos AET	1.0
96-h LC 50 for Crangon septemspinosa in spiked-sediment bioassays (Aroclors 1242 + 1254)	>4.18
Mean LC 50 R. abronius toxicity in 10-d spiked-sediment bioassays	10.8
Intermediate Microtox toxicity in Waukegan Harbor sediments	1,140 ±2,230

Source: Long (1989)

"PCBs generally do not appear to be highly toxic in acute lethality tests . . . their effects are more likely expressed in a chronic exposure or sublethal (e.g., mutagenic) endpoint . . . In data from Puget Sound, there was a pattern of increasing mean concentrations of PCBs between nontoxic samples and moderately toxic samples, but there was no incremental increase in PCB concentrations between moderately and highly toxic samples . . . Biological effects have been predicted or observed from as low as 18 ppb to 10,800 ppb in marine studies, a difference of about 600 fold. It is apparent from these data that there is very little consensus as to the biologically unacceptable concentration of PCB in sediments."

The statement indicating little consensus may be somewhat extreme, as a range of species would be expected to demonstrate varying sensitivity. However, this illustrates the typical variability that can be found when dealing with effects-based testing. Therefore, it is imperative that site specific data be used when considering effects-based action levels.

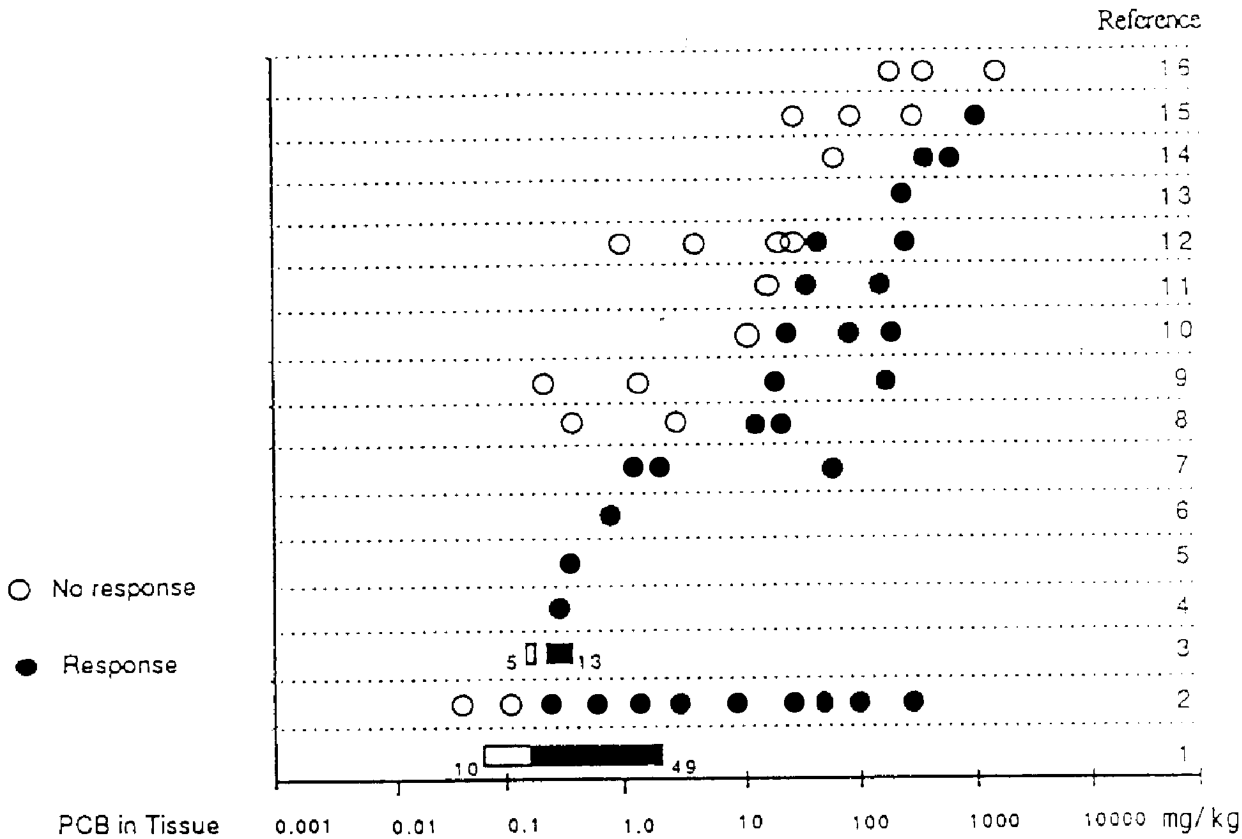
Dexter and Field (1989) have addressed sediment PCB target levels for the protection of aquatic biota, in a unique fashion. They first correlate sediment/tissue contaminant concentrations and then summarize the literature on biological responses vs. tissue concentration. These results are combined to yield target level curves.

Their results are presented in Figures 4-1 and 4-2. To aid in interpreting the figures, one should note that in bivalve tissue (e.g., mussels), tissue:sediment ratios are mostly greater than 10 (median = 20) for low TOC (<1%) and less than 10 but greater than 1 (median = 4) for TOC >2%. Tissue:sediment ratios in liver tissue (e.g., fish livers) tend to be roughly an order of magnitude higher.

Swartz (1989) has performed acute sediment toxicity testing of Aroclor 1254 using Rhepoxynius abronius in spiked clean marine sediments (Yaquina Bay, Oregon). His results for 10-day exposures are as follows:

LC_{10}	6.7 µg/kg
LC_{50}	10.8 µg/kg with 95% fiducial limits of 9.8 - 11.8 µg/kg.

It should be noted that Rhepoxynius abronius is a very sensitive species, and therefore, it is expected that less sensitive species would show an LC_{50} value potentially higher than the one reported for Rhepoxynius abronius.



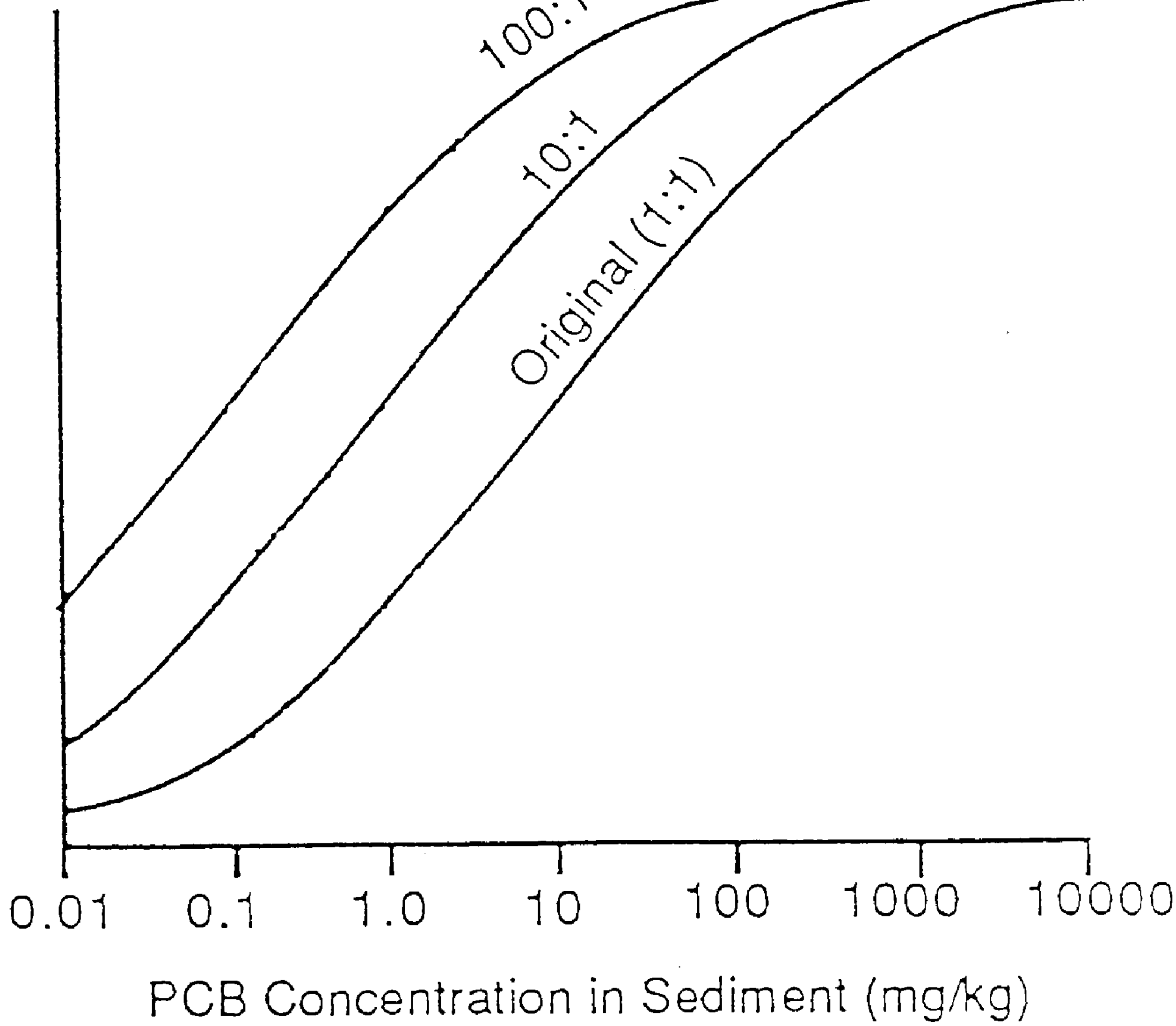
The data in the figure are from:

1.	von Westernhagen et al. 1981	Reduced hatch	Baltic flounder	ΣPCB (field)
2.	Melancon and Lech 1983	Enzyme activity	Rainbow trout	ΣPCB (field)
3.	Monod 1985	Egg mortality	Char	ΣPCB (field)
4.	Spies et al. 1985	Reproduction	Starry flounder	ΣPCB (field)
5.	Hogan and Brauhn	Egg mortality	Rainbow trout	A1242
6.	Johansson et al. 1970	Egg mortality	Atlantic salmon	ΣPCB (field)
7.	Nestel and Budd 1975	Kidney necrosis	Rainbow trout	A1254
8.	ACOE 1988	Reproduction	Fathead minnow	ΣPCB (field)
9.	Bengtsson 1980	Mortality	Minnow	Clophen A50
10.	Defoe et al. 1978	Growth	Fathead minnow	A1248
11.	Hansen et al. 1971	Mortality	Spot; pinfish	A1254
12.	Hansen et al. 1975 minnow	Mortality	Sheepshead	A1016
13.	Lowe et al. 1972	Tissue changes	Oyster	A1254
14.	Nebeker and Puglisi 1974	Reproduction	Scud	A1248
15.	Nebeker et al. 1974	Egg hatchability	Fathead minnow	A1254
16.	Cruger et al. 1976	Growth	Coho salmon	4-, 5-, 6-Cl

ERC Environmental and Energy Services Co.

Graphical Presentation of Biological Responses to PCB Exposure

FIGURE 4-1



(Using three different potential tissue:sediment concentration ratios, as indicated)

ERC Environmental and Energy Services Co.

The Cumulative Frequency Plot of Figure 5-1
as a Function of the PCB Concentrations in Sediments

FIGURE **4-2**

4.6 Summary/Conclusion

The most recent, in-depth investigations as described in the previous sections propose the following total PCB sediment quality criteria (saltwater) for protection of aquatic life:

Approach	Criteria Value	Criteria at 3% TOC, μg/g-dw
Chronic levels		
EP	41.8 μg/goc (8.29-214)	1.3 (0.25-6.4)
AET (benthic)	65 μg/goc (12-190, other species)	2.0 (0.4-5.7)
SLC	3.66 μg/goc (0-4.58)	0.11 (0-0.14)
SQT (major effect)	0.8 μg/g	>0.8
Acute levels		
Bioassay (LC_{50}-acute)	10.8 μg/g (9.8-11.8)	>10.8
(LC_{10}-subacute)	6.7 μg/g	>6.7

These levels are consistent with previous regulatory guidance (Table 4-3). In addition to the PCB sediment action levels in Table 4-3, the EP and AET levels have been presented before EPA's Science Advisory Board for consideration in the development of nation-wide sediment criteria for nonpolar hydrophobic organic chemicals.

Table 4-3

HISTORIC REGULATORY GUIDANCE ON PCB SEDIMENT CONTAMINANT LEVELS

Guidance	Level, ppm (μg/kg)
USGS Alert Level	0.02
1978 Ontario Ministry of the Environment Guidelines	0.05
EPA/ACOE Puget Sound Interim Criteria	0.38
Netherlands sediment quality classification of slight concentration	<0.1
New England class 3 (high contamination) levels	>1
1977 EPA Region V guidelines	1 - 10
TSCA soil levels - hazardous waste (federally promulgated)	50
Washington State 1988 draft (lowest apparent effect threshold)	4.0 at 3% TOC
California State Water Resources Control board (cleanup guideline)	50

SECTION 5
RECOMMENDATIONS FOR PCB ACTION LEVELS SPECIFIC TO CONVAIR LAGOON

5.1 GENERAL CONSIDERATIONS

The criteria summarized in Section 3.3 may be used to develop PCB sediment action levels for Convair Lagoon. The diversity and fundamental differences in the approaches used to develop these criteria preclude application of a rigorous statistical model or protocol to define the action levels. Rather, these levels are defined using best professional judgment following weight of evidence reasoning. Table 5-1 presents recommended action levels, developed on this basis. Justification for these values is as follows:

- For the most sensitive species (chronic), the < 10 ug/goc concentration corresponds to the average of the lower bound EP and AET (Puget Sound) values (which are in good agreement). The 65 ug/goc concentration corresponds to the median AET (Puget Sound) value which is slightly above the corresponding median EP value (41.8 ug/goc) for the predominant persistent homologs (corresponding to Aroclor 1254). Upper bound criteria values were not used as they would not be protective of the most sensitive species. Also, Convair Lagoon may not have the most sensitive species upon which this database was developed.

- For the typical species, the median EP (41.8 ug/goc) and unnormalized SQT (0.8 ug/g) (at 2% TOC) values are in very good agreement and slightly lower than the median AET (Puget Sound) value. Thus 40 ug/goc was judged to be a reasonable lower bound for typical species. For the upper bound, the EP (214 ug/goc) and AET (Puget Sound 190 ug/goc) are close, but somewhat less than the subacute bioassay results (335 ug/goc, converted to normalized basis). Since species are typical (i.e., not most sensitive) the subacute bioassay results on the sensitive species were judged to represent a reasonable chronic upper bound.

Table 5-1

RECOMMENDED PCB ACTION LEVELS FOR CONTAMINATED SEDIMENTS

Protection Level	PCB Action Level (µg/goc)	µg/g @ 3% oc
Most sensitive benthic species (Chronic effects)	<10 - 65	<0.3 - 2.0
Typical benthic species (Chronic effects)	40 - 335	1.2 - 10.0
Most sensitive species (Acute effects)	490 - 590	14.2 - 17.7[a]

[a] The range was reported as 9.8-11.8 µg/g in a bioassay test sediment of approximately 2% TOC. This converts to 14.7 to 17.7 µg/g at 3% TOC on a theoretical basis.

- For sensitive species the rigorous (acute) bioassay test results were considered more realistic in comparison with extrapolations of chronic based EP, AET, or SLC values. Therefore the range reported for the bioassay acute testing was selected as the most sensitive species (acute) range.

The action levels in Table 5-1 are presented on an organic-carbon normalized basis. They may be applied to any PCB contaminated sediment location by use of local TOC concentrations to develop a site specific criteria on a mass basis (mg/kg or ppm). The results for 3 percent TOC are presented in the table as an illustrative example. The applicable TOC ranges are approximately 0.5 - 10 percent. Action levels determined for sediments outside this sediment TOC range are not considered as reliable.

5.2 ACTION LEVELS BASED ON PROTECTION OF BENTHIC AQUATIC SPECIES

Action levels, protective of benthic aquatic species, specific to Convair Lagoon were estimated using the recommended PCB cleanup goals presented in Table 5-1 together with the site-specific total organic carbon concentrations (TOC) presented in Section 3.0. Using the Phase II TOC data, for which appropriate analysis and QA/QC was maintained, geometric mean TOC concentrations were determined in the area of PCB contamination.

These values are presented in Table 5-2 and provide an adequate representation of the typical median TOC values expected in bulk sediments. Recognizing that the potentially exposed benthic organisms reside on the surficial sediments, the appropriate TOC value to use in determining action levels would be that corresponding to the 0-1 foot interval, i.e., 2.72 percent. This value is also not significantly different than the next 1-foot interval of 2.65 percent TOC. Application of 2.72 percent TOC to Table 5-1 values yields the following ranges for Convair Lagoon for protection of benthic aquatic species:

Table 5-2

CONVAIR LAGOON MEAN TOC CONCENTRATIONS

Sediment Depth Interval (feet)	Geometric Mean TOC (%)	No. of Samples
0 – 1	2.72	26
1 – 2	2.65	26
2 – 3	2.04	26
3 – 4	1.47	26
4 – 5	2.49	21
5 – 6	2.10	21
6 – 7	1.28	21
Overall	2.04	167

Protection Level	PCB Action Level, mg/kg Dry Weight
Most sensitive benthic species, chronic effect	<0.3 - 1.8
Typical benthic species, chronic effects	1.1 - 9.1
Most sensitive species acute effects	13.3 - 16.0

It should be noted that the above ranges are sufficiently conservative and should not be adjusted by an additional margin of safety or protection factor.

5.3 Action Levels Based on Historical Precedence and Regional Considerations

Review of the activities and ROD action levels at other sites with PCB sediment contamination (Section 2.0) strongly indicate that protection of most sensitive benthic species (which correspond to this estimated level) are not the driving force in establishing cleanup goals. For example, the Hudson River project (NYSDEC) may not even establish a final goal but just dredge hot spots. The action levels that NYSDEC personnel are now discussing are between 10 and 50 ppm. Even these levels may be optimistic.

Waukegan Harbor has adopted the federal Toxic Substances Control Act (TSCA) action level for contaminated material (soils) of 50 ppm as the most conservative level. New Bedford Harbor may consider protection of typical benthic species (approximately 5-25 ppm PCB with local TOC values); however, engineering constraints may limit achievable levels to approximately 10 ppm in former hot spot areas.

The latest EPA ROD levels typically range from 5-10 ppm. Historic (mid 1970s) soil spill/sediment-sludge sites have been remediated at much higher target goals (500 - 1000 ppm PCB) with no identified adverse human health effects or levels above background in associated monitoring wells or nearby drinking wells. Again, these are illustrative of typical levels where protection of aquatic species is not the driving concern in remediation.

Another factor which must be considered in establishing action levels is the existing (i.e., background level) PCB contamination in greater San Diego Bay. Review of the levels reported in Section 3.0 clearly indicate ubiquitous PCB contamination at approximately 0.1-1 ppm, with several areas from 1-5ppm. Applying the tissue:sediment BCF factors reported by Dexter and Field (Section 4.1.5) to the mussel watch tissue, data (Section 3.0) also supports this conclusion and suggests that a typical "background" sediment PCB level in much of the harbor ranges from 0.5 - 2 ppm. This range may be underestimated as the mussels are often suspended in the water column rather than placed on the surficial sediments. It is evident, however, that any action level below approximately 5 - 10 ppm lies within two standard deviations of the background level range, i.e., within the statistical expected variation of PCB contamination for the entire bay. Establishment of such an action level would therefore infer the impossible task of remediation of the entire harbor.

A final factor in establishing ranges is the ultimate use of the Lagoon. For example, if the lagoon is to be filled in, it is illogical to set levels protective of benthic species. Other use scenarios, such as restricted access (i.e., controlled uses, such as no fishing or no swimming) may allow higher residual levels to remain following remediation. Action levels based on use considerations can only be developed through a formal risk assessment addressing multipathway exposure to biota.

5.4 SELECTION OF SITE-SPECIFIC ACTION LEVELS

Based on the evaluations in Sections 5.2 and 5.3, it is evident that there is no one goal (single value) that satisfies all constraints (i.e., protective of benthic species, historic regulatory precedent, engineering/economic feasibility, harbor background concentrations, ultimate use). Therefore, we are recommending 10 ppm as the action level for elevated hot spots and a lower value of 5-10 ppm in other areas if possible benthic chronic effects become a major concern. Any goal below 5 ppm is unreasonable based on EPA precedent and existing harbor background levels. Final action levels should consider engineering feasibility and their appropriateness to remedial alteratives. For example, if the Lagoon is filled, in-place capping of all hot spots would be sufficient to eliminate risk for aquatic biota.

SECTION 6
REFERENCES

Barker, D. 1986. Investigation of Polychlorinated Biphenyls (PCBs) in the Convair Lagoon Portion of San Diego Bay. Regional Water Quality Control Board, San Diego Region.

Berger, Karl (NYSDEC). 1990. Personal Communication Telephone discussions with R.D. Kadeg (Ebasco). Subject. Remedial activities concerning the Hudson River PCB sediment contamination.

Brownawell, B. J. and J. W. Farrington. 1985. "Partitioning of PCBs in Marine Sediments" In: Signlea, A.C. and A. Hatlori, eds. Marine and Estuarine Geochemistry. Lewis Publishers, Inc. Chelsea, MI.

Brownawell, B. J. and J. W. Farrington. 1986. "Biogeochemistry of PCBs in Interstitial Waters of a Coastal Marine Sediment." Geochimica et Cosmochimica Acta, Vol., 50. pp. 157-159.

Chapman, P. N. 1986. "Sediment Quality Criteria from the Sediment Quality Triad: An Example." Environmental Toxicology and Chemistry, Vol. 5. pp. 957-964.

Chapman, P. N., R. C. Barrick, J. M. Neff and R. C. Swartz. 1987. "Four Independent Approaches to Developing Sediment Quality Criteria Yield Similar Values for Model Contaminants." Environmental Toxicology and Chemistry, Vol 6. pp. 723-725.

DeLappe, B. W., C. Younghans-Haug, J. Bott, N. Morgan and M. Martin. 1988. Data Report on Polynuclear Aromatic Hydrocarbons and Synthetic Organic Compounds in San Diego Bay Sediments, a Project Performed Under Interagency Agreement with the Regional Water Quality Control Board, San Diego Region. Trace Organics Facility, California Dept. of Fish and Game, Long Marine Laboratory, Univ. of California, Santa Cruz.

Dexter, R. and J. Field. 1989. "A Discussion of Sediment PCB Target Levels for the Protection of Aquatic Organisms" in "oceans 89, Vol. 2 - Ocean Pollution." Proceedings of Oceans 89 conference, September 18-21, 1989, Seattle, Washington. Marine Technology Society and Oceanic Engineering Society of the Institute of Electrical and Electronics Engineering, Piscataway, New Jersey.

ERCE. 1989. A Dredged Material Bioassay at Continental Maritime of San Diego, Pier 6, San Diego, California. Prepared by ERC Environmental and Energy Services Co., San Diego, CA. Prepared for Continental Maritime of San Diego.

Hawker, D. W. and D. W. Connell. 1988. "Octanol-Water Partition Coefficients of Polychlorinated Biphenyl Congeners" Environmental Science and Technology. Vol. 22 No. 4 pp.382-387.

Hutzinger, O., S. Safe and V. Zitko. 1974. "The Chemistry of PCBs" CRC Press, Cleveland, OH.

Lockheed. 1982. Bioassay Investigations of Sediments From the Site of the Proposed Atkinson Marine Pier and Floating Drydock. Prepared by Lockheed Ocean Science Laboratories, San Diego, CA. Prepared for Ferver Engineering Co., San Diego, CA.

Lockheed. 1983a. Chemical Analyses of Sediment Collected From the East Basin of Harbor Island. Prepared by Lockheed Ocean Science Laboratories, San Diego, CA. Prepared for the San Diego Unified Port District.

Lockheed. 1983b. Bioassay Investigations of Sediments From the Southwest Marine, Inc. Proposed Floating Drydock Site. Prepared by Lockheed Ocean Science Laboratories, San Diego, CA. Prepared for Woodward-Clyde Consultants, Walnut Creek, CA.

Lockheed. 1983c. Bioassay Investigations of Sediments From National Steel and Shipbuilding Company's Floating Drydock Site and Berths 3 and 4. Prepared by Lockheed Ocean Science Laboratories, San Diego, CA. Prepared for WESTEC Services, Inc. San Diego, CA.

Lockheed. 1984. Bioassay Investigations of Sediment From the East Basin of Harbor Island. Prepared by Lockheed Ocean Systems Laboratory, San Diego, CA. Prepared for the San Diego Unified Port District.

Long, E. R. 1989. "A Comparison of Sediment Quality Criteria Developed from Effects-Based Approaches: Do We Have Convergence or Divergence?" in "Oceans 89, Vol. 2 - Ocean Pollution." Proceedings of Oceans 89 conference, September 18-21, 1989, Seattle, Washington. Marine Technology Society and Ocean Engineering Society of the Institute of Electrical and Electronics Engineers, Piscataway, New Jersey.

Neff, J. M., D. J. Bean, B. W. Carnaby, R. M. Vaga, T. C. Gulbransen and J. A. Scanlon. 1986. "Sediment Quality Criteria Methodology Validation: Calculation of Screening Level Concentrations from Field Data." EPA SCD 7. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C.

Neff, J. M., J. Q. Word and T. C. Gulbransen. 1987. "Recalculation of Screening Level Concentrations for Nonpolar Organic Contaminants in Marine Sediments." U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C.

NOAA. 1987. NATIONAL STATUS AND TRENDS PROGRAM for Marine Environmental Quality, Progress Report. A Summary of Selected Data on Chemical Contaminants in Tissues Collected During 1984, 1985, and 1986. National Oceanographic and Atmospheric Administration.

NOAA. 1988. NATIONAL STATUS AND TRENDS PROGRAM for Marine Environmental Quality, Progress Report; A Summary of Selected Data on Chemical Contaminants in Sediments Collected During 1984, 1985, 1986 and 1987. National Oceanographic and Atmospheric Administration.

Nolan, Cindy (USEPA Project Officer). 1990. Personal Communication. Discussion with R. Venkateswar (Ebasco). Subject. OMC/Waukegan Harbor PCB remediation sites.

Pavlou, S. P. 1987. "The Use of the Equilibrium Partitioning Approach in Determining Safe Levels of Contaminants in Marine Sediments" in Dickson, K. L., A. W. Maki, W. W. Brungs eds. "Fate and Effects of Sediment-Bound Chemicals in Aquatic Systems." Pergamon Press, New York, New York.

Phillips, Brandt, Reddick. 1986. Sunroad Marina, Harbor Island. Prepared by Phillips, Brandt, Reddick, San Diego, CA. Prepared for the San Diego Unified Port District.

Phillips, P.T. 1988. California State Mussel Watch Ten Year Data Summary, 1977-1987. Water Quality Monitoring Report No. 87-3. California State Water Resources Control Board.

PTI Environmental Services. 1989. "Briefing Report to the EPA Science Advisory Board: The Apparent Effects Threshold Approach." Office of Puget Sound, Puget Sound Estuary Program, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

RWQCB. 1989. Results of Sediment Sampling at the Campbell Shipyard. Prepared by Quality Assurance Laboratory. Prepared for the Regional Water Quality Control Board, San Diego Region.

Salazar, M. H. and S. M. Salazar. 1985. Ecological Evaluation of Organotin-Contaminated Sediment. Naval Ocean Systems Center.

San Diego Unified Port District. 1984. Shelter Island Boatyard Renovation Environmental Assessment. Prepared by WESTEC Services, Inc. Prepared for the San Diego Unified Port District.

Swartz, R. C. 1989. "Overview of Sediment Criteria Development Methodologies." 13th Symposium on Aquatic Toxicology and Risk Assessment. ASTM Committee E-47 on Biological Effects and Environmental Fate. April 16-18, Atlanta, Georgia.

SWRCB. 1984. California State Mussel Watch 1981-1983. Biennial Report. Trace Metals and Synthetic Organic Compounds in Mussels from California's Coast, Bays and Estuaries. California Dept. of Fish and Game.

SWRCB. 1988. State Mussel Watch Program, Summary of 1988 Data: Polychlorinated Biphenyls (PCBs) in Mussels (ppb, DRY weight). California Dept. Fish and Game.

SWRCB. 1989. State Mussel Watch Program, Summary of 1989 Data: Polychlorinated Biphenyls (PCBs) in Mussels (ppb, DRY weight. California Dept. Fish and Game.

TRA. 1988. Characterization of the Vertical Extent of Contaminated Sediments in Convair Lagoon, San Diego Bay. Prepared by Teledyne Ryan Aeronautical, San Diego, CA. Prepared for the California Regional Water Quality Control Board, San Diego Region.

TRA. 1989. Characterization of the Extent of Contaminated Sediments in Convair Lagoon. Prepared by Teledyne Ryan Aeronautical, San Diego, CA. Prepared for the California Regional Water Quality Control Board, San Diego Region.

U.S. Environmental Protection Agency, Region II and New York State Department of Environmental Conservation. 1987. "Draft Joint Supplement to the Final Environmental Impact Statement on the Hudson River PCB Reclamation Demonstration Project." USEPA/NYSDEC, Albany, New York.

U.S. Environmental Protection Agency. 1977. "Monitoring of Trace Constituents During PCB Dredging Operations: Duwamish Waterways." EPA/910/9-77/039. EPA, Seattle, WA.

U.S. Environmental Protection Agency. 1984. "Superfund Record of Decision (EPA Region 2): Hudson River PCBs Site, NY." EPA/ROD/R02-84/004. EPA, Washington, D.C.

U.S. Environmental Protection Agency. 1986a. "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) CleanUp.." EPA 600/6-86-002 U.S. Environmental Protection Agency, Office of Research and Development, Office of Health and Environmental Assessment, Exposure Assessment Group, Washington, D.C.

U.S. Environmental Protection Agency. 1988h. "Cleaning of Outboard Marine Corporation/Waukegan Harbor Site - Explanation of Significant Differences." USEPA Office of Public Affairs, Region V, Chicago, IL.

U.S. Environmental Protection Agency. 1989a. "Briefing Report to the EPA Science Advisory Board on the Equilibrium Partitioning Approach to Generating Sediment Quality Criteria.." EPA 440/5-89-002 U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C.

WESTEC. 1984. Bioassay Investigations of Sediments From the South Bay Boat Yard, South San Diego Bay. Prepared by WESTEC Services, Inc., San Diego, CA. Prepared for South Bay Boat Yards, Inc., San Diego, CA.

WESTEC. 1985a. Bioassay Investigations of Sediments From National Steel and Shipbuilding Co. Berth 9 and 10, San Diego Bay. Prepared by WESTEC Services, Inc., San Diego, CA. Prepared for National Steel and Shipbuilding Co., San Diego, CA.

WESTEC. 1985b. Bioassay Investigations of Sediments From the Continental Maritime Facility, San Diego Bay. Prepared by WESTEC Services, Inc., San Diego, CA. Prepared for Continental Maritime of San Diego.

WESTEC. 1987a. National City Marine Terminal Maintenance Dredging, San Diego Bay, San Diego, California. Prepared by WESTEC Services, Inc., San Diego, CA. Prepared For the San Diego Unified Port District.

construction and implementation phase; and the demonstrated level of development and reliability for the site and waste-specific condition in New Bedford Harbor.

The implementation of a technology considers factors relating to the technical, institutional, and administrative feasibility of installing, monitoring, and maintaining that technology. The cost estimates developed for each technology included direct and indirect capital costs, and operation and maintenance expenses (O&M). These criteria were applied only to the technology/process option and not to the site as a whole. For the first operable unit (i.e., the Hot Spot area) the technology types/process options that were retained are presented in Figure B-4. These may be different for the second applicable unit based on the waste and site-specific characteristics of the remainder of the site.

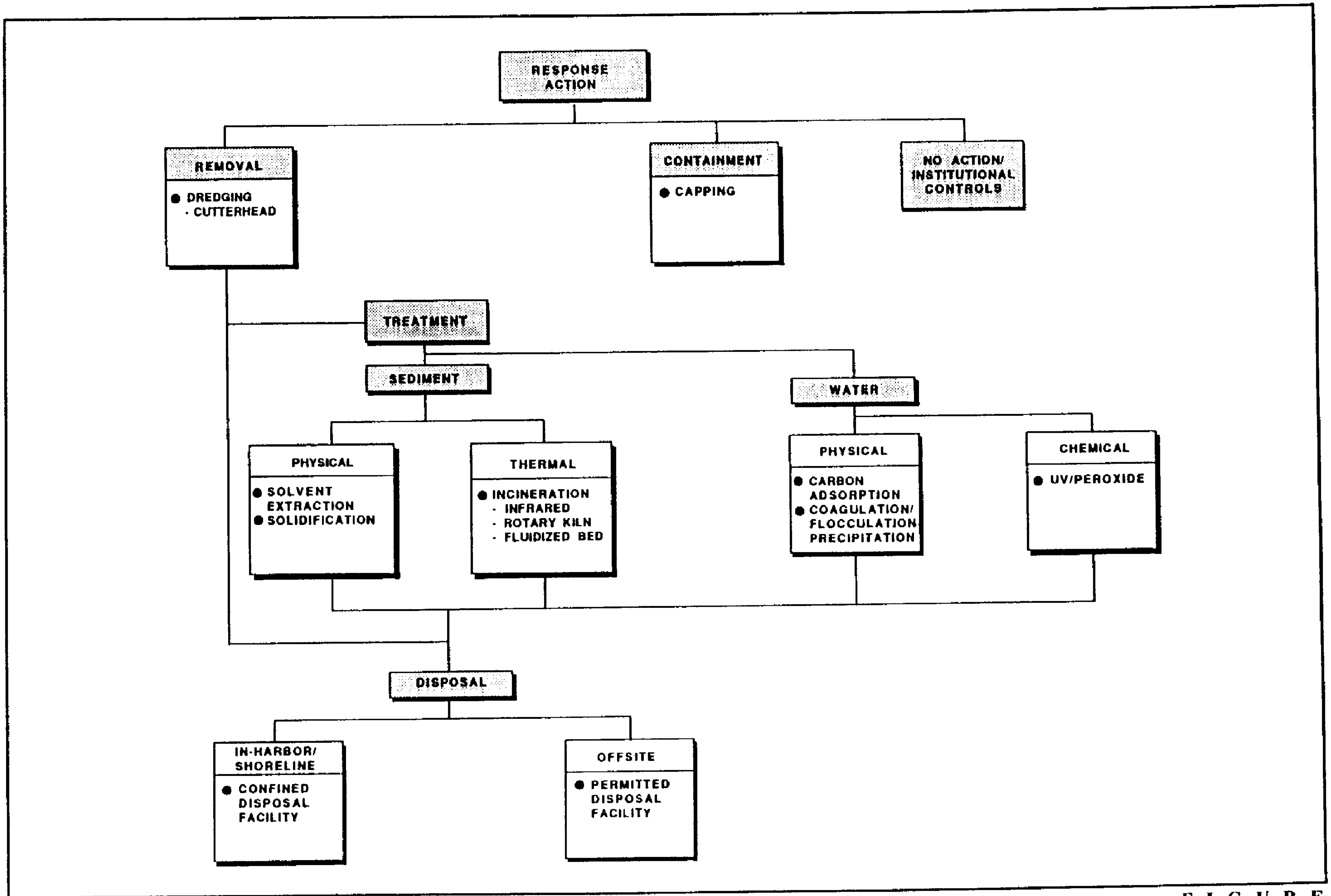
B.3.3 <u>Development and Screening of Remedial Alternatives</u>

Using combinations of technologies/process options that were retained through detailed evaluation, Ebasco assembled remedial alternatives to address the site response objectives. The range of alternatives included no-action, containment, and alternative(s) that permanently and significantly reduce the mobility, toxicity, or volume of hazardous waste. To reduce the number of alternatives and preserve the range described above, Ebasco conducted an alternative screening process. The evaluation criteria were effectiveness, implementability, and cost. The alternatives that were developed and the results of the screening are presented in Table B-2.

B.3.4 <u>Detailed Analysis of Alternatives</u>

The detailed analysis of alternatives is intended to provide decision makers with sufficient information concerning a range of proposed remedial actions in order to select a single remedy that meets the following CERCLA requirements:

- protective of public health and the environment
- identifies ARARs which will not be attained as an interim remedy
- attains ARARs (or provides grounds for invoking a waiver)
- cost-effective
- preference for permanent solution that uses treatment technologies or resource recovery techniques to the maximum extent practicable.



FIGURE

B-4

Technology Types and Process Options Development for the Hot Spot Feasibility Study

Table B-2

RESULTS OF BENCH- AND PILOT-SCALE TESTS OF TREATMENT TECHNOLOGIES CONDUCTED FRO NEW BEDFORD HARBOR

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

Technology	Results of Treatment Test	Advantages	Disadvantages	Retained
Solvent Extraction (B.E.S.T. Process)	• 99.1% reduction in PCBs in low level (780 ppm) sediment after 3 extraction stages • 99.4% reduction in PCBs in high level (4,300 ppm) sediment after 3 extraction stages reagent recovery • 90% solids recovery • Apparent immobilization of metals	• High PCB removal • Not limited by moisture content • Energy efficient • Proven in field test • Commercial units available	• TEA solvent is flammable • Secondary treatment for details may be required.	Yes
Alkali Metal Dechlorination KPEG process	• 99.8% removal of PCBs in low level (440 ppm) sediment after 9 hours • 99.8% removal of PCBs in high level (7,300 ppm) sediment after 12 hours • 75% reagent recovery (min) • 43% solids recovery (dry wt)	• High PCB removal • Biphenyl ether end product not acutely toxic, and does not bioaccumulate.	• Low reagent/ sediment recovery suggests material handling problems need to be overcome • Secondary treatment necessary for metals • Moisture inhibits dechlorination reaction • No commercial process available at present time	No

Table B-2 (Continued)

RESULTS OF BENCH- AND PILOT-SCALE TESTS OF TREATMENT TECHNOLOGIES CONDUCTED FRO NEW BEDFORD HARBOR

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

Technology	Results of Treatment Test	Advantages	Disadvantages	Retained
Solidification/ Stabilization	• Chemical stabilization properties of the three technologies tested were similar • Hardened material exceeded 50 psi USEPA-OWSER standard • PCB Leachability reduced by 10X to 100X (depending on formulation) • Cadmium and zinc leachability significantly reduced; eliminated in one process • Copper and nickel apparently mobilized	• Effective stabilization of PCBs • Effective stabilization of cadmium and zinc • Numerous commercial processes available	• Apparent mobilization of certain heavy metals • No information or data on long-term structural integrity of solidified material	Yes
Vitrification	• 99.94% destruction of PCBs • 99.9985% DRE (Soil-to-offgas) • Metal concentrations in TCLP extract below regulatory limits	• Effective destruction of PCBs and encapsulation of metals	• High energy requirements • No commercial units available at this time	No

Table B-2 (Continued)

RESULTS OF BENCH- AND PILOT-SCALE TESTS OF TREATMENT TECHNOLOGIES CONDUCTED FRO NEW BEDFORD HARBOR

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

Technology	Results of Treatment Test	Advantages	Disadvantages	Retained
Liquified gas extraction (propane)	• 97% reduction of PCBs in low level (<400 ppm) sediment after 10 passes through unit • 96% reduction of PCBs in high level (>2,000 ppm) sediment after 6 passes through unit • 93% solids recovery	• High PCB removal	• Further development needed to address problems with materials and system operating parameters experienced during pilot test • No commercial units available at this time	No
Advanced Biological Methods (aerobic)	• Limited degradation of lower chlorinated congeners (di- and trichlorobiphenyls) • No degradation of higher chlorinated PCB isomer groups	• Insufficient data to assess advantages of this relative to other treatment processes	• Incomplete destruction of PCBs • Insufficient data to determine process rates and process design parameters	No
Plate and Frame Filter Press	• 38% solids sample dewatered to 62% solids cake	• Effective methods of sediment dewatering • Commercial units readily available	• None identified	Yes

- preference for treatment that reduces mobility, toxicity, or volume as a principal element

Each of the four alternatives that passed the screening process were evaluated against the nine criteria below:

- short-term effectiveness
- long-term effectiveness and permanence
- reduction of mobility, toxicity, or volume
- implementability
- cost
- compliance with ARARs
- overall protection of public health and the environment
- state acceptance
- community acceptance

B.3.5 Containment

Ebasco has evaluated many containment technologies for the New Bedford Harbor site. These have included innovative approaches (i.e., chemical sediments) as well as traditional sand and gravel caps. The analysis has been conducted for shallow and deep water environments using both hydraulic and mechanical equipment. For the Hot Spot FS only capping was retained.

B.3.6 Dredging and Disposal

As part of the detailed evaluation, Ebasco was indirectly involved in the field evaluation of three dredges and two sediment disposal techniques. This field pilot-scale test involved the dredging and disposal of 7,500 yd^3 of sediment from New Bedford Harbor. This test resulted in the recommendation of the Cottonhead Dredge for the Hot Spot area of the Harbor (Figure B-4).

B.3.7 Sediment Treatment

The detailed evaluation of sediment treatment technologies was a comprehensive effort that examined many emerging technologies in addition to well-established processes.

Of all the technology types evaluated, a thermal treatment had been widely used in full-scale operations. Three types of incineration were considered applicable to treat the New Bedford Harbor sediment and were therefore retained for alternative development: infrared, rotary kiln and fluidized bed. Each unit would achieve similar results but are constructed and operated differently.

To provide site- and waste-specific performance data for these technologies, six bench-scale and pilot-scale tests were completed on New Bedford Harbor sediment (Table 5-3). Following evaluation of the test data, triethylamine solvent extraction, solidification and plate and frame filter press technologies were retained for alternative development (Figure B-4).

B.3.8 Present Status

EPA Region I is presently in the process of writing a record of decision (ROD) for the hot spot that requires dredging of PCB-contaminated sediments in excess of 4,000 ppm. This material would be dewatered and incinerated on site at a shoreline location adjacent to the estuary.

APPENDIX C

OUTBOARD MARINE CORPORATION SITE
WAUKEGAN HARBOR, ILLINOIS

APPENDIX C
OUTBOARD MARINE CORPORATION SITE
WAUKEGAN HARBOR, ILLINOIS

C.1 BACKGROUND

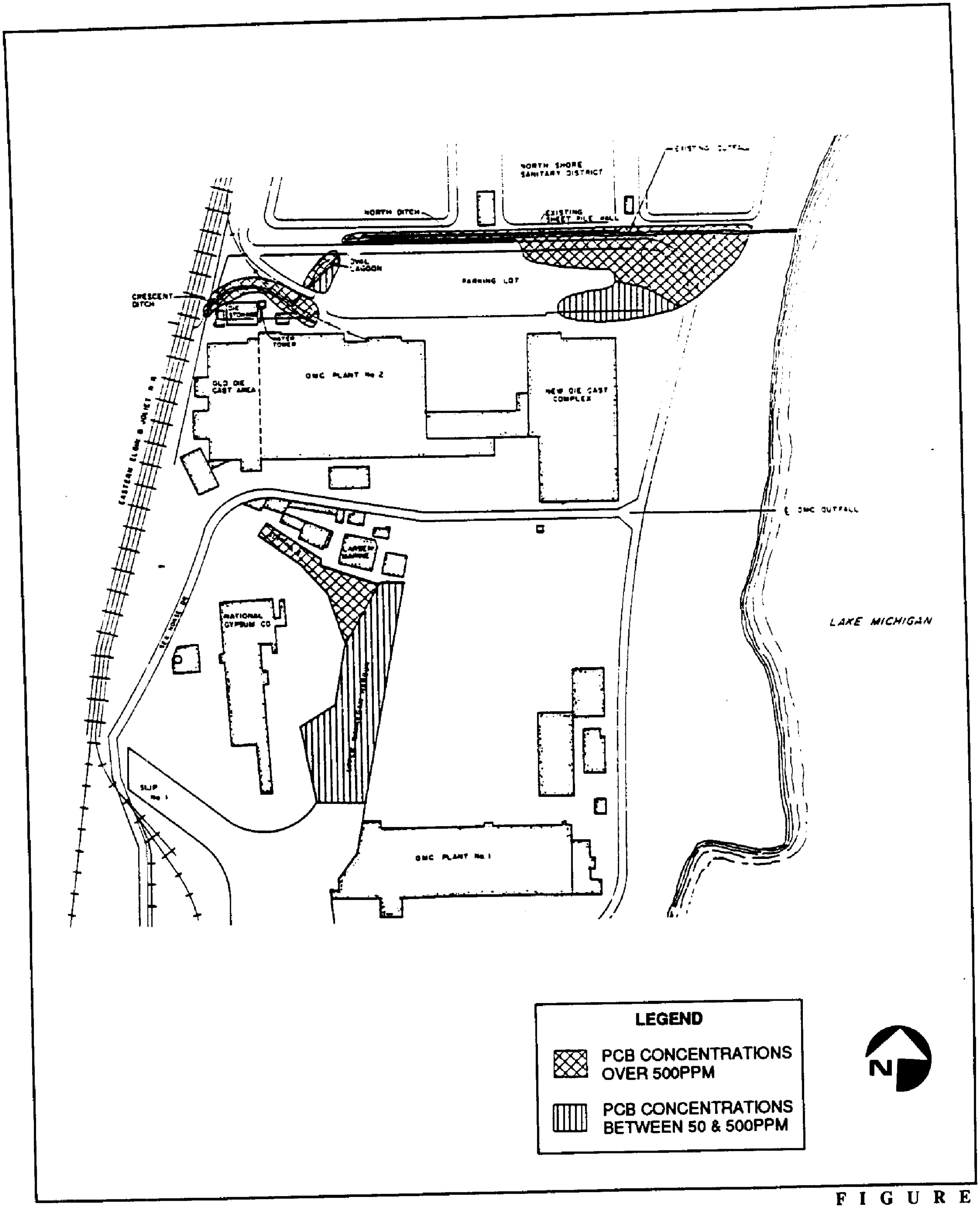
Outboard Marine Corporation (OMC) operates a recreational marine products manufacturing plant located on the west shore of Lake Michigan in Waukegan, Illinois, about 37 miles north of Chicago and 10 miles south of the Wisconsin state border (Figure C-1).

From approximately 1961 to 1972, OMC purchased a hydraulic fluid used in the diecasting works that contained PCBs. Some of these fluids escaped through floor drains. The floor drains discharged to an oil interceptor system which discharged to the North Ditch. Some of the PCBs escaped from a portion of the oil interceptor, diversion and pump system and were released into the harbor. The harbor area discharge was located in the western end of Slip 3 and the north property discharge was in the Crescent Ditch. The discharge pipe to the harbor was sealed in 1975 (USEPA 1988h). In 1976, high levels of PCBs were discovered in the soils and harbor sediments on-site.

As a result of these discharges, large quantities of PCBs are in Waukegan Harbor and on OMC property in the North Ditch/Oval Lagoon/Crescent Ditch area and in the parking lot and Slip 3. It is estimated that there are over 700,000 pounds of PCBs on OMC property and approximately 300,000 pounds of PCBs in Waukegan Harbor. The range of PCB concentrations is a few parts per million in the harbor channel to over 10,000 ppm in selected hot spots. Figure C-1 presents the distribution of PCB contaminants.

C.2 REGULATORY ACTION

In 1984, after conducting numerous studies of PCB contamination at the site and completing a Feasibility Study (FS) which analyzed various alternative remedies to clean up the contamination, the EPA, in accordance with Superfund regulations, selected a recommended remedial alternative to be implemented, using monies from the Hazardous Substances Trust Fund (Superfund). This remedial selection is set forth in the 1984 Record of Decision (ROD) authorizing expenditures of $21 million to clean up the site. That same year the engineering design work for the selected remedial action was initiated.



FIGURE

C-1

OMC Site- Before Remedial Action

However, in late 1985, design work on the project was suspended pending the conclusion of litigation between OMC and EPA regarding access to OMC's property since such access was essential to continue the design process.

Subsequently, EPA and OMC agreed to end ongoing access litigation. Shortly thereafter, OMC submitted a proposal to clean up the site. The negotiations between OMC, EPA, and Illinois Environmental Protection Agency (IEPA) since late 1986 have resulted in the present Consent Decree. Under this decree, OMC will finance a Trust to implement the cleanup and will ensure performance of the Trust. The Consent Decree establishes the areas to be remediated, the methods to be used, and the financial responsibility, both immediate and long-term, for the cleanup (USEPA 1988h).

C.3 Cleanup Criteria and Remedial Considerations

The objective of the 1984 ROD was to clean up general areas within the site which contained PCB contamination of 50 ppm or greater and remove hot spots and encapsulate material (defined as greater than 10,000 ppm). With this criteria in mind, three main areas of contamination were targeted for remediation: 1) The Upper Harbor and Slip 3; 2) the OMC parking lot, which is at the north end of the site and covers approximately 9 acres; and 3) the North Ditch, Crescent Ditch and Oval Lagoon areas, which are on OMC property immediately to the north and west of the parking lot. The criteria for defining the areas for remediation are similar in the present remedy as in the 1984 ROD; however, the details for accomplishing the cleanup have changed. One significant difference is that the definition of "hot spots" has been expanded to include areas greater than 500 ppm. Details of these RODs are presented below.

The remedy selected in the 1984 ROD consisted of the following elements (USEPA 1988h):

- All PCB "hot spots" of 10,000 ppm and above were to be dredged from Slip 3, dewatered, fixed and sent to an off-site licensed chemical waste landfill.

- Remaining sediments in Slip 3 and the Upper Harbor were to be dredged, dewatered in large lagoons to be constructed on OMC property, and disposed of in a containment cell to be constructed above the parking lot area.

- "Hot spots" (over 10,000 ppm) on the North Ditch area were to be removed, fixed and transported for off-site disposal.

- The dredged material from Slip 3 and the Upper Harbor was to be placed on the parking lot area,encapsulated by slurry walls and capped with a layer of impermeable clay.

- The North Ditch area was to be enclosed with slurry walls and capped with impermeable clay.

The 1988 proposed remedy addresses the same areas for remediation as were addressed in the 1984 ROD (Slip 3 and the Upper Harbor; the North Ditch, Crescent Ditch/Oval Lagoon area on OMC property and the OMC parking lot).

The following is a summary of the proposed steps to be taken in the remedial action for the site (USEPA 1988h):

- A new slip will be constructed on the east side of the Upper Harbor to replace Slip 3, and Larsen Marine will be relocated from its present location to the new slip.

- Slip 3 will be permanently isolated from the Upper Harbor by the construction of a double-walled, braced, and soil backfilled sheet pile cutoff wall. After the slip is isolated, an impermeable clay slurry wall with a minimum thickness of three feet will be constructed which will be tied into the underlying clay till and a permanent containment cell will be built in the slip.

- The most highly contaminated sediments from Slip 3 with PCB concentrations in excess of 500 ppm will be dredged from the slip and removed and isolated for treatment. The Upper Harbor will be dredged and the dredged materials placed in the newly constructed Slip 3 Containment Cell.

- Two additional containment cells will be constructed using the same design used for the construction of the Slip 3 Containment Cell. The East contaminment Cell will encompass part of the parking lot area and land to the east of the lot and the West Containment Cell will encompass the Crescent Ditch and Oval Lagoon area. Before constructing the West Contaminment Cell, soils contaminated in excess of 10,000 ppm will be excavated and removed for treatment.

- Soils and sediments excavated from Slip 3, and the North Ditch, Crescent Ditch and Oval Lagoon areas designated for treatment will be subjected to an on-site thermal or chemical extraction process. After startup, this treatment technology is guaranteed to remove at least 97 percent of the PCBs by mass from the contaminated materials without endangering public health. The treated sediments will be placed in the West Contaminment Cell. Extracted PCBs will be disposed of off-site in accordance with all applicable federal and state laws.

- A short-term water treatment facility will be constructed for treating water generated during the remedial construction activities. Dredge water will be treated by sand filtration. Other water generated during the course of remedial activity will be treated utilizing the sand filtration step to remove sediments from the water, followed by carbon adsorption, to achieve acceptable standards established by EPA. A smaller permanent water treatment facility will be constructed to treat water extracted from the containment cells. Treated water will be discharged to the North Shore Sanitary District or to an on-site location approved by EPA.

- When all materials have been deposited in the cells, they will be closed and capped with a high density polyethylene (HDPE) liner and soil cover. The cells will include extraction well systems which are designed to prevent the migration of PCBs from the cells. The three cells will be operated and maintained by OMC.

