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WESTERN DISTRICT OF WASHINGTON
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IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON
SEATTLE DIVISION

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AT SEATTLE
CLERK U.S. DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
BY DEPUTY

UNITED STATES OF AMERICA Plaintiff, v. LOCKHEED MARTIN CORPORATION Defendant.	CIVIL ACTION NO. CV03 1180C LSSOU RA CONSENT DECREE

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TABLE OF CONTENTS

I. BACKGROUND 3
II. JURISDICTION 5
III. PARTIES BOUND 6
IV. DEFINITIONS 6
V. GENERAL PROVISIONS 10
VI. PERFORMANCE OF THE WORK BY SETTLING DEFENDANTS 11
VII. REMEDY REVIEW 15
VIII. QUALITY ASSURANCE, SAMPLING, AND DATA ANALYSIS 16
IX. ACCESS AND INSTITUTIONAL CONTROLS 18
X. REPORTING REQUIREMENTS 22
XI. EPA APPROVAL OF PLANS AND OTHER SUBMISSIONS 24
XII. PROJECT COORDINATORS 26
XIII. ASSURANCE OF ABILITY TO COMPLETE WORK 27
XIV. CERTIFICATION OF COMPLETION 29
XV. EMERGENCY RESPONSE 30
XVI. PAYMENTS FOR RESPONSE COSTS 31
XVII. INDEMNIFICATION AND INSURANCE 34
XVIII. FORCE MAJEURE 36
XIX. DISPUTE RESOLUTION 38
XX. STIPULATED PENALTIES 41
XXI. COVENANTS NOT TO SUE BY PLAINTIFF[S] 45
XXII. COVENANTS BY SETTLING DEFENDANTS 48
XXIII. EFFECT OF SETTLEMENT; CONTRIBUTION PROTECTION 50
XXIV. ACCESS TO INFORMATION 51
XXV. RETENTION OF RECORDS 53
XXVI. NOTICES AND SUBMISSIONS 54
XXVII. EFFECTIVE DATE 55
XXVIII. RETENTION OF JURISDICTION 55
XXIX. APPENDICES 56
XXX. COMMUNITY RELATIONS 56
XXXI. MODIFICATION 56
XXXII. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT 57
XXXIII. SIGNATORIES/SERVICE 57
XXXIV. FINAL JUDGMENT 58

I. BACKGROUND

A. The United States of America ("United States"), on behalf of the Administrator of the United States Environmental Protection Agency ("EPA"), filed a complaint in this matter pursuant to Sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. §§ 9606, 9607.

B. The United States in its complaint seeks, inter alia: (1) reimbursement of costs incurred by EPA and the Department of Justice for response actions at the Lockheed Shipyard Sediment Operable Unit ("LSSOU") of the Harbor Island Superfund Site ("Site") in Seattle, Washington, together with accrued interest; and (2) performance of studies and response work by the defendants at the Site consistent with the National Contingency Plan, 40 C.F.R. Part 300 (as amended) ("NCP").

C. In accordance with the NCP and Section 121(f)(1)(F) of CERCLA, 42 U.S.C. § 9621(f)(1)(F), EPA notified the State of Washington (the "State") on May 1, 2002, of negotiations with potentially responsible parties regarding the implementation of the remedial action for the LSSOU, and EPA has provided the State with an opportunity to participate in such negotiations and be a party to this Consent Decree. The State has concurred with EPA with regard to the selection of the remedial action for the LSSOU.

D. In accordance with Section 122(j)(1) of CERCLA, 42 U.S.C. § 9622(j)(1), EPA notified the Washington State Department of Ecology, Washington State Department of Natural Resources, U.S. National Oceanographic and Atmospheric Administration, the U.S. Department of Fish and Wildlife, the Muckleshoot Indian Tribe and the Suquamish Indian Tribe, May 1, 2002, of negotiations with potentially responsible parties regarding the release of hazardous substances that may have resulted in injury to the natural resources under Federal trusteeship and encouraged the trustees to participate in the negotiation of this Consent Decree.

E. The defendant that has entered into this Consent Decree ("Settling Defendant") does not admit any liability to the Plaintiff arising out of the transactions or occurrences alleged in the complaint, nor does it acknowledge that the release or threatened release of hazardous substances at or from the LSSOU constitutes an imminent or substantial endangerment to the public health or welfare or the environment.

F. Pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, EPA placed the Site on the National Priorities List, set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on September 8, 1983, 48 Fed. Reg. 40658.

G. In response to a release or a substantial threat of a release of hazardous substances at or from the Site, EPA commenced a Remedial Investigation and Feasibility Study ("RI/FS") for the Site pursuant to 40 C.F.R. § 300.430, which was completed in 1996.

H. Settling Defendant and other PRPs at the Site completed a Supplementary Remedial Investigation ("SRI") Report on August 29, 1996, related to sediment portions of the Site.

I. Pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, EPA published notice of the completion of the FS and of the proposed plan for remedial action in a major local newspaper of general circulation. EPA provided an opportunity for written and oral comments from the public on the proposed plan for remedial action for the former Shipyard Sediment Operable Unit ("SSOU") of the Site. A copy of the transcript of the public meeting is available to the public as part of the administrative record upon which the Regional Administrator based the selection of the response action.

J. The decision by EPA on the remedial action to be implemented at the former SSOU is embodied in a final Record of Decision ("ROD"), issued on November 27, 1996, on which the State concurred. The ROD includes a responsiveness summary to the public comments. Notice of the final plan was published in accordance with Section 117(b) of CERCLA.

K. EPA issued an Explanation of Significant Differences ("ESD") for the LSSOU on February 22, 2002, after the SSOU was divided into two operable units including the LSSOU. EPA issued a second ESD on March 31, 2003 further refining the remedy. All references to the ROD in this Consent Decree include both ESDs.

L. Pursuant to an Administrative Order on Consent ("AOC") for Remedial Design issued on July 16, 1997, the Settling Defendant completed a Remedial Design Investigation Report and a Basis of Design Report on April 2, 1999 and January 15, 2002, respectively.

M. Based on the information presently available to EPA, EPA believes that the Work will be properly and promptly conducted by the Settling Defendant if conducted in accordance with the requirements of this Consent Decree and its appendices.

N. Solely for the purposes of Section 113(j) of CERCLA, the Remedial Action selected by the ROD and the Work to be performed by the Settling Defendant shall constitute a response action taken or ordered by the President.

O. The Parties recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and implementation of this Consent Decree will expedite the cleanup of the LSSOU and will avoid prolonged and complicated litigation between the Parties, and that this Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, it is hereby Ordered, Adjudged, and Decreed:

II. JURISDICTION

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331 and 1345, and 42 U.S.C. §§ 9606, 9607, and 9613(b). This Court also has personal jurisdiction over the Settling Defendant. Solely for the purposes of this Consent Decree and the underlying complaint, Settling Defendant waives all objections and defenses it may have to jurisdiction of the Court or to venue in this District. Settling Defendant shall not challenge the

terms of this Consent Decree or this Court's jurisdiction to enter and enforce this Consent Decree.

III. PARTIES BOUND

2. This Consent Decree applies to and is binding upon the United States and upon Settling Defendant and its successors and assigns. Any change in ownership or corporate status of Settling Defendant including, but not limited to, any transfer of assets or real or personal property, shall in no way alter Settling Defendant's responsibilities under this Consent Decree. Settling Defendant shall provide a copy of this Consent Decree to each contractor hired to perform the Work (as defined below) required by this Consent Decree and to each person representing Settling Defendant with respect to the LSSOU or the Work and shall condition all contracts entered into hereunder upon performance of the Work in conformity with the terms of this Consent Decree. Settling Defendant or its contractors shall provide written notice of the Consent Decree to all subcontractors hired to perform any portion of the Work required by this Consent Decree. Settling Defendant shall nonetheless be responsible for ensuring that its contractors and subcontractors perform the Work contemplated herein in accordance with this Consent Decree. With regard to the activities undertaken pursuant to this Consent Decree, each contractor and subcontractor shall be deemed to be in a contractual relationship with Settling Defendant within the meaning of Section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3).