- Throughout the construction and treatment processes, stringent measures will be taken to protect public health and the environment. These health and safety measures will include air monitoring, dust suppression, and all other necessary protective measures, which will be detailed during the design phase and submitted to EPA for approval before construction and remedial action are initiated.

The major differences between the 1984 ROD and the 1988 Consent Decree are as follows (USEPA 1988h):

- The 1988 decree provides for a new slip to be built to replace the old Slip 3 and relocates Larsen Marine to the new slip.

- The present remedy expands the definition of "hot spot" areas to include all material in Waukegan Harbor 500 ppm and above, thereby including a larger amount of material.

- The containment cells are built in-ground with protective slurry walls tied into the clay till and extraction wells to maintain an inward hydraulic gradient (a lower water level inside the cell than outside).

- The "hot spot" material is to be treated on-site in the manner discussed above, rather than transported off-site for disposal in a licensed PCB landfill. The on-site treatment eliminates the need for dewatering lagoons called for in the 1984 ROD.

The proposed remedy will greatly reduce existing risks to PCB exposure on OMC property and will improve the water quality of Waukegan Harbor. The 1988 remedy will result in at least an equivalent protection of public health and the environment as the 1948 ROD. The 1984 ROD determined that excavation and off-site disposal of hot spot areas was necessary to enhance the reliability of on-site containment. The proposed remedy expands the amount of material designated for removal and treatment by including all contaminated materials in excess of 500 ppm rather than the 1984 level of those in excess of 10,000 ppm.

The hot spot material, rather than being transported off-site for disposal in a licensed landfill, will be treated so that after startup, at least 97 percent of the PCBs will be removed and destroyed. The public will not be exposed to the risks involved in transporting large amounts of contaminated materials off-site. In addition, treatment of the PCBs in this manner is consistent with the goal of SARA to permanently reduce the toxicity, mobility, and volume of hazardous materials.

Placing low concentration materials from the Upper Harbor in the Slip 3 Containment Cell will provide an equivalent level of protection as the above-ground vault specified in the

1984 ROD. Containment in Slip 3 reduces the risks inherent in handling and transporting the contaminated materials and eliminates the use of on-site dewatering lagoons. This containment alternative was previously recommended by EPA but was withdrawn because of the economic impact on the harbor. The 1988 proposed remedy allows the advantages of this method while providing for the economic well-being of the businesses affected.

The containment cells actively prevent migration of PCBs through slurry walls by maintaining an inward hydraulic gradient through a system of extraction wells. The volume of sediments being placed into the cells is greater than in the 1984 remedy; however, the sediments will have been treated on-site and 97 percent of the PCBs extracted, thus reducing the volume of PCBs in the cells. In addition, the cells will be capped with a synthetic liner which will prohibit precipitation infiltrating from the outside. Samples will be taken at regular intervals from monitoring wells outside the walls of the cells to ensure that PCBs are not migrating into the surrounding soils and groundwater, thus safeguarding the public health and environment.

C.4 Remedial Alternatives

OMC evaluated two treatment technologies for hot spot sediments (greater than 10,000 ppm): (1) the TACIUK Process and (2) the BEST Process. The TACIUK Process is a thermal process based on recovering oil from oil shale and tar sands in Canada. The BEST Process is a chemical extraction process employing triethylamine (TEA) as a solvent. Both were deemed to be technologically equivalent, but the TACIUK Process was chosen because of lower cost. If the TACIUK Process fails to achieve the results, OMC will bear total responsibility and will have to implement an alternative (Nolan 1990).

There were additional reasons for rejecting the BEST Process. The EPA oversight contractor revealed that there were questions regarding the financial solvency of the vendors of the BEST technology. In addition, OMC was not convinced that the technology would work because there are no commercial systems currently operating with this technology. Control of solvent emissions in the air was a third major concern.

458-0973

STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone: (619) 265-5114

FACSIMILE TRANSMITTAL

TO

Fax Phone Number: Public Line (619) 458-0943

Name Bill Lester
Title/Section
Agency ERC
Agency Address
Telephone Number ( ) ATSS (8)

FROM

Fax Phone Number: Call Regional Board office for number

Date May 15 1990 Time Sent 11:40 AM
Sender David Barker
Title/Unit Senior Engineer

California Regional Water Quality Control Board
San Diego Region
9771 Clairemont Mesa Blvd., Suite B
San Diego, California 92124-1331

Telephone Number: (619) 265-5114 ATSS (8) 636-5114
Number of pages being transmitted (including transmittal sheet): 9
File Designation:
Special Instructions/Comments:

The new Ocean Plan standards and AET concentrations are on page 2 of the enclosed letter.

PLEASE NOTIFY THE FAX RECIPIENT IMMEDIATELY

NOTE: If you need assistance regarding this transmittal, please contact Kristin Wiard (name) at (619) 265-5114 or ATSS (8) 636-5114

8/89

TRANSMISSION REPORT

THIS DOCUMENT (REDUCED SAMPLE ABOVE) WAS SENT

** COUNT **
# 9

*** SEND ***

NO	REMOTE STATION I. D.	START TIME	DURATION	#PAGES	COMMENT
1	4580943 ++	5-15-90 11:38	5'27"	9	
		TOTAL	0:05'27"	9	

XEROX TELECOPIER 7020

File Driscoll

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone: (619) 265-5114

January 26, 1990

CERTIFIED MAIL - RETURN RECEIPT REQUESTED
P 954 098 903

Mr. Thompson Fetter, President
Kettenburg Marine Corporation
2810 Carleton Street
San Diego, California 92106

Dear Mr. Fetter:

REMEDIAL ACTION ALTERNATIVES ANALYSIS REPORT

As you know, on January 5, 1990 I issued Complaint No. 90-04 for Administrative Civil Liability to Kettenburg Marine Corporation for the failure to submit a complete Remedial Action Alternatives Analysis Report (RAAAR) by the June 30, 1989 due date specified in Cleanup and Abatement Order No. 88-78, as amended. As noted at length in Complaint No. 90-04, the report submitted on September 7, 1989, did not contain much of the information required under Directive 3 of the cleanup and abatement order. The purpose of this letter is to provide you with additional guidance on the information that will be needed to complete the required RAAAR. I am also requesting under the authority of Water Code Section 13267 that you submit, by February 2, 1990, a plan of study, including a time schedule, for completion of a RAAAR which addresses the factors described below.

As we discussed at our meeting on January 12, 1990, the Regional Board has sent copies of the RAAAR document to members of the San Diego Bay Technical Advisory Committee (SDBTAC) for their review and comment. SDBTAC was established by the Board in late 1987 to provide technical guidance to the Board on contamination investigations in San Diego Bay. Through the early interaction of the various environmental and health agencies which are represented on SDBTAC, the Board anticipates that there will be greater agreement and support for the individual cleanup strategies which are ultimately approved by the Board. The advisory committee completed review of your September 7 report in December 1989. A copy of a letter from the United States Fish and Wildlife Service, an agency member of the advisory committee, regarding the report, is enclosed.

You should be aware that California Ocean Plan was revised in 1988. The water quality objectives for both copper and mercury are both more stringent in the revised plan. The new objectives are as follows:

Constituent	Water Quality Objective *		
	6-Month Median	Daily Maximum	Instantaneous Maximum
Copper	3 ug/l	12 ug/l	30 ug/l
Mercury	0.04 ug/l	0.16 ug/l	0.40 ug/l

* Unless the Board is presented with conclusive evidence to support different objectives for the interstitial water found in bottom sediments, these objectives are considered to apply to all waters of San Diego Bay, including such interstitial waters.

You should also be aware that the Apparent Effects Threshold (AET) concentrations which were calculated for mercury and copper levels within Puget Sound sediments have been changed to the following values:

Constituent	Apparent Effects Threshold (normalized to dry weight)		
	Amphipod AET	Oyster AET	Benthic AET
Copper	1300 mg/Kg	390 mg/Kg	530 mg/Kg
Mercury	2.1 mg/Kg	0.59 mg/Kg	2.1 mg/Kg

To be conservative, the most stringent AET values should be used for remediation analyses (390 mg/Kg for copper and 0.59 mg/Kg for mercury. When evaluating the remediation alternatives which are required to provide a complete RAAAR, please use the above values for both the Ocean Plan water quality objectives and the AETs derived from Puget Sound. Please continue to use the 6 ng/l water quality objective for tributyltin in your remediation evaluations.

Our specific comments on the RAAAR document, which should aid you in producing a more complete and scientifically defensible report, in compliance with Cleanup and Abatement Order No. 88-79, as amended, are summarized below:

(1) On page 2, the report states that the distribution of mercury and tributyltin (TBT) was estimated using "linear regression correlation coefficients". When viewing the accompanying figures, provided in Appendix B of the report, it is impossible to determine which data are real and which are estimated. The correlation documentation presented in the appendix suggests that copper-TBT and copper-mercury are highly correlated ($r = .84$ and $.75$ respectively, $df = 13$, $p = <.01$). However, it is not the correlation coefficient that is used to provide estimates of TBT and mercury from non-analyzed samples but rather the linear regression equation. And these are never provided. The report should be appropriately expanded to include the full documentation of the calculations which were performed, including the linear regression equation.

(2) On page 4, the report states: "After reviewing data concerning the technical merits of the various remedial approaches, the current level of understanding for each, and relative costs, it was determined that the only two viable approaches for Commercial Basin sediments are: 1) Dredging, using the most appropriate method of excavation, followed by disposal of dredge spoils (without treatment), and 2) Leaving the sediments in place." The report does not provide any documentation demonstrating that other cleanup alternatives in addition to dredging and no action are precluded. The report should be expanded to include a thorough description of the review process which was used to evaluate the various remedial approaches. The report should include the estimated costs of the various approaches which were considered, as well as their environmental effects.

(3) On page 6, interstitial water samples are reported to have been collected and analyzed. Apparently only free standing water at the top of the sediment cores was sampled, and interpreted to represent interstitial water. We do not agree that this is interstitial water. A standardized elutriate test such as the one used by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers would be appropriate. For in-situ sampling, a syringe can be inserted into the sediment, the pore water withdrawn, filtered to remove all entrained particulates, and analyzed. Discussion of interstitial water

concentrations of any of the contaminants is inappropriate until true interstitial water has been collected and analyzed. I noted, however, that the concentration of copper within the free standing water at the top of 13 of the 15 sediment cores is in excess of the 3 ug/l standard prescribed within the enclosed 1988 Ocean Plan. It is likely that the concentration of copper and other contaminants which is contained within the actual interstitial water is at least as high as that found within the standing water of the collected sample cores. Although required under the cleanup and abatement order, no data is presented within the report on the concentration of tributyltin which is present within interstitial waters.

The report should be expanded to include a complete description of the methods used to collect and analyze interstitial water. Contaminant concentrations found within the interstitial water should be compared to the total recoverable contaminant concentrations found in the sediment. The sediment concentrations of copper, mercury, and tributyltin which will not cause interstitial water concentrations to exceed the numerical water quality objectives previously discussed, should be identified within the RAAAR. Calculations of sediment volumes and cleanup costs should be made and reported from these values.

(4) On page 7, the RAAAR proposes an action threshold of 800 mg/kg of copper to protect the beneficial uses of Commercial Basin. As required by the cleanup and abatement order, documentation is needed to show how cleanup to a copper level of 800 mg/kg, and the corresponding levels of mercury and tributyltin, would serve to protect the beneficial uses of Commercial Basin and not cause water quality standards contained in the enclosed 1988 Ocean Plan and other prescribed policies to be exceeded.

There are two federally listed endangered species, the California least tern (Sterna antillarum browni) and the brown pelican (Pelecanus occidentalis). which may be affected by contaminated sediment in the commercial boat basin. There are three colonies of least terns in proximity to the basin which could very likely be feeding there at certain times of the year. Brown pelicans which breed mostly in Mexico disperse between July and November to the southern California coast, including San Diego Bay and the Commercial Boat Basin.

The discussion of the 800 mg/Kg alternative did not address bioaccumulation and/or biomagnification of contaminants through the food chain and the potential adverse effects on the marine habitat, saline habitat, preservation of rare and endangered species, and shellfish harvesting beneficial uses of San Diego Bay. Through the processes of bioaccumulation and biomagnification, contaminants can be transferred from sediment into benthic and epibenthic infauna which are consumed by fish which in turn are consumed by birds. Each transfer between trophic levels can magnify the contaminant concentration until they become toxic. For example the fact that mercury, which can concentrate over 40,000 times in oysters and thus can cause biomagnification through the food chain, is well documented in the literature.

(5) On page 8, the document states that the distribution of copper, mercury, and tributyltin within bottom sediments may not be related to boat repair facility discharges, as described in the Regional Board's Cleanup and Abatement Orders for these facilities. Instead, the document states that ". . . the distribution patterns can also be explained by normal hydrology and sediment deposition phenomena of Commercial Basin." A competent hydraulic oceanographer or sedimentologist should be consulted to substantiate or refute this hypothesis. Documentation of sediment grain size distribution, current patterns, and other parameters, are needed in order to provide support for the theory that the distribution of the three elevated trace metals simply reflects natural deposition patterns.

Grain size analyses were not discussed in the report. Such data could help define the natural deposition patterns in Commercial Basin. In the absence of such data, Regional Board staff has conducted a cursory review of the Phase II core descriptions (shown in Figures A-2 through A-17 of the Phase II Report). These descriptive records do not provide support for the theory that the metal distribution is simply related to natural deposition. As an example, the upper 2 1/2 feet of sediment found at the central channel station, near the mouth of Commercial Basin, (core station VS-6-R4), was characterized as "Brown, micaceous, silty fine sand". In spite of the fine nature of this sediment, the concentration of metals in the upper one foot was found to be quite low. The concentration of copper, mercury, and tributyltin are reported as 128 mg/Kg, 2.8 mg/Kg, and 0.15 mg/Kg, respectfully. Near the boatyards, the sediment ranged from silty fine sand to "medium to coarse sand". The metal concentrations found in the core which was characterized as "medium to coarse sand", were 2260 mg/Kg, 10.3 mg/Kg, and 10 mg/Kg, for copper, mercury, and tributyltin, respectively. These and other core data appear to contradict the theory that high metal concentrations are simply related to fine grain sediments, and that the distribution of such fine grain sediments occurs along the shoreline, - not in the central portion of Commercial Basin.

(6) On page 9 of the document, there is a general description of the behavior of copper, mercury, and tributyltin under different environmental conditions. Reference should be made to the specific conditions which exist in Commercial Basin, and how these conditions are affecting the biological availability of the metals. Documentation should be provided to support any such conclusions. The availability of sediment-associated metals to marine biota depends upon the physical and chemical nature of the sediment and water at the locale in question. Information on particle size, pH, redox potential, presence of chelating agents, and total organic carbon are needed to assess the biological availability of metal contamination in Commercial Basin.

The Regional Board will consider site-specific data on the biological availability of the metal contaminants in determining cleanup levels in Commercial Basin. In order to better evaluate this situation we recommend that:

a) Some limited sediment toxicity test should be performed (either whole sediment or elutriate tests) for use to define cleanup standards in addition to chemical criteria.

b) A limited bioaccumulation study should be conducted using benthic invertebrates and resident fish (including a forage fish) to determine if contaminants are bioavailable and if they are being transferred through the food chain. We would suggest analyzing 5 composite of two species of fish and two species of invertebrates. The fish sample should include one forage species like the topsmelt (Atherinoos affinis) which is fed on by the California least tern and one predator species.

c) Using information from item (b), a simple risk assessment should be performed to evaluate if any beneficial uses of San Diego Bay are being adversely affected by the presence of contaminants within Commercial Basin, and if so, what cleanup level would be expected to protect the beneficial uses.

(7) On page 11, sediment deposition and transport mechanisms are again referenced to explain the distribution of metals within Commercial Basin. Documentation of how these mechanisms actually operate in Commercial Basin should be provided in the report. Again, a competent hydraulic oceanographer or sedimentologist should be consulted to provide supporting technical information.

(8) The general description of "Natural Remedial Processes", on page 11, seems inappropriate. Unless the San Diego Port Authority and the boatyards surrounding Commercial Basin are willing to permanently refrain from maintenance dredging, and allow the basin to gradually fill with sediment, the natural capping that such sedimentation could provide is irrelevant.

Technical information demonstrating that leaving the sediments in place would protect the beneficial uses of San Diego Bay and would not cause water quality objectives for copper, mercury, and tributyltin contained in the Ocean Plan and other State Board policies to be exceeded in San Diego Bay waters will need to be submitted to support consideration of a natural capping remediation alternative. The natural capping process proposed relies on sedimentation and action of benthic biota in transferring contaminated sediments to deeper levels. The report is silent on how long this process might take or what the effects on the waters of San Diego Bay might be until capping has been achieved. Although capping by sedimentation may be a viable alternative in some portions of San Diego Bay, sediment resuspension due to prop wash and the need to do maintenance dredging in the Commercial Basin portion of San Diego Bay limits the viability of this option.

(9) On page 11, the document states: "The process of transferring surface sediments to deeper layers can be accelerated by the benthic biota (7).. The report should provide a discussion of this process and how it can be expected to affect the sediments of Commercial Basin. Similarly, the report should evaluate the potential for benthic organisms to assimilate sediment contaminants and incorporate them into the food chain. Deposit feeding worms and clams can easily burrow down to 10 cm and beyond where they rework sediment and either incorporate contaminants within their tissue or excrete the contaminated sediment. Because of the great potential for biomagnification, it is critical that transport mechanisms be evaluated for mercury.

(10) Many of the conclusions and recommendations which are provided on pages 11 through 13 of the report, are not sufficiently supported by technical documentation. As noted earlier in this letter, the concentration of metals which is contained within true interstitial water is not known. Also, interstitial water may not be the primary means by which benthic biota assimilate the contaminants. As noted earlier, conclusions based on natural sediment burial

processes or basin hydrology are inappropriate unless these processes are first clearly defined for Commercial Basin.

(11) On page 13, the report states: "The number of unresolved issues surrounding Commercial Basin remediation and the lack of evidence of significant environmental impact due to the constituents studied indicate that Alternative (E) # No Disturbance of Sediments is the appropriate selection. Alternative (E) will not result in any negative environmental effects or limitations on the beneficial uses of Commercial Basin." The report should name the "unresolved issues". The report should also provide evidence to support the conclusion that no negative environmental effects or limitations will be realized by selecting Alternative (E).

I believe that the data which has been collected to date, under the directives of the cleanup and abatement order, supports the Regional Board's original conclusions that elevated levels of copper, mercury, and tributyltin within Commercial Basin sediments are primarily the result of discharges from the boatyard facilities surrounding the basin. Unless sound scientific data is provided to show that these metals are not adversely affecting the beneficial uses of San Diego Bay, it must be assumed that such adverse affects may be occurring.

If you have any questions regarding this matter please contact me or Mr. Greig Peters of my staff, at (619) 265-5114.

Very truly yours,

David T Barker for

LADIN H. DELANEY
Executive Officer

Enclosures

db/gp

cc: Mr. Allen D. Haynie
Latham and Watkins
Attorneys at Law
701 B St, Suite 2100
San Diego, CA 92101

Mr. Don Nay
General Manager
San Diego Unified Port District
P.O. Box 488
San Diego, CA 92112

5510 Morehouse Drive
San Diego, California 92121
Telephone: 619-458-9044
Fax: 619-458-0943

ERC
Environmental and Energy Services Co.

90-150-330
May 7, 1990

Mr. David Barker
Regional Water Quality Control Board
9771 Clairemont Mesa Blvd., Suite B
San Diego, CA 92124

Subject: Amendment to Schedule for Driscoll Custom Boats Cleanup and Abatement Order No. 89-31 for Submittal of Remedial Action Alternatives Analysis Report (RAAAR)

Dear David:

I am writing this letter to document our recent phone conversations regarding an amendment to the Cleanup and Abatement Order schedule for Driscoll Custom Boats. Based on this conversation it is my understanding that the Driscoll report will be submitted on June 1, 1990, which is the same schedule imposed on other boatyards prepraring similar reports. If you have any questions regarding this modification in the schedule, please contact me.

Sincerely,

William C. Lester
Senior Scientist

WL/ks

cc: Tom Driscoll - Driscoll Custom Boats
Steve McDonald - Luce, Forward, Hamilton & Scripps
Jan Driscoll - Gray, Cary, Ames & Frye
39103006

5510 Morehouse Drive
San Diego, California 92121
Telephone: 619-458-9044
Fax: 619-458-0943

ERC
Environmental and Energy Services Co.

90-151-330
May 7, 1990

Mr. David Barker
Regional Water Quality Control Board
9771 Clairemont Mesa Blvd., Suite B
San Diego, CA 92124

Subject: Amendment to Schedule for Paco Terminals Progress Report No. 9 Under Cleanup and Abatement Order 85-91, and Report No. 5 Under the Administrative Civil Liability Complaint

Dear David:

I am writing this letter to document our recent phone conversation regarding the revised due dates for the subject documents. Based on our conversation the new due date for each progress report will be May 15, 1990. If you have any questions regarding this modification in the schedule please contact me.

Sincerely,

William C. Lester
Senior Scientist

WL/ks

cc: John Lormon - Gray, Cary, Ames & Frye
35146001

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone: (619) 265-5114

April 27, 1990

Certified Mail - Return Receipt Requested
P 453 806 133

Mr. Thomas Driscoll
Driscoll Custom Boats
2438 Shelter Island Drive
San Diego, California 92106-3185

Dear Mr. Driscoll:

RE: MONITORING AND REPORTING PROGRAM -- DRISCOLL CUSTOM BOATS

The enclosed Monitoring and Reporting Program is a draft of the document which I will recommend be signed/issued by our Executive Officer on May 11, 1990. The program is being issued under the authority of the California Water Code, Sections 13267 and 13383.

The Monitoring and Reporting Program, which will be effective immediately upon issuance, shall consist of semiannual sediment monitoring and reporting requirements. As cited throughout the program, the first monitoring results were to be submitted to the Regional Board no later than June 30, 1990. Please note however that the June 30, 1990 date has been temporarily suspended and that you will be notified of the new due date in a future letter. The suspension applies to the 1990 reporting schedule only. Also enclosed with the monitoring program is a letter dated March 12, 1990 addressing recent inquiries.

You should be aware that all monitoring reports shall be submitted under penalty of perjury in accordance with the Monitoring Report Schedule in Section I of this monitoring program. Any person failing or refusing to furnish information required under the Monitoring and Reporting Program or falsifying any information provided therein may be held liable civilly under Water Code Section 13323 and 13385. Civil liability may be imposed administratively by the Regional Board under Water Code Section 13385 for monitoring and reporting violations in an amount up to $10,000 for each day in which the violation occurs.

Draft monit

If you have further questions or comments about the program, please give me a call at (619) 265-5114 prior to May 7th.

Sincerely,

Deborah S. Jayne

Deborah S. Jayne
Environmental Specialist

Enc: Monitoring and Reporting Program
Attachment A
March 12, 1990 letter

cc: Mr. Karl Lytz, Latham & Watkins
Mr. Don Nay, San Diego Unified Port District
Mr. Jay Powell, Environmental Health Coalition
Mr. Lyn Haumschilt, National Steel & Shipbuilding Company
Ms. Jan Driscoll, Attorney at Law

re: TCO-LTR.DCB

TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

MONITORING AND REPORTING PROGRAM

DRISCOLL CUSTOM BOATS

SAN DIEGO COUNTY

The following shall constitute the Monitoring and Reporting Program for Driscoll Custom Boats:

A. **MONITORING PROVISIONS**

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. All samples shall be taken at the monitoring points specified in this Monitoring and Reporting Program. Monitoring points shall not be changed without notification to, and the approval of, the Executive Officer.

2. Monitoring must be conducted according to appropriate United States Environmental Protection Agency test procedures approved under:

   Title 40, Code of Federal Regulations (CFR), Part 136, "Guidelines Establishing Test Procedures for Analysis of Pollutants Under the Clean Water Act" as amended; or

   EPA Region 9 General Requirements For Sediment Testing of Dredged Material Proposed For Ocean Dumping (August 1989 or as amended); or

   Solid Wastes (SW) 846, "Test Methods for Evaluation of Solid Waste" as amended; or

   EPA 430/9-86-004. March 1987. "Quality Assurance/ Quality Control for 301(h) Monitoring Programs: Guidance on Field and Laboratory Methods", Tetra Tech; or

   EPA 430/9-82-010. November 1982. "Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters", Contract Number 68-01-5906,

   unless other test procedures have been specified in this Monitoring and Reporting Program or have been approved by the Executive Officer. These documents cover sample containers and container preparation, decontamination, preservation, storage, transport, holding times, laboratory methodologies, limits of detection, laboratory certifications, and quality assurance protocols, etc. The last two documents contain detailed field protocol for station positioning and sample collection.

3. All analyses shall be performed in a laboratory certified to perform such analyses by the California Department of Health Services or a laboratory approved by the Executive Officer.

4. If the discharger monitors any pollutants more frequently than required by this Monitoring and Reporting Program, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the discharger's Discharge Monitoring Report. The increased frequency of monitoring shall also be reported.

5. The discharger shall retain records of all monitoring information including all raw data sheets, field notes, sample logs, all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Monitoring and Reporting Program, and records of all data used to complete the application for an NPDES permit. Records shall be maintained for a minimum of five years from the date of the sample, measurement, report, or application. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Regional Board Executive Officer or the United States Environmental Protection Agency.

6. All monitoring instruments and devices used by the discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary to ensure their continued accuracy.

7. Records of monitoring information shall include:
   a. The date, exact place, and time of sampling or measurements;

b. the individual(s) who performed the sampling or measurements;
c. the date(s) analyses were performed;
d. the individual(s) who performed analyses;
e. the analytical techniques or methods used; and
f. the results of such analyses.

8. The discharger shall report any instances of noncompliance with state or federal law which may endanger health or environment. Any information shall be provided orally to the Executive Officer within 24 hours from the time the discharger becomes aware of the circumstances. A written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate and prevent recurrence of the noncompliance. The Executive Officer or an authorized representative may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

9. All applications, Discharge Monitoring Reports, or other information submitted to the Executive Officer of this Regional Board shall be signed and certified.

   a. The Report of Waste Discharge (permit application) shall be signed as follows:

      1. **For a corporation** - by a principal executive officer of at least the level of vice-President;

      2. **For a partnership or sole proprietorship** - by a general partner or the proprietor, respectively;

      3. **For a municipality, state, federal or other public agency** - by either a principal executive officer or ranking elected official; and

      4. **For a military installation** - by the base commander or the person with overall responsibility for environmental matters in that branch of the military.

b. All Discharge Monitoring Reports and any other information required by this Monitoring and Reporting Program or by the Executive Officer shall be signed by a person designated in paragraph (a) of this provision, or by a duly authorized representative of that person. An individual is a duly authorized representative only if:

1. The authorization is made in writing by a person described in paragraph (a) of this provision;

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity; and

3. The written authorization is submitted to the Executive Officer.

c. Any person signing a document required by this Monitoring and Reporting Program or by the Executive Officer shall make the following certification:

> "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

10. The discharger shall provide Regional Board staff with a written sampling schedule at least 5 working days in advance of each proposed sampling date to enable staff to observe sampling activities.

11. Upon request, the discharger shall provide the Regional Board with splits from any monitoring sample.

B. **MONITORING PROGRAM OVERVIEW**

The monitoring program for Driscoll Custom Boats shall consist of two major components:

1. Semiannual collection and analysis of surficial sediment samples; and

2. Annual completion of the Chemical Utilization Audit form (see Attachment A) and other reporting requirements.

Chemical Utilization Audit

The sampling stations and analytical parameters in this monitoring program are based on the Regional Board's current knowledge of Driscoll Custom Boats' business operations.

The purpose of the Chemical Utilization Audit is to summarize Driscoll's actual use of hazardous materials and wastes generated. This information will be used to further tailor the sediment monitoring program to specifically address Driscoll's operations and to update the program as new technology (chemicals, procedures, and equipment) replaces old.

C. **SURFICIAL SEDIMENT SAMPLES -- COLLECTION**

1. The sediment sampling program for Driscoll Custom Boats shall consist entirely of surficial sediment samples.

2. One sample shall be collected from each designated station on a semiannual basis.

3. Each sample shall consist of three replicates (jars of sediment) to be composited in the laboratory prior to analysis.

Samples shall not be discarded after analysis. All samples shall be frozen and retained for a period of no less than 45 days from the date on which Regional Board staff received the corresponding analysis results. At that time, staff shall be notified before the samples are discarded.

4. The surficial sediment samples shall be collected by grab or by divers. Once chosen however, the collection technique shall not be changed in upcoming years.

   Grab samples shall be taken with a 0.1 m^2 modified van Veen sampler (also known as chain rigged van Veen) or an Ekman dredge. The subsample to be analyzed, shall be taken from the top 2-3 inches of undisturbed grab sample. Detailed field protocol is provided in EPA's guidance documents 430/9-86-004 and 430/9-82-010 cited above.

   If the samples are to be diver-collected, jar lids shall be loosened on the surface but not opened. Once on the bottom, the jars shall be opened, used to skim the top 2-3 inches of sediment and closed. They shall not be opened again in the field. (During descent, the divers can stop momentarily to crack the jar lids open slightly. This will prevent the teflon liners from being pushed to the bottom of the jars upon opening.)

   In some instances, the divers may encounter areas which appear to be "bottomless" due to the fine silt composition of the top layer. In these areas, the sample shall be taken from the location where the diver first feels resistance due to compacting of the sediment. Protective gloves shall be worn to prevent sample contamination during collection (grab or diver).

5. <u>Sample Collection Plan</u>

   Samples shall be collected in accordance with a detailed Sample Collection Plan which has been approved by the Executive Officer prior to sampling. The plan shall address all collection protocol including station positioning method, sampling equipment, containers, preservation, transportation, etc.

Upon approval by the Regional Board Executive Officer, the Sample Collection Plan shall be followed for the collection of all data required under this monitoring program. Any proposed future changes to the Sample Collection Plan shall be submitted to the Executive Officer for review no later than February 15 of the year in which the changes are proposed to take effect.

6. Surficial sediment samples shall be collected from all stations specified in Table D below. Each sample shall be analyzed for the parameters and to the detection limits indicated in Tables D and E. The results shall be reported according to the schedule in Table I.

D. SEDIMENT MONITORING STATIONS AND ANALYSES

All sediments samples shall be collected and analyzed on a semiannual basis as specified in Table D below.

TABLE D

STATIONS AND ANALYSES

STATION ID	MERCATOR COORDINATES (feet) Easting	Northing	ANALYSIS TYPE Indicators Only[1]
DCB-01[2]	1700265	202675	X
DCB-02[3]	1700230	202700	X
DCB-03[4]	1700215	202715	X
DCB-04[5]	1700220	202735	X
DCB-05[6]	1700180	202740	X
DCB-06[6]	1700195	202765	X
DCB-07	1700240	202795	X
DCB-08[7]	1700150	202875	X
DCB-09	1699960	203075	X
STD-DCB-01[8]	1699880	202950	X
REF-01[9]	1727166	174167	X
REF-02[9]	1719833	190900	X
REF-03[9]	1715333	203833	X
TOTAL			13

TABLE D FOOTNOTES:

1. Indicators Only Analysis

Copper
Tributyltin (TBT)

2. Station DCB-01 is adjacent to the black PVC drain pipe located high under the embankment.

3. Station DCB-02 is located below the crane.

4. Station DCB-03 is located between the travel lift piers, mid-width.

5. Station DCB-04 is adjacent to the travel lift pier closest to the closed end of Commercial Basin and is approximately 25 feet from shore.

6. Stations DCB-05 and DCB-06 are located at the old marine railway.

7. Station DCB-08 is located below the High Seas Fuel Dock approximately 100 feet from shore (on the side of the dock closest to the mouth of Commercial Basin).

8. Station STD-DCB-01 is at the mouth of the city storm drain which is located at the base of Driscoll's work dock (the dock subleased for boat repair).

9. <u>Remote Reference Stations</u>

   The three remote reference stations are common to the monitoring programs of all shipyard and boatyard facilities in San Diego Bay. Driscoll Custom Boats may fulfill its sampling requirements for the remote reference stations by submitting results from samples collected at these stations by other entities during the sampling/reporting period.

E. ANALYSIS PARAMETERS AND DETECTION LIMITS

Sample analyses shall be conducted using approved laboratory methods capable of meeting the detection limits shown in Table E below and as referenced in Monitoring Provision A.2 of this Monitoring and Reporting Program.

Copper and tributyltin are the only parameters required for the "Indicators Only" analysis.

TABLE E

DETECTION LIMITS

PARAMETER	DETECTION LIMIT	FREQUENCY
Copper	0.1 mg/kg	semiannual
Tributyltin (TBT)[1]	1.0 ug/kg	semiannual

TABLE E FOOTNOTES:

1. Tributyltin (TBT)

   Concentrations of tributyltin shall be analyzed using protocol approved by the Executive Officer or as described in:

   Stephenson, M.D., and D.R. Smith. 1988. Determination of Tributyltin in Tissues and Sediments by Graphite Furnace Atomic Absorption Spectrometry. Analytical Chemistry, Vol.60, No. 7. pp 696-698; or

Stallard, M.O., and S.Y. Cola. 1989. Optimization of Butyltin Measurements for Seawater, Tissue, and Marine Sediment Samples. Applied Organometallic Chemistry 3:105-114; or

Unger, M.A. et al. 1986. GC Determination of Butyltin in Natural Waters by Flame Photometric Detection of Hexyl Derivatives with Mass Spectrometric Confirmation. Chemosphere, Volume 15, Number 4. pp 461.

2. <u>Total Organic Carbon (TOC)</u>

Although not initially required, composited sediment from each sample shall be retained for the possible future conduct of Total Organic Carbon analysis. All samples shall be frozen and retained for a period of no less than 45 days from the date on which Regional Board staff received the corresponding analysis results. At that time, staff shall be notified before the samples are discarded.

F. MONITORING RESULTS AND REPORTS

1. Discharge Monitoring Reports

Monitoring results must be reported on Discharge Monitoring Report forms or other media approved or provided by the Executive Officer. The Executive Officer may, in the future, require the input of monitoring data into a computerized data base.

Each Discharge Monitoring Report shall contain all required sampling results in tabular and graphic presentations. All concentrations shall be reported in both dry and wet weights. The tabular form shall provide current, as well as all historical monitoring program data. The first Discharge Monitoring Report shall be submitted no later than June 30, 1990 and semiannually thereafter. (See general note last page.)

2. Station Maps

Graphic presentation of results shall consist of a station map for each monitored contaminant indicating concentration gradient contours or the measured concentration at each station. The map shall be 17"x11" in size and drawn to a scale of 1"=100' or 1"=50'. The map shall show both Mercator coordinates and the California 10,000 foot grid. The map shall show only pertinent details such as structures, storm drains, work areas, and sampling stations. A mylar master is recommended, photocopies may be submitted. The first station maps with sample results are due June 30, 1990 and semiannually thereafter as part of the Discharge Monitoring Report. (See general note last page.)

3. Chemical Utilization Audit

Once each year the Discharge Monitoring Report shall also include a completed Chemical Utilization Audit form (see Attachment A) as described in Section B of this Monitoring and Reporting Program. The form shall be signed by a responsible company official as designated in Monitoring Provision A.9. The first Chemical Utilization Audit is due June 30, 1990. (See general note last page.)

The first Chemical Utilization Audit report (June 30, 1990) must, as a minimum, cover only the months of November and December 1989 and need only be based on information which is readily available to the discharger as the result of other chemical reporting requirements. All subsequent Chemical Utilization Audit Reports (beginning with the June 30, 1991 report) must contain all required information.

4. Trend Curves And Statistical Analyses

Commencing at the end of the second monitoring year, the discharger shall develop and submit "trend curves" for each monitored constituent, in which concentrations are plotted as a function of time. The discharger shall also determine if a statistically significant change (increase or decrease) in sediment concentrations has occurred over time for each contaminant, relative to reference concentrations.

In making this determination, the discharger shall employ Cochran's Approximation to the Behrens-Fisher Students' T-Test as described in 40 CFR Part 264, Appendix IV, or another statistical procedure approved or directed by the Regional Board Executive Officer.

In all cases, the discharger shall report as soon as possible the cause(s) of any increase in contaminant concentrations, if they are known.

Monitoring results shall be compared against the following three sets of reference data:

1. Driscoll's own historical baseline data;

2. concentrations at the three remote reference sites; and

3. concentrations measured at the city storm drain, station STD-DCB-01.

The first trend curves and statistical analyses shall be submitted as part of the June 30, 1992 Discharge Monitoring Report and then annually thereafter.

5. <u>Program Evaluations</u>

Monitoring data, the Chemical Utilization Audit, trend curves, and the statistical analyses will be reviewed periodically and used to evaluate the effectiveness of the monitoring program. Staff will recommend program modifications to the Board as appropriate.

If, for example, a statistically significant increase in contaminant concentrations has not been shown during the first five reporting periods, the Regional Board may consider reducing the sampling frequency from semiannual to annual and/or reducing the number of constituents to be analyzed. Parameters, such as sampling frequency and/or the number of constituents, may also be increased if a statistically significant increase in contaminant concentrations has been shown.

If appropriate, effluent limits and effluent monitoring requirements may be added to this Monitoring and Reporting Program. Sediment quality criteria may also be added as it becomes available.

G. **BEST MANAGEMENT PRACTICES COMPLIANCE CERTIFICATION**

The discharger shall complete a report certifying either compliance or noncompliance with all conditions of the Best Management Practices Plan during each month. The reports shall be signed by a responsible company official as designated in Monitoring Provision A.9. Although completed monthly, the BMP Compliance Certification Reports need only be submitted to the Executive Officer semiannually.

H. **WASTE HAULING LOG**

The discharger shall submit a Waste Hauling Log showing the volume, type, disposition, and date of disposal for all wastes originating from yard operations. The log shall be signed by a responsible company official as designated in Monitoring Provision A.9 and shall be submitted to the Executive Officer semiannually.

I. MONITORING REPORT SCHEDULE

Monitoring reports shall be submitted to the Executive Officer in accordance with the schedule in Table I below.[1]

The first Discharge Monitoring Report including station maps shall be submitted no later than June 30, 1990 and semiannually thereafter. (See general note last page.)

The first Chemical Utilization Audit is due June 30, 1990. (See Sections B, F, and general note last page.)

The first trend curves and statistical analyses are due June 30, 1992.

TABLE I

MONITORING REPORT SCHEDULE

REPORT	REPORT FREQUENCY	SAMPLING/REPORTING PERIOD	REPORT DUE[2]
Discharge Monitoring Reports	Semiannual	December 1 - May 30 June 1 - November 30	June 30 Dec 30
Station Maps	Semiannual	December 1 - May 30 June 1 - November 30	June 30 Dec 30
Chemical Utilization Audit	Annual	Jan 1 - December 30	June 30
Trend Curves/ Statistical Analysis	Annual	June 1 - May 30	June 30
BMP Compliance Certification[3]	Semiannual	December 1 - May 30 June 1 - November 30	June 30 Dec 30
Waste Hauling Log[3]	Semiannual	December 1 - May 30 June 1 - November 30	June 30 Dec 30

TABLE I FOOTNOTES:

1. The same monitoring schedule will apply to all of the ship and boatyard repair facilities in the San Diego Region allowing the use of common reference stations, common Sample Collection Plans, and common consultants, etc.

2. See general note below.

3. Although submitted semiannually, the BMP Compliance Certification and the Waste Hauling Log must be completed more frequently (see Sections G and H for frequency).

Ordered by: ______________________

Arthur L. Coe
Acting Executive Officer

Dated : ______________________

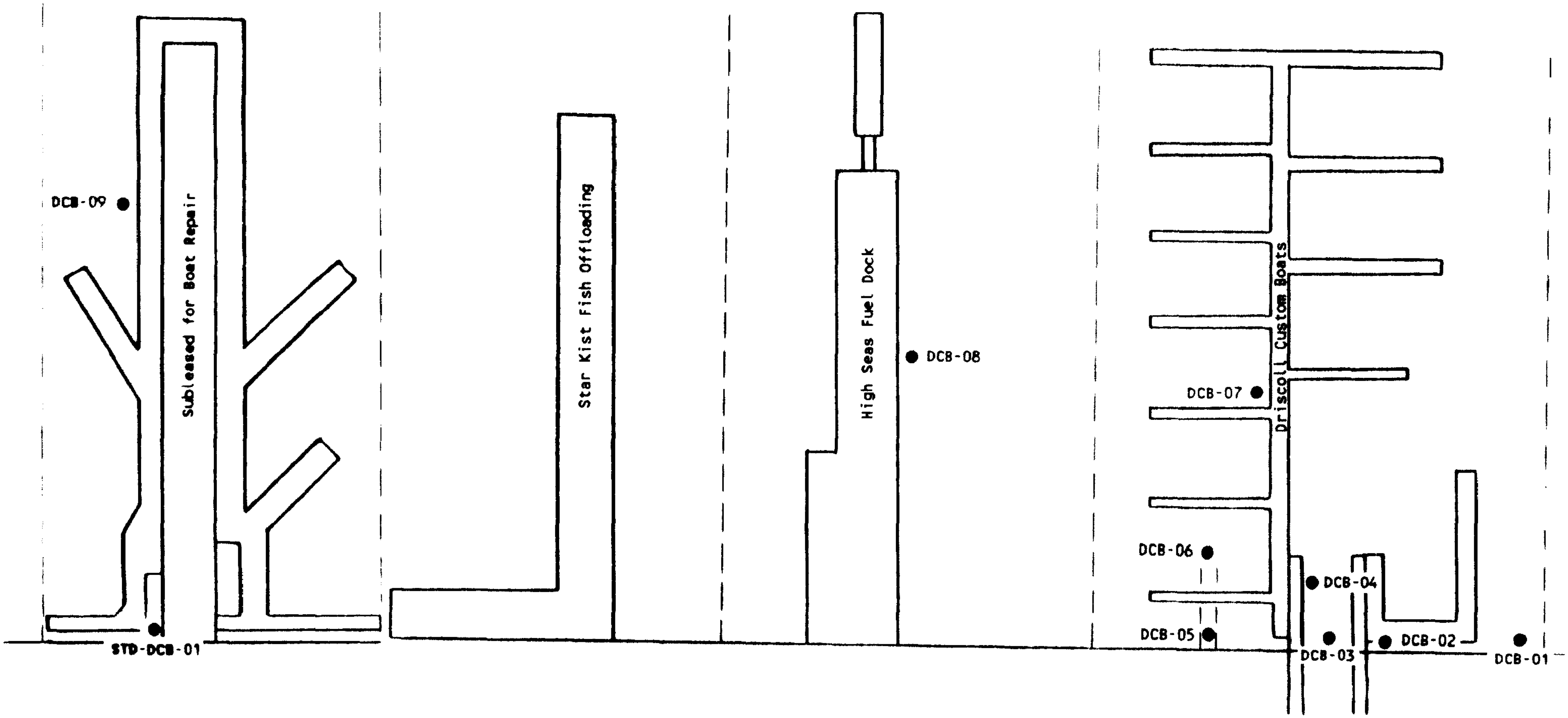
GENERAL NOTE:

THE JUNE 30, 1990 DEADLINE FOR SUBMISSION OF THE FIRST DISCHARGE MONITORING REPORTS AND OTHER REQUIRED INFORMATION HAS BEEN TEMPORARILY SUSPENDED. THE NEW DUE DATE WILL BE SPECIFIED IN A FUTURE LETTER. PLEASE NOTE THAT THE SUSPENSION APPLIES TO THE 1990 REPORTING SCHEDULE ONLY.

re: TCO.DCB

ATTACHMENT A

DRISCOLL CUSTOM BOATS



DRAFT MONITOR REPORT - Driscoll Custom Boats

PS Form 3800, June 1985 U.S.G.P.O. 1989-234-555

CERTIFIED MAIL

P 453 806 133

P 453 806 133

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL
(See Reverse)

Sent to	Mr. Thomas Driscoll
Street and No.	
P.O. State and ZIP Code	Driscoll Custom Boats
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date	

Is your RETURN ADDRESS completed on the reverse side?

● **SENDER:** Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.
1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)* 2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:	4. Article Number
Mr. Thomas Driscoll Driscoll Custom Boats 2438 Shelter Island Drive San Diego CA 92106	P 453 806 133 Type of Service: ☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail ☐ Return Receipt for Merchandise Always obtain signature of addressee or agent and DATE DELIVERED.
5. Signature — Addressee X	8. Addressee's Address *(ONLY if requested and fee paid)*
6. Signature — Agent X	
7. Date of Delivery	

PS Form **3811**, Apr. 1989 **DOMESTIC RETURN RECEIPT**

Thank you for using Return Receipt Service.

Draft monit program

● SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this car from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.
1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*   2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to: Mr. Thomas Driscoll Driscoll Custom Boats 2438 Shelter Island Drive San Diego CA 92106	4. Article Number P 453 806 133 Type of Service: ☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail ☐ Return Receipt for Merchandise Always obtain signature of addressee or agent and DATE DELIVERED.
5. Signature — Addressee X	8. Addressee's Address (ONLY if requested and fee paid) Driscoll Draft monitors program
6. Signature — Agent X M V Driscoll	
7. Date of Delivery 4/30/91	

PS Form 3811, Apr. 1989 DOMESTIC RETURN RECEI

P 453 806 133

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL
(See Reverse)

Sent to Mr. Thomas Driscoll	
Street and No Driscoll Custom Boats	
P.O., State and ZIP Code	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date 4-27-90	

PS Form 3800, June 1985 U.S.G.P.O. 1989-234-555

DRAFT MONITOR REPORT - Driscoll Custom Boats

REMEDIAL ACTION ALTERNATIVES ANALYSIS REPORT

DRISCOLL CUSTOM BOATS, COMMERCIAL BASIN, SAN DIEGO, CALIFORNIA

Volume 1 - Technical Report

Submitted to:

California Regional Water Quality Control Board
San Diego Region

Submitted by

Driscoll Custom Boats
2438 Shelter Island Drive
San Diego, California 92106

Original Submittal - June 1, 1990
Amended Submittal - October 17, 1990

ERCE

REMEDIAL ACTION ALTERNATIVES ANALYSIS REPORT

DRISCOLL CUSTOM BOATS, COMMERCIAL BASIN,
SAN DIEGO, CALIFORNIA

Volume 1 - Technical Report

Prepared for:

Driscoll Custom Boats
2438 Shelter Island Drive
San Diego, California 92106

Prepared by:

ERC Environmental and Energy Services Co.
5510 Morehouse Drive
San Diego, California 92121-1709
(619) 458-9044

Original Submittal - June 1, 1990
Amended Submittal - October 17, 1990

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The distribution of copper, mercury, and tributyltin (TBT) in the sediments of Commercial Basin have been investigated in several studies. Initially, the California Department of Fish and Game investigated the distribution of these and other contaminants in the upper few inches of basin sediment. These data were used by the Regional Water Quality Control Board (RWQCB) to define cleanup levels in cleanup and abatement orders issued to boatyards on Commercial Basin. Subsequently, consultants for various boatyards conducted studies to further define the distribution of these contaminants in response to the cleanup and abatement orders. The results of these studies show several basic patterns. The large boatyards tend to have high concentrations of the metals in the sediments offshore of their facilities. Driscoll Custom Boats is one of the smaller boatyards, and has lower concentrations of these metals than nearby large boatyards.

The distributions of contaminants in the vicinity of the Driscoll lease reflect the following patterns. The highest levels of mercury and TBT were observed east of the Driscoll lease and at the end of Commercial Basin west of the Driscoll lease. Copper exhibits a similar but less distinct distribution. These patterns strongly suggest that the contaminants found within the boundaries of the Driscoll lease have largely arrived there as a result of the redistribution of contaminants from areas of higher concentration to the east and west. This redistribution is probably a function of natural sediment movements within the basin and high energy transport from boat propeller wash and bow thrusters.

Several issues were identified during preparation of this response to the four cleanup alternatives presented by the RWQCB. The requirement for cleanup to an arbitrary background level is based on the rationale that the concentration of metals in an area unaffected by pollution sources is acceptable. However, it may also be possible that greater metal concentrations would not result in significant negative impacts depending on the availability of the contaminants (e.g, bioavailability) to the biological communities. Consequently, selection of background in this manner may result in arbitrarily stringent cleanup standards.

Use of the AET levels for cleanup is also inappropriate since they were designed as a screening tool to decide at what level biological testing should be conducted to evaluate toxicity. Based on the biological studies done on behalf of Shelter Island Boatyard, Mauricio and Sons, Eichenlaub Marine and Kettenburg Marine it appears that the AET cleanup levels should be about 500 mg/kg for copper and 4.8 mg/kg for mercury.

Ocean Plan levels for much of Commercial Basin's sediments are not attainable without a cleanup of most of the basin. This limitation also effectively controls Alternative 4 by making it at least as stringent as Alternative 3.

There are several major reasons to not implement cleanup activities. These include: no regional approach to the problems, including cleanup coordination and source control, and no consistent relationship between the concentration of metals in the sediment and toxicity as measured by biological studies.

There is presently no region-wide approach to the cleanup. This lack of coordination during cleanup activities would likely produce a patchwork of clean and contaminated sediments, with spillage and redistribution of contaminated material into cleaner areas during and after dredging. The control of continuing non-point source discharges will also have to be a part of any plan. Despite the efforts made in the elimination of sources of contamination into Commercial Basin, additional sources still remain. Until controlled, these activities will minimize the effectiveness of any cleanup.

At present there is no clear and consistent relationship between trace metal concentrations in marine sediments and toxicity or bioaccumulation in marine animal tissue. Data from some studies show biological problems resulting from excessive sediment trace metal concentrations. Others show no relationship between metal concentrations in sediments and bioaccumulation of those metals in animal tissue, a primary indicator of negative impacts on the biota.

Therefore, the best alternative at present is to leave the sediments in-place, at least until a region-wide approach is developed, complete source control is achieved, and clearly definable biological impacts can be demonstrated. At that time the viability of the cleanup should be reevaluated.

Analysis of the four alternatives identified by the RWQCB include cleanup scenarios which would meet 1) background concentrations of contaminants in Commercial Basin sediments, 2) Apparent Effects Threshold (AET) criteria in basin sediments, 3) Ocean Plan criteria in basin water and interstitial water, and 4) any plan which would essentially comply with Ocean Plan criteria.

Results of the analysis of sediment contaminants relative to background levels show that, the most of Commercial Basin is above the cleanup levels identified by the RWQCB. Any cleanup of less than the entire basin would require the adoption of substantially higher cleanup levels for the three metals than presently proposed.

Results of bioassay and bioaccumulation tests and characterizations of the benthic community, suggest that higher contaminant levels would be acceptable for the cleanup than the AET values presented in the Cleanup and Abatement Orders. Overall, the various bioassay results from all studies suggest that a copper level of about 500 mg/kg and a mercury level of about 4.8 mg/kg would not significantly impact the benthic biological communities of Commercial Basin.

Results from the Driscoll interstitial water study suggests that sediment concentrations from much of the basin have interstitial water concentrations that exceed Ocean Plan standards. A cleanup plan covering much of the basin would be needed to clean up the sediment to a sufficiently low level to meet Ocean Plan criteria in interstitial water.

RWQCB Alternative 4 precludes any alternative not meeting Ocean Plan standards. Consequently, within the framework provided, there are no possible alternatives that we can present.

The value of a cleanup based on chemical criteria, as proposed by the RWQCB, has certain limitations. For example, NOAA has observed that there is no clear relationship between the trace metal concentration and biological effects. This is based on nation-wide NOAA National Status and Trends data which fails to show a consistent relationship between concentrations of a number of trace metals in sediments from urban sites and those in the livers of target fish species. Other investigators identify the importance of the relationship between uptake of trace metals and bioavailability and the fact that bioavailability is strongly influenced by a complex suite of physical, chemical and biological factors in the sediment. Simple chemical analyses defining the concentrations of chemicals do not explore these important relationships. In fact, evaluation of the concentration of copper and mercury in the tissue of experimental California mussels placed in Commercial and Shelter Island Basins as part of the California State Mussel Watch program indicate no major differences between the two sites despite considerable differences in the sediment concentrations of these metals.

In response to the Cleanup and Abatement Order several cleanup and treatment or disposal methodologies have been identified. Cleanup technology for in-situ treatment of trace metals in submerged sediments is not commercially viable, leaving removal of the sediments as the only option. Sediment removal methods include mechanical, hydraulic, and pneumatic dredging. Disposal options include capping in-place, in-bay containment, beach replenishment, ocean disposal, confined ocean disposal, landfill, and construction fill. Non-removal remedial actions include leave in-place, burial of contaminated material by natural sedimentation, natural detoxification, and dispersal of contaminated material by wave action and currents.

Conventional types of dredges are in routine use throughout the United States and are well suited to the removal of contaminated sediments. Process water from the dredging operations would most easily be discharged to the bay. However, it would need to meet Ocean Plan standards, which would likely require treatment of some type.

Of the options identified, we believe that using the material for on-site construction fill, land disposal, or possibly ocean disposal are the most practical and feasible disposal solutions. Capping in-place, in-bay containment, beach replenishment, and confined ocean disposal are not viable alternatives.

Estimates of the total volume of sediment that need to be removed to meet the Cleanup and Abatement Order criteria from within the Driscoll lease were calculated for copper concentrations of 63, 112, and 390 mg/kg. Estimated total volume of sediment for each concentration is 3,529 CY for a level of 63 mg/kg, 3,284 CY for 112 mg/kg, and 1,865 CY for 390 mg/kg. The volume to be cleaned up if cleanup levels were determined by the bioassay and biological data (i.e., 500 mg/kg) would be slightly greater than the volume for 390 mg/kg. Estimated cleanup cost guidelines range from approximately $262,000 to $2,015,000 assuming the material is non-hazardous.

SECTION 1

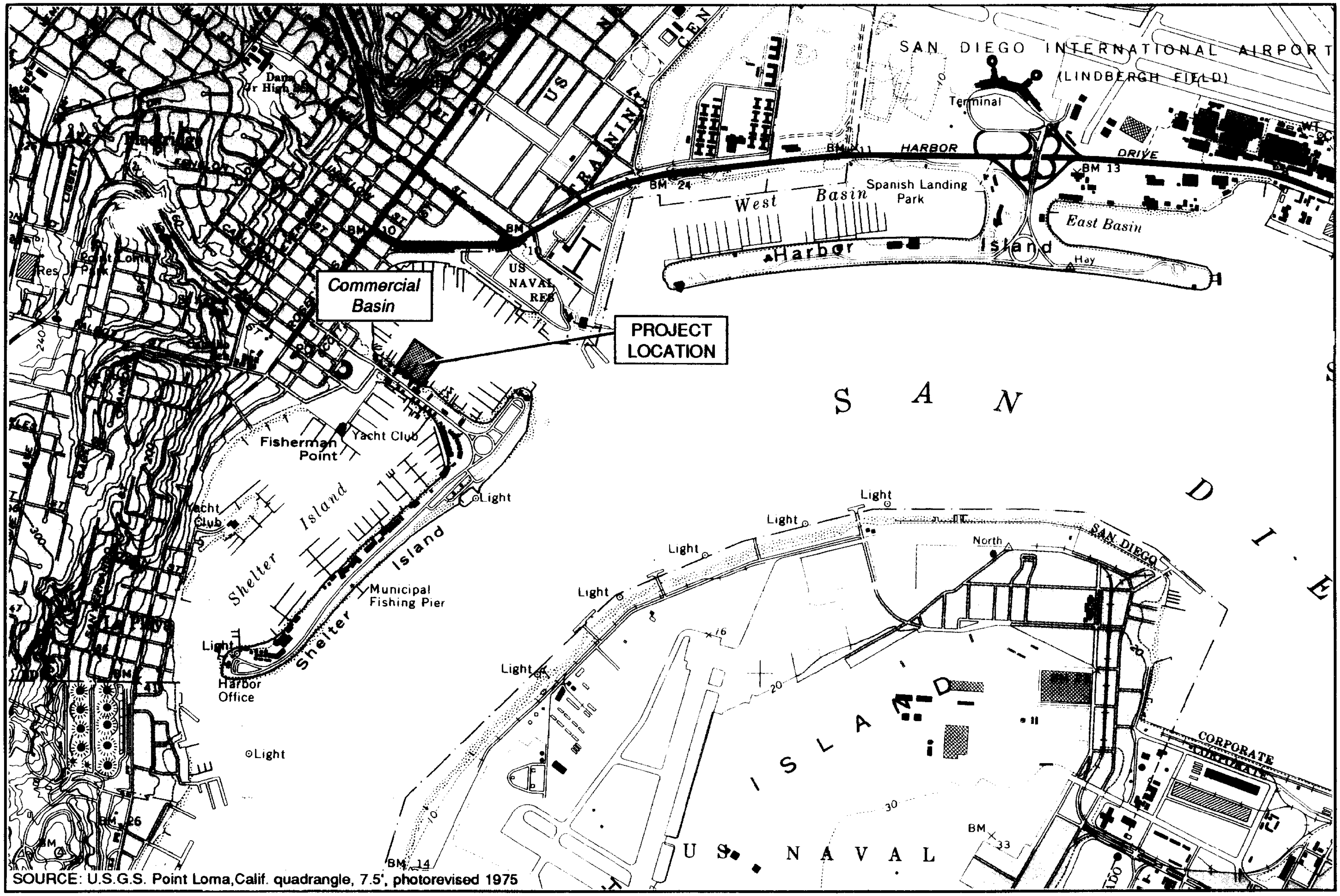
INTRODUCTION

The Regional Water Quality Control Board (RWQCB), San Diego Region, issued Cleanup and Abatement Order No. 89-31 to Driscoll Custom Boats. This order specifies that Driscoll Custom Boats shall evaluate the need and feasibility for reducing the sediment copper, mercury, and tributyltin concentrations in those portions of San Diego Bay affected by alleged discharges from Driscoll Custom Boat. As a part of the response to the order, Driscoll submitted sampling plans for RWQCB review and approval. Subsequently, these plans were implemented to define the levels of copper, mercury, and tributyltin (TBT) in the sediments that may have resulted from activities at Driscoll Custom Boats. This report summarizes results of these studies and addresses the range of remedial action alternatives to cleanup contaminated sediments in Commercial Basin. The general project area is shown in the Figure 1 site map. The specific study area is shown in Figure 2.

1.1. Approach

The overall approach to responding to the RWQCB order has been to use existing information collected by the California Department of Fish and Game (CFG 1988) and Woodward-Clyde (WCC 1989) and supplement this information as required by additional site specific studies. To date three phases of investigation have been proposed and approved by the RWQCB.

The Phase I sampling study was conducted to define the horizontal and vertical extent of copper concentrations within the Driscoll Custom Boat lease. The Phase I analysis was limited to copper because the sources of copper, mercury, and tributyltin in the Commercial Basin sediments are all generally assumed to be associated with antifouling bottom paint from boat hulls and boat repair operations. The potential pathways into the environment are expected to be similar for the different metals. Results of previous sampling efforts in the area support this hypothesis. Therefore, it was assumed that the distribution of copper would be representative of the distribution of all contaminants. Diver cores were used to collect core samples to a sediment depth of up to 4 feet below the bay bottom or refusal of the sampler to penetrate further. The Phase II sampling effort involved additional diver collected cores to map the horizontal and vertical concentrations of sediment copper,

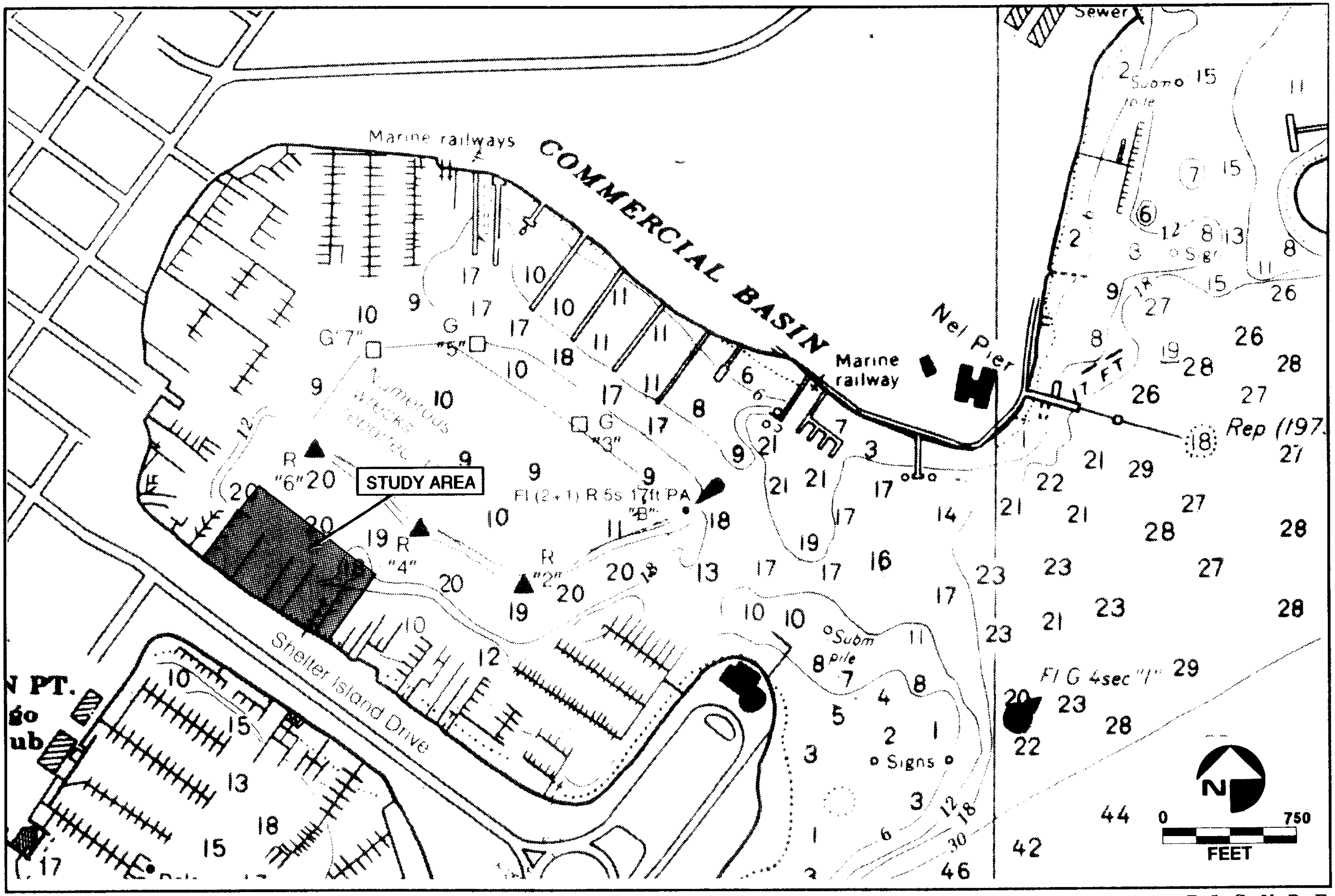


ERC Environmental and Energy Services Co.

Site Vicinity Map

FIGURE

1



ERC Environmental and Energy Services Co.

Site Location Map

FIGURE 2

mercury, and tributyltin within an expanded study area near the Driscoll facilities, and from the area near a storm drain outfall in Shelter Island Yacht Basin that drains the street in front of the Driscoll Custom Boats property. These samples were collected to address data gaps and issues that were identified during the Phase I study. In addition, a vibracore was used to collect samples of deeper sediments, and diver collected cores were used to sample surface sediments and interstitial water. Twenty samples were analyzed for copper, mercury and tributyltin in order to develop a relationship between copper and each of the other metals.

The objective of Phase III was to obtain data from an area that contained typical small boat and marina operations, but without the boatyard activities of Commercial Basin. The results will provide information on the concentrations of metals occurring in sediments from sources such as the presence of small boats and general marina operations. Since these activities can be considered a recreational beneficial use and are not likely to be abated, we believe that the metal concentrations associated with these activities represent a level for metals in the sediments in San Diego Bay consistent with present and future beneficial uses. Consequently, this information this will provide an alternative cleanup level to be evaluated.

SECTION 2

METHODS

2.1. Phase I

Details of the Phase I study are presented in ERCE 1989.

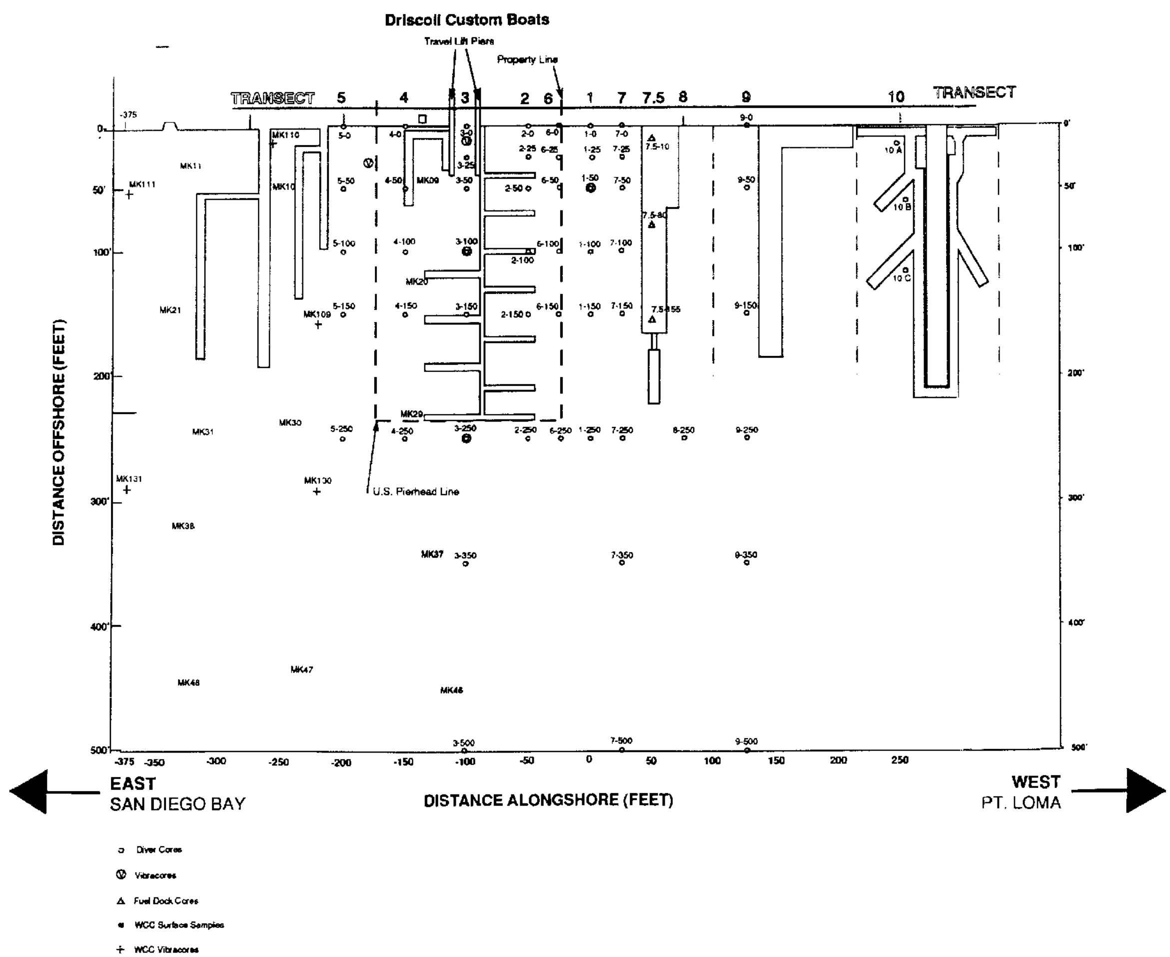
2.2. Phase II

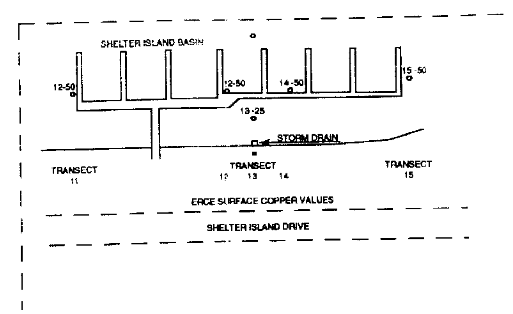
Thirty-three dive core, 5 vibracore, and 10 interstitial water samples were collected during Phase II. Forty-two of the sites were located in Commercial Basin, and six sites were located in Shelter Island Yacht Basin near the outlet of a storm drain that receives the surface runoff from the road frontage of Driscoll Custom Boats.

Prior to sampling, the origins of all transects were permanently marked on the shore with fluorescent spray paint. A transit was used to establish each transect perpendicular to the bulkhead line. The transect lines were 3/8 inch nylon line with marks at pre-selected distances from the origin. Samples were collected along each transect at locations ranging from as close to the bulkhead as possible (0 to 10 feet) to as much as 500 feet offshore from the bulkhead. Sample site locations are shown in Figure 3. Sample sites are identified by transect number and distance offshore, e.g., the sample site 50 feet offshore on transect 6 is referred to as Location 6-50.

2.3. Phase III

Twenty sites were selected in Shelter Island Yacht Basin to collect background sediment quality data. Sampling locations were chosen to cover the spectrum of conditions beneath docks in the basin. Positions were chosen from an aerial photograph taken in 1989 and are shown in Figure 4. The locations were reviewed by the RWQCB and one station (DR3-11) was moved at their request to a location near a storm drain outlet. The positioning during Phase III was accomplished by collecting all samples at recognizable points next to existing docks.





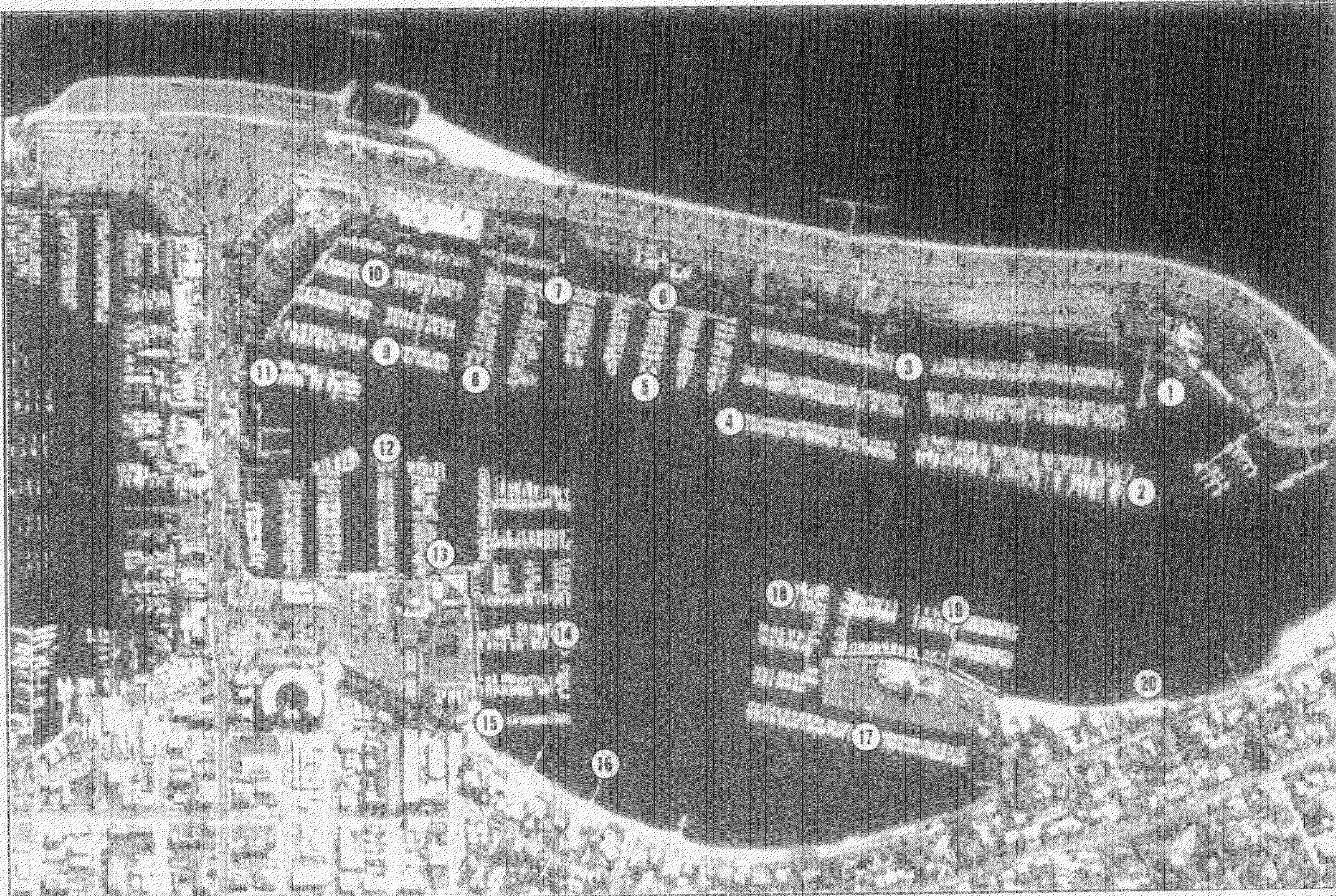
SHELTER ISLAND YACHT BASIN SAMPLING LOCATIONS.

ERC Environmental and Energy Services Co.

Phases I and II Sampling Locations

FIGURE 3

CUT 007343



ERC
Environmental
and Energy
Services Co.

Shelter Island Yacht Basin Sampling Locations

FIGURE
4

2.4. Horizontal and Vertical Distribution - Phase II

2.4.1. Diver Collected Cores

A total of thirty-three diver collected cores were taken. Twenty sampling sites were located along three transects (Transects 6, 7, and 9) to the west of Driscoll Custom Boats. Transect 6 is 25 feet east of Phase I Transect 1 with six sites. Transect 7 is 25 feet west of Transect 1, with eight sites, and Transect 9 is 125 feet to the west of Transect 1, with six sites. One site was located 25 feet offshore on Phase I Transect 1, two sites were along an offshore extension of Transect 3, one was offshore on Transect 8 (75 feet west of transect 1), and three were along the Gledhill dock (Transect 10). The six Shelter Island Basin sites were located offshore from a storm drain outlet. Two sites were directly offshore of the outlet, one was 25 feet and one 100 feet, two were 50 feet offshore and 50 feet to each side of the storm drain; and two were located 50 feet offshore and further from the storm drain outlet.

Twenty-three diver cores were analyzed for sediment copper only. Ten samples from six sites in Commercial Basin were analyzed for sediment mercury and TBT as well as copper.

Diver core tubes were 4 feet long, 2-inch diameter aluminum tubing. The precleaned coring tubes were inserted into the sediment to a depth of 4 feet, or to refusal depth. After insertion of the core tube, depth of penetration was recorded. The tube was then sealed at the top, removed from the sediment and taken to the surface, where it was capped, cleaned and decontaminated, labeled, and stored in an upright position in a cooler. The label on each core tube included date, time, and location of sample collection; sample collectors and the top of the core tube. At the end of each sampling day, the cores were transported to the laboratory for cool storage (4°C) until subsampling.

2.4.2. Vibracore

Vibracoring was performed to obtain data from sediments too deep to be sampled with the diver cores. Vibracore stations were located at sites 1-50, 3-0, 3-100, 3-250 and 5-50. Vibracoring tubes were 4-inches in diameter x 6 feet 8 inch aluminum pipe sections. The vibracore tubes sampled to a depth of 6 feet 8 inches below bay bottom or refusal.

2.5. Horizontal Distribution - Phase III

The core tubes used during Phase III were 1 foot long, 2-inch diameter aluminum tubing. At each location the diver inserted a pre-labeled core tube one foot into the sediment. The top was then sealed and the core returned to the surface, where it was capped, cleaned and decontaminated, and stored in a cooler. The label on each core tube included date, time, location where sample was collected, and sampler collectors . At the end of the sampling day, the cores were transported to the laboratory for cool storage (4°C) until subsampling.

2.6. Interstitial Water

Samples were collected at nine sites along Transects 6 and 7 for copper, mercury, and TBT analysis of interstitial water and sediment. One of these sites (6-0) was intertidal and was sampled twice, once on the rising and once on the falling tides. This was done to evaluate the effects of contact time between water and the sediment. The interstitial samples were collected in 4-inch diameter, 1 foot long tubes following the same procedure used with the 2-inch sediment tubes.

2.7. Laboratory

2.7.1. Sample Processing

Subsampling was performed at the analytical laboratory by ERCE personnel. Initially samples from the segment representing each vertical foot of depth, except the segment representing the second foot down were subsampled and analyzed. Data from the top foot was used to define areas of high copper concentration from recent sources. The analysis of the lower segments from each sample were used to identify the approximate depth of contamination in the sediment and define historical concentrations of those metals.

In order to determine the vertical distribution of copper in the sediments each core tube was subdivided into segments, each representing 1 foot of the actual vertical sediment column beneath the bay bottom. The length of each segment was determined by the proportional relationship between the actual depth of penetration of the core sampling tube into the bay bottom and the actual length of the sediment contained in the core sampling tube. This provides an estimate of the actual length of each subsample compensating for compaction of the sediment during sample collection.

Basically, each primary core was divided into sections representing up to 1 foot in actual depth in the bay sediments to permit determination of the vertical distributions of the metals in the sediment column as described above. During subsampling a core barrel was removed from the refrigerated sample storage room and secured in a pipe stand. The core barrel was measured and marked into segments accounting for the sampler induced compaction, as previously described. Each segment was labeled with station and subsample numbers.

Following labeling, the core barrel was cut with a pipe cutter. The sediment samples within each core were individually separated with a clean knife. A subsample from each segment was extracted by pushing a 12-inch long, 1 1/2 inch diameter aluminum tube lengthwise through the center of the sediment sample. This subsampling procedure, developed by ERCE (TRA 1988), minimizes the possibility of cross-contamination of deeper sediment by the passage of the primary core sampler through the potentially greater contamination in the surface sediments. The subsamples were then extruded into pre-labeled precleaned jars, homogenized with a spatula, and returned to the cold room. The jars were relinquished to laboratory personnel, along with appropriate chain-of-custody documentation at the completion of the subsampling process.

Laboratory personnel removed subsamples for copper, mercury, tributyltin, and percent moisture analysis from the jars. The remaining sediment was retained for future evaluation as needed.

Interstitial sediment cores were opened at the laboratory and the free water at the top of each core carefully removed. A 0.5-mm mesh nytex screen was fitted across the bottom of each tube. The tube was then allowed to drain into a clean plastic container for 24 hours at 4° C. The screen allowed the water in the core to drain while minimizing the amount of particulates in the sample. This interstitial water was analyzed for copper, mercury, or TBT. One quarter to one liter of water was required for each metal analysis. Since 250 ml was the maximum volume obtained from any sample, each sample was analyzed for only one metal. A subsample was also removed from each core for sediment copper, mercury, and TBT analysis.

2.8. Chemical Analyses

Chemical analyses were conducted on Phase II samples by Analytical Technologies as follows.

Interstitial Water Samples

Interstitial Copper; MIKB extraction, analysis by Method 6010

Interstitial Mercury; analysis by Method 7470

Interstitial TBT; analysis by Hydride Cryogenic AA technique (Valkirs et al. 1986)

Sediment Samples

Sediment Copper; extraction by Method 3050, analysis by Method 6010

Sediment Mercury; analysis by Method 7471

Sediment TBT; analysis by Hydride Cryogenic AA technique

Chemical analyses were conducted on Phase III samples by Analytical Technologies as follows.

Sediment Copper; extraction by Method 3050, analysis by Method 6010

Sediment Mercury; analysis by Method 7471

Sediment TBT: analysis by the GC Grignard technique, as requested by RWQCB staff. Four sample splits were also run by the Hydride Cryogenic technique to enable comparison of the results obtained by the methods used in Phases II and III.

All techniques except the Hydride Cryogenic AA and the Grignard GCFPD techniques are listed in EPA SW 846. The Hydride Cryogenic technique is described in Valkirs et al. 1986. The Grignard GCFPD technique is described in Stallard and Cola 1989.

2.9. Comparison of TBT Methods

There are several chemical techniques in use for the analysis of waters and sediments for TBT. One is the Hydride Cryogenic technique (Valkirs et al. 1986). A purge and trap with hydride derivatization is used to separate out the butyltins from water or sediment samples, which are then measured by Atomic Absorption (AA) detection. Another is the Moss Landing method (Stephenson and Smith 1988). Methylene chloride is used to extract the butyltins from sediments or tissues. Tributyltin is then separated from the mono- and dibutyl fractions and read with a graphic furnace AA. A third method utilizes a gas chromatograph with flame photometric detector (GC FPD). The butyltins are extracted with methylene chloride, derivatized with hexylmagnesium bromide and analyzed by GC FPD.

During the Phase II study at Driscoll, the analysis for TBT in water and sediments was performed by the Hydride Cryogenic technique (collected from October 31 to November 3, 1989). After discussions with RWQCB staff during March, 1990, the analytical method was changed to GC FPD using the Grignard derivatization for the Phase III sediment samples (collected March 29, 1990). Four sediment samples were analyzed with by both techniques for intercalibration purposes.

In 1988, the California Department of Fish and Game sampled the sediments in Commercial Basin for the RWQCB. The analysis for TBT was by the Moss Landing method (Stephenson and Smith 1988). The Cleanup and Abatement Order for Driscoll Custom Boats called for the use of the Moss Landing AA method for TBT analysis in order to maintain consistency with the CDFG 1988 sampling. At the same time, however, samples collected by the RWQCB related to boatyard activities in Commercial Basin were being analyzed at their contract laboratory (Quality Assurance Laboratory) by the Hydride Cryogenic method. This was done until at least April 26, 1989. At some point between April 1989 and late November 1989 the RWQCB contract lab changed the method being used. The method presently used by the contract lab is GC FPD with Grignard derivatization.

The largest data set for TBT in the bay has been collected by the Naval Ocean Systems Center (NOSC). They used the Hydride Cryogenic technique in 1986 (Valkirs et al. 1986) for water and sediments. By 1989, however, some groups at NOSC (Stallard et al. 1989) had switched to the GC FPD, while others (Kram et al. 1989) continued to use the Hydride Cryogenic method for sediments. The GC FPD technique is presently considered to be the most appropriate method available for sediment analysis. It is also applicable for waters, but is more difficult and time consuming. Water samples are presently being analyzed at NOSC for TBT by the Hydride Cryogenic method.

The Hydride Cryogenic technique provides good separation of the butyltin species, is specific to butyltins, and is very sensitive for seawater samples (Stallard et al. 1989). It was used by Valkirs et al. (1986) for analysis of sediments. It is not, however, the best technique for TBT in sediment. Some of the TBT in sediment is bound with the sediment particles and is not removed when washed with sodium borohydrate. The results provide a measure of available rather than total TBT.

The Moss Landing method uses a methylene chloride extraction to remove all butyltins from the sediment. The extraction also removes other tin species from the sediments. These include inorganic tin and methyltins. Thus results obtained by Graphite Furnace AA may be inaccurate, due to inclusion of other tin species in the measurement .

The GC FPD technique uses a solvent extraction to remove all the tin species from the sediments. The GC is then able to separate out the butyltins with the GC column during the analysis. Once the technique has been learned and the system is tuned properly it provides results apparently superior to the other techniques presently in use. The technique can be difficult to run, however, and care must be used in the analysis in order to obtain valid data (pers. comm, Mark Stephenson California State Mussel Watch program).

Since the EPA has not chosen a method for the determination of TBT in seawater or sediment, the choice of methods in the recent past was somewhat open. The Hydride Cryogenic technique was chosen during Phase II for several reasons. Since the same technique was being used by the RWQCB, the results would be most compatible with those concurrently obtained by the RWQCB. At least one other boatyard in Commercial Basin selected the same technique for their Phase II and Phase III sample analysis. Compatibility of our data with theirs would be useful in basin-wide planning. Three additional boatyards conducted analyses, but did not report the technique used or the results obtained.

Most commercial laboratories are not set up to analyze TBT by the Moss Landing method, due to difficulties inherent in the technique. The most available method from commercial labs was the Hydride Cryogenic technique, offered by Quality Assurance Laboratory of San Diego and ToxScan of Watsonville, California. ToxScan was very familiar with the technique, having done the TBT analysis for a large number of marine sediment projects on the west coast. They were chosen for the analysis. When the Phase III samples were analyzed, the GC FPD technique was used for the sediment butyltins by QA Laboratory, as mentioned above. In order to make the results as compatible as possible between Phases II and III, four sample splits were analyzed by the Hydride Cryogenic technique. Substantial discrepancies were found in the results between the techniques. A third analysis was then done on sample splits for the same four samples at the Naval Ocean Systems Center

(NOSC) using the GC FPD technique. The results of the calibration can be found in Appendix F The results must be treated tentatively due to the lengthy time that the samples were held between sampling and the analysis at NOSC. The samples were held at 4°C for over 60 days during this period.

2.10. Quality Control

Sample splits were given to the RWQCB for Phases II and III. Sediment samples from the top foot at each of the six Phase II Shelter Island Yacht Club sites and from Phase III sites DR3-3 and DR3-17 were chosen by RWQCB staff. Those samples were analyzed at Quality Assurance Laboratory. Data on field replicates is presented in Appendix E.

SECTION 3

RESULTS AND DISCUSSION

3.1. Distribution of Contaminants in the Sediment

The distribution of copper, mercury, and TBT in the sediments of Commercial Basin have been investigated in several studies. Initially, the California Department of Fish and Game (CFG 1988) investigated the distribution of these and other contaminants in the upper few inches of basin sediment. These data were used by the RWQCB in cleanup and abatement orders issued to boatyards on Commercial Basin. Subsequently, consultants for various boatyards have conducted studies to further define the distribution of these contaminants in response to the cleanup and abatement orders. This report evaluates the results of these studies and considerable additional sampling at Driscoll Custom Boats in order to better define the distribution of contaminants and potential sources. This involves looking at the large scale distribution of contaminants within a rectangle 2,000 by 500 feet in size which encompasses the south shore of Commercial Basin. This large scale study area, location of sampling sites from various studies, and the Driscoll lease boundary (small rectangle) is shown in Figure 5. This area also includes several other boatyards. Maurico and Sons is located immediately to the east of Driscoll's lease and Shelter Island Boatyard is located to the east of Maurico. Eichenlaub Marine is located several hundred feet to the west of the Driscoll lease and Kettenberg Marine is located adjacent to Eichenlaub at the extreme west end of the basin. The lease immediately west of Driscoll is the HiSeas Fuel Dock. Evaluation of the larger area allows identification of potential sources or "areas of higher concentration" and their relationship to Driscoll Custom Boats.

Table 1 summarizes all data on copper concentration in the sediments from Phases I and II. Table 2 summarizes sediment and interstitial water data for copper, mercury, and TBT from Phase II. Table 3 summarizes Phase II sediment copper data offshore the storm drain outlet in the Shelter Island Yacht Basin. Table 4 summarizes the copper, mercury, and TBT data from Phase III studies in the Shelter Island Yacht Basin.

3.1.1. Copper Distribution

The large scale distribution of copper in the upper 2 inches of sediment is based on data collected by the California Department of Fish and Game (1988) and is presented in Figure

6. Figure 6a shows all sample locations, 6b those locations from CFG (1988), and 6c contours of copper concentrations based on the data from sites in 6b. The highest values observed occurred immediately east of the Driscoll lease (1,260, 1,750, 1,862, 2,237 and 3,120 mg/kg) and at the extreme west end of the basin (2,313 mg/kg).

The small scale distribution of copper in the bay sediments in the vicinity of Driscoll Custom Boats was mapped and contoured at depths of 1, 3, and 4 feet below the bay bottom Figures 6 through 11. These contours are based on the Driscoll data and results of vibracore samples from the Woodward-Clyde study (WCC 1989). These figures present the distribution of copper in two formats: 1) a set of contour lines overlaying a map of the study area at a scale of 1 inch equals 100 feet and 2) a shaded plot at the same scale, where copper values are represented by a graduated series of patterns ranging from white (100 mg/kg dry weight [dw]) to black (>500 mg/kg dw). The shaded plot allows a broad overview of the distribution and emphasizes any patterns that may be present. The contour lines allow a more detailed evaluation of the relationship of the copper distribution to the basin features. Data were contoured at 100 mg/kg dw isopleths up to 500 mg/kg dw. Values greater than 500 are included in the area encompassed by the 500 mg/kg dw contour. More detailed contouring of high values was conducted but resulted in a confusing series of lines in a very small area.

The map for the 1 foot depth is based on data collected during Driscoll Phases I and II and data from Woodward Clyde (1989). Maps for the 3 and 4 foot depths are based on Driscoll Phases I and II results. All data used in the contouring are presented in Tables 1 and 2.

Contours of the top 1 foot below the bay bottom (Figure 7) show two patterns. The first is higher concentrations of copper (>500 to 4,360 mg/kg dw) along the shoreline on the Driscoll and adjacent lease that extend offshore approximately 150 feet. The highest copper value (4,360 mg/kg dw) obtained during this study was found at a site in this area immediately east of the eastern boundary of the Driscoll lease. The second pattern indicates a plume of higher copper values originating west of the Driscoll lease and extending east into the Driscoll lease.

Contours based on data at depths of 3 and 4 feet below the bay bottom show the same basic patterns described for 1 foot. However, because sampler refusal was reached at a depth of 1 foot at several sampling sites near the shoreline, we contoured two different scenarios, representing a probable best and worst cases. Figures 8 and 10 reflect the distribution patterns if you assume that the copper concentration below refusal depth is zero (i.e., best case). Figures 9 and 11 reflect the distribution patterns if you assume that the copper concentration below refusal depth is equal to the copper value found at the sample above it in the sediment column. For the sample sites nearshore, this approach results in the use of data obtained from the 1 foot sample because refusal depth was one foot (i.e., worst case). For the best case scenario, the highest copper value is adjacent to the Driscoll lease between transects 4 and 5. For the worst case scenario, the highest copper values extend along the shoreline in both the Driscoll and adjoining lease. The highest value is however still on the adjoining lease. The plume of high copper values in the 1 foot data that originated west of the Driscoll lease and extended toward Driscoll are also evident at 3 and 4 feet.

3.1.2. Mercury Distribution

The distribution of mercury is summarized in Figure 12 for three data sets: a) Fish and Game Data (CFG 1988), b) combined data for the upper 1 foot of sediment based on Driscoll Data and vibracore data from Woodward Clyde studies (1989), c) data from the upper few inches of sediment based on results from Shelter Island Boatyard studies (PTI 1990). Although these studies all cover different areas they have been plotted on the same map to facilitate comparisons. CFG (1988) data show two areas of high mercury values. Highest values were report at the west end of the basin (14.4 and 19.9 mg/kg) and decreased in an easterly direction. The second highest mercury values were located immediately east of the Driscoll lease (12.2, and 9.9 mg/kg) and in an adjacent area of the Driscoll lease (10.5 mg/kg). Data from the Driscoll studies and WCC (1989) cover a much smaller area but reflect a similar pattern. Values as high as 22.8 and 93.3 mg/kg were reported in the area immediately east of the Driscoll lease and decreased toward the Driscoll lease. The Shelter Island Boatyard data also show a similar pattern in the vicinity of the Driscoll lease. The highest mercury value (14.0 mg/kg) observed during this study was immediately east of the Driscoll lease. Values decreased at sampling sites to the east and west of this high value.

To summarize this information we combined the data into a single set of information and contoured the distribution of mercury (Figure 13) although the samples from different data sources were obtained using different sampling equipment (e.g., diver cores, vibracore) and samples were collected at different depths (e.g., 0-2 inches and 0-12 inches). We believe this is acceptable because the surface layers of sediment are well mixed due to biological and physical disturbance (e.g., propeller wash, current, and sediment transport within the basin). This speculation is supported by SIBY data (Table 1;1989) which shows that contaminant concentrations at depths of 0-2 inches and 6-12 inches from four sites exhibited no consistent vertical distributional patterns. Because of the impact of the single very high value of 93.3 mg/kg value on the contour lines we contoured the data with (13b) and without (13c) this value. The basic patterns previously observed for the individual data sets are reflected in both presentations of the combined data.

3.1.3. TBT Distribution

The distribution of TBT is summarized in Figure 14 for three data sets: a) combined Fish and Game data (CFG 1988) and Woodward Clyde vibracores; b) Driscoll data ; c) data from the upper few inches of sediment based on results from Shelter Island Boatyard studies (PTI 1990). The data combined in Figure 14a were collected using similar methods and TBT chemical analyses were conducted with the same method. Data in Figures 14b and 14c were collected with different methods and/or analyses were conducted by different analytical methods (see Section 2 for a more complete description of TBT analytical methods). Although these studies primarily sampled different areas, they have been plotted on the same map to facilitate comparisons.

Figure 14a shows two areas of high TBT values. Highest values were reported immediately east of the Driscoll lease (19,000 ng/g). High values were also observed midway (13,000 ng/g) between the Driscoll lease and the west end of the basin and at the west end of the basin (>6,000 ng/g). Data from the Driscoll and Shelter Island Boatyard studies cover a much smaller area but reflect a similar pattern. Driscoll data show low TBT values immediately adjacent to shore along the western edge of the Driscoll lease, a higher value approximately 25 feet offshore, and steadily decreasing values further offshore. The Shelter Island Boatyard data also show a similar pattern in the vicinity of the Driscoll lease. The highest TBT values (275 and 110 ng/g) observed during this study were immediately east of the Driscoll lease. Values decreased at sampling sites to the east and west.

3.2. Summary and Conclusions

The distribution of all three contaminants reflect two similar patterns. First, the highest levels of mercury and TBT were observed immediately to the east of the Driscoll lease. Second, high levels of both contaminants were found to the west of the Driscoll lease at the end of Commercial Basin. This pattern strongly suggests that the contaminants found on the Driscoll lease are the result of the redistribution of contaminants from the nearby "areas of higher concentration" due to natural sediment and water circulation.

TABLE 1
SEDIMENT COPPER CONCENTRATION IN SAMPLES AT DRISCOLL CUSTOM BOATS. VALUES REPORTED AS MG/KG DRY WEIGHT.

Data Source	Sample Method	Sample Type	Transect Number	Distance Alongshore (feet) [1]	Distance Offshore (feet)	Penetration Depth (inches)	Sediment Depth: Depth 1 ft	Depth 2 ft	Depth 3 ft	Depth 4 ft	Depth 5 ft	Depth 6 ft	Depth 7 ft
Driscoll Phase I	Diver Core	Sediment	5	-200	0	16	1510	309	-	-	NA	NA	NA
				-200	50	48	854	1690	200	116	NA	NA	NA
				-200	100	48	635	547	32.5	11.4	NA	NA	NA
				-200	150	41	429	178	23.5	32.3	NA	NA	NA
				-200	250	22	177	18.3	-	-	NA	NA	NA
Driscoll Phase I	Diver Core	Sediment	4	-150	0	12	1860	-	-		NA	NA	NA
				-150	50	29	504	58.5	83.6	-	NA	NA	NA
				-150	100	39	529	167	14.8	14.9	NA	NA	NA
				-150	150	48	382	223	32.7	3.7	NA	NA	NA
				-150	250	21	152	9.3	-	-	NA	NA	NA
Driscoll Phase I	Diver Core	Sediment	3	-100	0	7	2680	-	-	-	NA	NA	NA
				-100	25	29	739	173	5.6	-	NA	NA	NA
				-100	50	18	670	8.4	-	-	NA	NA	NA
				-100	100 [2]	48	781	582	18.5	16.9	NA	NA	NA
				-100	150	29	379	160	14.5	-	NA	NA	NA
				-100	250	48	356	238	122	86.3	NA	NA	NA
Driscoll Phase I	Diver Core	Sediment	2	-50	0	<12	2870	-	-	-	NA	NA	NA
				-50	25	30	661	296	104	-	NA	NA	NA
				-50	50	38	579	176	24.8	-	NA	NA	NA
				-50	100	27	479	154	11.4	-	NA	NA	NA
				-50	150	22	250	16.2	-	-	NA	NA	NA
				-50	250	48	413	404	138	38.8	NA	NA	NA
Driscoll Phase I	Diver Core	Sediment	1	0	0 [3]	47	131	24.1	26.3	26.8	NA	NA	NA
				0	50	40	530	594	470	169	NA	NA	NA
				0	100	33	208	27.3	20.4	-	NA	NA	NA
				0	150	14	155	-	-	-	NA	NA	NA
				0	250	36	265	74.6	25.2	-	NA	NA	NA
Driscoll Phase II	Diver Core	Sediment	1	0	25	41	307	N A	10.3	6.2	NA	NA	NA
	Vibracore	Sediment	1	0	50	49	193	N A	3.2	5.7	-	-	-

TABLE 1
SEDIMENT COPPER CONCENTRATION IN SAMPLES AT DRISCOLL CUSTOM BOATS. VALUES REPORTED AS MG/KG DRY WEIGHT.

Data Source	Sample Method	Sample Type	Transect Number	Distance Alongshore (feet) [1]	Distance Offshore (feet)		Penetration Depth (inches)	Sediment Depth: Depth 1 ft	Depth 2 ft	Depth 3 ft	Depth 4 ft	Depth 5 ft	Depth 6 ft	Depth 7 ft
Driscoll Phase II	Vibracore	Sediment	3	-100	12	[4]	78	2310	N A	171	147	6.7	2.3	2.7
				-100	100		78	455	N A	2.8	5.2	17.9	3.5	2.9
				-100	250		69	363	N A	183	105	34.9	10.6	-
	Diver Core	Sediment	3	-100	350		35	367	N A	30.5	.	NA	NA	NA
				-100	500		42	302	N A	19.9	5.9	NA	NA	NA
Driscoll Phase II	Vibracore	Sediment	5	-180	30	[5]	78	4360	N A	724	546	370	254	78.7
Driscoll Phase II	Diver Core	Sediment	6	-25	0		15	141	10.4	-		NA	NA	NA
		Sediment-IW		-25	1			261	N A	N A	N A	NA	NA	NA
		Sediment-IW		-25	2			565	N A	N A	N A	NA	NA	NA
		Sediment		-25	25		23	894	124	-	.	NA	NA	NA
		Sediment-IW		-25	26			910	N A	N A	N A	NA	NA	NA
		Sediment		-25	50		46	521	N A	28.8	13.9	NA	NA	NA
		Sediment-IW		-25	51			277	N A	N A	N A	NA	NA	NA
		Sediment		-25	100		25	188	6.1	-	.	NA	NA	NA
		Sediment-IW		-25	101			200	N A	N A	N A	NA	NA	NA
		Sediment		-25	150		28	139	N A	5		NA	NA	NA
		Sediment-IW		-25	151			228	N A	N A	N A	NA	NA	NA
		Sediment		-25	250		48	396	N A	148	54	NA	NA	NA
		Sediment-IW		-25	251			253	N A	N A	N A	NA	NA	NA
Driscoll Phase II	Diver Core	Sediment	7	25	0		12	13.7	N A	-		NA	NA	NA
				25	25		1	10.1	N A	-		NA	NA	NA
				25	50		20	296	306	-		NA	NA	NA
				25	100		48	522	N A	31.6	16.3	NA	NA	NA
				25	150		48	501	N A	350	349	NA	NA	NA
				25	250		29	266	N A	36.8	30.5	NA	NA	NA
	Diver Core-IW	Sediment-IW		25	251			201	N A	N A	N A	NA	NA	NA
	Diver Core	Sediment		25	350		31	301	N A	12.1		NA	NA	NA
	Diver Core-IW	Sediment-IW		25	351			164	N A	N A	N A	NA	NA	NA
	Diver Core	Sediment		25	500		44	317	N A	32.1	6.2	NA	NA	NA
	Diver Core-IW	Sediment-IW		25	501			306	N A	N A	N A	NA	NA	NA

TABLE 1
SEDIMENT COPPER CONCENTRATION IN SAMPLES AT DRISCOLL CUSTOM BOATS. VALUES REPORTED AS MG/KG DRY WEIGHT.

Data Source	Sample Method	Sample Type	Transect Number	Distance Alongshore (feet) [1]	Distance Offshore (feet)	Penetration Depth (inches)	Sediment Depth Depth 1 ft	Depth 2 ft	Depth 3 ft	Depth 4 ft	Depth 5 ft	Depth 6 ft	Depth 7 ft
DFDS-DBX-1	Diver Core	Sediment	7.5	50	10		156	248	-	-	NA	NA	NA
DFDS-DBX-2B	Diver Core	Sediment	7.5	50	80		463	552	446	276	NA	NA	NA
DFDS-DBX-3	Diver Core	Sediment	7.5	50	155		175	24.7	25.2	-	NA	NA	NA
Driscoll Phase II	Diver Core	Sediment	8	75	250	41	422	N A	133	12.3	NA	NA	NA
Driscoll Phase II	Diver Core	Sediment	9	125	0	27	178	N A	47.8	-	NA	NA	NA
				125	50	41	364	N A	330	219	NA	NA	NA
				125	150	44	506	N A	13.9	9.8	NA	NA	NA
				125	250	34	211	N A	28	-	NA	NA	NA
				125	350	34	338	N A	12.5	-	NA	NA	NA
				125	500	43	310	N A	74	15.6	NA	NA	NA
Driscoll Phase II	Diver Core	Sediment	10	250	30	10	30.1	N A	-	-	NA	NA	NA
				250	60	48	382	N A	321	228	NA	NA	NA
				250	120	48	508	N A	441	346	NA	NA	NA
WCC 1989	Diver Core	Sediment	MK09	-133	49	NA	170	NA	NA	NA	NA	NA	NA
			MK10	-242	55	NA	1800	NA	NA	NA	NA	NA	NA
			MK11	-324	38	NA	270	NA	NA	NA	NA	NA	NA
			MK20	-138	131	NA	190	NA	NA	NA	NA	NA	NA
			MK21	-340	153	NA	100	NA	NA	NA	NA	NA	NA
			MK29	-138	240	NA	72	NA	NA	NA	NA	NA	NA
			MK30	-242	245	NA	57	NA	NA	NA	NA	NA	NA
			MK31	-313	251	NA	49	NA	NA	NA	NA	NA	NA
			MK37	-127	349	NA	80	NA	NA	NA	NA	NA	NA
			MK38	-329	327	NA	49	NA	NA	NA	NA	NA	NA
			MK46	-111	458	NA	81	NA	NA	NA	NA	NA	NA
			MK47	-231	442	NA	91	NA	NA	NA	NA	NA	NA
			MK48	-324	453	NA	70	NA	NA	NA	NA	NA	NA
			MK55	-105	562	NA	54	NA	NA	NA	NA	NA	NA
			MK56	-236	567	NA	48	NA	NA	NA	NA	NA	NA
			MK57	-345	578	NA	34	NA	NA	NA	NA	NA	NA

TABLE 1
SEDIMENT COPPER CONCENTRATION IN SAMPLES AT DRISCOLL CUSTOM BOATS. VALUES REPORTED AS MG/KG DRY WEIGHT.

Data Source	Sample Method	Sample Type	Transect Number	Distance Alongshore (feet) [1]	Distance Offshore (feet)	Penetration Depth (inches)	Sediment Depth Depth 1 ft	Depth 2 ft	Depth 3 ft	Depth 4 ft	Depth 5 ft	Depth 6 ft	Depth 7 ft
			MK66	-231	638	NA	34	NA	NA	NA	NA	NA	NA
			MK67	-329	655	NA	37	NA	NA	NA	NA	NA	NA
WCC 1989	Vibracore	Sediment	M109	-220	158	NA	394	NA	[6]	NA	NA	NA	NA
			M110	-256	13	NA	2280	NA	[6]	[6]	NA	NA	NA
			M111	-373	53	NA	634	NA	[6]	[6]	NA	NA	NA
			M130	-220	295	NA	165	NA	[6]	NA	NA	NA	NA
			M131	-373	290	NA	125	NA	[6]	NA	NA	NA	NA

[1] "Distance Alongshore" represents the distance from the origin of Transect 1 alongshore.
Values preceeded by a "-" indicate the distance from Transect 1 toward the entrance to Commerical Basin.
Values preceeded by a "+" indicate the distance from Transect 1 toward the closed end of to Commerical Basin.

[2] The copper concentration for sample 3-100-4 (Phase I) was much higher than expected. An investigation of the color of the sediment and grain size showed that the sample had been mislabeled. The results presented here show the sample as 3-100-1, with each of the other samples from the core being moved to a greater depth by one foot.