IV. DEFINITIONS

3. Unless otherwise expressly provided herein, terms used in this Consent Decree which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Consent Decree or in the appendices attached hereto and incorporated hereunder, the following definitions shall apply:

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601, *et seq.*

"Consent Decree" shall mean this Decree and all appendices attached hereto (listed in Section XXIX). In the event of conflict between this Decree and any appendix, this Decree shall control.

"Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than a Saturday, Sunday, or Federal holiday. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business of the next working day.

"Effective Date" shall be the effective date of this Consent Decree as provided in Paragraph 103.

"EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

"Future Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States incurs in reviewing or developing plans, reports and other items pursuant to this Consent Decree, verifying the Work, or otherwise implementing, overseeing, or enforcing this Consent Decree, including, but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Sections VII, IX (including, but not limited to, the cost of attorney time and any monies paid to secure access and/or to secure or implement institutional controls including, but not limited to, the amount of just compensation), XV, and Section XXI. Future Response Costs shall also include all Interim Response Costs, and all Interest on those Past Response Costs Settling Defendant has agreed to reimburse under this Consent Decree that has accrued pursuant to 42 U.S.C. § 9607(a) during the period from January 1, 2002 to the date of entry of this Consent Decree.

"Interim Response Costs" shall mean all costs, including direct and indirect costs, (a) paid by the United States in connection with the LSSOU between January 1, 2002 and the Effective Date, or (b) incurred prior to the Effective Date but paid after that date.

"Interest," shall mean interest at the rate specified for interest on investments of the EPA

Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

"National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

"Operation and Maintenance" or "O & M" shall mean all activities required to maintain the effectiveness of the Remedial Action as required under the Operation and Maintenance Plan approved or developed by EPA pursuant to this Consent Decree and the Statement of Work ("SOW").

"Paragraph" shall mean a portion of this Consent Decree identified by an arabic numeral or an upper case letter.

"Parties" shall mean the United States and the Settling Defendant.

"Past Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States paid at or in connection with the LSSOU through December 31, 2001, on all such costs which has accrued pursuant to 42 U.S.C. § 9607(a) through such date.

"Performance Standards" shall mean the cleanup standards and other measures of achievement of the goals of the Remedial Action, set forth in Sections H and K of the ROD and Sections II and III of the SOW and any modified standards established by EPA pursuant to the "technical impracticability" provision of Paragraph 11.

"Plaintiff" shall mean the United States.

"RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901 *et seq.* (also known as the Resource Conservation and Recovery Act).

"Record of Decision" or "ROD" shall mean the EPA Record of Decision relating to the Shipyard Sediment Operable Unit, Harbor Island Superfund Site issued on November 27, 1996,

by the Regional Administrator, EPA Region 10, and all attachments thereto, including both ESDs. The ROD is attached as Appendix A.

"Remedial Action" shall mean those activities, except for Operation and Maintenance, to be undertaken by the Settling Defendant to implement the ROD, in accordance with the SOW and the final Remedial Design and Remedial Action Work Plans and other plans approved by EPA.

"Remedial Action Work Plan" shall mean the document developed pursuant to Paragraph 9 of this Consent Decree and approved by EPA, and any amendments thereto.

"Remedial Design" shall mean those activities undertaken by the Settling Defendant to develop the final plans and specifications for the Remedial Action pursuant to the Remedial Design Work Plan.

"Section" shall mean a portion of this Consent Decree identified by a Roman numeral.

"Settling Defendant" shall mean Lockheed Martin Corporation.

"Site" shall mean the Harbor Island Superfund Site. The Lockheed Shipyard Sediment Operable Unit ("LSSOU") of the Harbor Island Superfund Site encompasses approximately 4 acres, is located adjacent to the former Lockheed Shipyard at 2929 16th Avenue S.W. in Seattle, King County, Washington, and is depicted generally on the map attached as Appendix C.

"Statement of Work" or "SOW" shall mean the statement of work for implementation of the Remedial Action, and Operation and Maintenance at the LSSOU, as set forth in Appendix B to this Consent Decree and any modifications made in accordance with this Consent Decree.

"Supervising Contractor" shall mean the principal contractor retained by the Settling Defendant to supervise and direct the implementation of the Work under this Consent Decree.

"Waste Material" shall mean (1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); (2) any pollutant or contaminant under Section 101(33), 42 U.S.C. § 9601(33); and (3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27).