[3] Station 1-0 is located at the zero point of the grid

[4] The planned location of this sample site was 0 ft offshore. The actual sample was collected 12 ft offshore.

[5] The planned location of this sample site was 50 ft offshore and -200 ft alongshore. The actual sample was collected 30 ft offshore and -180 ft alongshore

[6] Samples were obtained , but were not used. Compaction was not measured, so the actual depth from which they were obtained is not known

IW: Interstitial Water

NA: Not Applicable

"-" Sampler reached refusal, consequently no sample was obtained.

TABLE 2

COPPER, MERCURY AND TBT IN SEDIMENT AND INTERSTITIAL WATER IN THE VICINITY OF DRISCOLL CUSTOM BOATS.

			IN SEDIMENT (dry weight)			IN WATER		
TRANSECT	DISTANCE OFFSHORE (feet)	DEPTH (feet)	Cu (mg/kg)	Hg (mg/kg)	TBT (ug/kg)	Cu (ug/l)	Hg (ug/l)	TBT (ng/l)
DIVER CORE SAMPLES								
3	350	1	367	7.9	< 1	NA	NA	NA
3	500	1	302	6.6	< 1	NA	NA	NA
3	500	3	19.9	< 0.4	< 1	NA	NA	NA
7	350	1	310	5.7	< 1	NA	NA	NA
7	350	3	12.1	< 0.3	< 1	NA	NA	NA
7	500	1	317	5.4	< 1	NA	NA	NA
7	500	3	32.1	0.7	< 5.4	NA	NA	NA
9	350	1	338	< 6.1	< 1	NA	NA	NA
9	500	1	310	6.9	< 1	NA	NA	NA
9	500	3	74	3.2	< 1	NA	NA	NA
INTERSTITIAL WATER SAMPLES								
6	0	1	261	2.3	94	100	NA	NA
6	0	1	565	1.6	66	22	NA	NA
6	25	1	910	4.8	590	NA	NA	440
6	50	1	277	1.6	20	NA	NA	210
6	100	1	200	3	8.5	10	NA	NA
6	150	1	228	3.1	4.6	9	NA	NA
6	250	1	253	4.5	5.2	NA	< 0.5	NA
7	250	1	201	7.2	< 1.0	NA	NA	< 6.0
7	350	1	164	4	< 1.0	NA	< 0.5	NA
7	500	1	306	6.8	< 1.0	NA	< 0.5	NA
WCC VIBRACORE DATA (WCC 1989)								
	M109	1	394	7.7	2400			
	M109	3	6	< 0.25	< 40			
	M110	1	2280	22.8	1900			
	M110	3	444	10.3	< 40			
	M110	4	2.7	< 0.31	ND			
	M111	1	634	93.3	3000			
	M111	3	42.7	7.1	< 40			
	M111	4	157	0.51	ND			
	M130	1	165	2	680			
	M130	3	3.2	< 0.25	< 40			
	M131	1	125	1.8	650			
	M131	3	12.9	< 0.25	< 40			
RWQCB Data from Driscoll Splits Samples								
11-	50	1	233	2.3	81.2			
12-	50	1	272	2.5	< 1.8			
13-	25	1	170	0.5	< 1.3			
13-	100	1	222	3.5	6			
14-	50	1	160	1.1	11			
15-	50	1	33.4	0.7	< 1.2			

TABLE 3
PHASE II SEDIMENT COPPER CONCENTRATION IN SAMPLES FROM SHELTER ISLAND YACHT BASIN.
VALUES REPORTED AS MG/KG DRY WEIGHT

Data Source	Sample Method	Sample Type	Transect Number	Distance Alongshore (feet) [1]	Distance Offshore (feet)	Penetration Depth (inches)	Sediment Depth: Depth 1 ft	Depth 2 ft	Depth 3 ft	Depth 4 ft
Driscoll Phase II	Diver Core	Sediment	11	140 (east)	50	48	218	N A	123	25.9
Driscoll Phase II	Diver Core	Sediment	12	25 (east)	50	37	265	N A	2.5	2.8
Driscoll Phase II	Diver Core	Sediment	13	0	25	21	65.2	11.8	-	-
Driscoll Phase II	Diver Core	Sediment		0	100	48	207	N A	40.3	18.3
Driscoll Phase II	Diver Core	Sediment	14	25 (west)	50	21	192	9.9	-	-
Driscoll Phase II	Diver Core	Sediment	15	120 (west)	50	17	42.9	18.2	-	-

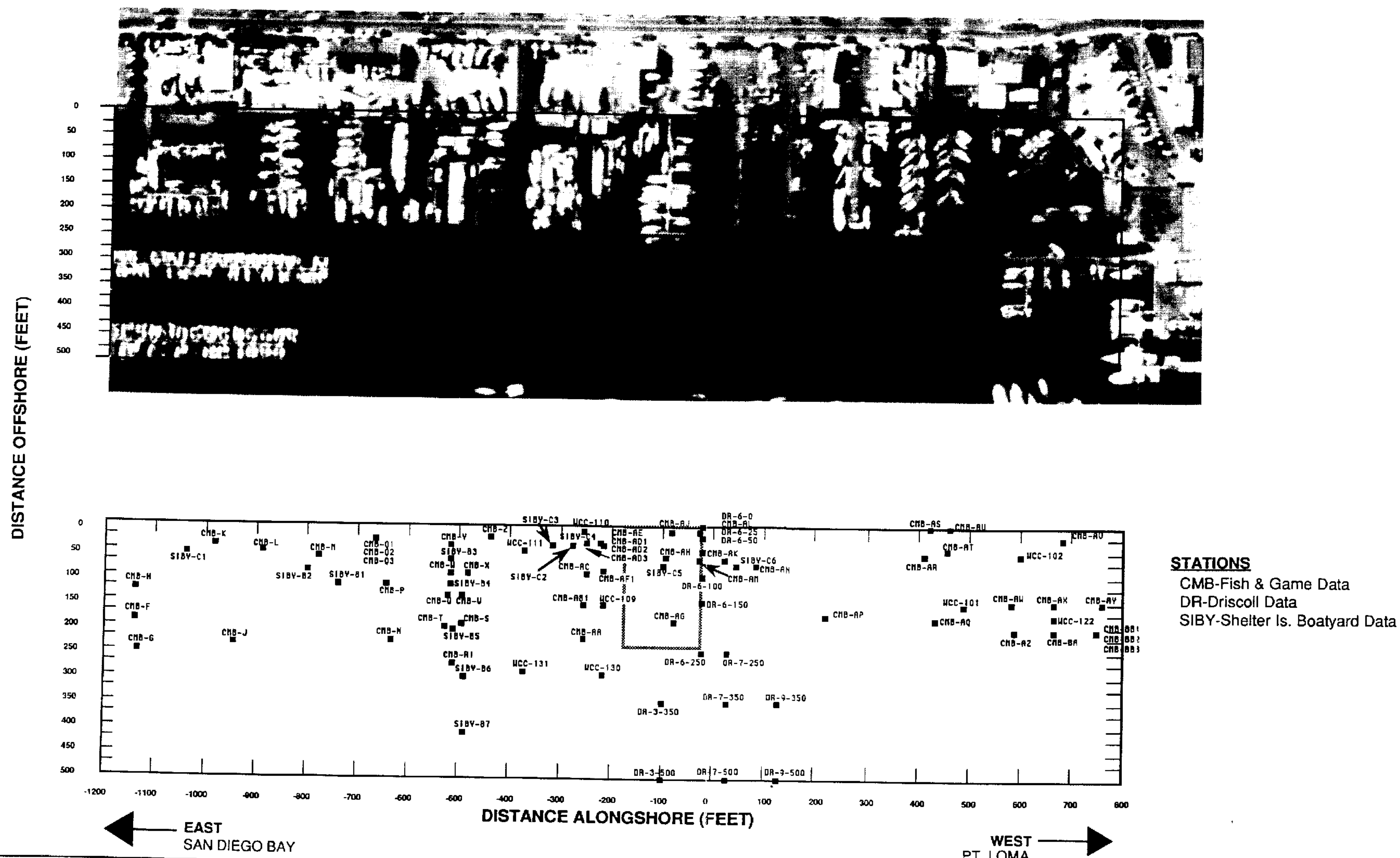
TABLE 4

COPPER, MERCURY AND TBT IN SEDIMENT FROM SHELTER ISLAND YACHT BASIN FOR COMPARISON WITH SEDIMENTS FROM DRISCOLL CUSTOM BOATS

SAMPLES COLLECTED 3/29/90

SAMPLE LOCATION	SEDIMENT DEPTH (feet)	Cu (mg/kg)	(dry weight) Hg (mg/kg)	TBT (ug/kg)	DBT (ug/kg)	MBT (ug/kg)	% MOISTURE
DIVER CORE SAMPLES							
DR3-1	1	75.2	0.29	40	7.6	< 1.5	34.3
DR3-2	1	82.6	0.52	< 2	< 2.0	< 2.0	51.1
DR3-3	1	77.1	0.49	12	9.1	< 1.5	33.8
DR3-4	1	48.1	0.37	< 1	11.4	< 1.4	29.7
DR3-5	1	60.1	0.28	37	< 1.4	< 1.4	30.6
DR3-6	1	89	0.56	117	12.9	< 1.4	30.2
DR3-7	1	89.8	0.97	20	24.4	< 1.6	38.5
DR3-8	1	55.6	0.45	11	15.3	< 1.4	28.3
DR3-9	1	126	1.01	21	30.8	< 1.9	48
DR3-10	1	155	0.91	< 2	43.4	< 2.1	51.6
DR3-11	1	104	0.57	27	49.8	< 1.5	33.8
DR3-12	1	127	1.1	< 2	13.4	< 2.2	55.2
DR3-13	1	164	1.32	22	15.1	< 2.2	53.5
DR3-14	1	54.9	0.32	10	< 1.4	< 1.4	30.4
DR3-15	1	243	0.79	558	56.0	< 2.9	66.1
DR3-16	1	104	0.75	28	< 2.0	< 2.0	49.4
DR3-17	1	107	0.98	32	22.6	< 1.9	46.8
DR3-18	1	60.5	0.52	26	17.6	< 1.8	43.1
DR3-19	1	65	0.39	22	11.7	< 1.7	40
DR3-20	1	37.1	< 0.25	61	15.6	< 1.4	29.3
RWQCB Data from Driscoll Splits Samples							
DR3-3	1	86.4	0.672	54, (55*)	> 1, 1	> 1.0	23
DR3-17	1	107.1	1.471	27	> 1.0	> 1.0	49

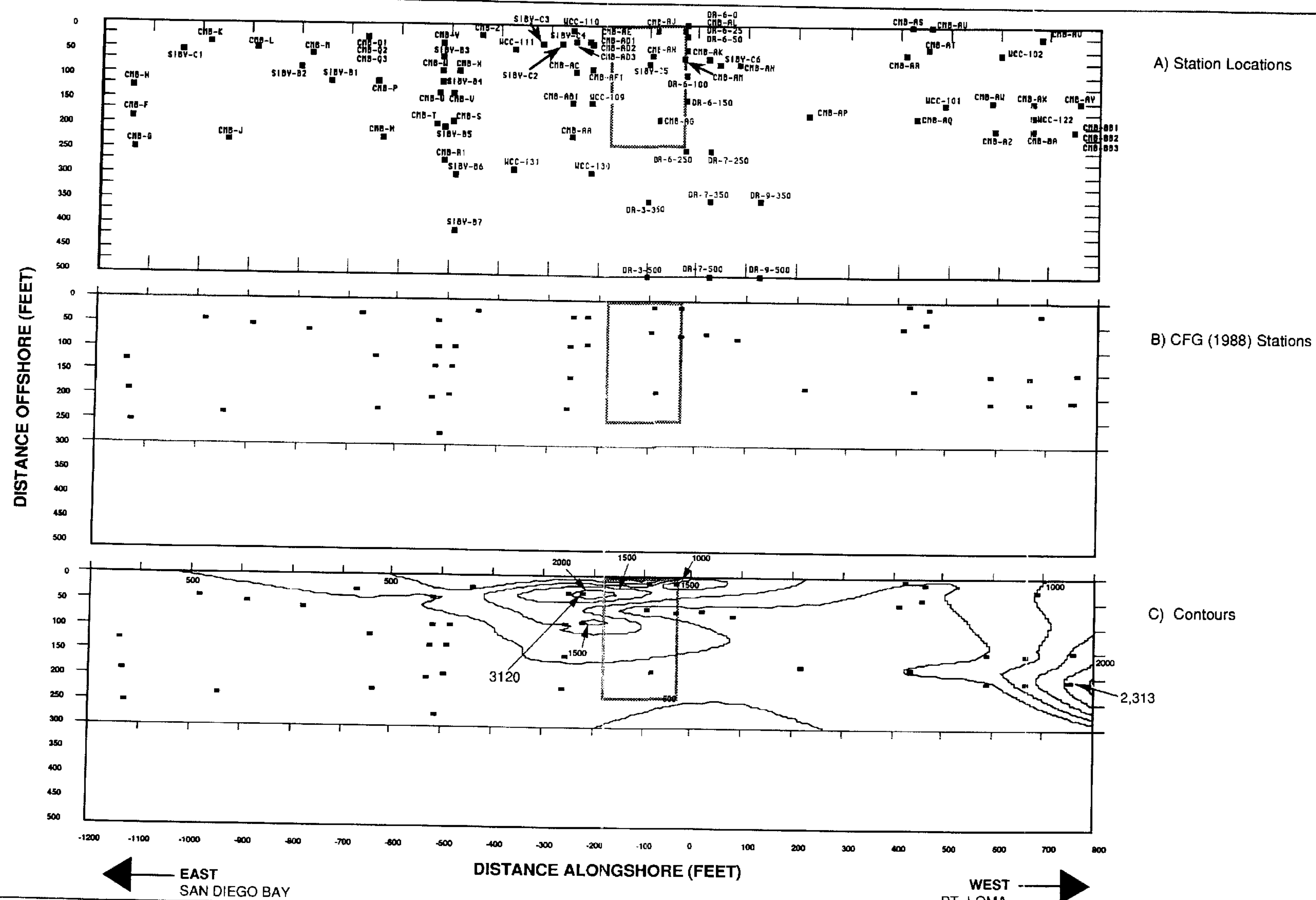
* Laboratory duplicate



ERC Environmental and Energy Services Co.

Locations of Sampling Sites from Various Commercial Basin Sediment Studies

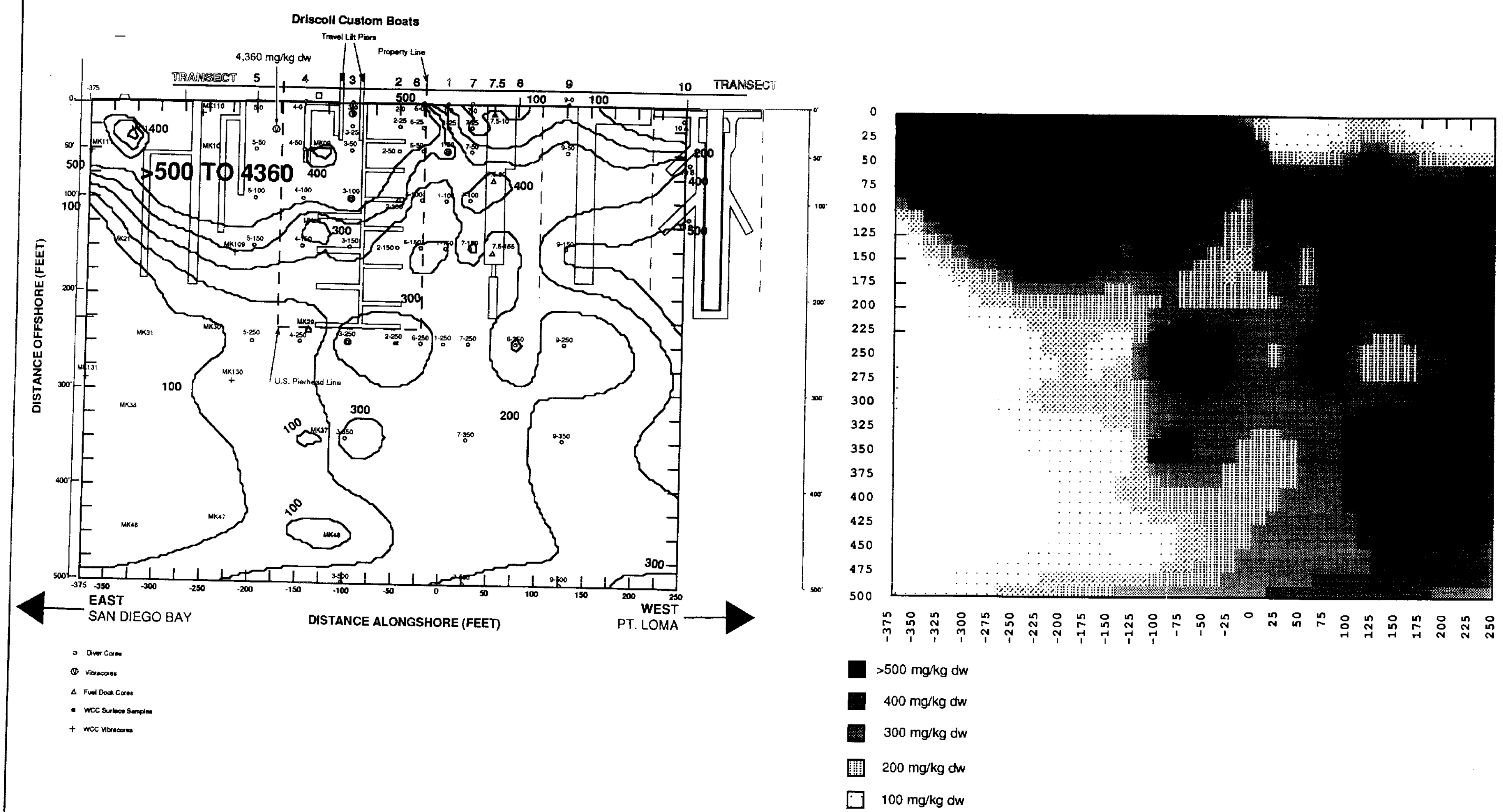
FIGURE 5



ERC
Environmental
and Energy
Services Co.

Distribution of Copper (mg/kg dw) in Surface Sediments Along the South Shore of Commercial Basin Based on Fish and Game Data

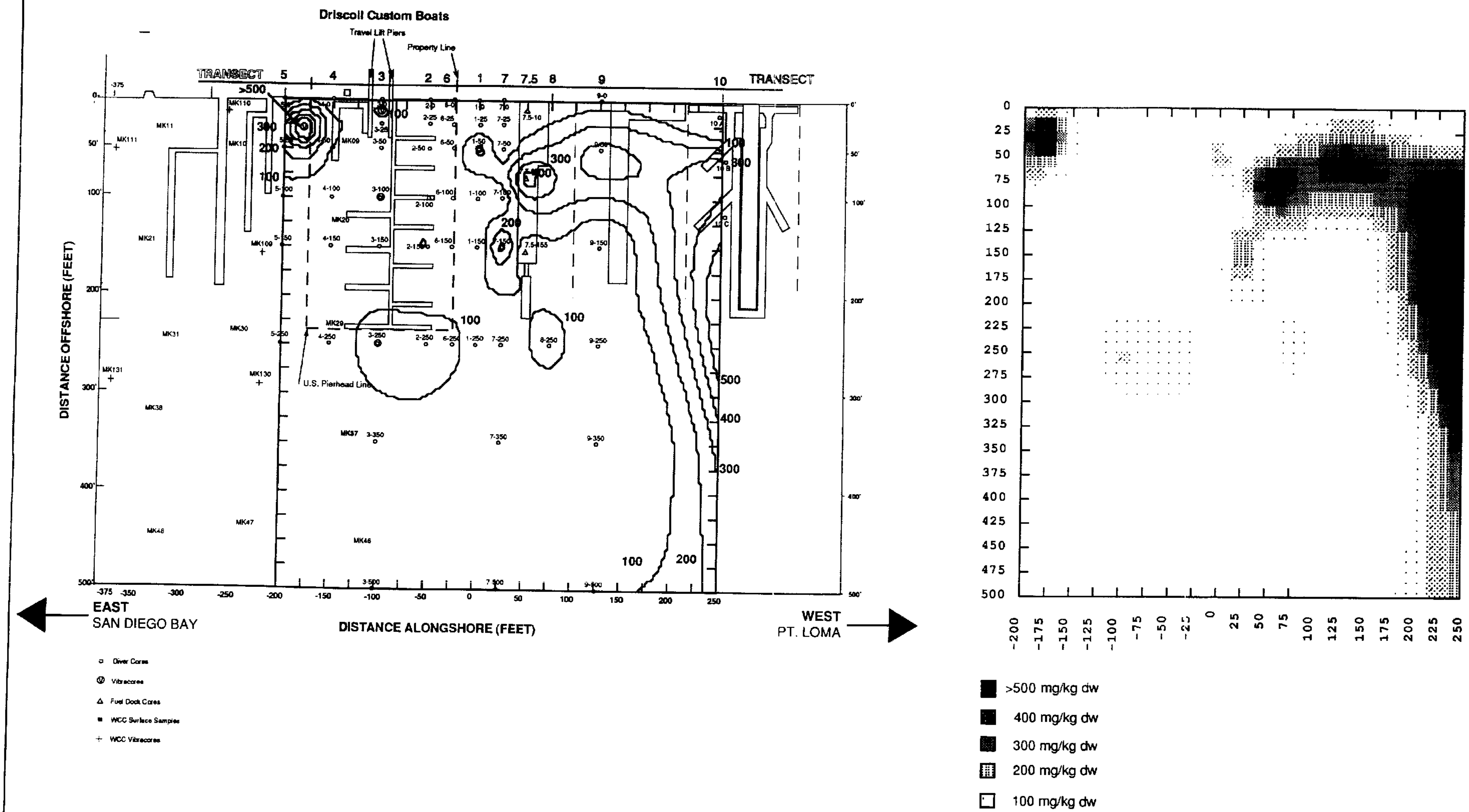
FIGURE
6



ERC Environmental and Energy Services Co.

Contours of Copper Concentrations at a Depth of 1 Foot Below the Bay Bottom

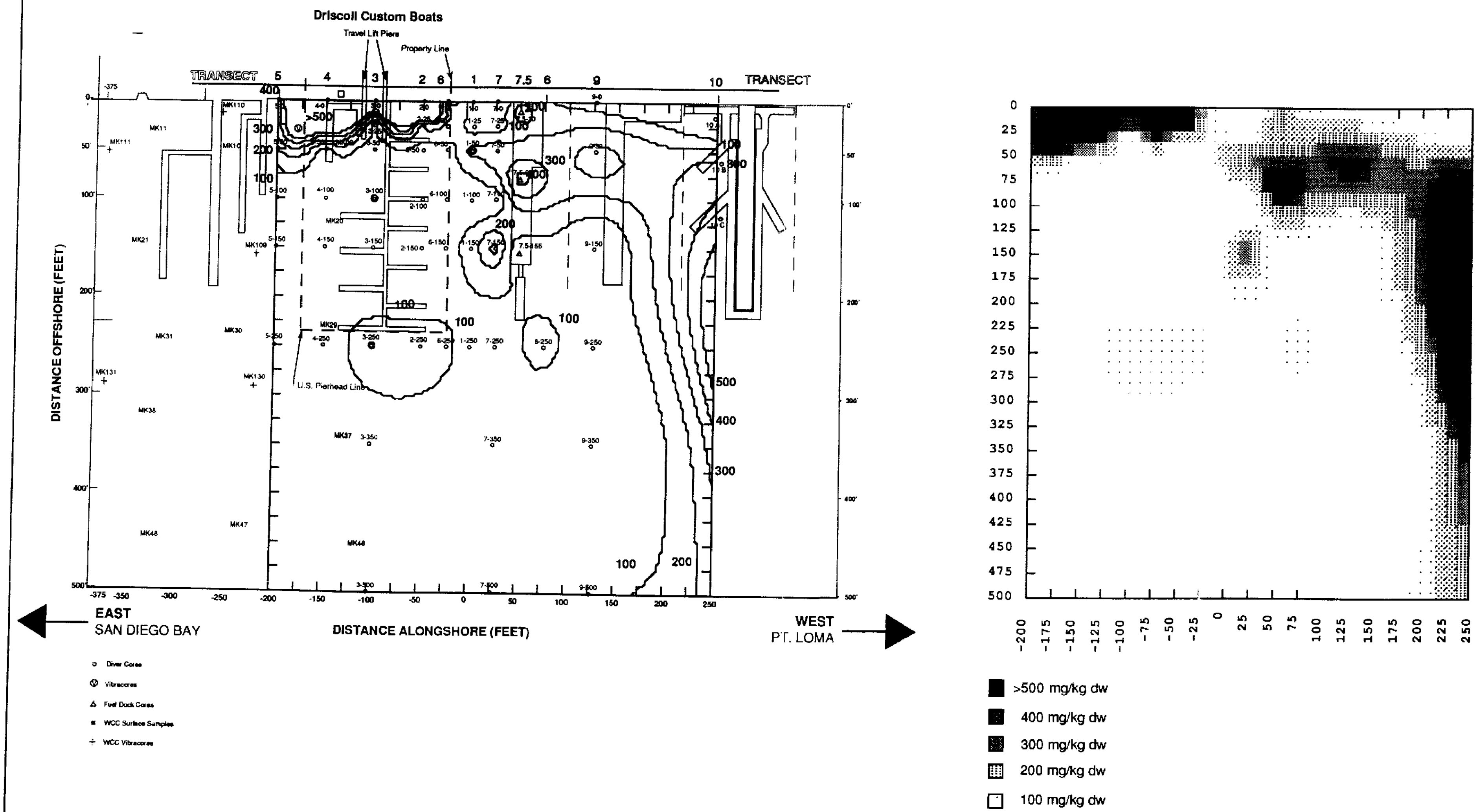
FIGURE 7



ERC Environmental and Energy Services Co.

Contours of Copper Concentrations at a Depth of 3 Feet Below the Bay Bottom
Assuming the Copper Value at Refusal is Zero

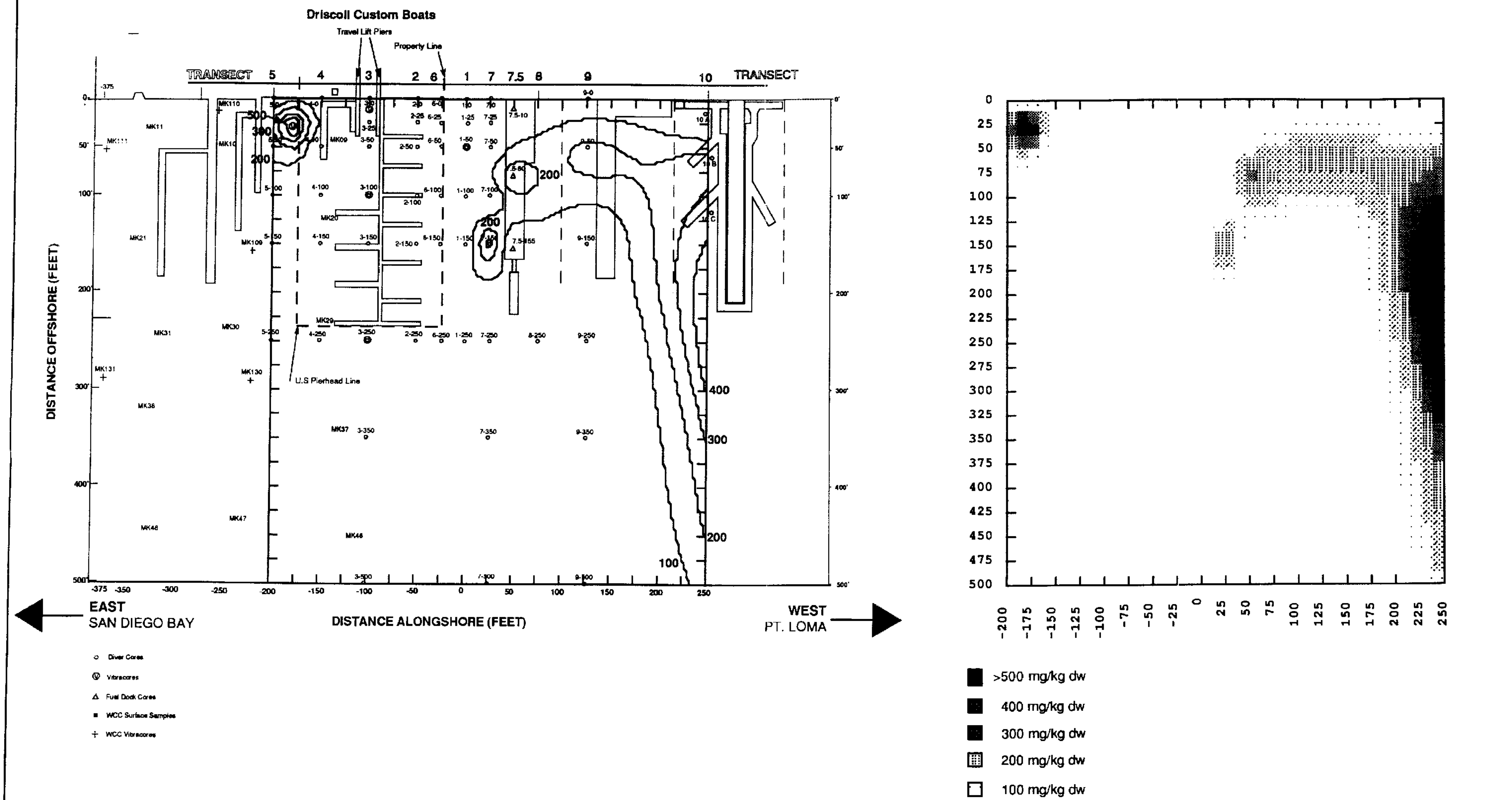
FIGURE 8



ERC Environmental and Energy Services Co.

Contours of Copper Concentrations at a Depth of 3 Feet Below the Bay Bottom
Assuming the Copper Value at Refusal Is Equal to the Value from the Sample Above

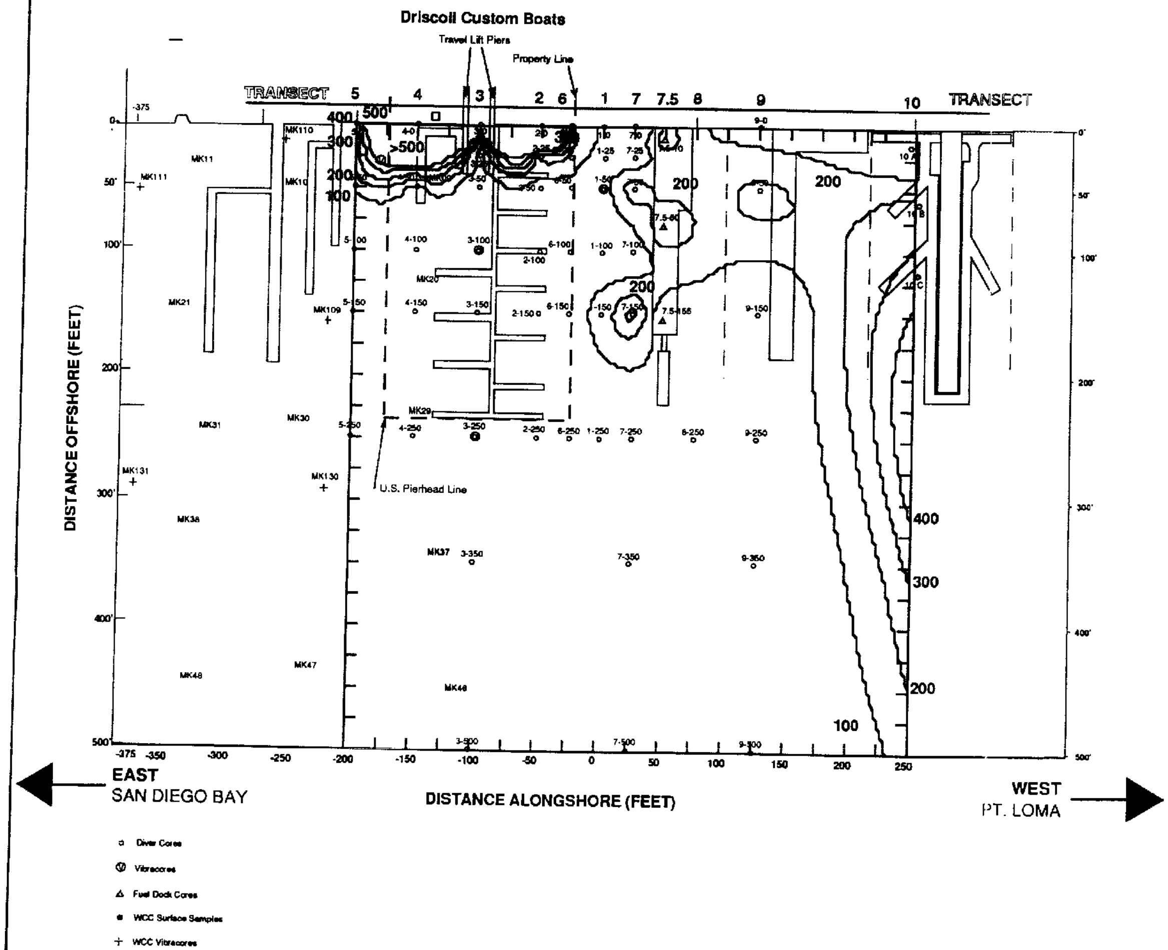
FIGURE 9

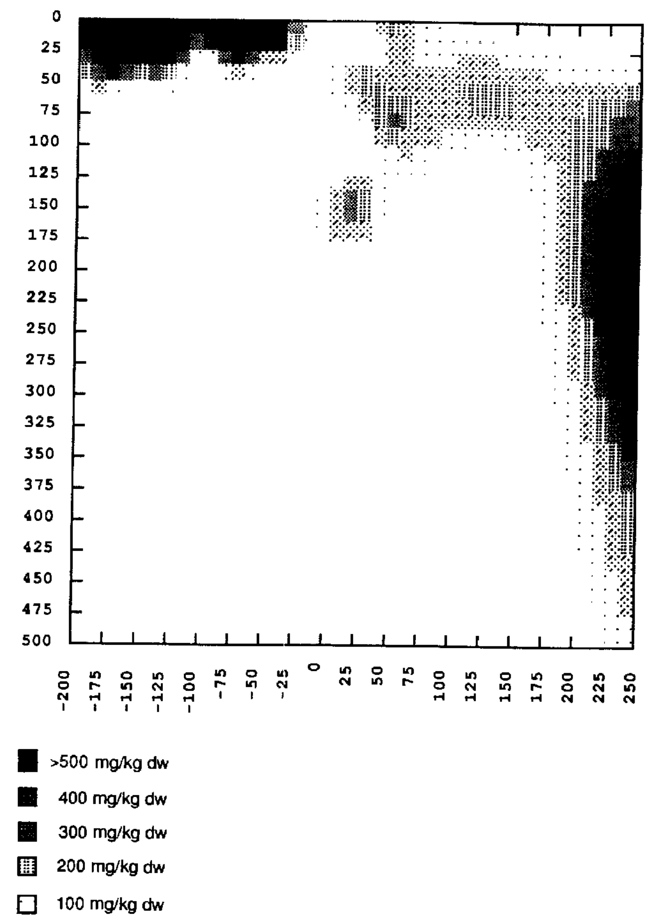


ERC Environmental and Energy Services Co.

Contours of Copper Concentrations at a Depth of 4 Feet Below the Bay Bottom Assuming the Copper Value at Refusal Is Zero

FIGURE 10

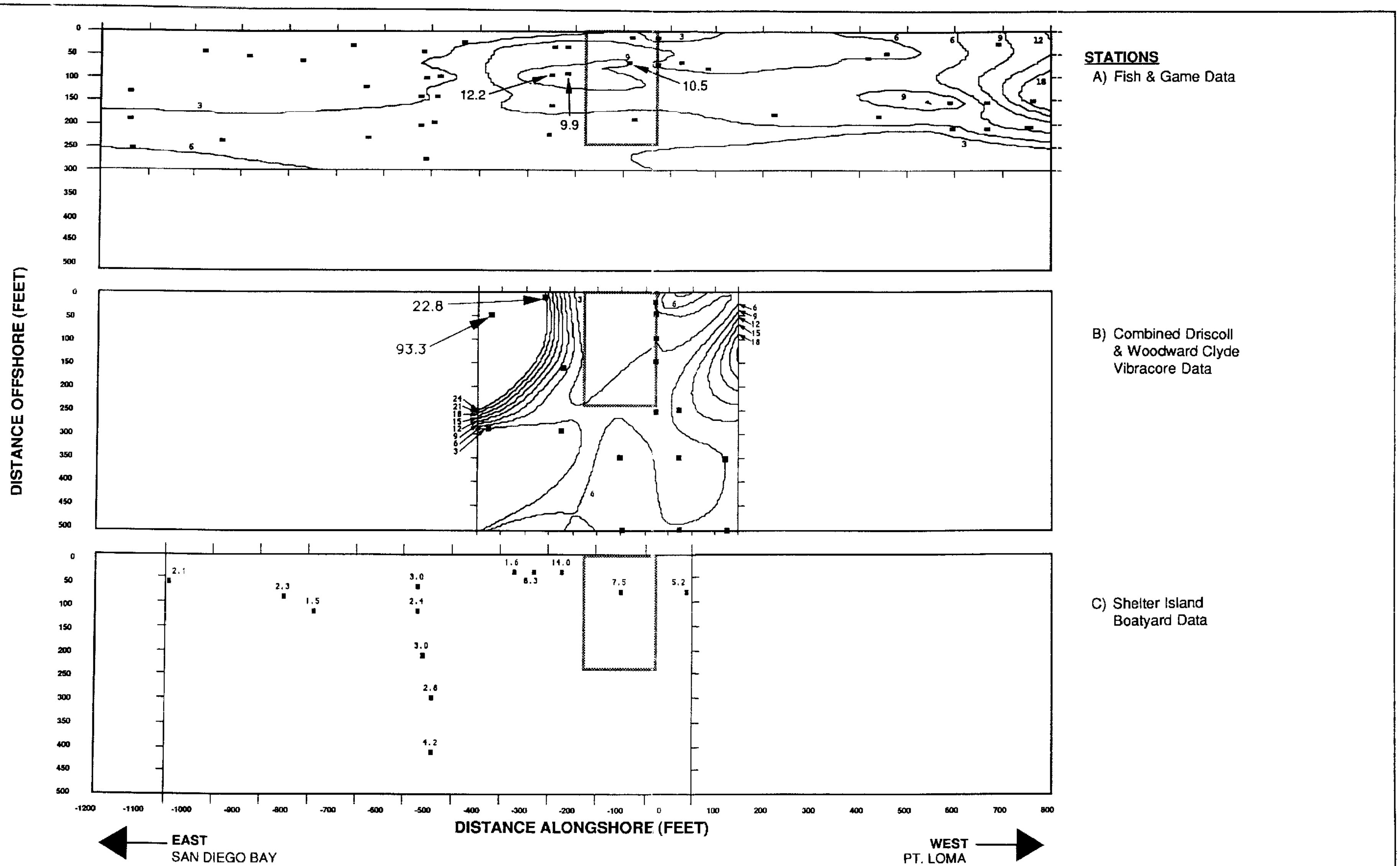




ERC Environmental and Energy Services Co.

Contours of Copper Concentrations at a Depth of 4 Feet Below the Bay Bottom
Assuming the Copper Value at Refusal Is Equal to the Value from the Sample Above

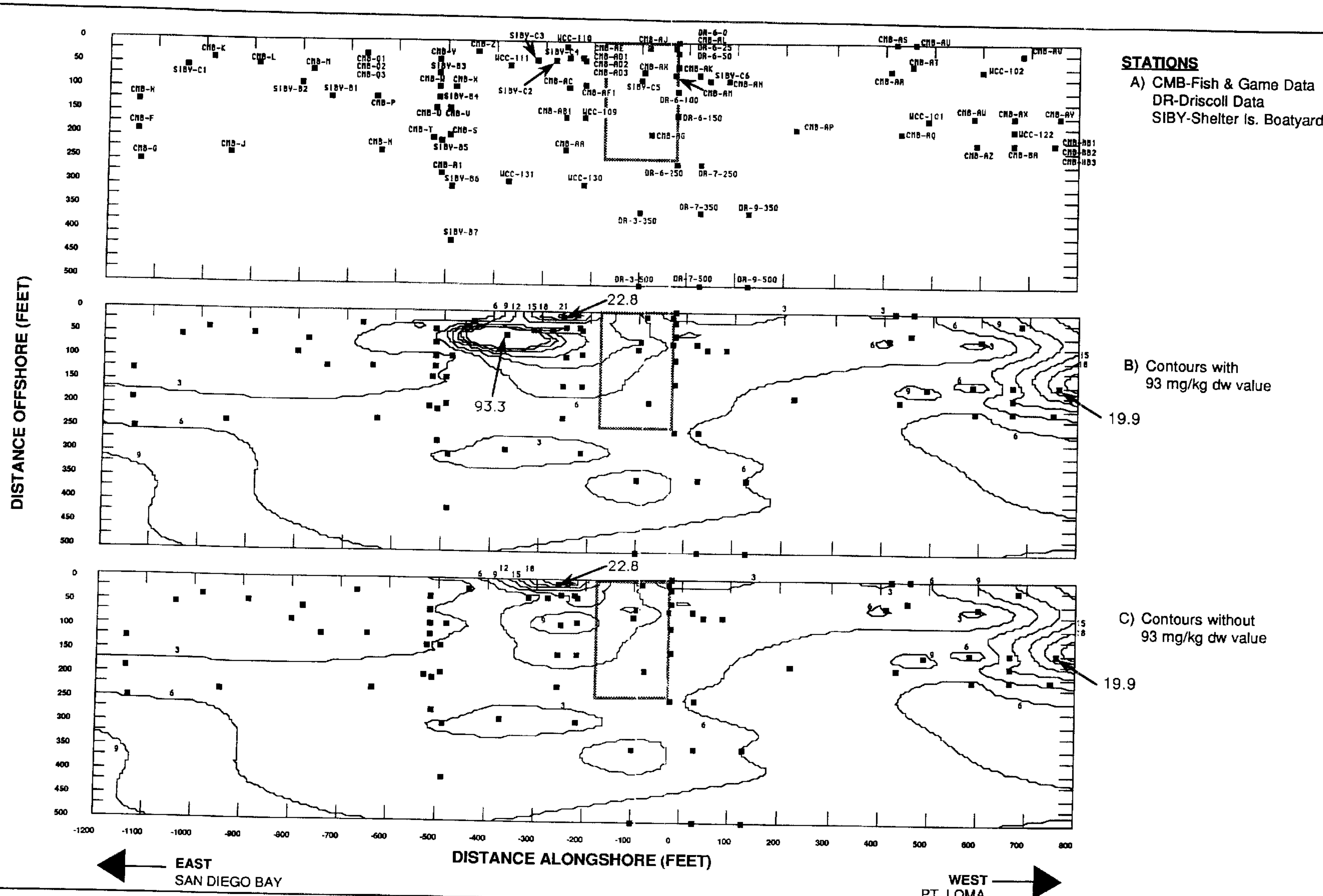
FIGURE 11



ERC Environmental and Energy Services Co.

Distribution of Mercury (mg/kg dw) in Surface Sediments Along the South Shore of Commercial Basin for Individual Data Sets

FIGURE 12

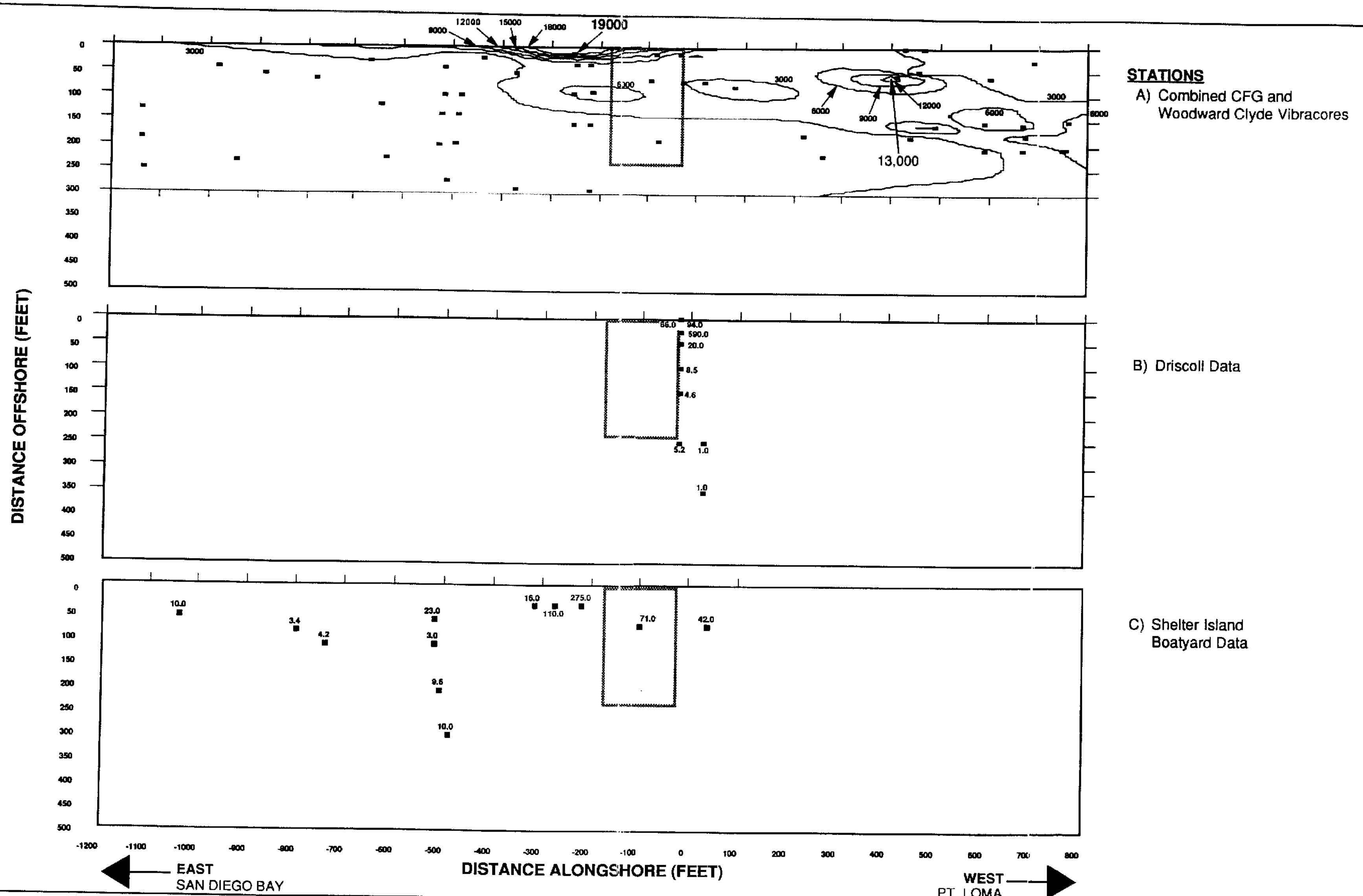


ERC Environmental and Energy Services Co.

Distribution of Mercury (mg/kg dw) Along the South Shore of Commercial Basin for all Data Combined

FIGURE 13

CUT 007372



ERC Environmental and Energy Services Co.

Distribution of TBT (ng/g dw) in Surface Sediments Along the South Shore of Commercial Basin for Individual Data Sets

FIGURE 14

4. SECTION 4
REMEDIAL ACTION ALTERNATIVES ANALYSIS

4.1. Overview

There are several conclusions that can be drawn from the results of studies conducted at Driscoll Custom Boats and other boatyards in Commercial Basin. These include conclusions regarding potential sources of contamination, the proposed cleanup alternatives of the RWQCB, and reasons to not implement any cleanup activities at this time. We have summarized this information in Section 4-1. More detailed discussions of this information is presented in Sections 4-2 through 4.6.

4.1.1. Sources of Contamination

Potential sources of copper, mercury, and TBT in Commercial Basin sediments are numerous (including boatyard activities). The results of this and other studies reviewed in this report show several basic distributional patterns. The large boatyards tend to have high concentrations of the metals in the sediments offshore of their facilities. Driscoll Custom Boats is one of the smaller boatyards, and has lower concentrations of these metals than nearby large boatyards. These patterns strongly suggest that the contaminants found within the boundaries of the Driscoll lease have largely arrived there as a result of the redistribution of contaminants from areas of higher concentration to the east and west. This redistribution is probably a function of natural sediment movements within the basin and high energy transport of sediments from boat propeller wash and bow thrusters. This disturbance and redistribution mechanism may account for much of the lower level contamination throughout the Basin.

4.1.2. Concerns and Limitations of RWQCB Alternatives

Several problems were identified during preparation of this response to the alternatives presented by the RWQCB. The requirement for cleanup to an arbitrary background level is based on the rationale that the concentration of metals in an area unaffected by pollution sources is acceptable. Existing information suggests that greater metal concentrations would not result in significant negative impacts depending on the availability of the contaminants (e.g, bioavailability) to the biological communities. Consequently, selection of background in this manner may result in arbitrarily low cleanup standards.

Use of the AET levels for cleanup is also inappropriate since they were designed as a screening tool to decide at what level biological testing should be conducted to evaluate toxicity. Based on the biological studies done on behalf of Shelter Island Boatyard, Mauricio and Sons, Eichenlaub Marine and Kettenburg Marine it appears that the biologically based cleanup levels should be about 500 mg/kg for copper and 4.8 mg/kg for mercury.

Ocean Plan levels for much of Commercial Basin's sediments are not attainable based on our data without a cleanup of most of the basin.

The limitations placed on Alternative 4 are such that the no-action alternative is effectively eliminated. Any alternative suggested must meet Ocean Plan standards, which precludes any true alternative.

4.1.3. Reasons to Not Implement Cleanup Actions

Several major reasons to not implement cleanup activities include: incomplete source control, no regional approach to problems, no consistent relationship between the concentration of metals in the sediment and toxicity as measured by bioassay tests , bioaccumulation, and benthic community analysis, and the potential problems generated by resuspension of contaminants during cleanup activities.

Great strides have been made in the elimination of sources of contamination into Commercial Basin directly from boatyard activities. However, additional sources still remain. They include but are not limited to, leaching of copper from antifouling boat hull paint, in-water hull cleaning activities by divers, and dust from sanding activities at locations around the basin that are not controlled, e.g., individuals working on their own boats, etc. Until source control is complete, the potential for continued contamination or recontamination will continue despite cleanup efforts. Until controlled these activities will minimize the effectiveness of any cleanup.

At present there is no region-wide approach to the cleanup. Since much of the basin may require cleanup under the existing Orders, the cleanup operations must be coordinated. A lack of coordination would likely produce a patchwork of clean and contaminated sediments, with spillage and redistribution from contaminated areas into cleaner areas during and after dredging. Although new point source discharges related to boatyards have been stopped, non-point source discharges (i.e., leaching from hulls and unauthorized underwater hull cleaning, etc.) will continue as long as these contaminants are used in antifouling paints. Any cleanup of portions of the Basin will probably be short-lived due to redistribution and probable recontamination from areas not cleaned at this time, and from new input from non-point sources. Consequently, any cleanup that is not part of a well organized regional plan that considers the Basin as a system is likely to be costly and not effective in reducing Commercial Basin contamination.

At present there is no clear and consistent relationship between trace metal concentrations in marine sediments and toxicity or bioaccumulation in marine animal tissue. There is a plethora of studies that show biological problems developing from excess sediment trace metal concentrations. There are also studies showing no relationship between metal concentrations in sediments and bioaccumulation of metals in animal tissue, a primary indicator of negative impacts on the biota.

Resuspension and probable redistribution of contaminants from the sediments will result from any type of removal operations. This resuspension of contaminants may cause the redistribution of contaminated material over a new and/or larger area during any cleanup operations.

Therefore, the best alternative at present is to leave the sediments in-place, at least until a region-wide approach is developed, complete source control is achieved, and clearly definable biological impacts can be demonstrated. At that time the viability of the cleanup should be re-evaluated.

4.2. RWQCB Order Cleanup Strategies

Four cleanup alternatives have been presented by the RWQCB. Section 4.2 provides a discussion of the alternative cleanup levels and strategies developed by the RWQCB. The four alternatives presented provide different approaches to the selection of a cleanup level. The discussions include descriptions of each alternative along with implications for cleanup. General results of the sediment studies conducted at Commercial Basin applicable to each alternative provide support for the response to each alternative. A section on potential cleanup methodologies provides information on basic methods of operation, cost, and feasibility of cleanup.

4.2.1. Alternative 1) removal and/or treatment of the contaminated sediment to attain the following background concentrations of Cu, Hg, and TBT in the bay sediment:

Cu 63 mg/kg, Hg 0.81 mg/kg, and TBT 193 ng/g

The basis for this alternative is that acceptable sediment concentrations for the contaminants of concern should be similar to those found in sediments collected from sites outside the influence of boatyard activities (i.e. reference areas). Consequently the RWQCB (CFG 1988) sampled three reference sites near the entrance to Commercial Basin expected to be outside the influence of boatyard activity . The mean sediment concentration of each of the three contaminants from these samples have been used by the RWQCB as representative of acceptable background conditions.

The potentially contaminated sediments of concern are located on the bottom of San Diego Bay. At present there is no commercially available technology for in-situ treatment to remove trace metals in submerged sediments, leaving removal of the sediments as the only option to address this alternative. The three possible destinations for the sediments once removed are ocean disposal, placement in a landfill or use as on-site construction fill.

The background, or reference, concentrations chosen by the RWQCB came from sediments at the entrance of Commercial Basin. The area is relatively remote from most point sources, e.g historic in-water hull cleaning at boatyards, rain and process water runoff from boatyards, etc, and nonpoint source discharges in Commercial Basin, including leachates from boat hulls, paint chips, and oxidized paint from underwater hull cleaning, air borne particulates from sanding, etc. In order to evaluate the appropriateness of the RWQCB reference sites we sampled sediments from the adjacent Shelter Island Yacht Basin (SIYB). Conditions in SIYB provide background concentrations from a location with similar nonpoint source inputs from the hulls of large numbers of small recreational boats with antifouling bottom paints, but no direct inputs from boatyards. The same rationale was used by the RWQCB when the California Department of Fish and Game (CFG 1988) sampled three sites in SIYB.
The mean concentration of copper from SIYB ranged from 96 to 112 mg/kg dw depending on various grouping alternatives (e.g., excluding or including results from sediments adjacent to storm drains). Overall the copper values ranged from 37.1 to 243 mg/kg dw. The mean concentration of mercury from SIYB ranged from 0.64 to 0.91 mg/kg dw

depending on various grouping alternatives. Overall, the mercury values ranged from <0.25 to 1.32 mg/kg dw. The TBT concentrations (GC FPD method) averaged 52.5 ng/g dw, with a range from <1 to 558 ng/g dw. The mean copper value was higher than the reference site in Commercial Basin. The mean concentrations of mercury and TBT were lower. Overall numerical difference in the concentration of contaminants between the two areas was small.

Results of this report show that, basically, the entire Commercial Basin and much of Shelter Island Basin are above the cleanup level if the RWQCB background concentrations are used. Any cleanup of less than the entire Commercial Basin would require the adoption of cleanup levels for the three metals that are substantially higher than presently proposed.

4.2.2. Alternative 2) Removal and/or treatment of the contaminated sediment to attain the following AET dry weight sediment concentrations for copper and mercury described in Finding 15 and the State Water Resources Control Board's proposed water quality criteria for TBT.

Cu 390 mg/kg, Hg 0.59 mg/kg, TBT 6 ng/l

The lower and maximum Apparent Effects Thresholds (AETs) were designed as screening tool by researchers working in Puget Sound to define a range of concentrations within which a chemical of concern might cause problems to the biota. If potential contaminants are found at concentrations below the Lower AET or screening level, there is no need for further analysis. Concentrations above the screening level indicate that further analysis is required to define whether a problem actually exists. Did they do it? If not, use AETs to be safe.

The present use of Lower AETs as regulatory limits seems inappropriate. The AETs were developed specifically for the biological and physical conditions found in Puget Sound. Species used in developing AETs may change their sensitivities with changing physical and biological conditions, and the species appropriate for Puget Sound are often inappropriate elsewhere. This was strongly stated in the PSDDA reports (Tetra Tech 1988) and repeated in the Cleanup and Abatement Order issued to Driscoll Custom Boats (Cleanup and Abatement Order No. 89-31). In the Alternative Action Response for Shelter Island Boatyard (SIBY 1989), the AET development authors further state that the present use of AETs is inappropriate.

A more appropriate requirement for this alternative would require bioassays and benthic studies for areas where contaminant concentrations exceed the most appropriate AETs. During studies conducted in response to the Cleanup and Abatement orders for the Commercial Basin boatyards, bioassays have been performed on sediments at Shelter Island Boatyard and Nielsen-Beaumont (formerly Mauricio and Sons), located to the east of Driscoll, and at Kettenberg Marine and Eichenlaub Marine, located to the west. Generally, sediment metal concentrations for copper, mercury, and TBT from Shelter Island Boatyard and Eichenlaub are similar to most sediments from Driscoll. The concentrations of sediment metals from Kettenberg and Mauricio are generally higher.

Results of *Repoxinius* (amphipod) bioassays performed on sediment from Shelter Island Boatyard (PTI 1990), showed no toxicity in the nearshore areas. The two sites with lower survival were located offshore and away from immediate boatyard activities. All three metals were found at levels below their maxima at those sites. The Eichenlaub bioassay test site results indicated no adverse effects based on bioassays, bioaccumulation, or benthic community analysis (KLI 1990). Results of bioassays at Mauricio and Kettenberg Marine provided mixed results (KLI 1990). Amphipod bioassay results from Kettenberg sediments showed higher survival than the reference site, despite much higher levels of both mercury and copper. The same test for Mauricio showed significantly lower survival despite lower concentrations of the same metals. The benthic community study showed Mauricio being most similar to Kettenberg, but with only Kettenberg being significantly different from the reference site.

These studies also investigated bioaccumulation on water column fish, benthic fish, water column invertebrates, and benthic invertebrates. The fish from the water column, due to their motility, are better indicators of general conditions in the entire bay. They showed little bioaccumulation. The benthic fish provide a better indicator of conditions in a specific area, since they may move less. Levels of bioaccumulation were higher for mercury, but still very low. Bioaccumulation in mussels in Commercial Basin was higher than from a reference site at Harbor Island in the bay (NOAA 1989b) for copper, but was lower for mercury.

The overall results for these tests suggest that less stringent levels should be set for the cleanup level than the AET values presented in the Cleanup and Abatement Order. At Shelter Island Boatyard, sediment concentrations at bioassay study sites with 250 mg/kg for copper, 4.2 mg/kg for mercury, and 23 ng/g for TBT (GC FPD method) showed no significant differences in amphipod mortality or reburial when compared with the reference site. Therefore these could be considered safe levels based on the SIBY bioassay results. Further, analysis of benthic community structure showed the stations with the highest levels of contaminants had benthic populations similar to stations with much lower contaminant levels. However, KLI (1990) showed significant differences in the benthic community between the reference and Kettenberg sites and amphipod survival in bioassays at Mauricio was also significantly lower than the reference site. Based on results for all boatyards it can be concluded that the levels that appear safe are 530 mg/kg for copper and 4.8 mg/kg for mercury. Overall, the bioassay results from all studies suggest that a copper level at about 500 mg/kg and a mercury level of about 4.8 mg/kg would not significantly impact the beneficial uses of Commercial Basin.

4.2.3. Alternative 3) Removal and/or treatment of contaminated sediment to attain the OCEAN PLAN water quality standards for Cu and Hg and the RWQCB standard for TBT

Cu 3 ug/l, Hg 0.04 ug/l, TBT 6 ug/l

Under this alternative it would be necessary to ascertain the degree of Cu, Hg, and TBT migration from the sediments to the water column that will occur and demonstrate that any Cu, Hg, and TBT migration would not cause the above concentrations to be exceeded in either the water column or the interstitial water found within the sediment.

Partitioning coefficients for the leaching of materials from the sediment to the water column can be calculated. In Commercial Basin a TBT partitioning coefficient value (Kp) of 1,673 was obtained by Valkirs et al.(1986). Using Valkirs' value, the sediment concentrations exceeding 10 ug/l would exceed 6 ng/l in the overlying water.

Present data provides information about the relationship between sediment and pore water (i.e., interstitial water) for copper. The results provide a Kp of 283 if three of the four samples are used (r^2=0.981). The remaining sample was sufficiently different from the other three that it dropped the r^2 value from 0.981 to 0.005. With this Kp value, a sediment concentration above 849 ug/kg would be expected to cause the ocean plan standard of 3 ug/l to be exceeded.

The interstitial water samples collected for mercury were all below the detection level (<0.5 ug/l) so a relationship could not be defined. This level of detection is the best routinely achievable by commercial chemistry laboratories.

TBT samples showed high variability with one concentration higher in the interstitial water than in the sediment. The results are probably an artifact of the Hydride Cryogenic technique used for the analysis. The technique is very sensitive for the analysis of water (Stallard 1989). It is not as sensitive for the analysis of sediments, as only a fraction of the TBT in the sediment is removed by the sodium borohydrate wash. The data suggest a net movement of TBT from the water column to the sediment, a situation that is not likely. The result is that we must rely on the relationship developed by Valkirs et al.(1986). See the TBT discussion in Materials and Methods (Section 2) and the results presented in Appendix F for additional information regarding TBT analysis problems.

In summary, sample results from all locations exceed Ocean Plan standards including all of Commercial Basin and much of Shelter Island Basin. No viable cleanup plan can be developed that would clean up the sediment to a sufficiently low level to meet the criteria for this alternative, based on these results.

4.2.4. Alternative 4) any remedial action alternative proposing the attainment of Cu, Hg, and TBT concentrations in the sediment, water column and interstitial water that will not cause the above concentrations to be exceeded in either the water column or the interstitial water that would comply with the following criteria:

1) The proposed Cu, Hg, and TBT concentrations to be attained in the affected San Diego Bay sediment contaminated zone will not alter the quality of San Diego Bay waters to a degree which unreasonably affects the beneficial uses of San Diego Bay.

2) The proposed Cu, Hg, and TBT concentrations to be attained in the affected San Diego Bay sediment contaminated zone will be consistent with the maximum benefit to the people of the state.

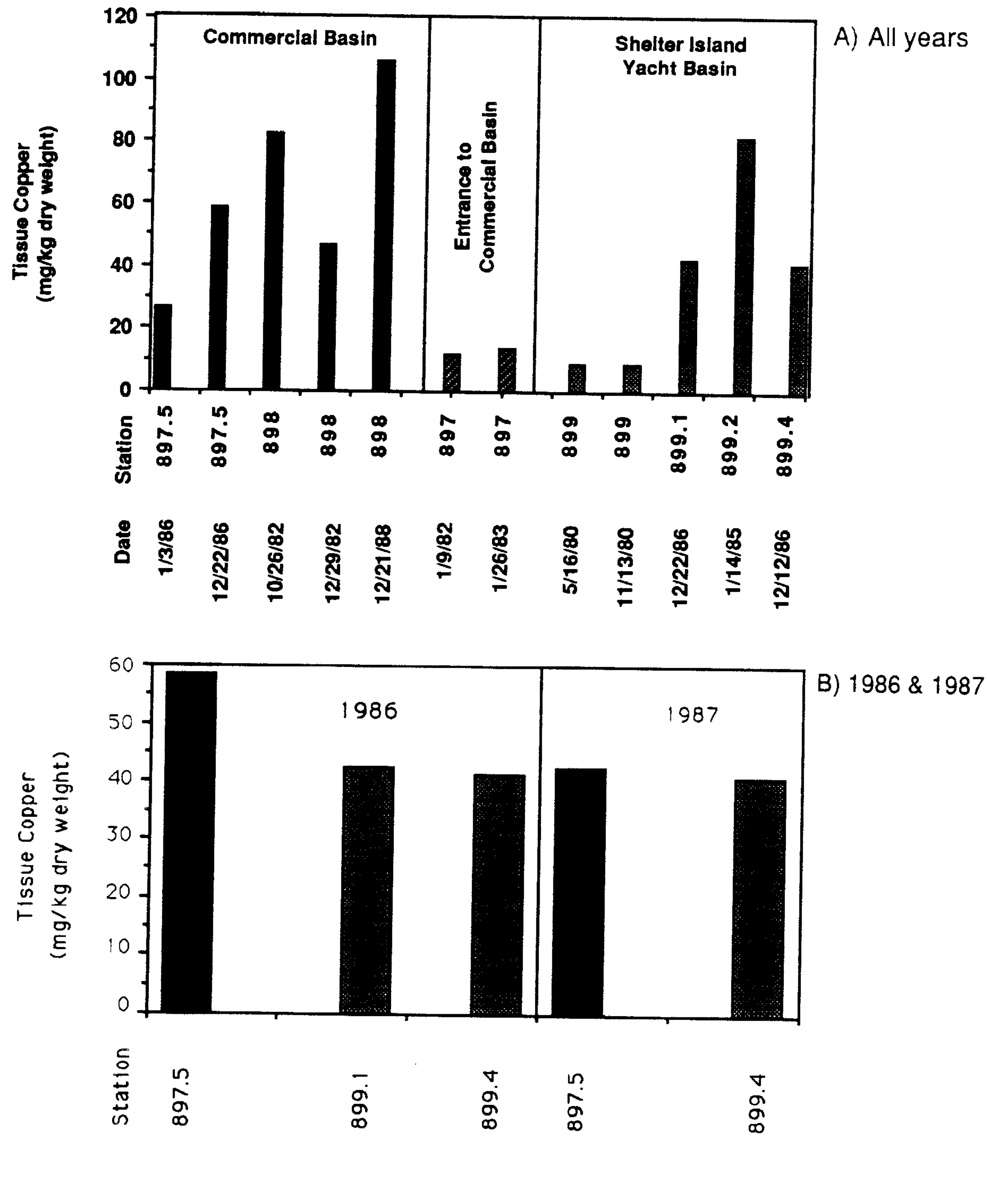
3) The proposed Cu, Hg, and TBT concentrations to be attained in the affected San Diego Bay sediment contaminated zone will not result in water quality less than prescribed in the Basin Plan, Ocean Plan or other prescribed policies.

Alternative 4 also states that any alternative presented, including the "no action", must comply with all three stated conditions. The required conditions include meeting Ocean Plan standards. As stated above, we believe this is not possible. Consequently, within the framework provided by Alternative 4, there are no possible alternatives that we can [redacted] present.

4.2.5. Summary and Conclusions

We have reviewed the alternatives presented, and despite reservations about the limitations imposed and the underlying need for a cleanup, we have continued with the analysis as required by the Cleanup and Abatement Order. One of the reservations is based on comments from NST and NOAA (1988) that there is no clear relationship between concentration and biological effects. A conclusion of the NOAA Benthic Surveillance Project (NOAA 1988) is "However, although concentrations of a number of trace metals were highest in sediments from urban sites, no positive correlations were found between concentrations of metals in sediment and those in the livers of target fish species." Long and Morgan (1990), refer to comments from Tessier and Campbell (1987) when they state "Uptake (and therefore, effects) of trace metal contaminants is largely a function of bioavailability. Bioavailability is strongly influenced by a complex suite of physical, chemical and biological factors in the sediment."

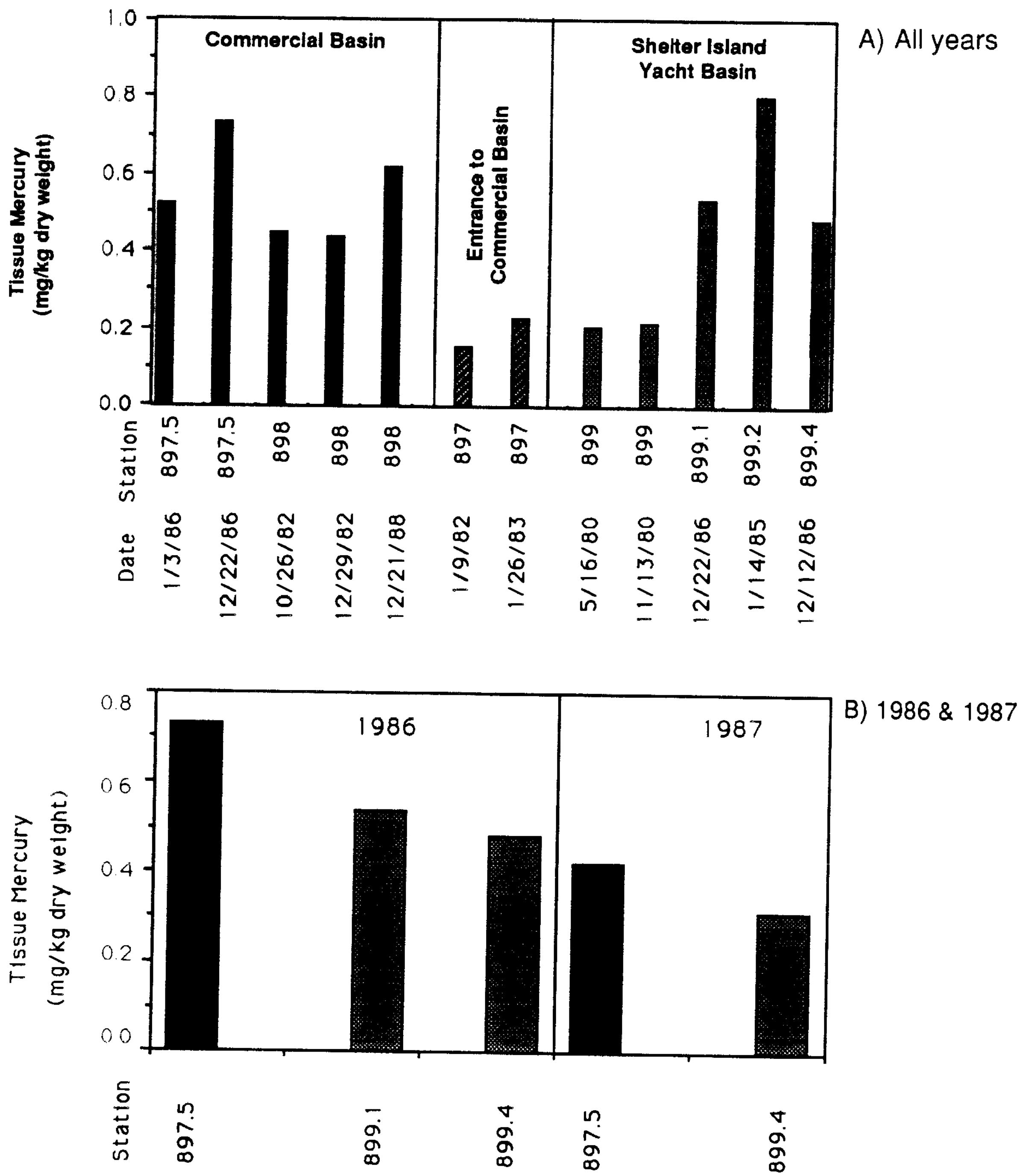
State of California Mussel Watch data from Commercial and Shelter Island Basins collected from 1977 to 1986 (SWRCB 1988), 1987 (SWRCB 1988), and in 1988 (SWRCB 1989) also tend to support the suggestion that there is no clear relationship between between concentrations of metals in sediment and those the tissue of biota (i.e., mussels) exposed to the sediments. Commercial Basin Stations (897.5 and 898) are located at the west end of the Basin where surface sediment values for copper ranged from 128 (Station CMB-BK) to 3,528 mg/kg (Station CMB-BU2) and averaged 947 mg/kg. Mercury ranged from 1.75 mg/kg (Station CMB-BK) to 19.91 mg/kg (Station CMB-AY) and averaged 6.75 mg/kg based on CFG (1988) data. Stations in Shelter Island Basin are located from near the entrance (899) to the back of the Basin (899.4). Sediment copper and mercury values in Shelter Island Basin range from 37.1 to 265 mg/kg (mean=112), and 0.28 to 1.32 mg/kg (mean=0.98), respectively based on data from this study. Comparison of all sites for all years for both basins (Figures 15a and 16a) generally indicate considerable similarity in the concentrations of copper and mercury in mussel tissue despite major difference in sediment metal concentrations. During 1986 and 1987 data were collected in both basins during the same time period. This data is presented in Figures 15b and 16b and indicate considerable similarity in the concentration of copper and mercury in tissues between areas, again despite major differences in sediment concentrations.



ERC Environmental and Energy Services Co.

Comparison of Copper Concentrations in Mussel Tissue for Commercial and Shelter Island Yacht Basins Based on State Mussel Watch Data

FIGURE 15



ERC Environmental and Energy Services Co.

Comparison of Mercury Concentrations in Mussel Tissue for Commercial and Shelter Island Yacht Basins Based on State Mussel Watch Data

FIGURE **16**

4.3. Leave In-Place or No Action Alternative

We have reviewed all the alternatives and believe that none will significantly improve the beneficial uses of the Commercial Basin environment to any measurable degree. This and other data show that the bounds of the contamination, based on the limits presented in the Cleanup and Abatement Orders are well beyond the lease boundaries of any boatyard, and that there is an apparent net motion of the contaminated sediments around the basin. Further results of this and other studies indicate that application of the cleanup levels specified in the cleanup orders would result in a cleanup of the entire Basin. New point source discharges related to boatyards have been stopped, however non-point source discharges, e.g. leaching from hulls and unauthorized underwater hull cleaning, etc., will continue as long as these contaminants are used in antifouling paints. Any cleanup of portions of the Basin will probably be short-lived due to redistribution and probable recontamination from areas not cleaned at this time, and new input from non-point sources. Consequently, any cleanup that is not part of a well organized regional plan that considers the Basin as a system is likely to be costly and not effective reducing Commercial Basin contamination.

4.4. Estimate of Sediment Volumes to be Cleaned Up

Based on data presented in Section 3, the entire southern and probably the entire Basin would have to be dredged to meet cleanup specifications in the Order for mercury and TBT. Because it is not possible to accurately determine the source(s) that caused this Basin-wide contamination no estimates of sediment volume were calculated.

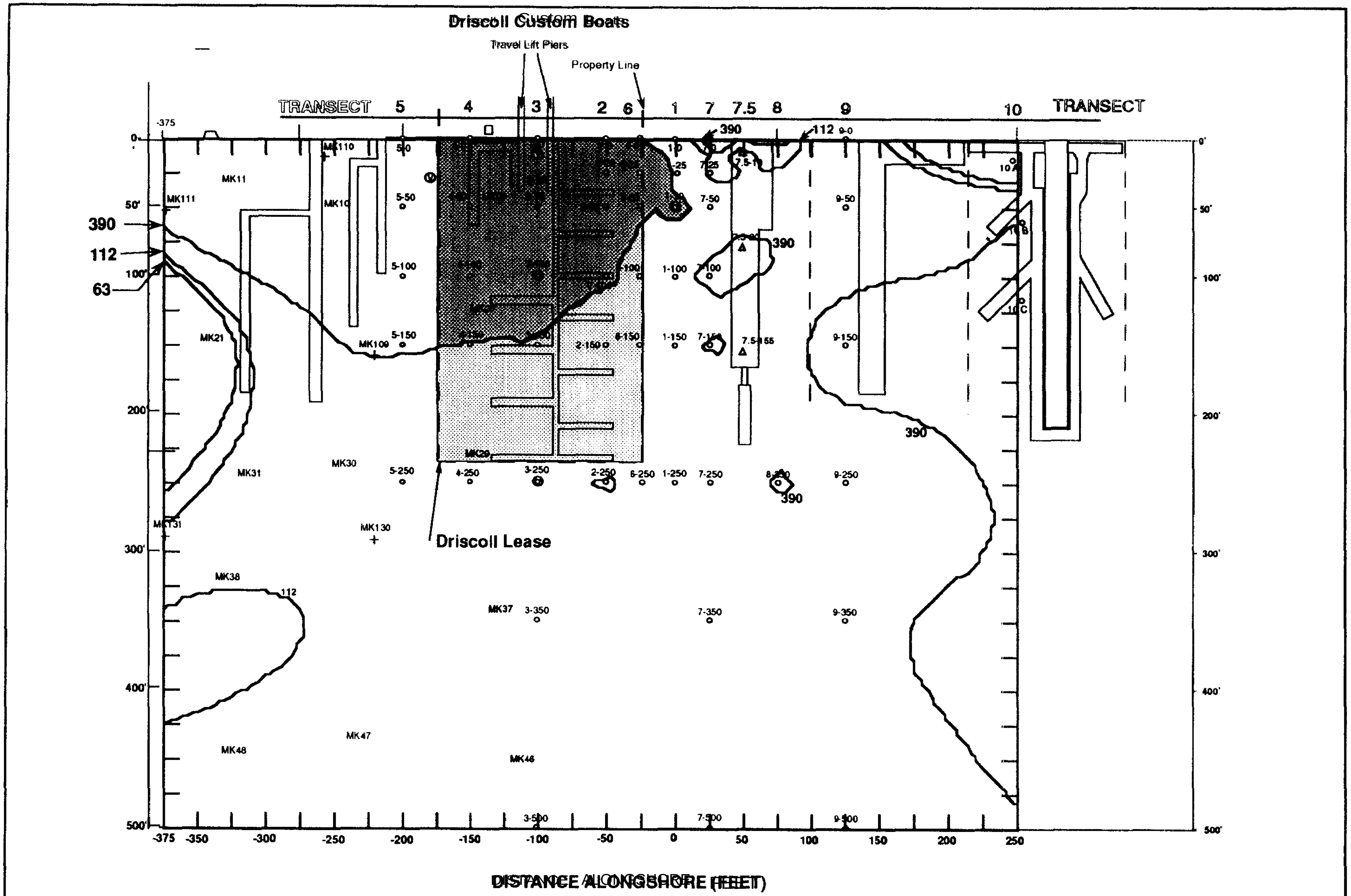
Estimates of the total volume of sediment that would need to be removed from within the Driscoll lease to meet Cleanup and Abatement Order specification were calculated for copper. This was accomplished by contouring the location of three target cleanup concentrations:) 63 mg/kg - the concentration specified in the Order, 2) 112 mg/kg - the background concentration determined from sampling in Shelter Island Basin, and 3) 390 mg/kg - the AET values specified in the order. Contours were plotted on a map of the project site and the area encompassed within each contour was calculated. Total sediment volume was independently estimated for three depths in the sediment column; the upper 1 foot, 3 feet, and 4 feet. The 2 foot depth was assumed to be the same as 1 foot. Estimates for depths of 1 and 2 feet were restricted to the cleanup concentration of 390 mg/kg because the location of contours for cleanup levels of 112 and 63 mg/kg are located were outside the Driscoll lease boundaries and can not be directly associated with a source on the Driscoll lease. The locations of the cleanup contours at a depths of 1 and 2 feet, 3 feet, and 4 feet are presented in Figures 17 through 19. Areas encompassed by each cleanup level are highlighted by a different pattern. The estimated volume of sediment for each cleanup concentration is summarized in Table 5. These estimated volumes were used in the following section to estimate the cost of cleanup for various cleanup methods.

Table 5. Estimated Cleanup Volumes for Copper Contaminated Sediments.

SEDIMENT		CUBIC YARDS	
DEPTH (ft)	63 mg/kg	112 mg/kg	390 mg/kg
1	1,349	1,349	761
2	1,349	1,349	761
3	416	290	174
4	415	296	168
TOTAL	3,529	3,284	1,865

4.5. Evaluation of Alternative Cleanup and Disposal Methodologies

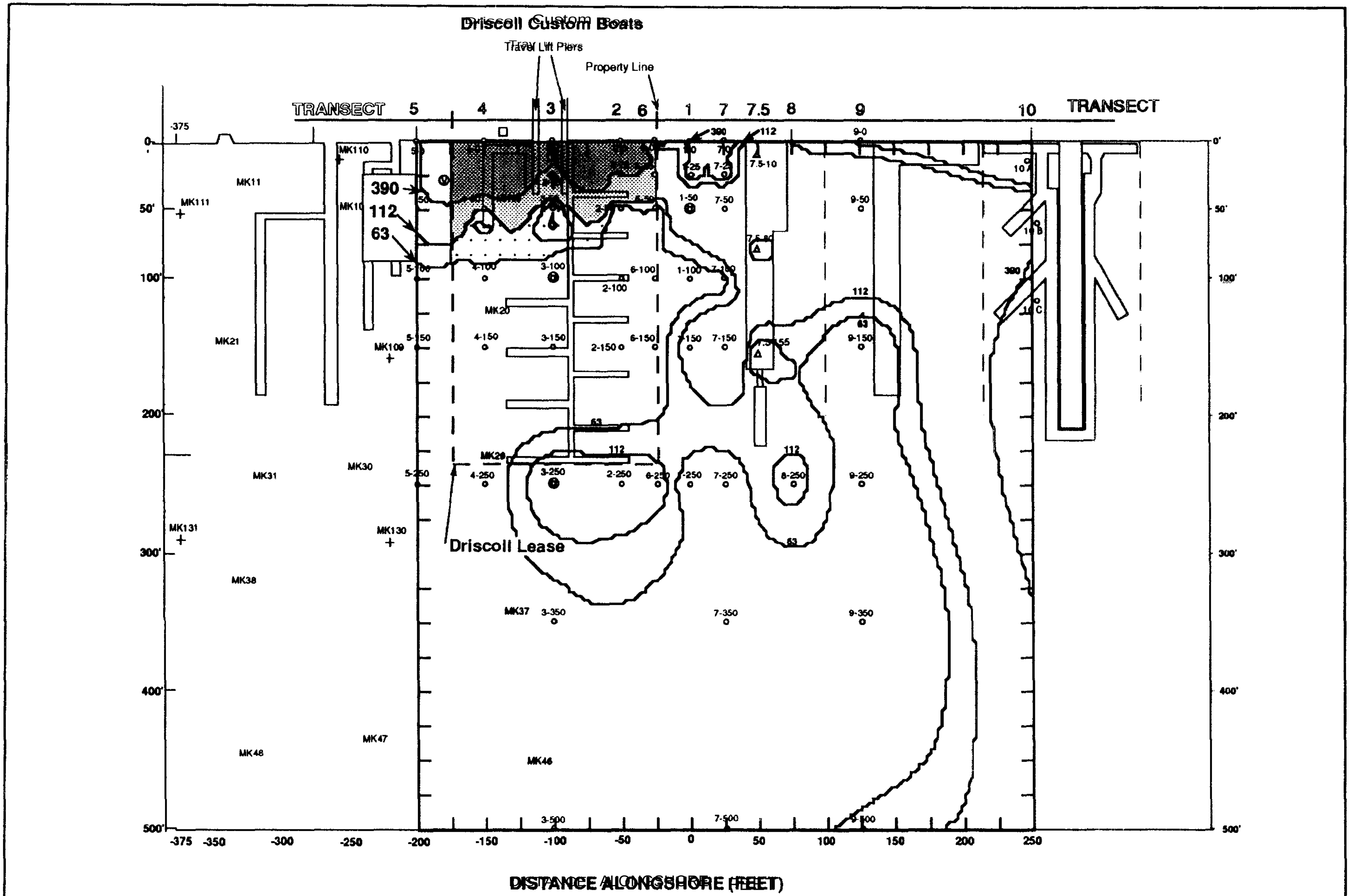
Several cleanup and treatment or disposal methodologies have been identified for removing, treating and/or disposing of contaminated sediment in San Diego Bay by Barker et. al. (1990). Sediment removal methods include mechanical e.g., clam shell, hydraulic e.g., cutterhead and pneumatic dredging. Treatment options include physical, biological, chemical and thermal methods. Disposal options include capping in-place, in-bay containment e.g., island construction, beach replenishment or other use e.g., construction fill, ocean disposal, confined ocean disposal, and landfill. Non-removal remedial actions include leave in-place, burial of contaminated material by natural sedimentation, natural detoxification, and dispersal of contaminated material by wave action and currents.



ERC Environmental and Energy Services Co.

Areas Contained within Target Cleanup Levels of 63, 112, and 390 mg/kg on the Driscoll Lease at a Depth of 1 foot Below Bay Bottom

FIGURE 17



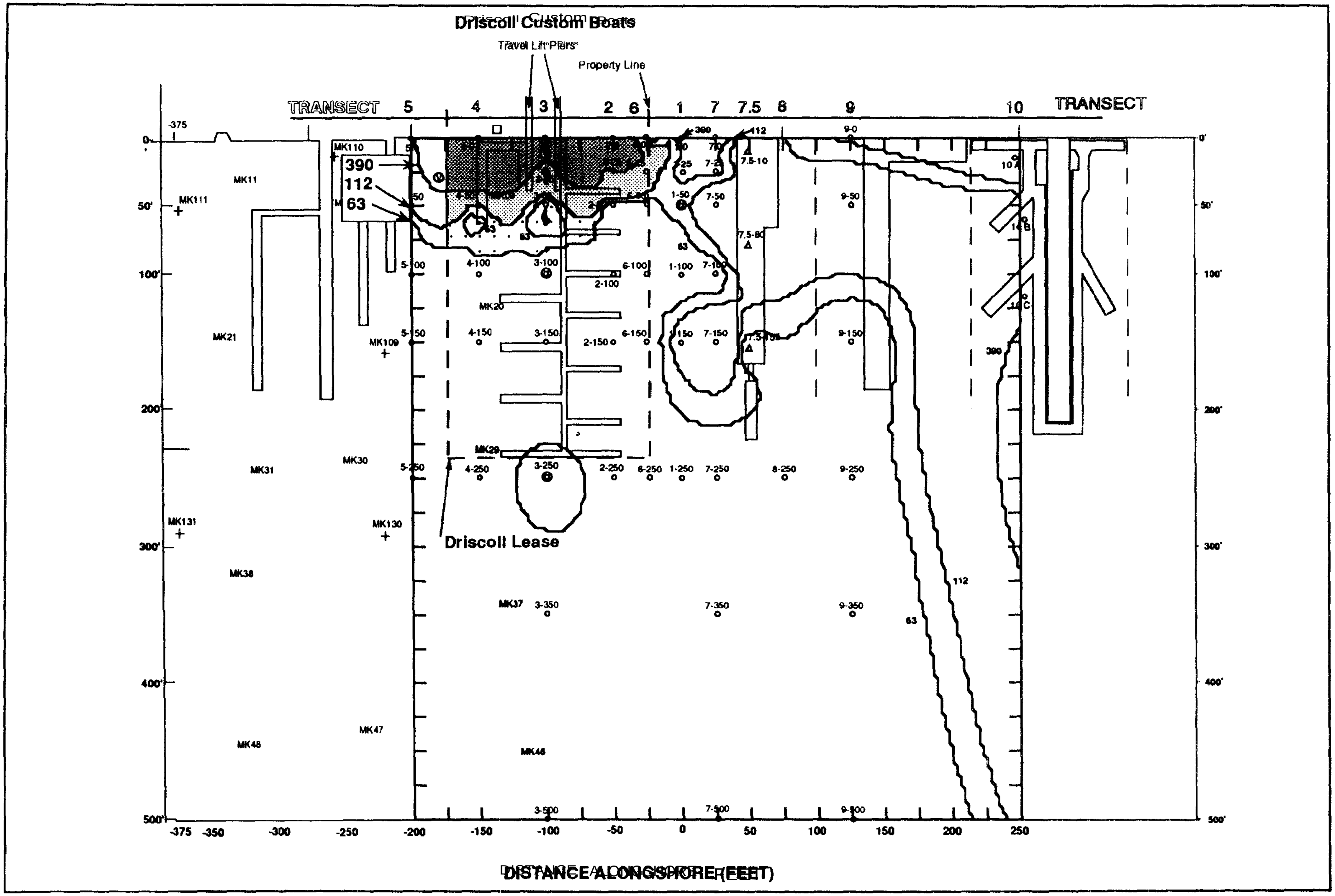
ERC Environmental and Energy Services Co.

Areas Contained within Target Cleanup Levels of 63, 112, and 390 mg/kg on the Driscoll Lease at a Depth of 4 feet Below Bay Bottom

FIGURE 18

51

CUT 007388



ERC Environmental and Energy Services Co.

Areas Contained within Target Cleanup Levels of 63, 112, and 390 mg/kg on the Driscoll Lease at a Depth of 3 feet Below Bay Bottom

FIGURE

19

52

CUT 007389

Regardless of the removal method, the contaminated sediment dredged from the bay must be separated into two distinct waste streams, solids and water. Once separated the waste streams may or may not require treatment. Both will require a variety of permits from both state and federal agencies prior to removal and disposal.

4.5.1. Dredge Methods

Conventional mechanical e.g., clamshell and hydraulic e.g., cutterhead dredges are in routine use throughout the United States for maintenance and new project dredging as well as the removal of contaminated sediments. Typically this equipment works as well as special equipment e.g. pneumatic dredges when operated with care (Palermo 1990) and is readily available. Some advantages and disadvantages of both systems are discussed below.

The mechanical dredge process is efficient and cost effective, and is capable of removing large amounts of sediment in short periods of time. Typical production rates range from 1,000 up to 5,000 CY/day for a clam dredge with a 20 CY bucket and 500 to 2,500 CY/day for a dredge with a 10 CY bucket, depending on conditions. However, this process could cause sediment resuspension during operation. Resuspension would potentially release contaminants into the water column in the from of particulates, from desorption from sediments, and/or release of interstitial water. These problems can be minimized with a sealed bucket and/or containment within a silt curtain, and by minimizing the duration of dredging operations.

A hydraulic dredge removes and transports sediment in liquid slurry form. This slurry generally consists of 10 to 20 percent solids and 80 to 90 percent water. Major disadvantages of hydraulic dredging include the large volume of water produced relative to the volume of sediment removed and the potential for excess turbidity from sediment disturbed but not sucked into the dredge. Typical production rates range from 1,000 to 5,000 CY per day. If we assume a production rate of 5,000 CY per day of slurry the dredge would produce 800,000 gallons of process water per day. This results in the need for large areas of land to serve as settling/dewatering areas for the slurry. This volume of water would likely require 40 Baker storage tanks (10 ft x 10 ft x 30 ft) to store and treat the water for each day of operation. The dredging operations would require 5 to 12 days to complete and require over 200 Baker tanks. The Baker tanks would require an area greater than 200 ft x 300 ft. The existing land area of the Driscoll lease is 150 ft x 120 ft.

If the water is discharged to the bay it may need to meet Ocean Plan standards (SWRCB 1990). This water will likely require treatment of some type which will be determined by further treatability tests. It may also be possible to discharge the water to the sewer but this has not been verified and is not likely.

4.5.2. Treatment and Disposal Methods

Of the options identified above, we believe that capping in-place, in-bay containment, beach replenishment, and confined ocean disposal are the least practical or feasible solutions. We believe the most practical and feasible disposal options involve using the material for on-site construction fill or land disposal. We also considered ocean disposal because it has been a traditional method for disposal of dredge material and because it is generally the most cost effective solution. However, it also is considered a low feasibility solution due to numerous restrictions. Rationale for these positions are discussed below by method.

4.5.2.1. Low Feasibility Solutions

Capping-in-Place

Capping-in-place involves placing approximately 3 feet of clean sediment on top of the contaminated sediment. This cover presumably seals the underlying contaminated sediment from the water column. This approach will reduce the depth of water in this already shallow area making it impractical to operate and berth boats for the boatyard. In addition, the integrity of the cap would, over time, become prone to disruption from boat propeller wash. This approach would also restrict the future use of this area since dredging for maintenance or new projects to increase the water depth to accommodate larger vessels would not be possible without re-addressing the contaminated sediment issues. Finally, monitoring the integrity of the cap would likely be required for an indefinite period of time and potential repair to a damaged cap could require expenditures in future years.

In-Bay Containment

In-bay containment could be accomplished by developing a special containment area, such as an artificial island. This would, however, generate numerous environmental issues such as loss of subtidal bay habitat and would require the interaction of several agencies to decide such factors as location, size, and operational procedures including long-term maintenance and containment responsibility. The permitting requirements of state and federal agencies are likely to be time consuming and formidable, especially if the material to be disposed on the island included hazardous waste listed under California Title 22 regulations.

Beach Replenishment

This alternative involves dredging the material from the existing location and placing it on a beach to replace sand lost due to erosion. Because of the nature of some components we believe that beach replenishment would be difficult to permit. If the material is an environmental problem in its present location in an industrial area it would be difficult to justify placing it on a public beach.

Confined Ocean Disposal

The proposed ocean disposal site known as LA-5 is the only officially designated ocean disposal site south of the Los Angeles area ocean disposal sites. Although this site has been temporally closed, the EPA expects that it will be open and operational by early 1991. However, it is located in approximately 500 feet of water, which would make capping or otherwise confining contaminated sediment impractical.

4.5.2.2. More Feasible Solutions

Ocean Disposal

Ocean disposal involves dredging the material (solids and associated water) from the bay, placing it in dump barges, and transporting it to the ocean disposal site (LA-5) offshore from San Diego for disposal. The sediment would be left as is, or chemically stabilized to permanently bind the contaminants to the sediment particles. Ocean disposal has been the traditional method used for dredge spoils. However, prior to disposal the proposed dredge sediment must pass a series of bioassay and chemical tests approved by the EPA and U.S. Army Corps of Engineers (COE) and be determined non-toxic and suitable for ocean disposal. The concentration of mercury in the sediments on the Driscoll lease and hydrocarbons associated with the adjacent fuel dock lease may preclude ocean disposal as an option.

Landfill

This alternative involves dredging the material from the bay and dewatering the sediment on land or in barges at the project site. The sediment would be left as is or chemically stabilized to permanently bind the contaminants to sediment particles. The sediment would then be trucked to a Class 3 landfill, such as Otay Mesa, for disposal. The water from the dewatering operation could be returned to the bay or discharged into the sewer, depending on the concentration of chemicals present. Treatment of the water is likely to be required before either discharge scenario can be implemented.

Onsite Construction Fill

This alternative involves dredging the material from the bay and dewatering the sediment on land or in barges at the project site. The sediment would be left as is or chemically stabilized to permanently bind the contaminants to sediment particles. The sediment would then be used as construction fill at the project site. The water from the dewatering operation could be returned to the bay or discharged into the sewer depending on the concentration of chemicals. Treatment of the water is likely to be required before either discharge scenario can be implemented.

4.6. Remedial Cost Estimates

Remedial cost estimates were developed for three of the more feasible cleanup methodologies discussed above, based on removal with either a clamshell or hydraulic dredge (Tables 6 and 7). More detailed information supporting the cost estimates in Tables 6 and 7 and Figure 20 are presented in Appendices G and H. All cost estimates are based on numerous assumptions (e.g., availability of equipment, ability to obtain required permits, ability to find a suitable disposal option, etc.) including the assumption that all material is non-hazardous under Title 22 protocols. Actual testing and classification of the material under California Title 22 is beyond the scope of the present investigation. However, comparison of the sediment chemistry results obtained during this investigation for the copper and mercury with Title 22 TTLC criteria indicate that the constituents on the Driscoll lease are below hazardous levels. Comparison of the California Department of Fish and Game data for the Driscoll lease shows similar results. Comparison of both data sets with the STLC value times 10 suggests that copper, mercury, and lead could exceed

STLC values when tested with the Wet Extraction Test (WET) protocol. If some or all the material is ultimately classified as hazardous then the cost estimates would be significantly greater. The cost for landfilling hazardous material would likely run significantly more than an order of magnitude higher than for a sanitary landfill. Because there are no Class 1 landfills in San Diego county, the cost of transportation and the logistics of removal would also increase significantly. Consequently, these cost estimates should be used as a guidelines and not an actual cost to conduct the work.

TABLE 6
SUMMARY OF ESTIMATED COST OF CLEANUP FOR CLAM DREDGE OPTION

	63 mg/kg	112 mg/kg	390 mg/kg
ESTIMATED NUMBER OF CUBIC YARDS OF SEDIMENT	3529	3284	1865
ESTIMATED GALLONS OF WATER	712663	663186	376627
ESTIMATED NUMBER OF TANKS (75 % SOLIDS)	18	17	9
ESTIMATED NUMBER OF BARGES (extra barge space allows initial settling of solids)	2	2	2

OPTION	OCEAN DISPOSAL		LANDFILL		ON-SITE		LEAVE IN PLACE
TREATED?	NO	YES	NO	YES	NO	YES	
COSTS COMMON TO ALL OPTIONS							
DOCK RELOCATION COSTS AT DRISCOLL BOATYARD							
SUBTOTAL	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
DREDGE REQUIREMENTS FOR ALL OPTIONS							
SUBTOTAL - 63 PPM	$181,527	$181,527	$181,527	$181,527	$181,527	$181,527	
SUBTOTAL - 112 PPM	$181,466	$181,466	$181,466	$181,466	$181,466	$181,466	
SUBTOTAL - 390 PPM	$181,111	$181,111	$181,111	$181,111	$181,111	$181,111	
ALTERNATIVES							
ALTERNATIVE - 63 PPM CLEANUP							
SUBTOTAL	$61,174	$547,927	$445,671	$728,237	$319,636	$644,550	
TOTAL	**$272,701**	**$759,455**	**$657,198**	**$939,764**	**$531,163**	**$856,077**	**1***
ALTERNATIVE - 112 PPM CLEANUP							
SUBTOTAL	$59,704	$519,260	$419,497	$688,833	$302,211	$610,955	
TOTAL	**$271,170**	**$730,726**	**$630,963**	**$900,299**	**$513,677**	**$822,421**	**1***
ALTERNATIVE - 390 PPM CLEANUP							
SUBTOTAL	$51,190	$353,223	$267,297	$460,007	$200,690	$417,337	
TOTAL	**$262,301**	**$564,334**	**$478,408**	**$671,118**	**$411,801**	**$628,448**	**1***

1* The costs for Option 7 are unceatin at this time. They will include legal and environmental assessment costs for the response to the Cleanup and Abatement Order

TABLE 7

SUMMARY OF ESTIMATED COST OF CLEANUP FOR CUTTER HEAD DREDGE OPTION

	63 PPM	112 PPM	390 PPM
ESTIMATED NUMBER OF CUBIC YARDS OF SEDIMENT	3529	3284	1865
ESTIMATED GALLONS OF WATER	712663	663186	376627
ESTIMATED NUMBER OF TANKS (10 % SOLIDS)	356	332	188
ESTIMATED NUMBER OF BARGES	12	11	6

OPTION	OCEAN DISPOSAL		LANDFILL		ON-SITE		LEAVE IN PLACE
TREATED?	NO	YES	NO	YES	NO	YES	
COSTS COMMON TO ALL OPTIONS							
DOCK RELOCATION COSTS AT DRISCOLL BOATYARD							
SUBTOTAL	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
DREDGE REQUIREMENTS FOR ALL OPTIONS							
SUBTOTAL - 63 PPM	$181,527	$181,527	$181,527	$181,527	$181,527	$181,527	
SUBTOTAL - 112 PPM	$181,466	$181,466	$181,466	$181,466	$181,466	$181,466	
SUBTOTAL - 390 PPM	$181,111	$181,111	$181,111	$181,111	$181,111	$181,111	
ALTERNATIVES							
ALTERNATIVE - 63 PPM CLEANUP							
SUBTOTAL	$653,606	$1,747,487	$1,499,428	$1,803,168	$1,394,566	$1,698,306	
TOTAL	**$865,133**	**$1,959,015**	**$1,710,955**	**$2,014,695**	**$1,606,094**	**$1,909,834**	**1***
ALTERNATIVE - 112 PPM CLEANUP							
SUBTOTAL	$634,819	$1,655,512	$1,421,178	$1,710,218	$1,323,596	$1,612,636	
TOTAL	**$846,285**	**$1,866,978**	**$1,632,644**	**$1,921,684**	**$1,535,062**	**$1,824,102**	**1***
ALTERNATIVE - 390 PPM CLEANUP							
SUBTOTAL	$526,009	$1,139,833	$968,865	$1,172,765	$913,448	$1,117,348	
TOTAL	**$737,121**	**$1,350,944**	**$1,179,976**	**$1,383,876**	**$1,124,559**	**$1,328,459**	**1***

1* The costs for Option 7 are uncertain at this time. They will include legal and environmental assessment costs for the response to the Cleanup and Abatement Order

SECTION 5

LITERATURE CITED

Barker, D. 1990. Cleanup Technology and Consequences of Remediation Report. San Diego Bay Symposium.

California Department of Fish and Game (CDFG). 1988. San Diego Bay Cleanup Project: Commercial Basin Sediment Data.

EPA 1986. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd edition), U.S. Environmental Protection Agency, Office of Solid Waste Emergency Response, November 1986.

ERC Environmental and Energy Services Company (ERCE). 1989. Horizontal and Vertical Distribution of Copper in the Sediment, Driscoll Custom Boats, Commercial Basin, San Diego, CA. Prepared for Driscoll Custom Boats.

KLI 1990. Appendix C: Sediment Biological Effects Study Report. Kinnetic Laboratories. Woodward-Clyde Consultants and Latham and Watkins.

Kram, M. L., P. M. Stang and P. F. Seligman 1989. Fate and Distribution of Organotin in Sediments of Four U. S. Harbors. Naval Ocean Systems Center.

Long, E. R. and. L. G. Morgan 1990. The Potential For Biological Effects Of Sediment-sorbed Contaminants Tested In The National Status and Trends Program. NOAA, National Ocean Survey.

NOAA 1988. NATIONAL STATUS AND TRENDS PROGRAM for Marine Environmental Quality, Progress Report; A Summary of Selected Data on Chemical Contaminants in Sediments Collected During 1984, 1985, 1986 and 1987. National Oceanographic and Atmospheric Administration.

NOAA 1989b. NATIONAL STATUS AND TRENDS PROGRAM for Marine Environmental Quality, Progress Report, A Summary of Data on Tissue Contamination from the First Three Years (1986-1988) of the Mussel Watch Project. National Oceanographic and Atmospheric Administration.

Palermo, M. 1990. Cleanup Technologies Review. San Diego Bay Symposium. June 1990.

PTI 1990. Supplemental Sampling Program for Shelter Island Boatyard (Commercial Basin, San Diego Bay).

SIYB 1989. Remedial Action Alternatives Analysis. Prepared by PTI for Shelter Island Boat Yard.

Stallard, M.O. and S.Y. Cola 1989. Optimization of Butyltin Measurements for Seawater, Tissue and Marine Sediment Samples. Applied Organometallic Chemistry, 3: 105-114.

Stallard, M. O., S. Y. Cola and C. A. Dooley 1989. Optimization of Butyltin Measurements for Seawater, Tissue, and Marine Sediment Samples 1989(3): 105-114.

SWRCB 1988. California State Mussel Watch Ten Year Data Summary: 1977-1987. Water Quality Monitoring Report No. 87-3. May 1988

SWRCB 1988. California State Mussel Watch Program Preliminary 1987-88 Results. Division of Water Quality, State Water Resources Control Board.

SWRCB 1990. California State Mussel Watch Program Preliminary 1988-89 Results. Division of Water Quality, State Water Resources Control Board.

SWRCB 1990. CALIFORNIA OCEAN PLAN: Water Quality Control Plan, Ocean Waters of California. California State Water Resources Control Board.

Stephenson, M. D. and D. R. Smith. 1988. Determination of Tributyltin in Tissues and Sediments by Graphite Furnace Atomic Absorption Spectrometry 60(7):

Tessier, A. P. and G. C. Campbell. 1987. Partitioning of Trace Metals in Sediments: Relationships with Bioavailability. In: Ecological Effects of In-Situ Sediment Contaminants. Development in Hydrobiology. Dordrecht, Boston, Lancaster, DR W. Junk.

Teledyne Ryan Aeronautical (TRA). 1988. Characterization of the Vertical Extent of Contaminated Sediments in Convair Lagoon. Prepared for Teledyne Ryan Aeronautical by WESTEC Services, Inc.

Woodward-Clyde Consultants (WCC). 1989. Commercial Basin Boatyards: Sediment Characterization and Remedial Action Alternatives Evaluation. Prepared for Latham & Watkins, 701 "B' St, Suite 2100, San Diego, CA.

Valkirs, A. O., P. F. Seligman and R. F. Lee 1985. Butyltin Partitioning in Marine Waters and Sediments. Oceans 86, Vol 4. September, 1985.