"Work" shall mean all activities Settling Defendant is required to perform under this Consent Decree, except those required by Section XXV (Retention of Records).

V. GENERAL PROVISIONS

4. Objectives of the Parties. The objectives of the Parties in entering into this Consent Decree are to protect public health or welfare or the environment at the LSSOU by the implementation of response actions at the LSSOU by the Settling Defendant, to reimburse response costs of the Plaintiff, and to resolve the claims of Plaintiff against Settling Defendant as provided in this Consent Decree.

5. Commitments by Settling Defendant. Settling Defendant shall finance and perform the Work in accordance with this Consent Decree, the ROD, the SOW, and all work plans and other plans, standards, specifications, and schedules set forth herein or developed by Settling Defendant and approved by EPA pursuant to this Consent Decree. Settling Defendant shall also reimburse the United States for Past, Interim and Future Response Costs as provided in this Consent Decree.

6. Compliance With Applicable Law. All activities undertaken by Settling Defendant pursuant to this Consent Decree shall be performed in accordance with the requirements of all applicable federal and state laws and regulations. Settling Defendant must also comply with all applicable or relevant and appropriate requirements ("ARARs") of all Federal and state environmental laws as set forth in the ROD and the SOW. State of Washington land management laws and regulations which may require rents, fees or other payments for use of state lands are not ARARs. The activities conducted pursuant to this Consent Decree, if approved by EPA, shall be considered to be consistent with the NCP.

7. Permits.

a. As provided in Section 121(e) of CERCLA and Section 300.400(e) of the NCP, no permit shall be required for any portion of the Work conducted entirely on-site (i.e.,

within the areal extent of contamination or in very close proximity to the contamination and necessary for implementation of the Work), including the Lockheed Shipyard Upland Operable Unit of the Site which has been delisted from the NCP. Where any portion of the Work that is not on-site requires a federal or state permit or approval, Settling Defendant shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals.

b. Settling Defendant may seek relief under the provisions of Section XVIII (Force Majeure) of this Consent Decree for any delay in the performance of the Work resulting from a failure to obtain, or a delay in obtaining, any permit required for the Work.

c. This Consent Decree is not, and shall not be construed to be, a permit issued pursuant to any federal or state statute or regulation.

VI. PERFORMANCE OF THE WORK BY SETTLING DEFENDANT

8. Selection of Supervising Contractor.

a. All aspects of the Work to be performed by Settling Defendant pursuant to Sections VI (Performance of the Work by Settling Defendant), VII (Remedy Review), VIII (Quality Assurance, Sampling and Data Analysis), and XV (Emergency Response) of this Consent Decree shall be under the direction and supervision of the Supervising Contractor, the selection of which shall be subject to disapproval by EPA. Within 10 days after the lodging of this Consent Decree, Settling Defendant shall notify EPA in writing of the name, title, and qualifications of any contractor proposed to be the Supervising Contractor. With respect to any contractor proposed to be Supervising Contractor, Settling Defendant shall demonstrate that the proposed contractor has a quality system that complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs." (American National Standard, January 5, 1995), by submitting a copy of the proposed contractor's Quality Management Plan (QMP). The QMP

should be prepared in accordance with "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA. EPA will issue a notice of disapproval or an authorization to proceed. If at any time thereafter, Settling Defendant proposes to change a Supervising Contractor, Settling Defendant shall give such notice to EPA and must obtain an authorization to proceed from EPA before the new Supervising Contractor performs, directs, or supervises any Work under this Consent Decree.

b. If EPA disapproves a proposed Supervising Contractor, EPA will notify Settling Defendant in writing. Settling Defendant shall submit a list of contractors to EPA, including the qualifications of each contractor, that would be acceptable to it within 30 days of receipt of EPA's disapproval of the contractor previously proposed. EPA will provide written notice of the names of any contractor(s) that it disapproves and an authorization to proceed with respect to any of the other contractors. Settling Defendant may select any contractor from that list that is not disapproved and shall notify EPA of the name of the contractor selected within 21 days of EPA's authorization to proceed.

c. If EPA fails to provide written notice of its authorization to proceed or disapproval as provided in this Paragraph and this failure prevents Settling Defendant from meeting one or more deadlines in a plan approved by the EPA pursuant to this Consent Decree, Settling Defendant may seek relief under the provisions of Section XVIII (Force Majeure) hereof.