OUT | DATE | OUT TO | FILE NUMBER OR NAME OUT | DATE | OUT TO | FILE NUMBER OR NAME OUT | DATE

5 Feb 94

PACO TERMINALS, INCORPORATED
SAN DIEGO UNIFIED PORT DISTRICT
COPPER ORE BAY SEDIMENT CLEANUP
NPDES CAO ORDER: 85-91
ENFORCEMENT **FILE: 6** 12/90-08/91
02-0045.05 STATUS: C

OUT

HILLYER & IRWIN
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
550 WEST C STREET, 16TH FLOOR
SAN DIEGO, CALIFORNIA 92101-3540

TELEPHONE (619) 234-6121
FAX (619) 595-1313

March 29, 1991

IN REPLY REFER TO
OUR FILE
8481.14

Mr. Arthur L. Coe, Executive Officer
David T. Barker, Senior Water Resource Control Engineer
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
San Diego Region
9771 Clairemont Boulevard, Suite B
San Diego, California 92124

APR - 1 1991

Re: **Cleanup and Abatement Order 85-91**
Addendum No. 6, Directive 4a

Dear Mr. Coe:

Counsel for the San Diego Unified Port District, upon consultation with counsel for Paco Terminals, Inc., submits this report in accordance with the requirements of Directive 4a of Addendum No. 6 to Cleanup and Abatement Order 85-91.

The Port District and Paco have been advised by telephone by outside counsel for Cyprus Mining Company that the mining companies have completed their pilot project analyzing bay sediment samples taken in 1991 off the National City Marine Terminal to determine the technical feasibility of reclaiming copper from the sediments. The Port District and Paco are pleased to report that Cyprus's outside counsel has advised that it has been preliminarily determined to be technically feasible for Cyprus to reclaim copper from the bay sediments off the former Paco site, provided that certain conditions are met.

Based on this advice, the Port District and Paco will include the "mining company option" as one of the alternative potential remediation methods to be studied for environmental, permitting and cost feasibility in choosing a cleanup plan which will be described to the Regional Board by August 1, 1991, in accordance with Addendum No. 6 to the Cleanup and Abatement Order.

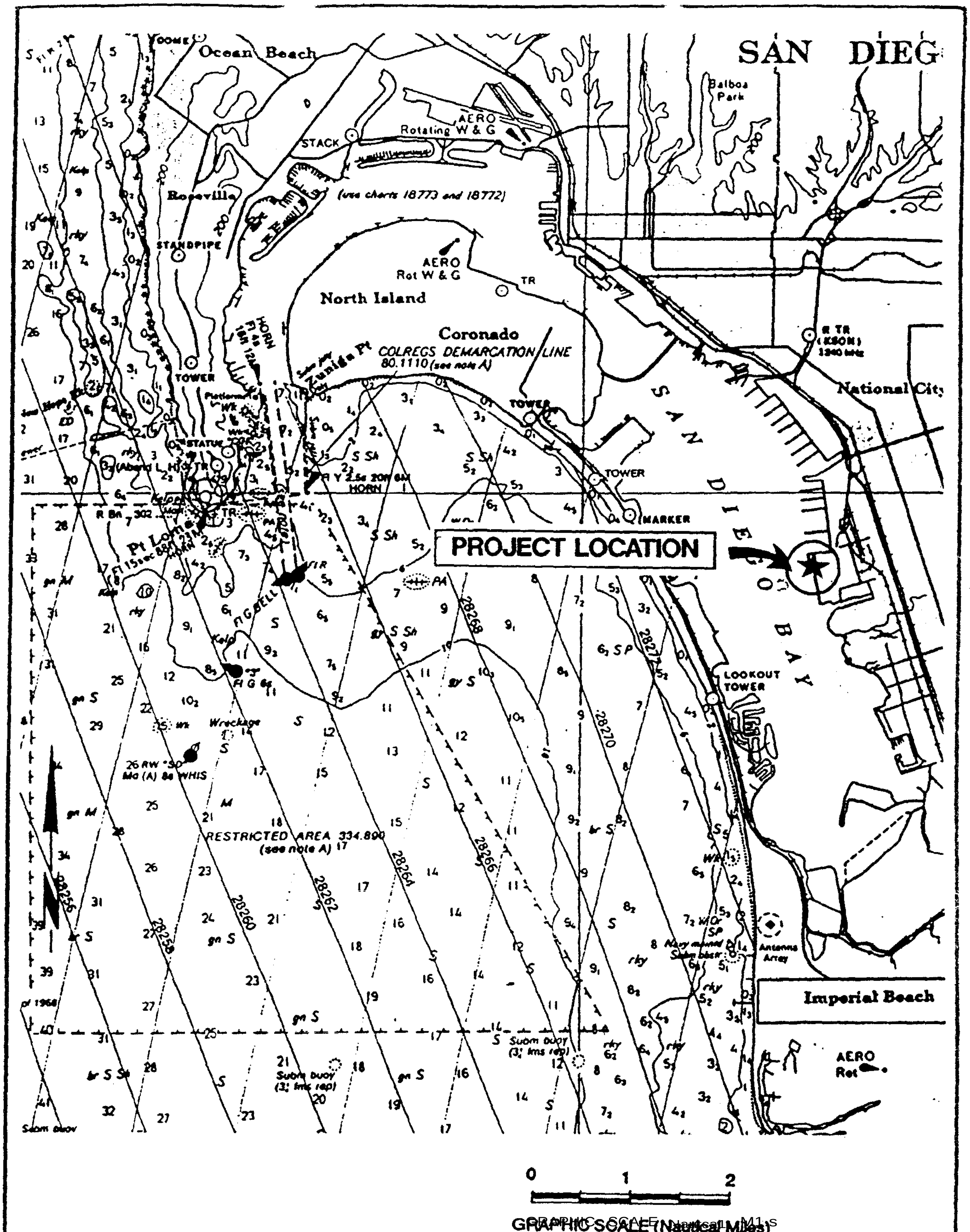
Very truly yours,

David B. Hopkins /KOJ

David B. Hopkins
HILLYER & IRWIN

Counsel for
SAN DIEGO UNIFIED PORT DISTRICT

DBH:koj
c: John J. Lormon, Esq., Counsel for Paco Terminals, Inc.
3/113/8481/14/1:coe03/29/91

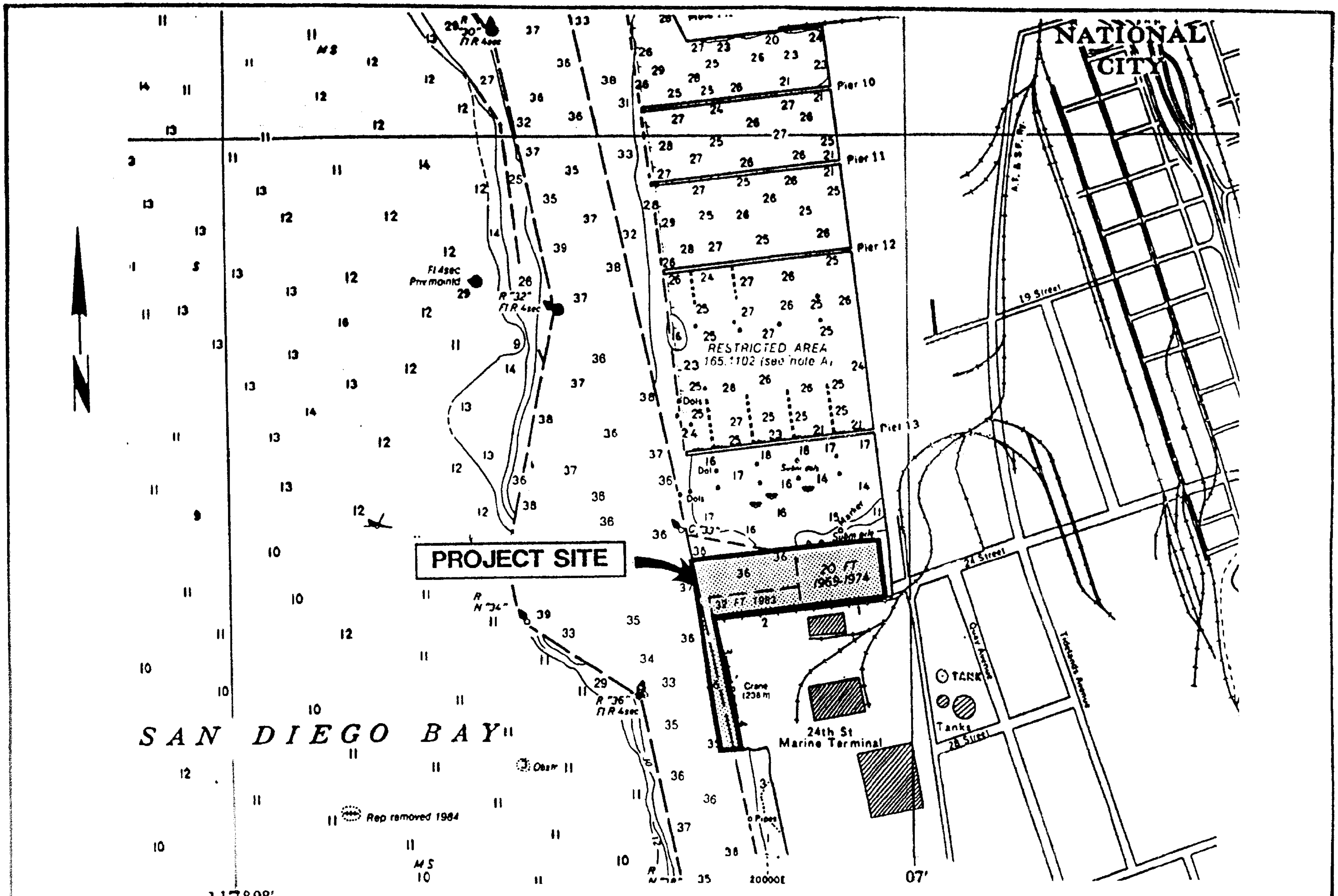


LOCATION MAP
NATIONAL CITY MARINE TERMINAL

DRAWN BY: cb	CHECKED BY:	PROJECT NO: 9153043P	DATE: 3-8-91	FIGURE NO: 1-1

WOODWARD-CLYDE CONSULTANTS

CUT 003456



0 500
GRAPHIC SCALE (Yards)

SITE MAP
NATIONAL CITY MARINE TERMINAL

DRAWN BY: cb	CHECKED BY:	PROJECT NO: 9153043P	DATE: 3-8-91	FIGURE NO: 1-2

WOODWARD-CLYDE CONSULTANTS

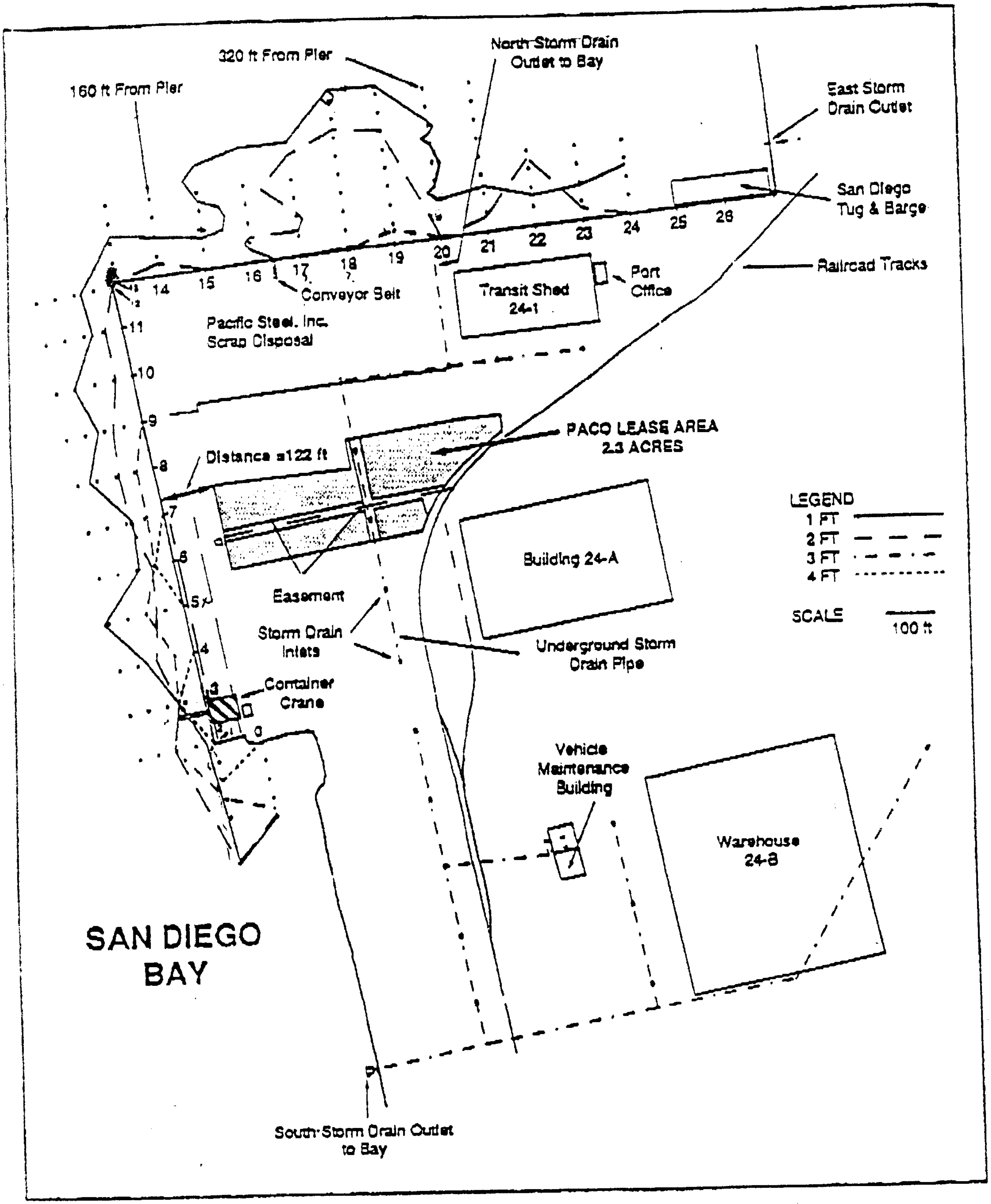
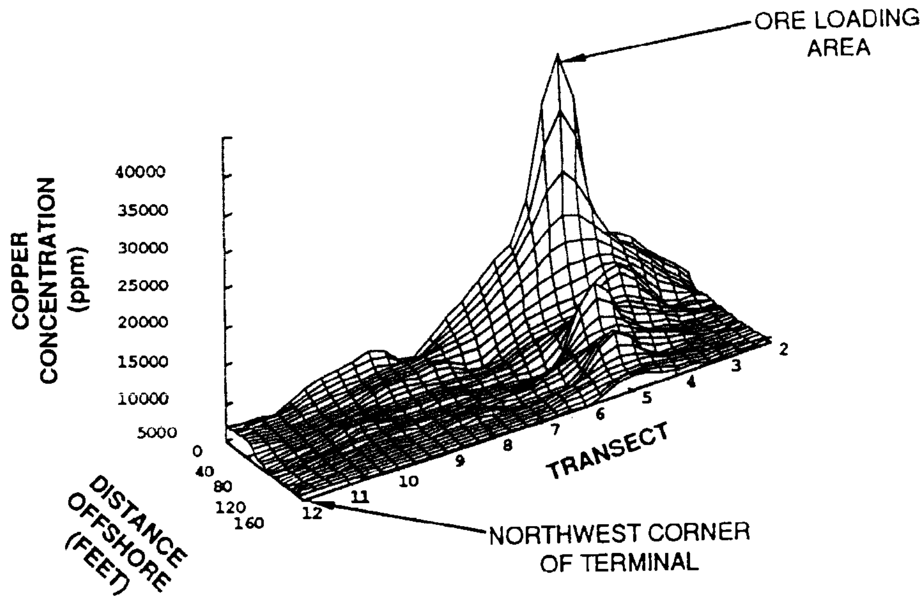
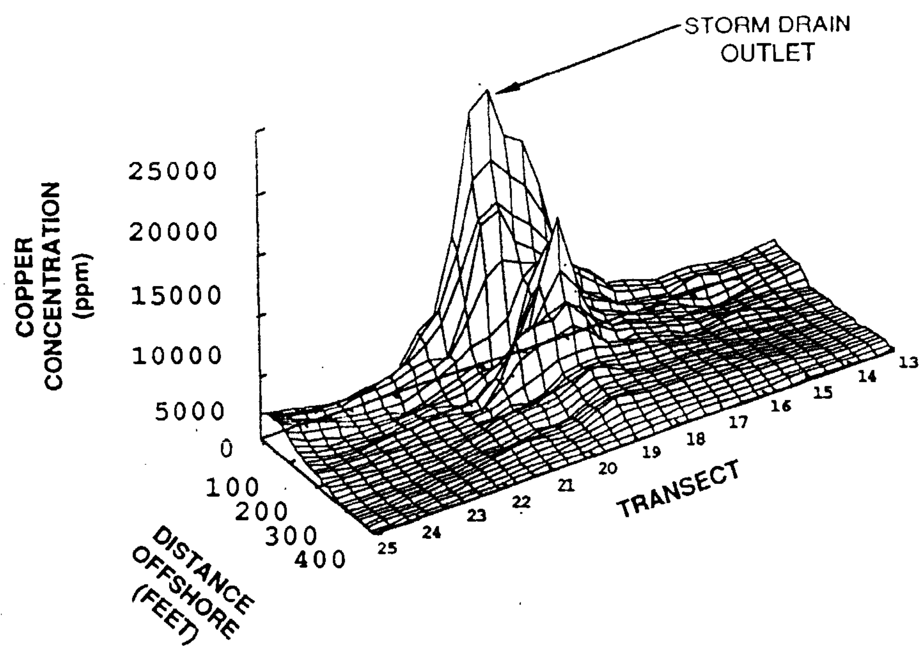


FIGURE 2. MAP OF 1000 MG/KG COPPER CONCENTRATION AT SEDIMENT DEPTHS OF 1, 2, 3, AND 4 FT.



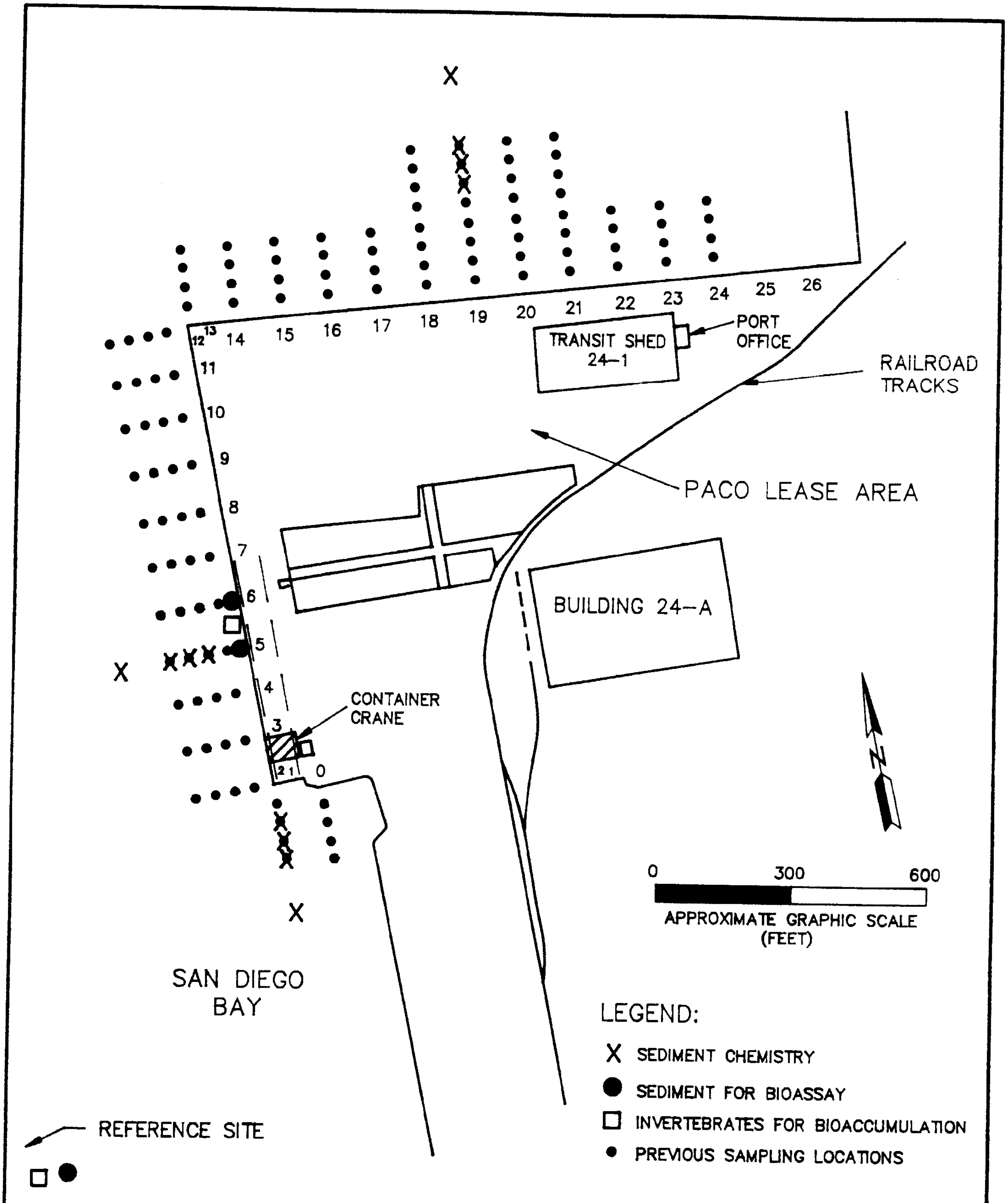
WEST SIDE OF TERMINAL



NORTH SIDE OF TERMINAL

ERCE

Figure 2. Three Dimensional View of Copper Concentration in the Upper 1 Foot of Bay Sediments



PROPOSED SAMPLING STATIONS
NATIONAL CITY MARINE TERMINAL

FN: NCTM	DRAWN BY: TEB	CHECKED BY:	PROJECT NO.: 9153043P	DATE: 3-11-91	FIGURE NO.: 4-1

WOODWARD-CLYDE CONSULTANTS

TRANSECT 1

Distance Offshore (feet)

Sediment Depth	160	120	80	40	0
1 FT.	1,280	1,390	1,030	2,260	2,280
2 FT	1,780	1,740	1,480	1,970	2,020
3 FT.	671	1,030	1,770	--	--
4 FT.	102	399	1,070	--	--

BULKHEAD

TRANSECT 5

Distance Offshore (feet)

Sediment Depth	160	120	80	40	0
1 FT.	2,090	6,010	10,200	5,520	37,200
2 FT	--	--	759	11,200	82,100
3 FT.	--	--	53	42,800	89,900
4 FT.	--	--	--	71	--

BULKHEAD

TRANSECT 19

Distance Offshore (feet)

Sediment Depth	320	280	240	200	160	120	80	40	0
1 FT.	1,920	1,820	2,820	2,450	6,780	13,100	10,300	8,900	17,300
2 FT	167	612	827	3,270	3,640	9,350	3,520	11,300	7,430
3 FT.	24	31	31	24	25	87	132	162	2,800
4 FT.	13	13	17	11	28	44	80	140	--

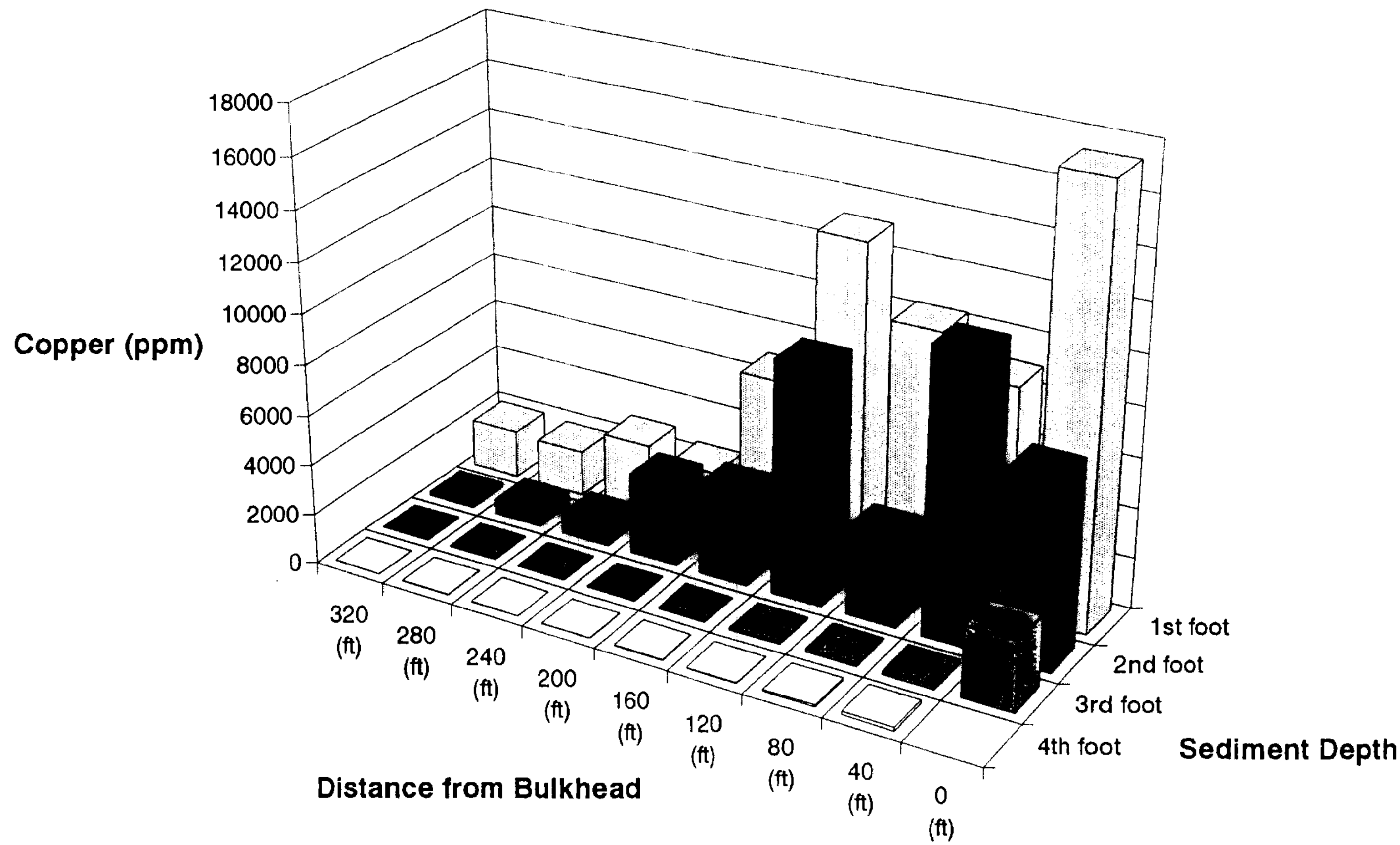
BULKHEAD

JANUARY 1989 COPPER CONCENTRATION IN SEDIMENT (ppm)
NATIONAL CITY MARINE TERMINAL

DRAWN BY: cb	CHECKED BY:	PROJECT NO: 9153043P	DATE: 3-15-91	FIGURE NO:

WOODWARD-CLYDE CONSULTANTS

Copper in NCMT Sediments: Transect 19 (Jan 1989)



TRANSECT 19

Distance Offshore (feet)

Sediment Depth	320	280	240	200	160	120	80	40	0
1 FT.	1,920	1,820	2,820	2,450	6,780	13,100	10,300	8,900	17,300
2 FT	167	612	827	3,270	3,640	9,350	3,520	11,300	7,430
3 FT.	24	31	31	24	25	87	132	162	2,800
4 FT.	13	13	17	11	28	44	80	140	--

BULKHEAD

CUT 003462

Number of Positive Values = 22
Number of Negative Values = 7
Total Number of Values = 29

TRANSECT 1

Distance Offshore (feet)

Sediment Depth	160	120	80	40	0	
1 FT.	- 1,280	- 1,390	+ 1,030	2,260	2,280	BULKHEAD
2 FT	- 1,780	- 1,740	+ 1,480	1,970	2,020	
3 FT.	+ 671	+ 1,030	+ 1,770	--	--	
4 FT.	+ 102	+ 399	+ 1,070	--	--	

TRANSECT 5

Distance Offshore (feet)

Sediment Depth	160	120	80	40	0	
1 FT.	+ 2,090	+ 6,010	- 10,200	5,520	37,200	BULKHEAD
2 FT	--	--	+ 759	11,200	82,100	
3 FT.	--	--	+ 53	42,800	89,900	
4 FT.	--	--	--	71	--	

TRANSECT 19

Distance Offshore (feet)

Sediment Depth	320	280	240	200	160	120	80	40	0	
1 FT.	- 1,920	+ 1,820	- 2,820	2,450	6,780	13,100	10,300	8,900	17,300	BULKHEAD
2 FT	+ 167	+ 612	+ 827	3,270	3,640	9,350	3,520	11,300	7,430	
3 FT.	+ 24	+ 31	+ 31	24	25	87	132	162	2,800	
4 FT.	+ 13	+ 13	+ 17	11	28	44	80	140	--	

JANUARY 1989 COPPER CONCENTRATION IN SEDIMENT (ppm)
NATIONAL CITY MARINE TERMINAL

DRAWN BY: cb	CHECKED BY:	PROJECT NO: 9153043P	DATE: 3-15-91	FIGURE NO:

WOODWARD-CLYDE CONSULTANTS

TABLE. A-10a. CRITICAL VALUES OF r FOR THE SIGN TEST
(Two-tail percentage points for the binomial for $p = .5$)

N	1%	5%	10%	25%	N	1%	5%	10%	25%
1					46	13	15	16	18
2					47	14	16	17	19
3				0	48	14	16	17	19
4				0	49	15	17	18	19
5			0	0	50	15	17	18	20
6		0	0	1	51	15	18	19	20
7		0	0	1	52	16	18	19	21
8	0	0	1	1	53	16	18	20	21
9	0	1	1	2	54	17	19	20	22
10	0	1	1	2	55	17	19	20	22
11	0	1	2	3	56	17	20	21	23
12	1	2	2	3	57	18	20	21	23
13	1	2	3	3	58	18	21	22	24
14	1	2	3	4	59	19	21	22	24
15	2	3	3	4	60	19	21	23	25
16	2	3	4	5	61	20	22	23	25
17	2	4	4	5	62	20	22	24	25
18	3	4	5	6	63	20	23	24	26
19	3	4	5	6	64	21	23	24	26
20	3	5	5	6	65	21	24	25	27
21	4	5	6	7	66	22	24	25	27
22	4	5	6	7	67	22	25	26	28
23	4	6	7	8	68	22	25	26	28
24	5	6	7	8	69	23	25	27	29
25	5	7	7	9	70	23	26	27	29
26	6	7	8	9	71	24	26	28	30
27	6	7	8	10	72	24	27	28	30
28	6	8	9	10	73	25	27	28	31
29	7	8	9	10	74	25	28	29	31
30	7	9	10	11	75	25	28	29	32
31	7	9	10	11	76	26	28	30	32
32	8	9	10	12	77	26	29	30	32
33	8	10	11	12	78	27	29	31	33
34	9	10	11	13	79	27	30	31	33
35	9	11	12	13	80	28	30	32	34
36	9	11	12	14	81	28	31	32	34
37	10	12	13	14	82	28	31	33	35
38	10	12	13	14	83	29	32	33	35
39	11	12	13	15	84	29	32	33	36
40	11	13	14	15	85	30	32	34	36
41	11	13	14	16	86	30	33	34	37
42	12	14	15	16	87	31	33	35	37
43	12	14	15	17	88	31	34	35	38
44	13	15	16	17	89	31	34	36	38
45	13	15	16	18	90	32	35	36	39

For values of N larger than 90, approximate values of r may be found by taking the nearest integer less than $(N - 1)/2 - k\sqrt{N + 1}$, where k is 1.2879, 0.9800, 0.8224, 0.5752 for the 1, 5, 10, 25% values, respectively.

Fivecoat and With
Certified Shorthand Reporters, Inc.
701 B Street • Suite 375 • San Diego, California 92101-8102
(619) 236-0333

RECEIVED
APR - 4 1991
SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

April 3, 1991

Brian Kelley
C/O Regional Water Quality Control Board
9771 Clairemont Mesa Blvd.
Suite B
San Diego, CA 92111

Dear Deponent:

Enclosed is the original transcript of your deposition which the attorneys have instructed us to send to you so you may exercise your right to review, change, if necessary, and sign your deposition.

As you read your testimony, if you desire to make any changes, draw a line through that which you wish to delete or change and then print the change above it. Initial any change you make.

After you have read through your deposition:

1. (X) Sign your name as given in the deposition. You will be signing under penalty of perjury.

   ( ) take your deposition to a notary public and in front of the notary public sign your name as given in the deposition. The notary public will then sign the jurat on the last page. This procedure should be followed whether or not you have made any changes.

2. (X) Return the signed transcript to Fivecoat and With in the envelope provided.

   ( ) Deliver the signed transcript to in the envelope provided.

You are invited to consult with an attorney at anytime regarding the above procedures.

Sincerely yours,

Pamela J. Rudeen

Pamela J. Rudeen
for
Fivecoat and With

CC: William V. Whelan, Esq.
David B. Hopkins, Esq.
Gisela L. Colon, Esq.
Robert S. McAnnally, Esq.
Philip C. Hunsucker, Esq.
Robert V. Richter, Esq.
Stephen A. Watson, Esq.
William L. Robinson, Esq.
P. Gerhardt Zacher, Esq.

DEPOSITIONS
ARBITRATIONS
CONVENTIONS
HEARINGS
VIDEO TAPE
DAILY COPY
CONFERENCE
SUITE AVAILABLE

11, insofar as they are applicable, shall govern hearings held pursuant to this subchapter.

NOTE: Authority cited: Section 1058, Water Code. Reference: Section 5007, Water Code.

HISTORY

1. Renumbering and amendment of former Section 1022 to Section 1023, and new Section 1022 filed 1–16–87; effective thirtieth day thereafter (Register 87, No. 10).

§ 1023. Further Procedure.

After the time for filing objections has expired, and after any necessary hearing has been held, a draft of the board's finding and determinations will be prepared and mailed to interested persons who have appeared in the proceeding together with a notice of the time when final action will be taken, which time will not be less than 30 days from the date of mailing the notice. Exceptions to the draft may be filed and served on opposing parties prior to the time stated in the notice and will be considered by the board in making its final determination. The board may cause such further investigation to be made as it deems necessary and for such purpose may defer making its final determination.

NOTE: Authority cited: Section 1058, Water Code. Reference: Section 5007, Water Code.

HISTORY

1. Renumbering and amendment of former Section 1023 to Section 1024, and renumbering and amendment of Section 1022 to Section 1023 filed 1–16–87; effective thirtieth day thereafter (Register 87, No. 10).

§ 1024. Shortening of Time.

The board may for cause and consistent with Section 5007 of the Water Code shorten any of the times stated in this article.

NOTE: Authority cited: Section 1058, Water Code. Reference: Sections 1020, 1021, 1022 and 1023, Water Code.

HISTORY

1. Renumbering and amendment of former Section 1023 to Section 1024 filed 1–16–87; effective thirtieth day thereafter (Register 87, No. 10).

Chapter 4.5. Procedures for Protecting Instream Beneficial Uses

NOTE: Authority cited: Sections 185, 1058 and 1252, Water Code. Reference: Sections 174, 183, 275, 1051, 1243, 1243.5, 1253, 1255, 1257, 13140, 13142 and 13170, Water Code; and Sections 21000, et seq., Public Resources Code.

HISTORY

1. New Subchapter 4.5 (Articles 1–3, Sections 1050–1060, not consecutive) filed 5–29–81; effective thirtieth day thereafter (Register 81, No. 22).
2. Repealer of Subchapter 4.5 (Sections 1050–1060, not consecutive) filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 40).

Chapter 5. Loans to Public Agencies

NOTE: Authority cited: Section 1058, Water Code. Reference: Chapter 6 (commencing with Section 13400), Division 7, Water Code.

HISTORY

1. Repealer of subchapter 5 (Articles 1–7, Sections 2001–2022) filed 9–2–81, effective thirtieth day thereafter (Register 81, No. 36). For prior history, See Registers 78, No. 9; 75, No. 31; 73, No. 33; and 67, No. 49.

Chapter 6. Review by State Board of Action or Failure to Act by Regional Board

§ 2050. Petition for Review by State Board.

(a) Any petition by an aggrieved person to the state board for review under Water Code Section 13320(a) of an action or failure to act by a regional board shall be submitted in writing and received by the state board within 30 days of any action or failure to act by a regional board. The petition shall contain the following:

(1) Name and address of the petitioner.

(2) The specific action or inaction of the regional board which the state board is requested to review and a copy of any order or resolution of the regional board which is referred to in the petition.

(3) The date on which the regional board acted or refused to act or on which the regional board was requested to act.

(4) A full and complete statement of the reasons the action or failure to act was inappropriate or improper.

(5) The manner in which the petitioner is aggrieved.

(6) The specific action by the state or regional board which petitioner requests.

(7) A statement of points and authorities in support of legal issues raised in the petition.

(8) A list of persons, if any, other than the petitioner and discharger, if not the petitioner, known by the regional board to have an interest in the subject matter of the petition. Such list shall be obtained from the regional board.

(9) A statement that the petition has been sent to the appropriate regional board and to the discharger, if not the petitioner.

(10) A copy of a request to the regional board for preparation of the regional board record, including a copy of the tape recording of the regional board action or a transcript, if available.

(b) If petitioner requests a hearing for the purpose of presenting additional evidence, the petition shall include a statement that additional evidence is available that was not presented to the regional board or that evidence was improperly excluded by the regional board. A detailed statement of the nature of the evidence and of the facts to be proved shall also be included. If evidence was not presented to the regional board the reason it was not presented shall be explained. If the petitioner contends that evidence was improperly excluded, the request for a hearing shall include a specific statement of the manner in which the evidence was excluded improperly.

NOTE: Authority cited: Section 1058, Water Code. Reference: Section 13320, Water Code.

HISTORY

1. Repealer of Subchapter 6 (§§2050 through 2053) and new Subchapter 6 (§§2050 through 2065) filed 8–30–72 as organizational and procedural; effective upon filing (Register 72, No. 36). For prior history, see Register 71, No. 3.
2. Repealer of Subchapter 6 (§§2050 through 2065) and new Subchapter 6 (§§2050 through 2065) filed 12–15–72; effective thirtieth day thereafter (Register 72, No. 51).
3. Amendment filed 1–9–74; effective thirtieth day thereafter (Register 74, No. 2).
4. Amendment filed 3–16–79 as an emergency; effective upon filing (Register 79, No. 11).
5. Certificate of Compliance filed 7–13–79 (Register 79, No. 28). 6. Amendment filed 12–7–81; effective thirtieth day thereafter (Register 81, No. 50).

§ 2050.5. Complete Petitions; Responses.

Upon receipt of a petition which complies with Section 2050 the state board shall give written notification to the petitioner, the discharger, if not the petitioner, the regional board, and other interested persons that they shall have 20 days from the date of mailing such notification to file a response to the petition with the state board. Respondents to petitions shall also send copies of their responses to the petitioner and the regional board, as appropriate. The regional board shall file the record specified in Section 2050(a)(10) within this 20–day period. Any response which requests a hearing by the state board shall comply with Section 2050(b). The time for filing a response may be extended by the board.

NOTE: Authority cited: Section 1058, Water Code. Reference: Section 13320, Water Code.

HISTORY

1. New section filed 3–16–79 as an emergency; effective upon filing (Register 79, No. 11).
2. Certificate of Compliance filed 7–13–79 (Register 79, No. 28).
3. Amendment filed 12–7–81; effective thirtieth day thereafter (Register 81, No. 50).

§ 2051. Defective Petitions.

Upon receipt of a petition which does not comply with Section 2050 the petitioner will be notified in what respect the petition is defective and the time within which an amended petition may be filed. If a properly amended petition is not received by the board within the time allowed the petition shall be dismissed unless cause is shown for an extension of time.

STATE OF CALIFORNIA PETE WILSON, Governor
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone (619) 265-5114

October 16, 1991

Laura Hunter, Director
Clean Bay Campaign
Environmental Health Coalition
1717 Kettner Boulevard, Suite 100
San Diego, CA 92101

Dear Ms. Hunter:

COMMERCIAL BASIN BOATYARDS

Enclosed is a copy of the tentative orders and addenda for the Commercial Basin boatyard cleanup and abatement orders. These tentative orders and addenda set cleanup levels of 530 mg/kg (dry weight) copper and 4.8 mg/kg (dry weight) mercury. The tentative orders for Shelter Island Boatyard and Eichenlaub Marine rescind the cleanup and abatement orders because no copper and mercury were found by the consultants above the cleanup levels. The tentative addenda for the remaining boatyards require cleanup of the sediment above the cleanup levels which is attributable to waste discharges from each boatyard.

These tentative orders and addenda will be considered by the Regional Board at the October 28 meeting which will begin at 9:00 a.m. in the Encinitas City Council Chambers at 535 Encinitas Boulevard, Suite 100, Encinitas, California. We would be happy to meet with you to discuss this matter prior to the board meeting.

Please contact Mrs. Kristin K. Schwall of my staff at the above number if you have questions or to schedule a meeting.

Very Truly Yours,

ARTHUR L. COE
Executive Officer

enclosures

STATE OF CALIFORNIA PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone (619) 265-5114

CERTIFIED MAIL - RETURN RECEIPT REQUESTED
P 780 925 723

October 15, 1991

Mr. Anthony Mauricio, President
Mauricio and Sons, Inc.
1864 National Avenue
San Diego, California 92113

ADDENDUM NO. 3 TO CLEANUP AND ABATEMENT ORDER NO. 88-86

Dear Mr. Mauricio:

Enclosed is a copy of Addendum No. 3 to Cleanup and Abatement Order No. 88-86 which establishes the cleanup levels for Mauricio and Sons, Inc. You will have the opportunity for a public hearing on this addendum at the Regional Board meeting on October 28, 1991.

If you wish to request a public hearing on the terms and conditions of Addendum No. 3 to Cleanup and Abatement Order No. 88-86 at the October 28 meeting, a written request should be submitted no later than October 23, 1991. Also enclosed is a copy of the hearing procedures which the Regional Board will follow on October 28, 1991, upon request of a hearing. The October 28 meeting will begin at 9:00 a.m. in the Encinitas City Council Chambers at 535 Encinitas Boulevard, Suite 100, Encinitas, California.

If you have any questions regarding this matter, please contact Mrs. Kristin K. Schwall of my staff at the above number.

Very Truly Yours,

David T. Barker
for

ARTHUR L. COE
Executive Officer

enclosures

cc with enclosures:

Mr. Allen D. Haynie, Attorney
Latham & Watkins
Attorneys at Law
701 B Street, Suite 2100
San Diego, California 92101-8197

Mr. Don Nay, Director
San Diego Unified Port District
P.O. Box 488
San Diego, CA 92112

Is your RETURN ADDRESS completed on the reverse side?

SENDER:
- Complete items 1 and/or 2 for additional services.
- Complete items 3, and 4a & b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt Fee will provide you the signature of the person delivered to and the date of delivery.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Anthony Mauricio
Mauricio ad Sons, Inc.
1864 National Ave
San Diego CA 92113

4a. Article Number

P 780 925 723

4b. Service Type

☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

10-16-91

5. Signature (Addressee)

8. Addressee's Address (Only if requested and fee is paid)

6. Signature (Agent)

PS Form 3811, November 1990 ★U.S. GPO: 1991—287-066 **DOMESTIC RETURN RECEIPT**

Thank you for using Return Receipt Service.

Add 3 to C&A 88-86

P 780 925 723

Certified Mail Receipt
No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

UNITED STATES POSTAL SERVICE

Sent to	A. Mauricio Mauricio & Sons, Inc.
Street & No.	1864 National Ave
P.O., State & ZIP Code	SD CA 92113
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	$
Postmark or Date	10-15-91

PS Form 3800, June 1990

CUT 007558

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

SIGN-IN SHEET

SDBTAC MEETING OF 1-22-91

~~Date~~	Name	Affiliation	~~Calling On~~	~~Time~~
[illegible]	Bill [illegible]	[illegible]		
	[illegible]	[illegible]		
1/22	Ralph Hicks	S D Port Dist.		
1/22	ALAN Greenberg PATRICIA MUNDY	Lewis, D'AMATO et al. (KOEHLER KRAFT)		
/	[illegible]	[illegible]		
1/22	THOMAS [illegible]	[illegible]		
1/22	Patricia Mundy	Lewis, D'Amato (Koehler Kraft)		
"	Eileen Ridley	Baghey Bowie & Bushwer		
1/22	Elvi Olesen	Singer & Crawford		
1/22	[illegible]	[illegible]		
1/22	Austin Crawford	Bay City Marine		
1/22/91	Gordon J. Louttit	WHITTAKER CORPORATION		
	Margi Etter	Kettenburg Marine		
✓	Ron Hobbs	Shelter Is Boatyard		
1/22/91	Sam Brown	Brown + McDonnell		
"	Laura Hunter	Env Health Co		
✓	John Wilson	Woodward-Clyde Cons.		
"	ARTHUR WOLFSON	Woodward-Clyde Cons.		
"	Allen Haynie	Latham & Watkins		

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

SIGN-IN SHEET

SDBTAC MEETING OF 1-22-91

~~Date~~	Name	Affiliation	~~Calling On~~	~~Time~~
	DAVID BAKER	RWQCB	(619) 265-511[illegible]	
	GREIG PETERS	"	"	
	KRISTIN WIRTZ	"	"	
	Mike Sowby	SWRCB	(916) 323-7205	
	Steve [illegible]	US Fish & Wildlife	714 [illegible] 4[illegible]	
	Chris Gonaver	County of SD	619 338-2201	
	David Valentine	Tetra Tech	4580365	

REMEDIAL ACTION ALTERNATIVES STUDY

COMMERCIAL BASIN BOATYARDS

Prepared by:

Woodward-Clyde Consultants
1550 Hotel Circle North
San Diego, California 92108

John L. Wilson, Ph.D
Program Manager

File: Bay City Marine
Copy of cover: Port, Driscoll, Kettenburg, Eichenlaub, Koehler Kraft, Mauricio & Son, Shelter Island

KOEHLER KRAFT COMPANY
FINDINGS AND RECOMMENDATIONS
PRESENTED TO
SAN DIEGO BAY TECHNICAL ADVISORY COMMITTEE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

DAMES & MOORE
JANUARY 21, 1991

THOMAS J. BARTEL
DAMES & MOORE
JANUARY 21, 1991

Koehler Kraft Company ("Koehler Kraft"), by its participation in this meeting of the San Diego Bay Technical Advisory Committee ("SDBTAC"), does not intend to waive any objections or legal or technical defenses it may have to this meeting, to any recommendation by the SDBTAC, to the Cleanup and Abatement Order No. 89-32, the Addendum thereto, to Notice of Violation N89-80, or to any proceedings of the California Regional Water Quality Control Board. Koehler Kraft reserves the right to amend or supplement these materials.

File: Koehler Kraft
Copy of Cover: Port, [illegible], [illegible], Exhibit [illegible], [illegible], [illegible]
Bay City Marine

Presentation on

SEDIMENT REMEDIAL ACTION ANALYSIS

for

SHELTER ISLAND BOATYARD

by

Thomas C. Ginn, Ph.D.

PTI Environmental Services

January 22, 1991

File: Shelter Island Boatyard

Copy of cover: Port, Driscoll, Ketenburg

STATE OF CALIFORNIA PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

9771 Clairemont Mesa Blvd., Ste. B
San Diego, California 92124-1331
Telephone. (619) 265-5114

January 11, 1991

Mr. Anthony Mauricio, President
Mauricio and Sons, Inc.
1864 National Avenue
San Diego, California 92113

PRESENTATION OF COMMERCIAL BASIN STUDY RESULTS

Dear Mr. Mauricio:

The Regional Board has now received all of the remedial action alternative analysis reports (RAAAR) from the boatyards in Commercial Basin. These reports have been forwarded to the members of the San Diego Bay Technical Advisory Committee (SDBTAC) for review and comment. A list of the committee members has been enclosed for your information. The committee was established so that Regional Board staff could receive input and guidance from the various committee members on the cleanup of contaminated sites in San Diego Bay.

A meeting of the SDBTAC to discuss proposed contaminated sediment cleanup levels in Commercial Basin has been scheduled for 10:00 a.m. on Tuesday, January 22, 1991, at the Regional Board office. You, your legal counsel, and your technical consultant are invited to attend this meeting. I would appreciate it if your consultant could be available at the meeting to make a presentation of the findings and recommendations on the cleanup of contaminants in Commercial Basin. There are four consultants representing the seven affected boatyards in Commercial Basin. Each of the four consultants will be given approximately 30 minutes to address the committee. The committee will then reconvene, after breaking for lunch, to discuss the merits of the various remediation alternatives. The afternoon session will be attended only by committee members. See the enclosed tentative agenda for more details.

The SDBTAC is not empowered by the Regional Board to decide on formal cleanup levels for Commercial Basin. In the near future, Regional Board staff will make a determination if cleanup levels need to be established. If cleanup is necessary, the Regional Board Executive Officer will issue a tentative addendum to the Cleanup and Abatement Order for each boatyard proposing final sediment cleanup levels. A formal public hearing before the Regional Board will be held after this addendum is issued. You will have the opportunity to present testimony to the Regional Board regarding any proposed sediment cleanup levels at that time.

SAN DIEGO BAY TECHNICAL ADVISORY COMMITTEE MEETING

AGENDA
JANUARY 22, 1991
SAN DIEGO REGIONAL BOARD OFFICE
9771 CLAIREMONT MESA BLVD, SUITE B
SAN DIEGO, CA 92124-1331
10:00 a.m.

ORDER OF PRESENTATION

Regional Board staff: introductory comments

Woodward-Clyde Consultants: presentation of findings for Bay City Marine, Eichenlaub Marine, Kettenberg Marine, and Mauricio and Sons.

PTI Environmental Services: presentation of findings for Shelter Island Boatyard.

ERC Environmental and Energy Services Co: presentation of findings for Driscoll Custom Boats.

Dr. William Bretz: presentation of findings for Koehler Kraft Company.

California Regional Water Quality Control Board
San Diego Region

SAN DIEGO BAY TECHNICAL ADVISORY COMMITTEE (SDBTAC)
MEMBER DISTRIBUTION LIST
(12-89)

Steven Goodbred
U.S. Fish and Wildlife Service
Division of Ecological Services
Federal Bldg, 24000 Avila Road
Laguna Niguel, CA 92656

Frank Palmer
Division of Water Quality
State Water Resources Control Board
Sacramento, CA

Dwayne Maxwell
California Department of Fish and Game
330 Golden Shore, Suite 50
Long Beach, CA

Chris Gonaver
Environmental Health Services
1700 Pacific Highway
San Diego, CA 92101

Christopher Wogee
State Department of Health Services
Food and Drug Branch
1350 Front Street, Room 2050
San Diego, CA 92101

Richard F. Ford
Department of Biology
San Diego State University
San Diego, CA 92115

David W. Valentine
Tetra Tech, Inc.
9645 Scranton Road, Suite 200
San Diego, CA 92121

Ms. Nennet Alverez
Chief, Technical and Support Services Unit
Region 4
Toxic Substances Control Program
State Department of Health Services
245 West Broadway, Suite 350
Long Beach, CA 90802 ATTN: Steve Baxter

David T. Barker and Greig Peters, San Diego Regional Board

1550 Hotel Circle North
San Diego, CA 92108
(619) 294-9400
Fax (619) 293-7920

Woodward-Clyde Consultants

RECEIVED
OCT 23 1991
SAN DIEGO REGIONAL
WATER QUALITY CONTROL BOARD

October 21, 1991
Reference No. 9153043P

Mr. David Barker
California Regional Water Quality
Control Board, San Diego Region
9771 Clairemont Mesa Boulevard, Suite B
San Diego, CA 92124-1331

REMEDIAL ACTION
COMMERCIAL BASIN BOATYARDS
SAN DIEGO, CALIFORNIA

Dear Mr. Barker:

Woodward-Clyde Consultants (Woodward-Clyde) is submitting this report to you to bring to your attention new information regarding the ecosystem response to copper and mercury which has come to light in recent weeks. We feel that this information, combined with the information that we have that the State will be releasing new standards for establishment of sediment quality objectives for enclosed bays and estuaries in California should be considered before proceeding with a remediation program in Commercial Basin at this time. We hope that you will come to the same conclusion after your review of the information presented here.

Sincerely,

WOODWARD-CLYDE CONSULTANTS

John Wilson, Ph.D.
Manager, Environmental Science Group

JLW/hal (E/9153043P)

Enclosure

ORIGINAL REPORT FILED IN
BAY CITY MARINE
COPIES OF COVER LETTER FILED IN
KETTENBURG
MAURICIO
DRISCOLL
FISHERMAN
SHELTER ISLAND BY
KOEHLER KRAFT

TABLE OF CONTENTS

Woodward-Clyde Consultants

REVIEW OF IMPACT OF COPPER AND MERCURY-CONTAINING SEDIMENTS ON MARINE ENVIRONMENT COMMERCIAL BASIN, SAN DIEGO BAY

1.0 EXECUTIVE SUMMARY

Sediments in sections of Commercial Basin are currently considered by some to pose unacceptable risks to human health and the environment due to the presence of copper and mercury. As such, there are those who advocate immediate dredging and removal of the suspect sediment material. However, recent information has led to a new understanding of toxicity in marine sediments and this has led to some new interpretation of data developed earlier.

Best scientific judgment should be the basis for establishing cleanup levels for contaminated sediment remediation. There are no federal or state government marine sediment criteria. Consequently, most remediation efforts are directed toward guesstimating the impact of sediment contaminants on overlying water column ecosystems. The objective of remedial action is to create an environment that does not harm human populations and restores the site's natural ecological balance. Bioassay results allow an assessment of future adverse impacts from contaminated material, while bioaccumulation and community structure analyses permit evaluations of how the existing community has responded to exposure to the contaminants.

The majority of aquatic contamination problems are concerned with groundwater, streams or lakes. Very few projects to date have addressed marine environments. The heavily buffered chemical nature of the marine environment is very different from freshwater situations. Consequently, cleanup criteria developed for freshwater environments are not readily transferable to marine situations.

The toxicity of copper (Cu) is dependent upon the dissolved ionic concentration of Cu. Antifouling paints are effective because the cuprous oxide dissolves at the paint-water interface and exerts toxicity in this microenvironment. However, the released Cu ion quickly forms complexes with chloride and organic ligands in seawater and this reduces the toxicity of Cu. Therefore, except for the microenvironment at the paint-seawater interface, Cu typically occurs in forms in the marine environment that exhibit low toxicity.

The most toxic forms of mercury (Hg) are organic mercury compounds such as methylmercury. Methylmercury results from biological transformation by microbial enzymatic activity and by non-enzymatic additions of methyl groups to Hg^{+2} in aquatic systems. Methylmercury in marine sediments is then rapidly degraded into methane and inorganic mercury. Furthermore, mercury in sediments binds with sulfide and naturally occurring organic compounds and becomes largely unavailable to benthic organisms. As a result of these recent findings, the US EPA is developing procedures to normalize mercury sediment concentration criteria to organic content.

With respect to the present situation, results of recent bioaccumulation and bioassay tests with organisms from Commercial Basin found no statistically significant differences from results involving reference organisms. In addition, bioassay tests conducted with contaminated sediment from other portions of San Diego Bay did not indicate adverse impacts on the biota. Community structure analysis of the biota in Commercial Basin sediments indicates the presence of a viable benthic fauna typical of many regions of San Diego Bay.

The available scientific information indicates that the Beneficial Uses of San Diego Bay will not be impacted by the existing sediments in Commercial Basin. Therefore, there is no scientific basis to support a cleanup level below the politically mandated Title 22 limits of the State of California.

2.0 INTRODUCTION

This report is the third in a series of reports dealing with remedial action alternatives for Commercial Basin Boatyards in San Diego, California. These reports respond to directives in Cleanup and Abatement Orders (CAOs) issued by the California Regional Water Quality Control Board, San Diego Region (WQCB-SD) to four boat repair and maintenance facilities, collectively known as the Commercial Basin Boatyards.

Among other directives and issues, the Commercial Basin Boatyard CAOs require compliance with the Water Quality Control Plan for Enclosed Bays and Estuaries of California adopted by the Water Resources Control Board, State of California (WRCB, 1991). The Bays and Estuaries Plan establishes water quality objectives to protect designated beneficial uses of bays and estuaries in California.

In recent weeks much new information has come to light which sheds serious doubt on the wisdom of using either copper or mercury levels in sediment to establish cleanup levels, at least as they are measured by the methods used in the Commercial Basin study. Indeed, the State of California and the EPA are currently examining different methods for establishing sediment cleanup criteria.

The purposes of this report are to bring into focus the implications of the new data as they relate to Commercial Basin and to examine the wisdom of setting a cleanup level at this time. It is important to review the details of the evaluation criteria for beneficial uses, however, to put into perspective the purpose of the bay beneficial use program.

3.0 BENEFICIAL USES OF SAN DIEGO BAY

The beneficial uses of San Diego Bay are described in the "Comprehensive Water Quality Control Plan Report, San Diego Basin, Region 9" (WRCB and WQCB-SD, 1974). According to the plan, the existing beneficial uses of San Diego Bay are as follows:

- Industrial service supply - uses which do not depend primarily on water quality such as mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization;

- Navigation - includes commercial and naval shipping;

- Water contact recreation - includes all recreational uses involving actual body contact with water, such as swimming, wading, waterskiing, skin diving, surfing, sport fishing, uses in therapeutic spas, and other uses where ingestion of water is reasonably possible;

- Non-contact water recreation - recreational uses which involve the presence of water but do not require contact with water, such as picnicking, sunbathing, hiking, beachcombing, camping, pleasure boating, tidepool and marine life study, hunting, and aesthetic enjoyment in conjunction with the above activities as well as sightseeing;

- Ocean commercial and sport fishing - the commercial collection of various types of fish and shellfish, including those taken for bait purposes, and sport fishing in ocean, bays, estuaries, and similar non-freshwater areas;

- Saline water habitat - provides an inland saline water habitat for aquatic and wildlife resources;

- Preservation of rare and endangered species - provides an aquatic habitat necessary, at least in part, for the survival of certain species established as being rare and endangered species;

- Marine habitat - provides for the preservation of the marine ecosystem including the propagation and sustenance of fish, shellfish, marine mammals, waterfowl, and vegetation such as kelp;

- Fish migration - provides a migration route and temporary aquatic environment for anadromous and other fish species; and

- Shellfish harvesting - the collection of shellfish such as clams, oysters, abalone, shrimp, crab and lobster for either commercial or sport purposes.

WRCB and WQCB-SD (1974) also addressed "potential beneficial uses" of the waters of the San Diego Basin. The agencies indicated that the potential uses would probably develop prior to the year 2000 through the implementation of any of the alternative water quality control plans discussed in that document. However, no additional, "potential" beneficial uses were identified for San Diego Bay.

4.0 PREVIOUS CLEANUP LEVEL RECOMMENDED FOR COMMERCIAL BASIN SEDIMENT

The Commercial Basin Boatyards Remedial Action Alternatives Analysis Report submitted to the California Regional Water Quality Control Board, San Diego Region October 12, 1990 evaluated the feasibilities and estimated costs of alternative remedial strategies for contaminated sediments. A cleanup level for copper of 530 mg/kg dry weight and for mercury of 4.8 mg/kg dry weight was recommended to comply with CAO directives to attain copper concentrations in the sediment, water column, and interstitial water that:

- Will not alter the quality of San Diego Bay waters so as to unreasonably affect beneficial uses of the Bay;
- Will be consistent with the maximum benefit to the people of the state; and
- Will not result in water quality less than prescribed in the Basin Plan, Ocean Plan, or other prescribed policies.

It is important to note this cleanup level was established given the information available at the time. Since then we have learned more about the chemistry of mercury and copper in marine sediments and understand more about how the biological communities respond to the presence of these metals in sediments.

5.0 CLEANUP LEVELS VERSES DISCHARGE LEVELS

Remediation addresses the present situation at an environmental site known to have been effected by an historical action. The objective of a remedial action is to create an environment that 1) does not harm human populations and 2) if possible, restores the site's natural ecological balance. The nature of the remedial action to be taken will be strongly dependent upon the type of environment involved and how that environment has historically responded to disturbance. Thus, cleanup levels must be established with consideration for both human health and ecological well-being, and levels will often vary from environment to environment. Consequently, cleanup levels cannot be regulated as across-the-board fixed quantities for chemical substances. They must be established for individual ecological environments based on assessments of site-specific influences on toxicities and bioavailabilities of the contaminants of concern.

The use of bioassay techniques was developed in recognition of the need to relate use of the environment to the physiological and ecological needs of various types of environments. In determining cleanup levels, bioassay results allow an assessment of potential future adverse impacts from the occurrence of the suspect material at a site. Bioaccumulation and community structure analyses permit evaluations of how the existing community has responded to exposure to the introduced suspect material. This information allows the establishment of a cleanup level and the appropriate remedial action(s) to be made, with due consideration of the collateral damage caused to the existing ecological balance in the affected environment by implementing the remedial action(s).

Permitted discharge levels have been developed as tools to balance the need to maintain the natural environment and the need to dispose of by-products from human activity. Thus, permitted discharge levels are designed to reflect the expected levels at which no future adverse impacts are likely to occur due to the discharge.

Cleanup and discharge criteria address different objectives. Discharge levels are intended to prevent change to the existing conditions by controlling the introduction of new or suspect materials. Cleanup levels are intended to minimize change to the "healthy" portions of the existing conditions while controlling future adverse effects from material already existing in the environment. Therefore, cleanup levels may often be appropriately set at higher levels than permitted discharge levels.

6.0 CUPROUS OXIDE INTRODUCTION TO MARINE ENVIRONMENTS FROM ANTIFOULING PAINT

The dissolution of cuprous oxide in sea water at the paint-water interface is the mechanism causing toxicity to fouling organisms. Initially, the surface film of toxicant dissolves into the water. After the cuprous oxide content of that layer is depleted material from the deeper layers will diffuse toward the paint film surface. At the same time, water penetrates the residual matrix structure. Reacting with sea water, the cuprous oxide forms the complex ions $CuCl_2^-$ and $CuCl_3^{-2}$. These complexes then undergo several precipitation and sorption reactions that remove them from the aqueous phase. The red color of the paint changes to green because these reactions cause the formation of copper carbonate and copper oxychloride. The presence of these compounds on the surface of the paint adversely impacts the further dissolution of cuprous oxide. The practice of wiping hulls in the water removes this covering layer and starts the cycle of cuprous oxide leaching and chemical formation of the copper carbonate barrier again.

7.0 COPPER TOXICITY IN MARINE ENVIRONMENTS

Copper toxicity is largely related to the concentration of the dissolved copper ion at the surface/water interface. Partitioning of copper between the aqueous and solid phases in an aquatic environment is governed by such factors as pH, ionic strength, presence of organic ligands and other competing ions. A major factor influencing copper speciation (and toxicity) is pH. Unlike terrestrial and freshwater systems, marine environments are highly buffered systems. Consequently, marine systems do not experience the large pH changes that can occur in fresh water environments.

Marine environments maintain a pH value slightly less than 8. This is particularly significant since ionic copper concentration decreases about one order of magnitude for every 0.5 increase in pH above 6 (Stumm and Morgan, 1981). Consequently, the concentrations of ionic copper in seawater are typically very low and available copper generally forms numerous copper complexes in marine sediments. Among the complexes are copper sulfides, the dominant forms of copper complexes in anoxic situations. Copper sulfides are extremely insoluble; consequently the majority of copper in marine sediments is bound in forms that do not release ionic copper to the interstitial water or overlying water column. In fact, Elderfield *et al.* (1981a; 1981b) and Elderfield (1981) have shown copper is removed from the water column rather than released to it by marine sediments.

Numerous studies have shown biotoxicity of copper is highly correlated with ionic concentration (Sunda and Guillard, 1976; Sunda and Lewis, 1978; Dodge and Theis, 1979; Meador, 1991). Windom *et al.* (1982) investigated the impact of metal-enriched food on particulate-feeding infaunal organisms. They found copper-enriched food did not adversely impact particulate feeding polychaetes. Furthermore, even when the nutritional value of the particles (i.e., nitrogen content) was enriched, no adverse impact was observed due to the presence of copper in the food.

The natural chemistry of copper in salt water creates a situation where primary impacts of introduced copper will be felt in the benthic community. Only if the introduced quantity exceeds the buffering capacity of the system will the equilibrium distribution result in biotoxic ionic copper concentrations in the water column. As this is rarely the case, the water column impacts from ionic copper are essentially nonexistent in the marine environment. Because of sulfide complexation in most marine sediments, copper is essentially biologically unavailable in marine sediments.

8.0 PRINCIPLES OF AQUATIC CHEMISTRY OF SEDIMENT-ASSOCIATED COPPER

As discussed by Lee and Jones (1983), US EPA (1985), and indicated above, chemical contaminants exist in aquatic systems in a variety of forms, only some of which are available to adversely affect aquatic life and related beneficial uses. Tessier and Campbell (1987) concluded from their study of the partitioning of trace heavy metals in sediments, "*... the total concentrations of a metal in sediments provides little indication of the potential interactions of the sediments with the abiotic* [non-living] *and biotic* [living] *components...*" They noted the complexity of heavy metal/sediment association, pointing out that heavy metals in sediments can be associated with clay surfaces, clay structural matrices, fulvic acids, surfaces of iron and manganese hydrous oxides, detrital as well as freshly precipitated carbonates, nodules, detrital organic matter of terrestrial and aquatic origin, and crystalline and amorphous sulfides. The complexity of the chemistry of heavy metals in sediments makes their significance to aquatic life difficult to ascertain by strictly chemical means.

In this section, a review of recent research into the chemistry and bioavailability of sedimentary copper in marine environments is presented. As much of this material has bearing on our understanding of the actual toxicity of copper versus its absolute concentration in marine sediments, the information is germaine in the development of appropriate cleanup levels in Commercial Basin.

The free cupric ion (Cu^{+2}) is the most toxic form of copper (Meador, 1991). Particulate (insoluble) forms of copper, resulting from precipitation reactions and sorption (attachment of dissolved copper onto sediment particle surfaces), are essentially unavailable to be toxic to or accumulate within aquatic organisms. In addition, soluble copper can react with organics and inorganics to form soluble chemical complexes that are not toxic to aquatic life. Symes and Kester (1985) developed a copper (+2) - ion speciation model. They found that the inorganic speciation of copper in seawater (pH = 8.2, 25°C) is dominated by copper carbonate complexes and only 2.9% of inorganic copper exists as the free copper (+2) ion. Thus, insoluble and the non-toxic soluble forms of copper present in sediments limit the impact that the total concentration of copper in the sediments has on aquatic organisms.

Elderfield (1981) reported that on the order of 80% of the dissolved copper (separated by centrifugation followed by filtration through a 0.4 μm pore-size filter) in the interstitial waters of the anoxic sediments of Narragansett Bay was complexed with natural dissolved organic matter or associated with colloidal organic matter. He also reported that insoluble sulfide was a major factor controlling the availability of dissolved copper in the interstitial waters and that it caused the copper concentration in the interstitial waters to be very low. Elderfield *et al.* (1981a) reported that the fluxes of copper and several other heavy metals from the anoxic sediments to the interstitial water were extremely low due to the formation of metal sulfides. They further suggested that there is a small net flux of sulfide-forming metals, including copper, into anoxic sediments. Elderfield *et al.* (1981b) reported that the concentrations of copper in the interstitial water were controlled by highly insoluble copper sulfides; the copper concentrations in the interstitial water decreased with increasing depth in the sediments and became undetectable within a few cm of the sediment-seawater interface. The concentrations of copper found in the interstitial waters of the sediment that they studied were less than about 1 μg/L. It may thus be concluded that interstitial water copper is typically low in concentration and the available copper is largely complexed by or bound to organics that would reduce the availability of copper to be toxic to aquatic life.

Meador (1991) investigated the bioavailability of copper as a function of pH and dissolved organic carbon in fresh water. He found that both factors were important in controlling the amount of ionic copper in solution and the toxicity of the copper to *Daphnia magna*. The copper was less available (less toxic) at higher pHs, as would be expected owing to the formation of less toxic copper complexes with hydroxyl species. At the pH's found in seawater, much of the copper in solution would be expected to be present as copper-hydroxyl complexes. Meador (1991) also noted that dissolved organic carbon complexed with ionic copper to form copper complexes; copper in water with higher dissolved organic carbon content was less toxic than the same amount of copper in water with lower concentrations of dissolved organic carbon.

The chemistry of metal sulfides in sediments is highly complex and not fully understood. However, it is known that in anoxic (oxygen-free) environments cupric sulfide is one of the most stable, insoluble forms of copper. In addition, in oxic (oxygen-containing) environments, copper can be readily removed from solution through a variety of precipitation reactions. Furthermore, copper tends to strongly sorb onto sediment particles. Lindsay (1979) reported that sorption of copper can lower the concentrations of soluble copper almost to the same degree as the precipitation of copper as a sulfide. Therefore, anoxic and oxic precipitated and sorbed species of copper are largely unavailable to aquatic life.

Windom *et al.* (1982) studied the uptake (accumulation) of metals by a marine polychaete (worm), *Capitella capitata*, as it is influenced by the metal content and "nutritional status" (i.e., nitrogen content) of the organic detritus that the organism uses for food. They found that the nitrogen content of the detritus influenced the accumulation of metals in the organism. They also reported an influence of the heavy metal content of the detrital food source on the accumulation of metals, although their data did not indicate a positive correlation between the detrital copper concentration and the amount of copper accumulated in those organisms in their test conditions. Those results point to the complexity of the factors controlling uptake of heavy metals from particulates in aquatic systems. Factors not related to contaminants, such as the nitrogen content of the detritus particles used as food, appear to exert some influence on the uptake of heavy metals from the particles by certain aquatic organisms.

Thus, it is evident from the literature that sediment-associated copper (either in the oxic or anoxic sediment layers) would not be expected to be available to cause toxicity or accumulate in marine aquatic organisms. It would also be expected that substantial portions of the low concentrations of soluble copper in a water column or in the interstitial waters of a marine sediment would exist as soluble complexes that are non-toxic to aquatic life.

The regulatory agencies are beginning to address the importance of sulfides in controlling the toxicity of many heavy metals. The US EPA is currently trying to develop sediment quality criteria for heavy metals based on normalization of the heavy metal concentrations in the sediment by the concentrations of "acid volatile sulfides" in the sediments. In this regard, Delos (1990) describes the concept of ambient-water-soluble forms of heavy metals, emphasizing the importance of establishing soluble concentrations to assess potential toxicity. Lee and Jones (1990) recommended that the state Water Resources Control Board apply its objectives to ambient-water-soluble forms of heavy metals since that approach more properly considers the toxic-availability of metals.

"Acid volatile sulfides" comprise a group of amorphous (non-crystalline) sulfides and polysulfides occurring in sediments that do not contain dissolved oxygen. In the absence of dissolved oxygen, sulfate in sediments is reduced to sulfide. The sulfides, in turn, interact with heavy metals to form highly insoluble metal sulfides. Those reactions are discussed by Morse *et al.* (1987). It has been found (DiToro *et al.*, 1990) that when the molar sum of the so-called acid volatile sulfides exceeds the molar sum of the non-iron heavy metals in the sediment, the heavy metals in the sediment are not available, and hence are not toxic, to aquatic life. This finding is to be expected based on the chemistry of heavy metal sulfides in sediments.

At the US EPA "Contaminated Sediment Assessment Methods Workshop" held in May 1991, several US EPA representatives and their contractors discussed their current work on the use of acid volatile sulfides in the estimation of the availability of heavy metals in sediments. Their work on this topic includes the development of a standardized analytical procedure for the determination of acid volatile sulfides in sediment (US EPA, 1991a). The measurement of amorphous sulfides in sediments is operationally defined; the amount of sulfide measured depends on the analytical procedure used and the forms in which the sulfide exists in the particular sediment.

The techniques are still being refined and interpretation of results is yet to be finalized. However, the measurement of total metal concentration relative to the total quantity of sulfides will provide a much more realistic measure of the potential for adverse impacts posed by the presence of a particular heavy metal such as copper in marine sediments (US EPA, 1991).

In the marine environment bacterial decomposition of organic matter depletes the dissolved oxygen in the sediment. The larger organisms living in the sediment cause movement of water and sediment in the upper 10 to 15 centimeters of sediment bed. The net balance of oxygen consumption and oxygen utilization usually results in the upper 10 to 15 cm of sediment being oxic and all sediment below that depth is anoxic. In finer grained, organic-rich sediments, the oxic layer may be less than 1 cm in thickness. Thus, a major portion of the copper found in marine sediments can be expected to be associated with sulfides and would not be considered in the ambient-water-soluble toxic category. Sulfide data are not available for the majority of marine sediments. Consequently, establishing a total copper cleanup level would be apparently inappropriate based on our current understanding of copper chemistry, bioavailability, and toxicity in marine sediments.

9.0 REGULATORY CRITERIA STATUS

The US EPA water quality criterion for copper in marine waters is a one-hour average not to exceed 2.9 μg Cu/L (US EPA, 1985). According to Hansen (1991), the US EPA is not currently working toward revision of that criterion, even though it is well-established that, for many waters, its current criterion value is unnecessarily restrictive for the protection of aquatic life-related beneficial uses. In its "Enclosed Bays and Estuaries Plan," the California Water Resources Control Board adopted the US EPA copper criterion as the state water quality objective for the protection of marine organisms in its enclosed bays and estuaries from impacts related to copper (Water Resource Control Board, State of California, 1991). The state of California objectives for the protection of organisms in open marine waters ("Ocean Plan") are a six-month median concentration of 3 μg Cu/L, a daily maximum concentration of 12 μg Cu/L, and an instantaneous maximum concentration of 30 μg Cu/L (Water Resource Control Board, State of California, 1990). While the basic numeric values for the water quality objectives for copper in the Enclosed Bays and Estuaries Plan (2.9 μg Cu/L) and the Ocean Plan (3 μg Cu/L) are essentially the same, the Ocean Plan allows excursions in concentrations 10-times the basic objective. This difference in the excursions allowed in the two Plans reflects the high degree of uncertainty that exists in developing the water quality objectives. While San Diego Bay is included under the Enclosed Bays and Estuaries Plan rather than the Ocean Plan, it is important to understand that the water quality objectives in both Plans are designed to protect the same types of marine organisms.

As implemented today, it is our conclusion that US EPA water quality criteria and state water quality objectives equivalent to those criteria are, in general, overly restrictive in protecting aquatic life-related designated beneficial uses. This is especially true for copper. Several issues need to be considered in the evaluation of the potential impact that an exceedance of the water quality objective for copper means for aquatic life-related designated beneficial uses. Of particular importance is the fact that the US EPA water quality criteria, and therefore the state water quality objectives, are based on worst-case or near-worst-case assumptions.

The laboratory studies used to establish the criteria values presented the contaminant tested to the organisms in 100% available forms; the objectives, however, are applied to total concentrations of contaminants irrespective of availability. As discussed earlier copper (as well as many other contaminants) exists in aquatic systems in a variety of forms, only some of which are available to affect aquatic life. Thus, the concentration of total copper in a water is an unreliable measure of the potential for the copper to adversely affect aquatic life.

The criteria/objectives are based on the assumption an organism receives a chronic (extended-duration) exposure to the chemical. Even though the copper criterion and objective are listed as "one-hour average maximum" levels, organisms can be exposed to concentrations higher than the objective for periods of time considerably greater than one hour without adverse impact (Lee, pers. comm., 1991). In a system such as San Diego Bay, the exposure duration of water column organisms to sediment-associated contaminants would be expected to be considerably shorter than the chronic exposure duration. Storms, ship traffic, unusual tides, etc. can resuspend sediments into the water column for short periods of time; the sediments then settle again. Soluble contaminants that could be released during that time would be expected to be rapidly diluted or resorbed/precipitated.

The overly restrictive nature of the water quality objective for copper in marine waters is also recognized by the San Francisco Bay Water Quality Control Board. At this time, the San Francisco Regional Board is conducting a study to develop a water quality objective for copper in San Francisco Bay waters that is more appropriate than that developed by the State Board. The justification for that effort is that total copper concentrations in San Francisco Bay waters exceed the water quality objective, yet the waters have been found to be non-toxic to sensitive forms of aquatic life. It may therefore be concluded that the water quality objective applicable to San Diego Bay (one-hour average concentration not to exceed 2.9 μg Cu/L) is more restrictive than needed for the protection of beneficial uses and that concentrations of copper in the San Diego Bay waters, and for that matter, its interstitial waters, can exceed this amount without significant adverse impacts on beneficial uses.

10.0 TOXICITY OF SEDIMENTS IN SAN DIEGO BAY

Since available forms of chemicals cannot typically be determined by chemical analysis, evaluation of the potential impact of chemical contaminants on aquatic life is typically provided through standard toxicity tests (bioassays) using reliable, sensitive test organisms. The exposure that an organism receives in a toxicity test is typically more severe than the organism would receive in the field (Lee and Jones, 1983).

This type of test was performed with sediments from the Commercial Basin. Results were presented in the previous report (Woodward-Clyde, 1991). Essentially, there was no significant difference between toxicity to reference sediments and the "contaminated" sediments. This result has been observed in other San Diego Bay sediment studies as well.

Lockheed Ocean Science Laboratories (Lockheed, 1983) conducted a study of the sediments in the vicinity of Southwest Marine Inc. (Yard No. 4) to determine their suitability for ocean disposal after dredging. Two different locations within the Southwest Marine area were investigated; one contained a copper concentration of 910 mg/kg, and the other, 2,000 mg/kg. The reference sediment used in those studies contained 790 mg/kg copper. Toxicity tests were performed on those sediments using a mysid *(Acanthomysis sculpta)*, a mollusc *(Macoma nasuta)*, and a polychaete *(Neanthes arenaceodentata)* using the US EPA and US COE standard dredged sediment 10-day, solid-phase testing procedure. The 10-day toxicity tests for the controls, reference sediment, and the two study site sediments showed no toxicity to any of the three types of test organisms. The toxicity tests on standard liquid/suspended particulate phase derived from the same sediments using a copepod *(Acartia tonsa)*, a mysid *(Acanthomysis sculpta)*, and a flat fish (sand dab) *(Citharichthys stigmaeus)*, showed no toxicity. Therefore, very high levels of copper in sediments at locations other than the Commercial Basin were found to be non-toxic to a variety of standard, sensitive test organisms.

The Naval Ocean Systems Center (NOSC) released a report in April 1980 summarizing the results of sediment bioassays conducted for the NAVSTA San Diego dredging project (Salazar *et al.*, 1980). That report presented the results of sediment analyses and toxicity tests conducted between March 1978 and January 1980 on sediments collected from the area of the 13 Navy piers extending for about two miles immediately north of the NCMT to Chollas Creek, and sediments collected from the north side of North Island in the northern part of the Bay. The copper concentrations in sediment samples taken from those areas ranged from about 20 mg Cu/kg to more than 1,700 mg/kg, and many of the samples contained copper in the 200 to 500 mg/kg concentration range. A variety of organisms, including copepods, mysid shrimp, clams, fish, and benthic polychaete worms, were used in toxicity tests on sediments from the pier areas, and copper concentrations in the toxicity test sediments ranged from 80 to 995 mg/kg with many of the values in the 200 to 300 mg/kg range. While several of the sediment samples caused toxicity to some of the test organisms, in general, most of the samples caused no toxicity. The toxicity that was observed appeared to be unrelated to the concentration of copper in the sediment.

Salazar and Salazar (1991) summarized the results of toxicity tests conducted on San Diego Bay sediment during the 1980's as part of the Navy's dredging projects for various locations in the Bay. The study areas were principally on the west side of the Bay near its mouth, and at the Navy piers between Chollas Creek and the NCMT, specifically Fuel Pier, Med

Moor A, Med Moor B, Mole Pier, Commercial Basin, Deperming Pier, Piers 1/2, 1, 2A, 2B, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and JK, Chollas Creek, Supply Pier, and Seawall. For each area, the chemical characteristics of the sediments, including copper concentrations, were reported as were the results of dredged sediment bioassays and bioaccumulation tests conducted in accordance with US EPA and US COE dredged sediment evaluation procedures. Typically, particulate-phase tests were conducted with *Acanthomysis sculpta* (mysid), *Citharichthys stigmaeus* (flat fish), and *Acartia tonsa* (copepod). Solid-phase tests were conducted with *A. sculpta*, *Macoma nasuta* (clam), and *Neanthes arenaceodentata* (polychaete worm). The copper concentrations in the sediments ranged from about 20 to 250 mg/kg. There was no toxicity to any of those organisms in the toxicity tests conducted. It was concluded that there would be no significant adverse impacts associated with the disposal of sediments dredged from those areas at the US EPA-designated marine disposal sites off the southern California coast (Salazar and Salazar, 1991).

These various studies of San Diego Bay sediment toxicity to various organisms indicate that copper is not causing an adverse impact on the marine environment of San Diego Bay; nor, does it pose a threat to the beneficial uses of San Diego Bay.

11.0 SAN DIEGO BAY REPORT

The San Diego Bay Report (Long and Morgan, 1990) reviewed conditions in San Diego Bay and reached several conclusions; some implying that copper was a problem in San Diego Bay. Drs. Lee and Jones reviewed the technical aspects of the report and reported these conclusions were not supportable.

For example, Long and Morgan (1990) compiled information on the concentrations of chemicals in sediments and the results of assessments of biological response to those sediments. Some of the biological responses included alterations in numbers and types (i.e., assemblages) of organisms, exceedances of established sediment classifications (such as AET classifications used in Puget Sound of Washington State), and results of toxicity tests on sediments containing a variety of contaminants. While the "toxic" responses were related to the concurrent presence of a wide variety of contaminants in a sediment, and not necessarily a response to a specific contaminant, Long and Morgan (1990) assembled the information, by chemical, in tables of these chemical "co-occurrences." Thus, although the cause of the biological response could not be specifically attributed to an individual constituent, the same degree of response was associated with the concentration of each individual chemical contaminant measured in the sediment. The tables of co-occurrence were not intended to suggest cause-and-effect relationships between the concentration of an individual chemical and the "associated" toxic response. The information on the table of co-occurrence for each chemical was ordered from low concentration to high, and the lower 10-percentile and the 50-percentile computed for each. The Long and Morgan (1990) "ER-L" and "ER-M" values were the values for the 10-percentile and 50-percentile, respectively. While the lowest concentration on a table can indicate that, independent of the specific cause of the toxic response, no sediment that contained that given amount of a chemical has been found to cause a response, none of the values or percentiles can indicate that toxicity would be expected for a particular concentration of any chemical.

The analysis made by Long and Morgan (1990) does not support the implications that the various concentrations of contaminants, including copper, listed by Long and Morgan as causing a toxic effect were actually the causative agents. It must also be understand that sediment concentration data cannot be translated into effects on aquatic life (Lee and Jones, pers. comm., 1991). For example, while Long and Morgan (1990) listed an organism impact to a Massachusetts Bay sediment that contained copper at a concentration of 15 mg/kg, there is virtually no possibility that copper at that concentration in those sediments was responsible for that response. Those particular sediments contained a wide variety of other contaminants at concentrations that had a much higher probability of having caused the toxic response.

One of the major difficulties with the Long and Morgan (1990) approach is that it enables individuals with a limited understanding of aquatic chemistry and the impacts of various forms of aquatic contaminants on aquatic life to obtain a numeric value for a particular contaminant with which to assert that level of that contaminant at some location could be having an adverse impact on biological communities. However, a critical review of the Long and Morgan results, in light of what is known about the aquatic chemistry of various elements, can provide insight into whether copper in a particular sediment could be causing impacts on aquatic communities at the concentrations found (Lee and Jones, pers. comm., 1991). As discussed above, because of its very strong tendency to form insoluble, unavailable compounds and organic and inorganic complexes, copper should not be considered to be a significant agent for causing biological responses in sediments that contain a wide variety of other contaminants. While Long and Morgan listed an ER-L for copper in sediments as 70 mg/kg and the median concentration (ER-M) of 390 mg/kg, it is highly likely that those numbers have no relationship to the actual toxicity of copper in sediments from which those data were derived. Copper in sediments at much higher concentrations is known not to cause toxicity responses. This was shown in an earlier study (Woodward-Clyde, 1991), for example, in which copper in concentrations of tens of thousands of mg/kg did not produce toxicity responses in eight different types of toxicity test organisms. As noted previously, the precipitation and complexation reactions of copper associated with sediments and their interstitial waters provide an effective detoxification mechanism that renders copper in many marine sediments inert or essentially inert.

12.0 POTENTIALLY APPROPRIATE COPPER CLEANUP LEVELS

Recent studies at the National City Marine Terminal concluded that a copper cleanup level of 1,000 mg/kg dry weight was conservatively protective of the beneficial uses of San Diego Bay (Woodward-Clyde, 1990). In fact, it is probable that a much higher level would also protect the bay.

The State of California defines copper concentrations of 2,500 mg/kg wet weight (CCR Title 22) as hazardous material. This wet weight value converts to about 4,000 mg/kg dry weight in marine sediments. Dry weight values were reported in previous studies of the Commercial Basin. It is proposed that, in the absence of evidence of toxic conditions due to metal concentrations in the sediments, cleanup levels should be based on existing regulatory criteria. Thus, the regulatory cleanup level for Commercial Basin would be 4,000 mg Cu/kg dry sediment.

13.0 MERCURY IN SAN DIEGO BAY

Mercury may exist in either its elemental form (Hg^{o}), as an inorganic substance or bound with organic material. In general, mercury is more toxic than copper in the environment.

In the past, discharges of mercury into the environment were primarily in the form of inorganic mercury and practically none as organic mercury (Hanson, 1971; Wallace et al., 1971). Yet the majority of mercury found in organisms is in the form of methylmercury, a highly toxic form of mercury. Methylmercury apparently results from biological transformation by microbial enzymatic activity and by non-enzymatic additions of methyl groups to Hg+2 in biological systems (Windom and Kendall, 1979).

Methylmercury in sediments is rapidly degraded by microbes into methane and inorganic mercury (Hg^o) (Sprangler et al., 1973a,b; Sommers and Floyd, 1974). Also, organic mercury in sediments is largely unavailable to deposit-feeding animals (Kendall, 1978) Consequently, the EPA is presently developing procedures to normalize mercury sediment concentration criteria to sediment organic content. The sediment standard will become the ratio of total mercury to total organic carbon in the sample (F. Lee pers. com.).

Berman and Bartha (1986) discovered that sulphide in anaerobic sediments also prevented mercury methylation. At their site in a New Jersey estuary, total mercury concentration was 1,000 mg/kg yet methylmercury concentrations (the highly toxic form of mercury) were less than 10 ug/kg.

Salazar et al. (1980) reported results of bioassay tests on San Diego Bay sediment. The clam *P. staminea* had greater than 97% survival when tested with sediment containing 66.5 ppm mercury. The mysid, *M. elongata* had greater than 97% survival when tested with sediment containing 58.2 ppm mercury. *M. elongata* and the fish *C. stigmaeus* had greater than 97% survival when tested with elutriates of sediment containing 254.4 ppm mercury.

Tissue concentrations of mercury in Commercial Basin biota indicated no measurable mercury in *Bulla gouldiana*, the bottom dwelling mollusc. Mercury concentrations in *Panulirus interruptus* (lobster) were similar to the reference site and concentrations in *Portunus xantusii* (crab) were less than the reference site (Woodward-Clyde, 1990).

Based on the above results it appears much of the mercury in San Diego Bay may be in non-toxic forms, due to the chemistry of the sediment. The benthic communities in the area are well established and appear to be representative "healthy" benthic communities for their respective grain-size environments. Removal of the sediment will destroy these existing communities. Therefore, based on the available scientific data, selection of the State of California Title 22 criteria for mercury as a cleanup level will provide protection for the environment without undue destruction of the marine benthos.

14.0 CONCLUSIONS

Best scientific judgement should be the basis for establishing cleanup levels for contaminated sediment remediation. If a remediation program is to go forward at this time, it should be based on both human-health considerations and ecological well being. At present, the best scientific judgement supports use of Title 22 body-contact standards as the guideline for remediation.

The State and the EPA are at present evaluating the appropriate methods for measuring mercury and copper in marine sediments with the goal of setting cleanup criteria for marine sediments. At the time these criteria are established, the boatyards could conceivably be required to conduct yet another dredging program to meet these standards. Because these standards will be forthcoming soon, it would be better to dredge to these criteria thereby eliminating the need to disturb the environment twice; because most of the damage to the marine environment will occur during the dredging process due both to the physical disturbance and the unavoidable resuspension of some ionic copper and mercury.

What we presently know about the chemistry in Commercial Basin tells us that, once released to the water column and the sediments, most of both mercury and copper will be immediately converted to relatively non-toxic forms. Additionally, the studies which have been conducted in San Diego Bay sediment, indicate that the toxicity of the existing sediments to various organisms indicates copper and mercury are not causing adverse impacts on the marine environment of the bay; nor, do they apparently pose a threat to the beneficial uses of the bay.

15.0 REFERENCES

Berman M. and R. Bartha. 1986. "Control of the methylation process in a mercury-polluted aquatic sediment." Environmental Pollution (Series B). 11: pp. 41-53.

California Regional Water Quality Control Board, San Diego Region. 1991. 1990 Update of the Beneficial Uses and Water Quality Objectives of the Comprehensive Water Quality Control Plan for the San Diego Region. September 1991.

Delos, C. 1990. Personal communication to G. Fred Lee. Office of Water Regulations and Standards, US EPA, Washington, D.C.

DiToro, D. M., J.D. Mahony, D.J. Hansen, K.J. Scott, M.B. Hicks, S.M. Mayr, and M.S. Redmond. 1990. "Toxicity of cadmium in sediments: the role of acid volatile sulfide." Environmental Toxicology and Chemistry. 9: pp. 1487-1502.

Dodge, E.E. and T.L. Theis. 1979. "Effect of Chemical Speciation on the Uptake of Copper by *Chironomus tentans*," Environmental Science and Technology. 13: pp. 1287-1291.

Elderfield, H. 1981. "Metal-organic associations in interstitial waters of Narragansett Bay sediments," American Journal of Science. 281: pp. 1184-1196.

Elderfield, H., N. Leudtke, R.J. McCaffrey, and M. Bender. 1981a. "Benthic flux studies in Narragansett Bay." American Journal of Science. 281: pp. 768-787.

Elderfield, H., R.J. McCaffrey, N. Leudtke, M. Bender, and V.W. Truesdale. 1981b. "Chemical digenesis in Narragansett Bay sediments." American Journal of Science. 281: pp. 1021-1055.

Hansen, D. 1991. Personal communication to G. Fred Lee. US EPA Narragansett Laboratory. Narragansett, RI.

Hanson, A. 1971. "Manmade Sources of Mercury" in Royal Society of Canada, Proceedings, Special Synopsis on Mercury and Man's Environment. Ottawa, Canada. 201 pp.

Kendall, D.R. 1978. The role of macrobenthic organisms in mercury, cadmium, copper and zinc transfers in Georgia salt marsh ecosystems. Ph.D. thesis, Emory University, Atlanta, GA. 241 p.

Lee, G.F. and R.A. Jones. 1983. "Translation of laboratory results to field conditions: the role of aquatic chemistry in assessing toxicity." Aquatic Toxicology and Hazard Assessment 6th Symposium. ASTM Symposium Technical Papers 802. American Society of Testing Materials. Philadelphia, PA. pp. 328-349.

Lee, G. F. and R.A. Jones. 1987. "Water quality significance of contaminants associated with sediments: an overview." Fate and Effects of Sediment-Bound Chemicals in Aquatic Sediments. Pergamon Press. Elmsford, NY. pp. 1-34

Lee, G. F. and R.A. Jones. 1990. "Comments on draft statewide water quality control plans for: 1) inland surface waters of California (California inland surface waters plan); 2) enclosed bays and estuaries of California (California enclosed bays and estuaries plan) (November 2, 1990) and functional equivalent document (November 26, 1990)." Submitted in December 1990 to the California Water Resources Control Board. Sacramento, CA.

Lindsay, W. L. 1979. Chemical Equilibria in Soils. Wiley-Interscience. New York, NY.

Lockheed Ocean Science Laboratories. 1983. Distribution and abundance of fishes in central San Diego Bay California: a study of fish habitat utilization. Prepared for Ferver Engineering Co. San Diego, CA.

Long, E. R. and L.G. Morgan. 1990. "The potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program." NOAA Technical Memorandum NOS OMA 52. National Oceanic and Atmospheric Administration. Seattle, WA.

Meador, J. P. 1991. "The interaction of pH, dissolved organic carbon, and total copper in the determination of ionic copper and toxicity." Aquatic Toxicology. 19: pp. 13-32.

Morse, J. W., F.J. Millero, J.C. Cornwell, and D. Rickard. 1987. "The chemistry of the hydrogen sulfides and iron sulfide systems in natural waters." Earth-Science Reviews. 24: pp. 1-42.

Salazar, M.H., S.C. U'ren, and S.A. Steinert. 1980. Sediment bioassays for NAVSTA San Diego dredging project. NOSC Technical Report 570. Naval Ocean Systems Center. San Diego, CA. 46 pp.

Sommers, L.E. and M. Floyd. 1974. Microbio. Transformations of Mercury in Aquatic Environments. Purdue University, Water Reservoir Research Cent. Tech. Rep.. 54: 88 pp.

Sprangler, W.J., J.L. Spigarelli, J.M. Rose and H.M. Miller. 1973a. "Methylmercury: Bacterial Degradation in Lab Sediments." Science, 180: pp. 192-193.

Sprangler, W.J., J.L. Spigarelli, J.M. Rose, R.S. Slippin and H.M. Miller. 1973b. "Degradation of Methylmercury by Bacteria Isolated from Environmental Samples." Applied Microbiology. 25(4): pp. 488-493.

Stumm, W. and J.J. Morgan. 1981. Aquatic Chemistry: An Introduction Emphasizing Chemical Equilibria in Natural Waters. J. Wiley & Sons, New York, NY. 780 pp.

Sunda, W.G. and R.R.L. Guillard. 1976. The relationship between cupric ion activity and the toxicity of copper to phytoplankton. Journal of Marine Research. 34: pp. 511-529.

Sunda, W.G. and J.M. Lewis. 1978. Effect of complexation by natural organic ligands on the toxicity of copper to a unicellular alga, *Monochrysis lutheri*. Limnology and Oceanography. 23: pp. 870-876.

Symes, J.L. and D.R. Kester. 1985. Copper interaction with carbonate species based on malachite solubility in perchlorate medium at the ionic strength of seawater. Marine Chemistry. 16(3): pp. 189-211.

Tessier, A. and P.G. Campbell. 1987. "Partitioning of trace metals in sediments: relationships with bioavailability." Hydrobiologia. 149: pp. 43-52.

United States Environmental Protection Agency. 1985. Ambient Water Quality Criteria for Copper - 1984. EPA 440/5-84-031. Washington, D.C.

United States Environmental Protection Agency. 1991. Draft Analytical Method for Determination of Acid Volatile Sulfide in Sediment. EPA xxx/x-xx-xxx. Washington, D.C.

Wallace, R.A., W. Fulkerson, W.D. Shults and W.S. Lyon. 1991. "Mercury in the Environment: the Human Element." Oak Ridge National Laboratory, US AEC, Oak Ridge, TN. 61 pp.

Water Resources Control Board, State of California. 1990. Water Quality Control Plan, Ocean Waters of California. 23 pp.

Water Resources Control Board, State of California. 1991. Water Quality Control Plan for Enclosed Bays and Estuaries of California. 73 pp.

Windom H.L and D.R. Kendall. 1979. Accumulation and biotransformation of mercury in coastal and marine biota. The Biogeochemistry of Mercury in the Environment. J.O. Nriagu (Editor). Elsevier. New York, NY. 303-312 pp.

Windom, H.L., K.t. Tenore, and D.L. Rice. 1982. Metal accumulation of the polychaete *Capitella capitata*: influences of metal content and nutritional quality of detritus. Can. J. Fish. Aquat. Sci. 39: 191-196.

Woodward-Clyde Consultants. 1990. Remedial Action Alternatives Report prepared for Latham and Watkins.

Woodward-Clyde Consultants. 1991. Remedial Action alternatives for National City Marine Terminal prepared for San Diego Unified Port District.

ENVIRONMENTAL HEALTH COALITION
1717 Kettner Boulevard, Suite 100 • San Diego, California 92101 • (619) 235-0281

OUR FAX NO. 619-232-3670

FAX COVER SHEET

Date: 11-21

TO: Dave Barker

COMPANY: RWQCB

PHONE NO: ______ FAX NO. 5716972

FROM: Laura

TOTAL NUMBER OF PAGES INCLUDING COVER SHEET 5

COMMENTS:

File Copy

Printed on recycled paper

ENVIRONMENTAL HEALTH COALITION
1717 Kettner Boulevard, Suite 100 • San Diego, California 92101 • (619) 235-0281

November 21, 1991

Mr. Charles Badger and Regional Board Members
Regional Water Quality Control Board
9771 Clairemont Mesa Rd., Ste. B
San Diego, CA 92124

RE: Cleanup Levels for Commercial Basin

Dear Chairman Badger and Members of the Board,

Since the discussion of Commercial Basin cleanup level was continued until the December meeting, we would like to take the opportunity to make some preliminary remarks regarding this issue. This represents the official position of Environmental Health Coalition (EHC).

EHC supports, with a few modifications, the staff recommended cleanup level for copper and, tentatively, the cleanup method for TBT. EHC requests a stricter cleanup level for mercury.

BACKGROUND LEVELS

We concur with staff that the referenced background concentrations are levels that occur in areas of intensive industrial use. However, these levels are not natural background levels and should not be used as a baseline for other sites in the Bay. The reference of 'background' in this case could lead to confusion in the future.

TBT CLEANUP LEVEL

While we concur with staff that TBT remediation appears to be happening naturally, via natural chemical breakdown, we have a concern that as TBT breaks down, it does not go away. Tributlytin, after losing one butyl group, becomes dibutyltin, then mono-butyltin, and finally, elemental tin. Tin does not break down. What are the effects and mobility of these other compounds which are certain to be present in the bay sediments? Are we better (or worse) off with high levels of di- or monobutyltin in sediments? What are the effects of tin in the marine environment? What is the toxicity? Mobility? This remediation strategy should not be adopted until we know the answers to these questions. EHC requests that Regional Board require consultants perform further study to examine these possible effects.

After these concerns are allayed, we request that a cleanup level be set along with an expected timetable for natural remediation. If the sediments are not meeting the level of cleanup when expected there should be a formal cleanup of TBT. Without this schedule, we are left with no recourse to cleanup the TBT if it does not continue to dissipate. EHC holds that those who created the state of pollution in the Bay should bear the cost of cleanup-- not the public.

MERCURY CLEANUP LEVEL

EHC's major concern centers around the recommended cleanup level for mercury. Mercury comes in different forms, each having significantly different properties and effects on the environment. If the mercury at the site is in an organic form or could become organic through chemical reaction, its potential effect on Bay water quality is very serious. Organic mercury is that which moves up the food chain and bioaccumulates. In humans it can cause birth defects and central nervous disorders among other things. It is also the form most toxic to marine life.

The lack of bioaccumulation of mercury in finding #13 and the confusing data in finding #21 (which were attributed to grain size) could also be explained if there were differences of organic or inorganic mercury in the sediment mixture. For example, the lack of bioaccumulation could be explained if the mercury at the test site was inorganic. The higher toxicity of lower levels of mercury in finding #21 could be explained if that mercury were in an organic form. **However, even if all of the mercury were inorganic there is still the potential for it to transform into organic given time and certain sediment conditions.** Its continued presence poses a continued threat. Mercury also appears to have increased toxicity in the presence of lead and zinc. These elements that are co-disposed at this site. Metals can be radically and quickley changed by environmental factors and this fact should not be underestimated.

The posting of the Bay happened in part due to PCB levels in the fish but the health experts we have consulted with are even more concerned about the elevated mercury levels. Mercury left in the Bay will continue to affect the food chain for years to come and leave us with an unfishable Bay. People are eating fish out of the Bay and, in some cases, feeding their families with the fish and shellfish they collect. Mercury in the marine environment creates potential risks too serious to ignore. The recommended 4.8 ppm cleanup level is an order of magnitude too high.

EHC urges in the strongest terms possible a cleanup level of, no more than. .51 ppm, the apparent effects levels noted in the staff report.

EHC REJECTS AS DANGEROUS THE CHARACTERIZATION OF MERCURY IN COMMERCIAL BASIN SEDIMENTS IN WOODWARD-CLYDE REPORT

In reading this report we were struck by the implication that methylmercury (a highly toxic form of mercury) and dissolved copper (the most toxic form to marine life) become benign once in the water. Page 20 states:

> "What we presently know about the chemistry in Commercial Basin tells us that, once released to the water column and the sediments, most of the mercury and copper will be IMMEDIATELY (emphasis added) converted to relatively non-toxic forms."

This conclusion is dangerous and experts we have consulted do not support it. **WE STRONGLY URGE THE BOARD TO REJECT THIS CONCLUSION.** Mercury can be methylated from inorganic mercury in sludge and sediments. This could take a long time but it is always a possibility as long as inorganic mercury is present in the sediments. **Just because it may not be happening now is no guarantee that it will not happen in the future.** Once converted, methylmercury can leave the sediments and move up through the food chain. Inorganic mercury was the culprit in the Minimata spill and, 40 years later, the fish are still inedible.

WE URGE ADOPTION OF THE POST SAMPLING PROGRAM

EHC would ask that a the post-cleanup monitoring requirement be expanded to insure that 1) the TBT is reduced to a predetermined cleanup level and 2) the mercury and contaminants left in the Bay are not having an effect on the marine environment. Monitoring should take place over a period of years to be certain that the TBT continues to disappear and the mercury is not having an impact on the fish in the Bay.

COPPER CLEANUP LEVEL

EHC would prefer a cleanup level for copper of 390 ppm though we do understand the staff's reasoning for a level of 530 ppm. A cleanup level of 1,000 ppm as requested by the dischargers is wholly unacceptable. The Commercial Basin cleanup level must be lower than that of Paco Terminals because the type of copper deposited there is of a different nature that deposited at Paco Terminals. Just as mercury has different forms with different effects, so does copper. Insoluble copper (such as ore) can act quite differently than soluble or dissolved copper. Dissolved copper is far more toxic to marine life. I have attached quotes from a paper by Al Zirino submitted to the Port District's Toxic Waste Advisory Committee which addresses this issue.

EHC PROTESTS THE DRAWING OF SIMILARITIES BETWEEN THE COPPER IN COMMERCIAL BASIN AND PACO TERMINALS.

We support the Executive Officer's comments at the Regional Board meeting in October. You will all remember that, during discussions of Paco Terminals we were all told that this site was different because it was 'copper ore' and that the cleanup level might be different here than at boatyard and shipyard sites. EHC raised the concern then, and it is coming true now, that an effort would be made to liken these two sites when in fact the form of copper disposed was very different. We would ask that you do not equate these sites in terms of cleanup decisions.

REGIONAL BOARD COULD ORDER CLEANUP WITH OR WITH OUT PROOF OF TOXICITY

San Diego Bay is an impaired water quality body for copper, mercury, TBT, and PCB. This means it cannot recover on its own to the desired state of water quality. Seven boatyards in Commercial basin discharged these pollutants in violation of the law. This is all the evidence required for you to require cleanup of Commercial Basin to natural background levels. EHC recognizes that this was a very expensive mistake on the part of the boatyards. We understand that the Regional Board wishes to be reasonable in its cleanup order and that is why you have entered into a discussion of what level of cleanup should occur.

Science is not an absolute and scientists disagree often. What is less debatable is that the effects of mercury, on human health and in the marine environment, are nothing to fool with. By setting a protective cleanup level for mercury we prevent future risks to our health and environment.

Please contact me with any questions at 235-0281

Thank you very much for your time.

Sincerely,

Laura Hunter

Laura Hunter
Clean Bay Campaign

P.S. HAVE A HAPPY THANKSGIVING!!!

cc:
Regional Board Members
Mr. Art Coe
Mr. David Barker

Excerpts from a paper on Copper in San Diego Bay prepared for the Toxic Waste Advisory Committee by Dr. Al Zirino

> "Copper level in the bay water appear to be increasing with time....Once in the sediments, copper may be re-dissolved and this source may contribute significantly to the pool of dissolved copper in the Bay."

Dissolved copper is a very bioavailable form of copper and thus a serious threat to marine life.

In this paper it was also stated that the presence of copper in the bay has resulted in ecosystem alteration in terms of reduced species diversity, altered community and dominance patterns, and reduced biomass. It also holds that there is a correlation between reduced species diversity and altered community composition and increasing copper concentrations.

From the NOAA document, The potential for Biological Effects of sediment-sorbed contaminants in the National Status and Trends Program:

> "...mercury was the most toxic trace metal to aquatic organisms; and that toxicity was increased in the presence of zinc and lead."

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego**
Unified Port District

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
San Diego Region

CLEANUP AND ABATEMENT ORDER NO. 85-91

Paco Terminals, Inc.

San Diego Unified Port District

SAN DIEGO UNIFIED PORT DISTRICT'S WRITTEN DIRECT TESTIMONY FOR REGIONAL BOARD HEARING ON DECEMBER 9, 1991 REGARDING CLEANUP LEVEL AND ADJUSTMENT OF ADDENDUM NO. 6 TIME LINES

Submission Date:	November 22, 1991
Hearing Date:	December 9, 1991
Location:	San Juan Capistrano City Council Chamber 32400 Paseo Adelento San Juan Capistrano
Hearing Time:	9:00 a.m.

EXHIBIT LIST

EXHIBIT NUMBER	DATE	DOCUMENT
1.	11/04/91	SDUPD Progress Report on Paco Cleanup and Abatement Order and Inability to Meet December 1, 1991
2.	08/01/91	Quarterly Progress Report of San Diego Unified Port District
3.	10/30/91	Quarterly Progress Report of San Diego Unified Port District
4.	11/19/91	Judge McCue Working Group/Settlement Conference Report
5.	11/18/91	SDUPD Due Process Letter
6.		G. Fred Lee Summary Resume
7.		Rebecca Anne Jones Summary Resume
8.		Table 3-1. Summary of Toxicity Test Results NCMT-Area Sediments
9.		Table 8. Overall Summary of Toxicity Test Results NCMT-Area Sediments
10.	06/30/87	Greg Peters Memo re Data Review for Cleanup
11.	07/24/91	Deposition Transcript of Greg Peters
12.	04/05/91	Deposition Transcript of David Barker
13.	07/25/91	Deposition Transcript of Lance McMahan
14.		Jean Nichols Summary Resume

I. INTRODUCTION AND SUMMARY

Pursuant to notice mailed on November 8, 1991, the San Diego Unified Port District submits this written direct testimony on November 22, 1991, two weeks in advance of the Regional Board hearing on December 9, 1991. For convenience, the Port District's written testimony is presented in this single volume.[1] It addresses each of the three issues referred to in that notice and the accompanying letter from the Executive Officer dated November 8, 1991:

1. findings in the Port District's **Final Report:** Remedial Action Alternatives for National City Marine Terminal July 26, 1991 (the "Report" or "the Woodward-Clyde Report");

2. whether the current cleanup level of 1,000 ppm (dry weight) should be modified; and

3. whether the current time schedule contained in Addendum No. 6 should be modified.

Briefly, the Port District is pleased to report that preferred remediation alternatives have been identified and that substantial

---

[1]At the hearing, the testimony will be presented through a panel of four witnesses. Each witness will testify concerning particular areas. The witnesses are: Ralph T. Hicks Jr., the Port District's Environmental Management Coordinator, who will testify concerning overall project management and progress made since the filing of the Report; David B. Hopkins, the Port District's special counsel, who will testify concerning legal issues and the substantial progress being made in the conferences involving all interested parties before U.S. Magistrate McCue; Dr. Jean Nichols of Woodward-Clyde, who will testify concerning aspects of the Woodward- Clyde Report other than biological and risk assessment; and Dr. G. Fred Lee, who will testify concerning biological, toxicity and risk assessment aspects of the Report and, in particular, that the clean-up level may be significantly raised without adversely affecting the beneficial uses of San Diego Bay. Dr. Lee, with his associate Dr. R. Anne Jones, was a subcontractor to Woodward-Clyde with respect to the Report's toxicity, bioassay, and risk assessment issues. This written testimony has been reviewed by each of these witnesses, who either wrote or approved sections dealing with their subject areas.

Dr. Nichols' resume is Exhibit 14 hereto; Dr. Lee's is Exhibit 6; Dr. Jones' is Exhibit 7.

progress is being made toward accomplishing those alternatives.[2] The Report determines that the best remediation alternatives for meeting the 1,000 ppm cleanup level currently set in the Order is to treat differently sediments having copper concentrations less that 2,000 ppm (Level I sediments) from those having 2,000 ppm copper or more (Level II sediments). Level I sediments should be remediated through ocean disposal (if permitted by EPA) through mining company reclamation (if possible, despite the low copper concentrations) or, alternatively through containment behind a bulkhead or disposal at a non-hazardous waste landfill.[3] Level II sediments should be remediated through the "mining company option," under which the sediments will be delivered to Cyprus Mining Company in Sierrita, Arizona, for copper reclamation.

The Port District is working diligently to accomplish this plan, including meeting under the auspices of U.S. Magistrate Harry R. McCue. Those meetings include not only the Port District but also Paco, the mining companies, the manufacturer of the clamshell bucket utilized for much of the Paco operations, Paco's insurers and the Port District's insurers. The focus of the conferences before

---

[2]Just before this hearing was scheduled, Ralph Hicks, Environmental Management Coordinator for the Port District, wrote a letter to the Regional Board Members, Executive Officer and Counsel to advise them of the progress made on the project. That letter, dated November 4, 1991, is incorporated herein by reference and is attached as Exhibit 1. Also summarizing progress to date are the Port District's quarterly progress reports to the Regional Board dated August 1, 1991 (Exhibit 2) and October 30 (Exhibit 3).

[3]It should be noted that these Level I sediments, having copper concentrations of less than 2,000 ppm (dry weight) are far below the Title 22 TTLC standard of 2,500 ppm (wet weight); 2,500 ppm wet weight translates roughly into 4,000 ppm dry weight. See Deposition Testimony of Lance McMahan of Regional Board Staff (at p. 179, l. 2, p. 180, l. 12 (Exhibit 13).

Magistrate McCue has been to resolve the remaining technical issues concerning implementation of the mining company option and to resolve funding issues. The Port District and its consultant have also started the permit application process by meeting with representatives of the Army Corps of Engineers and the EPA to "clear" requirements for the consolidated federal permit.[4]

The Report concludes that meeting the current sediment cleanup standard of 1,000 ppm is likely to cost approximately $6.3 million if ocean disposal is not available for Level I, and reduced to about $4.6 million if ocean disposal is available for Level I. These costs are in addition to the $1.3 million for land side remediation already spent by the Port District. Thus, the total remediation project will cost between $6 million and $7.5 million. Obviously, these costs are far in excess of the approximately $1 million the Port District understands Paco estimated to be the cost of meeting the 1,000 ppm cleanup level in 1986 or 1987, when it was presumed that remediation could be by ocean disposal.

As to the cleanup level, the Report supports the conclusion that a much higher cleanup level than 1,000 ppm would be protective of the beneficial uses of San Diego Bay. The aquatic chemistry, toxicity, bioassay and risk assessment portions of the Report concluded that there was no showing of any increased toxicity or biological risk up to over 18,000 ppm (the highest level tested in

[4] As the Port District has notified the Regional Board on several occasions, permitting details depend in large part upon the Regional Board's ultimate approval of the cleanup level and remedial action plan, as well as on remaining technical issues to be resolved with Cyprus (most likely through a pilot project as recommended in the Report) concerning the form and water content of the material to be delivered to the mine for reclamation. See, e.g., Exhibits 1, 2, and 3.

the Report study). Based on this information, the Port District requests that the cleanup level be increased from 1,000 ppm to 4,000 ppm (dry weight); 4,000 ppm (dry weight) approximates the Title 22 TTLC standard, which is 2,500 ppm wet weight.

Because levels exceeding 18,000 ppm were not shown to be toxic, this proposed cleanup level of 4,000 ppm is highly conservative and protective of the beneficial uses of San Diego Bay. In addition, because it is below the Title 22 TTLC level, it avoids an additional set of regulatory concerns that might be implicated by exceeding the TTLC level. Finally, raising the cleanup standard would generate significant cost savings, which would greatly increase the likelihood that the project will be timely completed. It is estimated that increasing the cleanup level to 4,000 ppm would save approximately $2 million.

As to the Addendum No. 6 time lines, the Port District requests that the April, 1993 final deadline for remediation completion remain in place. The Port District is optimistic that that deadline can be reached. However, the Port District also requests that all intermediate deadlines in Addendum No. 6 be vacated and that no new intermediate deadlines be set at this time.

The Port District and the other interested parties are working diligently under Magistrate McCue's supervision to resolve all matters related to the cleanup. In a letter to the Regional Board Members, copied to all parties to his conferences, Magistrate McCue has requested:

> [T]hat those deadlines be flexible enough to allow our meetings to continue so that the parties may reach a consensus on the technical effectiveness and feasibility of the remediation method. I fear that requiring Paco and the Port

> to adhere to the current time deadlines could jeopardize the ongoing negotiations and prevent the parties from reaching a full consensus.

Letter from Magistrate McCue to Regional Board Member Arant, November 19, 1991, Exhibit 4 hereto.

The Port District shares Magistrate McCue's concerns that requiring adherence to artificial interim deadlines may unnecessarily jeopardize the delicate process of achieving a consensus of all parties to work together to accomplish the project. Moreover, there are already significant safeguards to assure that the parties are diligently pursuing cleanup. The parties are meeting approximately monthly before Magistrate McCue. The Regional Board has been invited to meet with Magistrate McCue as well. (See McCue letter, Exhibit 4.) In addition, the parties file quarterly progress reports with the Regional Board Staff. Therefore, both Magistrate McCue and the Regional Board have their fingers on the pulse of this project.

The balance of this written testimony will address these subjects in more detail. Because of their complexity, the Port District requests additional time for its presentation. We estimate that an adequate treatment of the issues will require at least one and one-half hours, and request that that much time be allocated for the Port District's presentation.[5]

---

[5] In addition to this testimony on the merits, the Port District has lodged several due process objections to the hearing procedures. Included in that objection was a request for 1.5 hours of presentation time rather than the 15 minutes allocated in the notice of hearing procedures. These objections were made in a November 18, 1991 letter and fax from counsel for the Port District to the Regional Board Executive Officer, incorporated herein by reference and attached as Exhibit 5.

II. **FINDINGS OF THE WOODWARD-CLYDE REPORT**

The Woodward-Clyde Report dated July 26, 1991 and submitted to the Regional Board on August 1, 1991 represents a major effort by not only Woodward-Clyde as the project manager, but also subcontractors G. Fred Lee & Associates, MEC Analytical System, Inc. and ERCE Environmental Services Company. It is impossible for this testimony to address all aspects of the Report. The Report is incorporated herein by reference.

The project included (1) determining the current horizontal and vertical distribution of copper in the sediments, (2) marine sediment sampling, (3) toxicity testing, (4) reviewing previous bioassay and bio-accumulation test results, (5) risk assessment, and (6) development and assessment of the best remediation alternatives and their associated costs.

A. **Horizontal and Vertical Distribution**

The Report concluded that there is no significant horizontal movement of the copper in the sediment. This conclusion is significant because one reason the Regional Board has pursued cleanup and the 1,000 ppm cleanup level was a concern that possible extension of the copper plume posed an environmental threat to additional areas of the bay, and posed a potential problem if cleanup were deferred despite uncertainty (at that time) as to its toxicity. Peters memo (Exhibit 10); Peters TR p. 44, lines 5-23.[6]

---

[6] The Port District had reason to review the Regional Board regarding establishment of the 1,000 ppm cleanup standard in connection with depositions noticed by insurance company lawyers of Regional Board Staff for the Paco Terminals insurance company litigation in which the Port District intervened. Paco Terminals, Inc. v. American Home Assurance Co., et al., consolidated civil action Nos. 602586-602587, Superior Court, San Diego County. As part of (footnote continued)

In addition to concluding that the copper is not moving horizontally, the Report also concludes that the copper appears to be moving vertically downward into the sediment, where it will become even less available to marine organisms. The Report compares copper concentrations found in sediment samples taken in 1989 and 1991. There is a general pattern of decrease in copper concentrations in surface sediments and a corresponding increase in copper levels deeper in those sediments. Downward movement of the copper ore would be expected because it is more dense than the sediment in which it is deposited. Because most marine life is found in the upper part of the sediment, movement of copper ore deeper in the sediments helps isolate the material from the zone of maximum biological activity.

B. Evaluation of Remediation Alternatives

Section 4 of the Report evaluates over a dozen different remediation alternatives, for meeting the current 1,000 ppm cleanup level. All alternatives were evaluated under a set of factors, including: impact on the marine environment and human population; responsiveness to the Regional Board's order; technical effectiveness; reliability; permanency; permitting feasibility; time for completion; and, cost. The alternatives that were analyzed (in addition to the mining company option) included: capping in place;

(footnote continued from previous page)
those depositions, the Port District reviewed Greg Peters' June 30, 1987 memo to the Paco Terminals file, LM, DB; regarding data review for cleanup. That memorandum is Exhibit 10 hereto. Also included as exhibits are portions of the deposition testimony of the author of the memo, Greg Peters, and the recipients of the memo, David Barker and Lance McMahan, all of the Regional Board Staff. Because the memo (Exhibit 10) is handwritten and partially illegible, included in Exhibit 11 are those portions of Greg Peters testimony in which he deciphers the memorandum.

in-situ stabilization, retention behind a cofferdam; retention behind a bulkhead; ocean disposal; Class I landfill (for materials over TTLC limits, unless a variance is obtained); Class III landfill (for materials below TTLC limits); solidification/stabilization; chemical fixation; and private land disposal capping.

Mechanical and hydraulic dredging were also analyzed for relative effectiveness. Mechanical dredging uses a clamshell, or a bucket like dredge to pick up the sediment. Hydraulic dredging involves slurrying the sediment with water and pumping the slurry. The primary difference between mechanical and hydraulic dredging is the amount of water present in the dredge material at the time of dredging. Therefore, the addition of dilution water increases the volume of the dredged material and adds to the problems associated with deposition of the material. Therefore, mechanical dredging was chosen for all dredging options.

The remedial alternatives analysis concluded that:

> Mechanical (clamshell) dredging would have the least impact on the bay;
>
> For materials with lower copper concentrations than 2,000 ppm (so-called Level I sediments), ocean disposal would be the preferred remediation alternative. However, the Report recognizes permitting difficulties regarding ocean disposal. The second and third choices for these materials were identified as mining company reclamation (if possible despite the low copper levels in these sediments) and bulkhead disposal.
>
> For materials containing copper concentrations in excess of 2,000 ppm (2%) (Level II materials) the mining company option was identified as the best alternative.

As shown, the Report designated these two categories of sediments Level I and Level II. Level I consists of sediments containing greater than 1,000 ppm but less than 2,000 ppm (dry weight) while Level II sediments are those with greater than 2,000 ppm copper (dry weight). The Report analyzed those two alternatives separately because the mining company had informed the parties that reclamation of the copper under the mining company option was feasible only for materials containing at least 2,000 ppm (2%) copper.[7]

Thus, the mining company option is clearly available for Level II materials. For Level I materials, ocean disposal is the preferred alternative. However, the Report recognizes permitting questions with respect to ocean disposal of Level I sediments even though they are far below any regulatory standard for hazardous material. If it remains necessary to remediate the Level I materials (as it would be under the current cleanup level), the next preferable options were the mining company option (if possible in light of the 2% requirement) or disposal behind a bulkhead.

Although the Report analyzed and identified remediation alternatives for sediment subject to the current 1,000 ppm cleanup level, the no action option would be appropriate for some sediments which are currently subject to the order. The main biological or scientific advantage of that alternative would be not unnecessarily disturbing the bay bottom and disturbing existing marine life in the process of removing those sediments. Cost savings is a practical advantage to leaving those sediments in place. As is apparent from the McCue conferences, the remediation project becomes more feasible as it becomes more affordable.

---

[7] For this reason alone, increasing the cleanup level from 1,000 ppm to at least 2,000 ppm would greatly simplify and economize the Plan. Raising the cleanup level to 2,000 ppm would have no adverse impact on the beneficial uses of San Diego Bay.

C. **Costs**

The Report estimated the following costs of the preferred remediation methodologies (assuming clamshell dredging for all alternatives):

Level I Material

Ocean Disposal (if available in light of permitting)	$ 170,000
Mining Company Option (if available in light of 2% limit)	1,700,000
Bulkhead Disposal	1,250,000

Level II Material

Mining Company Option	3,790,000

Common Costs to All Remediation Options

Permits	100,000
Dredging Plan	20,000
Verification of Cleanup	300,000 - 550,000
Pilot Project for Mining Company Option	21,180

Obviously, the total costs of the project are much in excess of the amount the Port District is informed Paco estimated for its original ocean disposal plan in 1987. Meeting the current cleanup level will cost approximately $4.6 million if the parties are successful in securing ocean disposal permitting from the EPA. The cost goes up to approximately $6.3 million if the mining company option is used for the Level I materials. These costs are in addition to the land side remediation costs already incurred by the Port District, which total approximately $1.3 million. Thus, the total remediation cost of the current cleanup level will be approximately

$7.5 million if ocean disposal is not available and approximately $6 million if ocean disposal is available for the Level I sediment.

Despite the substantial progress made before Magistrate McCue, the parties are having serious difficulties reaching agreement on a financial package sufficient to meet these needs and to satisfy the other concerns of the parties to the conferences. It is currently estimated that increasing the cleanup level to 4,000 ppm would reduce the costs by approximately $2 million (the entire cost of a Level I disposal and a portion of the cost of Level II disposal under the mining company option). This $2 million savings may ultimately be critical to approval of a financial formula under Magistrate McCue's auspices.

The Water Code authorizes this Board to take cost feasibility into consideration in making cleanup determinations. See Water Code §§ 13000; 13241(d). See also Environmental Health Coalition, State Water Resources Control Board Order No. WQ 91-10 (9/26/91).

The Port District understands that financial considerations were taken into account in setting the initial cleanup level at 1,000 ppm when it was anticipated that meeting that level could be accomplished at a relatively feasible cost. Now that that level is not achievable at those relatively feasible costs, the Port District requests that the Regional Board exercise its discretion to take cost into consideration in resetting the cleanup level.

While cost considerations should not override health risk and environmental quality issues, that would not be the case here. In this case, the beneficial uses of the bay would be protected by the

4,000 ppm cleanup level, or possibly even an 18,000 ppm cleanup level.

III. CLEANUP LEVEL

A 4,000 ppm cleanup level is conservative and protective of the beneficial uses of San Diego Bay.

The toxicity tests and the chemistry of the materials in the sediment indicate that a cleanup level of 15,000 ppm to 20,000 ppm would be protective of the beneficial uses of San Diego Bay. Thus, a 4,000 ppm (dry weight) cleanup level [equivalent to the 2,500 ppm Title 22 TTLC level] is conservative and would also be protective of the beneficial uses of San Diego Bay.

A. Toxicity Test Results and Aquatic Chemistry of Copper Support a Cleanup Level Up to 15,000 to 20,000 ppm

1. Experience of Dr. G. Fred Lee and Dr. R. Anne Jones

In the spring of 1991, as part of the study of remedial action alternatives for the NCMT sediments that was contracted to Woodward-Clyde Consultants, Drs. G. Fred Lee and R. Anne Jones were contracted to review the available information pertinent to assessing the hazards (risks) that the copper in the NCMT-area sediments represents to the designated beneficial uses of San Diego Bay. Secondarily, both existing and newly collected information was examined for implications for higher sediment copper concentrations' impacts on beneficial uses of San Diego Bay. Woodward-Clyde drafted the risk assessment portion of its report (Woodward-Clyde, 1991) from the information provided by the Report of Lee and Jones to Woodward-Clyde (Lee and Jones (1991)).

Drs. Lee and Jones have extensive experience in advising industry and governmental entities on water quality and sediment quality issues. They have also written extensively on sediment and water quality issues. Drs. Lee and Jones have substantial experience in aquatic chemistry, aquatic biology, aquatic toxicology, and environmental engineering pertinent to evaluating the water quality significance of contaminants associated with water and sediments. Dr. Lee has focused much of this 30-year professional career on developing and applying new technology for evaluating the water quality significance of contaminants in sediments. Dr. Lee has been involved in several projects involving the impact of copper on aquatic life, including projects related to Lake Monona in Madison, Wisconsin; Idarado Mining Company of Telluride; Colorado; New York Harbor. In Dr. Lee's experience in working on relationships between the presence of chemicals on water and aquatic life-related water quality, he has found that shallow bay systems tend to detoxify heavy metals with the result that what appear to be "excessive" concentrations well above water quality criteria or standards/ objectives may in fact have no adverse impact in aquatic life related beneficial uses. This phenomenon is consistent with and to be expected based upon the aqueous environmental chemistry of copper. It is also consistent with the test results in this case. Drs. Lee and Jones have been working on these topics as a team since the mid-1970s.[8]

2. Test Results

In previous studies reported by Woodward-Clyde (1991) sediments containing as much as 6,067 mg Cu/kg dry weight were used in toxicity tests. Table 8 to Lee and Jones 1991 includes these

[8]Curriculum vitae of Drs. Lee and Jones are attached as Exhibits 6 and 7, respectively.

results as well as the new results (Exhibit 9). Elutriates of those sediments were evaluated for toxicity (lethality) to shrimp and flat fish, and impact on fertilization and development of sea urchin eggs and embryos. Further, sediment-dwelling organisms (clams, worms, and amphipods) were tested principally for lethal impact of those sediments. In no case did the toxicity tests indicate a test response that was statistically different from that of control systems.

The spring 1991 risk assessment study included toxicity testing on sediments that contained as much as 18,755 mg Cu/kg dry weight with fish larvae and oyster larvae (sensitive life-stages), and amphipods. As shown in Table 3-1 to the Woodward-Clyde Report (Exhibit 8 hereto), **eight of the nine organism types tested (including the Pacific oyster embryos) exhibited <u>no</u> <u>toxicity</u>** response to the copper-contaminated sediments under the standardized laboratory toxicity test conditions.

Oyster embryos tested with sediments containing elevated copper did not show any statistically significant difference in survival or abnormality relative to the control tests. It is likely, therefore, that the copper in the sediments surrounding the terminal is in a form not bioavailable.

The Elutriate Bioassays included tests with Menidia beryllina and bivalve larvae. Neither showed toxicity that was related to the copper in the sediments. Rhepoxynius abronius (one of the two types of amphipods tested), exhibited a toxicity response, but it was independent of the copper concentration in the sediment.[9]

Additional evidence of the non-toxicity of the copper in the sediments of the NCMT is the biological community currently existing at the site. Studies of the numbers and types of organisms present in the sediments in the vicinity of the NCMT have shown that differences and similarities between numbers, types, and diversity or organisms in that area are not related to the amount of copper present in the sediments.

In previous studies it was found that concentrations of copper in the water column above NCMT-area sediments that contained elevated concentrations of copper were higher than the California water quality objective currently applicable to San Diego Bay. However, similar situations were found in other parts of San Diego Bay even prior to the Paco operations at the NCMT. As previously stated, the mussel Mytilus edulis (embryos of which the EPA found the most acutely sensitive to copper of the marine organisms it evaluated)

---

[9]Rhepoxynius is not native to San Diego Bay. Also, that organism is known to exhibit toxicity responses to a variety of ill defined physical and chemical conditions. In this investigation, the toxicity response manifested by that organism in response to laboratory exposure to the "reference" site sediments (low copper concentration) was as great as that manifested in response to laboratory exposure to the sediments containing elevated concentrations of copper. Thus the toxicity response of that organism was likely due to physical factors or to chemical factors other than copper.

In the previous testing conducted by ERCE, grandidierella japonica, an amphipod native to San Diego Bay, showed no significant responses to sediments with increased copper levels, up to 6,067 ppm.

An EPA representative has recently reported to the Port District and Woodward-Clyde that it recognizes that Rhepoxynius is not an appropriate test organism for determining the bio-toxicity of copper for ocean disposal determinations for sediments from this site. However, no final determination on this point has been made.

presently occurs naturally off the NCMT in an area in which the sediments contain some of the highest concentrations of copper. This indicates that the concentrations of copper reported in the water column near the NCMT sediments, if still present, are not available/toxic to those organisms.

The concentrations of copper in mussels planted in the vicinity of the NCMT as part of the State of California Mussel Watch program and in mussels collected from the piers and sediments near the terminal area, while elevated, were not significantly different from the concentrations in tissues of mussels taken from other parts of San Diego Bay. In addition, the copper concentration in body tissues of two species of mussels, one living on the piling and the other in the sediment, at the NCMT are very similar to the concentrations in the same types of mussels from the NPDES control area off Chula Vista.

Bio-accumulation, the accumulation of chemical contaminants within aquatic organism tissue, is of concern because of the potential for the accumulated body burden to adversely affect higher trophic-level organisms, primarily man and fish-eating birds. At this time, the only reliable method for determining whether the accumulation of chemicals in aquatic organism tissue is "excessive" is to compare the body burden in edible flesh with Food and Drug Administration (FDA) Action Levels. Copper is not particularly toxic to man, thus the FDA has not established Action Levels. Finally, based on the current information on the toxicity of copper to humans, the levels of copper in the mussels in the NCMT area would not be expected to represent a threat to public health.

B. The Low Availability of the Copper Ore Concentrate in this Aquatic Environment Also Supports a Much Higher Cleanup Level

The copper ore concentrate transferred at the NCMT was reportedly composed of finely divided cupric ferrous sulfide ($CuFeS_2$). A discussion of the aqueous environmental chemistry of this form of copper and its implications for the availability of copper from that source is presented in the risk assessment portion (Section 3) of the Woodward-Clyde (1991) Report.

As discussed by Lee and Jones (1991), while copper used in anti-foulant paints and from some other sources would be expected to be highly toxic to aquatic life, the copper ore concentrate-derived copper in the sediments would be expected to be non-toxic. It is well known that independent of the source of copper, detoxification reactions that occur in marine sediments cause toxic forms of copper to become non-toxic.

The copper ore concentrate consists of a form of copper (cupric ferrous sulfide) that is highly insoluble in anoxic (oxygen-free) sediments such as those beneath the thin oxidized layer at the sediment surface at NCMT. That form of copper, as it would exist in the sediments, is one of the most stable, insoluble, and thus unavailable forms of copper.

Based on the aquatic chemistry of copper, the copper ore concentrate derived copper in the NCMT area sediments would be expected to be unavailable to aquatic organisms. As previously shown, this expectation is borne out by the toxicity test data.

C. <u>The 1,000 ppm Remediation Objective Was not Based on Complete Scientific Evaluation</u>

The remediation objective of 1,000 mg Cu/kg dry weight was not developed on the basis of complete technical information about the impact of sediment-associated copper on water quality. Upon review of the information upon which that value was derived, Lee and Jones (1991) found that the analytical procedure used did not distinguish between soluble and particulate forms of copper. That resulted in an incorrect assessment of the amount of soluble, potentially toxic copper in the interstitial water of the sediment. Further, even if that measurement had been correct, there are significant questions about the appropriateness of using interstitial water concentrations of heavy metals, including copper, in anoxic sediments as a basis for judging the availability of copper to oxygen dependent benthic organisms. There is a variety of chemical reactions that occur in sediments that tend to make the copper and other heavy metals in interstitial waters non-toxic to aquatic life upon exposure to dissolved oxygen.

The Regional Board records concerning the development of the cleanup level, and the insurance litigation deposition testimony of Regional Board Staff involved in the development of the cleanup level, show that the 1,000 ppm cleanup standard was developed in part by balancing other considerations with cost-effectiveness.[10]

---

[10] The Regional Board records include a June 30, 1987 memo from Greg Peters to the Paco Terminals file, LM, DB regarding data review for cleanup (Exhibit 10 hereto). Also reviewed for this analysis were portions of the deposition testimony of Regional Board Staff noticed by insurance company attorneys in <u>Paco Terminals, Inc. v. American Home Assurance Co.</u>, consolidated civil action No. 602586-602587, San Diego Superior Court. The portions of the deposition testimony include the testimony of Greg Peters, pp. 36-51; 55-57 (footnote continued)

For example, those records indicate a Staff concern that the copper concentrations <u>might</u> add an additional insult on a biological community already impacted by man-based intrusions. (Peters memo, (Exhibit 12); Peters TR pp. 36-24 (Exhibit 13)). The toxicity results of the Report do not support the supposition that the copper is an additional insult. Moreover, the current biological community, while arguably less diverse than it would be if the City of San Diego did not exist at all, is far from a biological desert. For example, the Mytilus edulis (the embryos of which were found by the EPA to be the most acutely sensitive to copper of the marine organisms it evaluated) is found to occur naturally in the sediments having some of the highest copper concentrations found off the NCMT.

Another concern in setting the original level was that the copper in the sediments might move laterally, making remediation more difficult if the copper were found to be toxic in the future. (Peters memo, (Exhibit 12); Peters TR p. 34, lines 5-22 (Exhibit 13)). Again, lab testing supports that the material is not toxic, at least up to 18,755 ppm. Also, as previously stated, other aspects of the Woodward-Clyde study showed no evidence that the

---

(footnote continued from previous page)
(Exhibit 11 hereto); testimony of David Barker, pp. 169, 225-26 (Exhibit 12); and testimony of Lance McMahan, pp. 179-80 (Exhibit 13). Based on the depositions taken in the Paco insurance litigation, Greg Peters' June 1987 memo constitutes the Regional Board Staff's biological analysis supporting the 1,000 ppm cleanup level. David Barker was unable to identify any other biological information supporting the cleanup level. Barker TR p. 225, l. 14 through p. 226, l. 16 (Exhibit 12). Moreover, as of the date of his deposition, Mr. Peters was unaware of any better information on the biological effects of copper concentrate on marine organisms of the types that might be found in a more diverse biological community in San Diego Bay than he had at the time he wrote the memo. Peters TR p. 57, lines 10-14 (Exhibit 11). Because exhibit 37 to the transcript is handwritten and partially illegible, Exhibit 11 hereto includes Greg Peters' testimony deciphering the memo.

sediment is not moving laterally, but only appeared to be deeper into the sediment (because it is more dense that the rest of the sediment). As a result, migration is only making the high copper concentration less bioavailable, not more.

Finally, those records indicate that cost considerations were properly considered in setting the 1,000 ppm cleanup level. The amount of public and private funds needed for remediation depends in large part on the cleanup level selected. It may be concluded from the risk assessment that a remediation objective considerably above the 1,000 mg Cu/kg concentration could be established for NCMT area sediments and still protect the designated beneficial uses of San Diego Bay. The issue is what the cleanup level should be in light of the lack of toxicity demonstrated with sediments containing as much as about 18,000 mg Cu/kg dry weight (which is near the highest concentration found in the surface sediments in the 1991 study).

D. A 4,000 ppm (dry weight) Cleanup Level Would Protect the Bay and Also Avoid DHS Title 22 Considerations

The Regional Board record in setting the 1,000 ppm cleanup level shows a concern with allowing sediments to remain in the bay in excess of the Title 22 TTLC limit of 2,500 ppm (wet weight). Peters memo, p. 3 (Exhibit 10); Peters TR, p. 56, lines 8-16 (Exhibit 11); McMahan TR, p. 178, l. 19, through p. 179, l. 11 (Exhibit 13). That level approximately equals 4,000 ppm dry weight. McMahan TR, p. 179, l. 24, through p. 180, l. 12 (Exhibit 13). The TTLC standard was not set with reference to any marine system or marine environment or designed to determine whether copper ore is injurious to a marine system or environment. Peters TR, p. 56, lines 14-23 (Exhibit 12); McMahan TR, p. 179, lines 20-23 (Exhibit

13). Rather the TTLC standard was set with respect to land disposal of materials, in order to protect groundwater. Id. Thus, it could be strongly argued that the TTLC Title 22 standard is entirely irrelevant to the copper concentrations in this marine environment.[11] Nevertheless, setting the cleanup standard at 4,000 ppm (dry weight) would avoid those considerations and be consistent with the Regional Board Staff's concerns with allowing concentrations in excess of the TTLC level.

IV. INTERIM ADDENDUM NO. 6 DEADLINES MAY BE SAFELY VACATED

The Port District requests that all interim dates in Addendum No. 6 prior to the April, 1993 completion date be vacated and that no new interim deadlines be set. The settlement conferences before Magistrate McCue (currently taking place approximately monthly) and the parties' quarterly progress reports to the Regional Board provide ample opportunity for the Regional Board Staff to be certain that the parties are actively pursuing the remediation objective.

[11]Title 22 Chapter 30 regulations, developed for governing the classification of wastes for disposal, established a Total Threshold Limiting Concentration (TTLC) for copper in materials to be disposed without being classified as a "hazardous waste" at 2,500 mg Cu/kg wet weight (the equivalent of about 4,000 mg Cu/kg dry weight for the NCMT area sediments). Title 22 Chapter 30 also established procedures by which a variance from that classification can be obtained for materials that present an insignificant hazard to human health and safety, livestock and wildlife. In light of the review of the Statement of Reasons for those sections of Title 22 regarding the technical foundation of the TTLC for copper, and in light of the technical inappropriateness of applying even an appropriate TTLC value to sediments of the type being considered, it is concluded that it would be technically justified to seek a variance from the DHS Title 22 regulation that would classify NCMT area sediments containing greater than 2,500 mg Cu/kg wet weight as a hazardous waste. Nevertheless, the outcome of such a request cannot be guaranteed.

The Port District is not presently requesting that the final cleanup deadline of April, 1993 be moved. The Port District remains optimistic that the parties can meet that deadline.[12]

V. THE PARTIES HAVE MADE SUBSTANTIAL PROGRESS SINCE SUBMITTING THE REPORT

Since submitting the Report on August 1, the Port District has worked diligently toward accomplishing the recommended remediation. Those efforts have focused on securing permits and resolving the remaining technical and financing issues for implementing the Project and, in particular, the mining company option. These latter efforts have taken place in the conferences held under the auspices of Magistrate McCue.

A. Permitting

The Port District has made substantial progress toward securing permits necessary for the Project. Arguably, the most important permit is the federal consolidated dredge and fill permit requiring the approval of the Army Corps of Engineers and EPA. On September 18, 1991 a meeting was held among several agencies including the U.S. Army Corps of Engineers, California Fish and Game Department,

---

[12] However, even if the vacating of those dates were to result in some delay of the ultimate cleanup, there is no indication that delay would adversely affect water quality. The Report supports that the copper in the NCMT area sediments that was derived from copper ore concentrate is in forms largely unavailable to adversely affect water quality. This assessment has been substantiated through toxicity testing, and through the presence at the site of copper sensitive mussels. The chemical processes that occur in the sediment/water environment over time would be expected to maintain the copper in unavailable forms and to reduce the availability of more available forms. Extensive review and testing has led to the conclusion that at present the copper in the NCMT area sediments is not having an adverse impact on water quality; this would not be expected to change to a situation in which it would become adverse. Therefore, delay of whatever remediation may be decided upon would not be expected to adversely affect water quality.

and other regulators. There, the Port District and Woodward-Clyde presented a summary of the Woodward-Clyde Report and addressed questions and comments. Since that time, the Port District and Woodward-Clyde have met separately with other responsible agencies including the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

As a part of the process, the EPA unexpectedly requested updated bathymetry of all areas to be dredged, including overdredged areas. Bathymetry includes charting and mapping of the bay bottom over the entire area. The Port District had anticipated that 1988 bathymetry data would satisfy the agencies. Nevertheless, the agency requires more recent bathymetry. At the time of writing this testimony it is anticipated that the Port District will complete the new bathymetry by December 1, 1991.

If ocean disposal remains part of the Remediation Plan, the EPA will also require that the consolidated permit application contain sampling and bioassay testing data to support the ocean disposal. The EPA has already provided significant meaningful input to the Port District regarding the sampling program. The EPA has notified the Port District that the sampling to meet its requirements will be different than the sampling plan required by this board and which have already conducted as part of the Woodward-Clyde Report. The Port District and Woodward-Clyde have already begun designing the program to meet EPA's needs. At the conclusion of that process, the EPA can make a permit determination which will allow the California Coastal Commission to make a federal consistency determination.

The Regional Board's review and approval of the remedial action plan will allow the Port District to continue planning and to secure the final permits as necessary. Critical to that determination, is the determination of the cleanup level. The recommended remedial actions include ocean disposal for the sediments with the lowest copper concentrations currently subject to the order. If the cleanup level is raised as requested herein, ocean disposal will not be necessary. If ocean disposal is not necessary, it will not be necessary to complete the additional sampling program to be recommended by the EPA which, if received, is to be part of the consolidated permit application. The cost of that sampling program and testing for ocean disposal is estimated at approximately $80,000. Obviously, the parties would prefer to have a determination from this Board on the cleanup level (and, therefore, the need to address ocean disposal issues) before incurring those costs. For these reasons, and others, the Port District has requested the Regional Board to analyze and comment on the Report.

In addition to those questions regarding the federal dredge and fill permits, other permitting considerations depend upon technical issues yet to be resolved concerning the mining company option. Specifically, the size and water content of the materials acceptable to the mine are not yet known. The Report recommends conducting a pilot project involving dredging materials from the bay and shipping them to the mine for copper reclamation to help resolve these issues. Depending upon the progress made before Magistrate McCue, the parties hope that the pilot project may be run during the current dredge season. Only after that project will the parties be able to identify the specific types of permits that may be necessary to complete the mining company option.

B. Settlement Conferences Before Magistrate McCue

Significant progress is being made in a series of settlement conferences being held before Magistrate McCue. The Port District's efforts directly caused these settlement conferences to take place. On July 26, 1991 the Port District moved for a stay of litigation filed by Paco Terminals, Inc. against its insurers in which the Port District had intervened approximately six months earlier. In its motion for stay, the Port District successfully argued that the parties would all be better served by negotiating the manner in which the preferred remedial action plan would be implemented than by litigation over insurance coverage and cost responsibility issues. Superior Court Judge Meloche agreed and followed the Port District's suggestion that the parties to the insurance coverage litigation should be referred to Magistrate McCue. In addition, the Port District successfully argued that holding the conferences under Magistrate McCue's auspices could result in the participation of other interested parties who were under Magistrate McCue's jurisdiction; i.e., the mining companies, Paco's shareholders and the clamshell bucket manufacturer. In addition, the Port District pointed out that Magistrate McCue's working group conferences had resulted in the development of the mining company option in the first place.

Magistrate McCue has held settlement conferences on August 23, October 7 and October 28. The conferences have involved not only Paco, the Port District and Paco insurers, but also the Port

District's insurers, the mining companies and the manufacturer of the clamshell bucket used for a substantial portion of Paco's operations. Magistrate McCue has written to the members of this Board describing the progress made in those meetings toward building a consensus of all parties regarding the technical details of implementing and funding the plan. (See Exhibit 4).

> I am impressed by the substantial progress that has been made during these conferences and believe that the parties will agree to an ultimate resolution for an approved cleanup alternative and the funding of it. Over the months, I believe that the parties have worked very hard to fashion a final resolution of the problem. They have become less adversarial and more cohesive in working toward this common goal.

Those conferences will be facilitated by the Regional Board's approval of the recommended remedial action plan. There has been some concern among the parties that the Report, which is the foundation for the discussions may not be approved by the Regional Board.

Even more helpful to the conferences would be an adjustment of the cleanup level. It has been difficult to reach a consensus for funding all costs to reach the current cleanup level, especially given the serious permitting uncertainties regarding ocean disposal. Granting the request made here of raising the cleanup level to 4,000 ppm (dry weight) would make the funding goal much more achievable. As previously stated, even if the cleanup level is raised to 4,000 ppm, the total remediation cost would be approximately $5.5 million, including land side remediation.

November 22, 1991

Respectfully Submitted,

David B. Hopkins
HILLYER & IRWIN
Counsel to San Diego Unified
Port District

PACO TERMINALS, INCORPORATED
SAN DIEGO UNIFIED PORT DISTRICT
COPPER ORE BAY SEDIMENT CLEANUP
NPDES ORDER: 85-91
ENF. REPORT **FILE: 8** 06/92-06/93
02-0045.06 STATUS: C

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego Unified Port District**

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

SAN DIEGO UNIFIED PORT DISTRICT'S

WRITTEN RESPONSE SUPPORTING THE REGIONAL BOARD'S

ADDENDUM NO. 7 AND IMPOSITION OF 4,000 mg Cu/kg CLEANUP LEVEL

Submission Date:	June 3, 1992
Workshop Date:	[Not set]
Hearing Date:	[Not set]

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego Unified Port District**

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

SAN DIEGO UNIFIED PORT DISTRICT'S WRITTEN RESPONSE SUPPORTING THE REGIONAL BOARD'S ADDENDUM NO. 7 AND IMPOSITION OF 4,000 mg Cu/kg CLEANUP LEVEL

Submission Date: June 3, 1992

Workshop Date: [Not set]

Hearing Date: [Not set]

EXHIBIT LIST

EXHIBIT NUMBER	DATE	DOCUMENT
1.	05/28/92	Comments of G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D. on Environmental Health Coalition Petition for Review by State Water Resources Control Board of Regional Water Quality Control Board, San Diego Region, adoption of CAO 85-91, Addendum No. 7 on December 9, 1991
	11/22/91	Appendix A -- Transparencies (Selected) Used or Provided to Regional Board at December 9, 1991 Proceedings on CAO 85-91, Addendum No. 7
	12/06/91	Appendix B -- Supplemental Testimony of G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D. for the December 9, 1991 Hearing of California Regional Water Quality Control Board, San Diego Region, Regarding CAO 85-91, Tentative Addendum No. 7
	11/22/91	Appendix C -- G. Fred Lee, Ph.D. Summary Resume
	11/22/91	Appendix D -- Anne Jones-Lee, Ph.D. Summary Resume
2.	11/22/91	Jean A. Nichols, Ph.D. Summary Resume
3.	06/30/87	Memorandum of Greg Peters (Regional Board Staff) Regarding Data Review for Cleanup Level (Former 1,000 mg Cu/kg Cleanup Level)
4.	07/24/91	Portions of Deposition Transcript of Greg Peters Regarding Memorandum (Exhibit 3)
5.	04/05/91	Portions of Deposition Transcript of David Barker (Regional Board Staff) Regarding Biological Support for Former 1,000 mg Cu/kg Cleanup Level)
6.	07/25/91	Portions of Deposition Transcript of Lance McMahan (Regional Board Staff) Regarding Setting of Former 1,000 mg Cu/kg Cleanup Level)
7.	06/03/92	Declaration of David B. Hopkins Regarding Implementation of the Mining Company Option

TABLE OF CONTENTS

I. SUMMARY OF ARGUMENT

The San Diego Unified Port District (the "Port District") files this Response to the Petitions of the Environmental Health Coalition ("EHC") and Eugene Sprofera ("Sprofera") (collectively the "Petitions"). The Petitions challenge the San Diego Regional Board's adoption of Addendum No. 7 to Cleanup and Abatement Order 85-91 ("CAO") on December 9, 1991 to change the cleanup level under the CAO from 1,000 ppm copper (dry weight) to 4,000 ppm copper (dry weight). The Petitions request that this Board reverse the Regional Board and return the cleanup level to the former level of 1,000 ppm, set in 1987.

The Port District requests that the Regional Board's determination of a 4,000 ppm level be upheld. In the alternative, if the cleanup level is to be changed at all, it should be made less restrictive, consistent with the technical evidence that much higher concentrations of copper have no adverse impact to any beneficial uses of San Diego Bay.

All of the aquatic chemistry, toxicity, bioassay and risk assessment test results that have been submitted to the Regional Board conclusively establish that the 4,000 ppm cleanup level would cause no adverse impact on the beneficial uses of San Diego Bay. In fact, the Regional Board Staff at the December 9 hearing stipulated that there would be no adverse biological impact to San Diego Bay at a 4,000 ppm cleanup level -- or higher. (Hearing Tr. at 57.)

The technical information provided to the Regional Board concludes that there is no showing of any increased toxicity or biological risk at copper concentrations at this site exceeding 18,000 ppm, the highest level tested. Conversely, there is no evidence that there is any biological or beneficial use enhancement to be gained by reducing the current 4,000 ppm cleanup level back down to 1,000 ppm.

In addition, there are sound practical and economic reasons supporting the 4,000 ppm cleanup level. The Regional Board's decision to raise the cleanup standard from 1,000 ppm to 4,000 ppm will result in the savings of millions of dollars in cleanup costs and will greatly increase the likelihood that the cleanup project will be completed by the CAO's current deadline of April 1, 1993. Conversely, returning to the former 1,000 ppm cleanup level would be fatal to the current cleanup plan and would render compliance with the CAO's current deadline impossible.

The current cleanup plan -- known as the "mining company option" -- was developed in a long series of negotiations during the past several years involving the parties to various state and federal court lawsuits concerning the cleanup. These discussions have taken place under the auspices of Hon. Harry R. McCue, Magistrate for the United States District Court for the Southern District of California. Parties to the discussions have included Paco Terminals, the Port District, the various mining companies who shipped the copper concentrate to Paco, the manufacturer of the clamshell bucket that malfunctioned during the copper loading operation, several insurance companies and, on occasion, the Regional Board Staff and staff from other environmental agencies such as the Environmental Protection Agency (EPA) and the

Department of Health Services (DHS). These settlement conferences have resulted in a multi-party settlement agreement, now circulating in draft form, to reach a technically and financially feasible approach to accomplish the cleanup. However, all recent drafts of that agreement (now almost in final form) have specified that the agreement is contingent upon maintaining the current 4,000 ppm cleanup level. As will be explained, that contingency is critical for both financial and technical reasons.

Nevertheless, the Petitions raise several arguments against the current cleanup level. All rely on a combination of bad scientific, legal and public policy analyses that would result in the needless expenditure of millions of dollars of public and private funds -- and possibly jeopardize the entire cleanup project -- without achieving any additional environmental benefit.

All of the technical contentions raised by the EHC Petition are addressed and refuted, in order, in Exhibit 1 hereto. Exhibit 1 consists of the comments on the EHC Petition of Dr. G. Fred Lee and Dr. Anne Jones-Lee, who conducted the scientific and risk assessment analyses supporting the Port District's request to raise the cleanup level. All of Exhibit 1 and its appendices are incorporated herein by reference.[1]

---

[1]Appendix A to Exhibit 1 consists of selected overheads prepared for use at the Regional Board December 9, 1991 hearing summarizing the technical studies and information. Appendix B consists of Supplemental Written Testimony prepared by Drs. Lee and Jones-Lee for that hearing, addressing issues raised in written submissions following the filing of the Port District's written testimony for that hearing. Appendices C and D include summary curriculum vitae of Drs. Lee and Jones-Lee.

Drs. Lee and Jones-Lee have extensive experience in evaluating the water quality significance of chemical contaminants (footnote continued)

The primary technical argument Petitioners raise against the 4,000 ppm cleanup level is that it purportedly contributes to San Diego Bay's exceeding the maximum water column limit for copper of 2.9 ug Cu/L contained in this Board's Enclosed Bays and

---

(footnote continued from previous page)
in aquatic sediments and in advising both industry and government groups on water quality and sediment quality issues. Dr. Lee's experience spans a 30-year period. His academic background and professional expertise are largely in aquatic chemistry (fresh water and marine), public health, and environmental engineering. He has considerable experience in evaluating the water quality significance of heavy metals, and copper in particular, in several types of aquatic systems, including aquatic sediments. He has conducted more than $5 million in research on the sources, water quality significance, fate, and control of chemical contaminants in fresh water and marine systems and has published more than 500 professional papers and reports on the subject. He also taught graduate-level, introductory and advanced courses in aquatic chemistry for a period of 30 years. Dr. Lee has been active in developing water quality criteria and standards objectives for more than 20 years. He and Dr. Jones-Lee were highly active in review of the proposed water quality objectives for enclosed bays and estuaries adopted by the State Board in April, 1991.

Dr. Lee conducted more than a million dollars of contract research in the 1970s for the U.S. Army Corps of Engineers for the purpose of developing and evaluating the elutriate test. He and his graduate students developed the elutriate test bioassays that were subsequently adopted by the U.S. EPA and the Corps of Engineers as the standard test protocol for evaluating the potential toxicity of dredged sediment associated contaminants. (This particular expertise is significant because a major portion of EHC's analysis is based on faulty application of elutriate test data and an unsupportable attempt to extrapolate water column concentrations from elutriate concentrations.)

Dr. Jones-Lee has 18 years of experience in aquatic biology and aquatic toxicology pertinent to evaluating the water quality significance of chemical contaminants in sediments. Her Ph.D. dissertation was specifically devoted to developing guidance on the evaluation of the impacts of sediment associated contaminants on water quality.

All of the Exhibits attached hereto were submitted to the Regional Board, and are part of the Regional Board record, with two exceptions, which are submitted to the State Board pursuant to 23 C.C.R. §2050(b). One exception is Exhibit 1 (and Appendix B thereto), which are explained above. The other is the Declaration of David B. Hopkins (Ex. 7, Hopkins Decl.), which concerns events
(footnote continued)

Estuaries Plan. (California Enclosed Bays and Estuaries Plan; Water Quality Control Plan for Enclosed Bays and Estuaries of California, SWRCB WQ 91-13 (April 1991) (the "EBE Plan")). This conclusion is entirely unfounded. There is no evidence that the 4,000 ppm cleanup level (or the difference between a 1,000 ppm level and 4,000 ppm level) is contributing to any violation that may exist of the EBE Plan water column limitation for copper. The EHC's conclusions to the contrary are based upon scientifically unsupportable attempts to derive water column concentrations from interstitial water concentrations and/or from elutriate concentrations.

In addition, the numerical objectives of the EBE Plan should not be applied to this CAO, involving sediment cleanup, in any event. The numerical objectives contained in the EBE Plan are designed to set effluent limitations for permitted waste discharges into enclosed bays and estuaries. Sediment quality is addressed only in the narrative objective (not the numerical objectives) for the EBE Plan. The 4,000 ppm cleanup level is in full compliance with those narrative objectives, which provide that sediment concentrations shall not adversely affect beneficial uses. Substantially higher levels would also be in full compliance.

Another cornerstone of Petitioners' arguments is that the former 1,000 ppm cleanup level establishes the maximum level that

---

(footnote continued from previous page)
that took place subsequent to the December 9, 1991 Regional Board hearing, primarily involving implementation of the mining company option and new events concerning Magistrate McCue's settlement conferences.

will protect the beneficial uses of the Bay. As will be shown, the decision to adopt the previous 1,000 ppm level was based on incomplete and inadequate scientific evaluation in 1987. Current scientific analysis establishes that a much higher cleanup level would protect the beneficial uses of the Bay just as adequately. Site-specific bioassay and toxicity testing establishes that there are no adverse biological effects at copper concentrations up to 18,755 ppm. Also, the biological community at the site includes the mussel Mytilus edulis, which is reported by the U.S. EPA to be, in its embryo stage, most acutely sensitive to copper. The natural occurrence of Mytilus edulis at the site strongly supports the Regional Board's decision to raise the cleanup level.[2]

The EHC also contends that it was improper for the Regional Board to take economic factors into account in changing the former cleanup level. The Water Code authorizes the Regional Board and State Board to take cost feasibility into consideration in making cleanup determinations. See Water Code §13000; §13241(d). See also Environmental Health Coalition, SWRCB Order No. WQ 91-10. Economic factors were properly included in setting the original 1,000 ppm cleanup level in 1987. Similarly, the Regional Board acted properly in considering economic factors in resetting the cleanup level to 4,000 ppm.

Finally, the EHC's request for continued biological monitoring and mitigation should be denied. The CAO already requires post-cleanup monitoring to verify that the cleanup level

---

[2] The natural occurrence of Mytilus edulis at the site would also support a much higher cleanup level, and even that no remedial action be required.