9. Remedial Action.

a. Within 45 days after the approval of the final design submittal, Settling Defendant shall submit a work plan to EPA for the performance of the Remedial Action at the LSSOU ("Remedial Action Work Plan"). The Remedial Action Work Plan shall provide for construction and implementation of the remedy set forth in the ROD and achievement of the Performance Standards, in accordance with this Consent Decree, the ROD, the SOW, and the design plans and specifications developed in accordance with the Remedial Design Work Plan

and approved by EPA. Upon its approval by EPA, the Remedial Action Work Plan shall be incorporated into and become enforceable under this Consent Decree. At the same time as it submits the Remedial Action Work Plan, Settling Defendant shall submit a Health and Safety Plan to EPA for field activities required by the Remedial Action Work Plan which conforms to the applicable Occupational Safety and Health Administration and EPA requirements including, but not limited to, 29 C.F.R. § 1910.120.

b. The Remedial Action Work Plan shall include the following: (1) schedule for completion of the Remedial Action with major milestones as identified in Section V of the SOW; (2) procedures and methodology for implementing performance monitoring, quality assurance including construction quality assurance and water quality monitoring: (3) methods for satisfying permitting requirements; (4) methodology for implementation of the Operation and Maintenance Plan; (5) methodology for implementation of the Contingency Plan; (6) identification of the Remedial Action team; (7) identification and compliance plan for performance standards including habitat restoration and enhancement; and (8) procedures and plans for the decontamination of equipment and the disposal of contaminated materials. The Remedial Action Work Plan also shall include a schedule for implementation of all Remedial Action tasks identified in the final design submittal and shall identify the initial formulation of Settling Defendant's Remedial Action Project Team (including, but not limited to, the Supervising Contractor).

c. Upon approval of the Remedial Action Work Plan by EPA, Settling Defendant shall implement the activities required under the Remedial Action Work Plan. Settling Defendant shall submit to EPA all plans, submittals, or other deliverables required under the approved Remedial Action Work Plan in accordance with the approved schedule for review and approval pursuant to Section XI (EPA Approval of Plans and Other Submissions). Unless otherwise directed by EPA, Settling Defendant shall not commence physical Remedial Action activities at the LSSOU prior to approval of the Remedial Action Work Plan.

10. Settling Defendant shall continue to implement the Remedial Action and O&M until the Performance Standards are achieved and for so long thereafter as is otherwise required under this Consent Decree.

11. Modification of the SOW or Related Work Plans.

a. If EPA determines that modification to the work specified in the SOW and/or in work plans developed pursuant to the SOW is necessary to achieve and maintain the Performance Standards or to carry out and maintain the effectiveness of the remedy set forth in the ROD, EPA may require that such modification be incorporated in the SOW and/or such work plans, provided, however, that a modification may only be required pursuant to this Paragraph to the extent that it is consistent with the remedy selected in the ROD.

b. If Settling Defendant objects to any modification determined by EPA to be necessary pursuant to this Paragraph, it may seek dispute resolution pursuant to Section XIX (Dispute Resolution), record review Paragraph. The SOW and/or related work plans shall be modified in accordance with final resolution of the dispute.

c. Settling Defendant shall implement any work required by any modifications incorporated in the SOW and/or in work plans developed pursuant to the SOW in accordance with this Paragraph.

d. Nothing in this Paragraph shall be construed to limit EPA's authority to require performance of further response actions as otherwise provided in this Consent Decree.

12. Settling Defendant acknowledges and agrees that nothing in this Consent Decree, the SOW, or the Remedial Design or Remedial Action Work Plans constitutes a warranty or representation of any kind by Plaintiff that compliance with the work requirements set forth in the SOW and the Work Plans will achieve the Performance Standards.

13. a. Settling Defendant shall, prior to any off-Site shipment of Waste Material from the Site to an out-of-state waste management facility, provide written notification to the appropriate state environmental official in the receiving facility's state and to the EPA Project

Coordinator of such shipment of Waste Material. However, this notification requirement shall not apply to any off-Site shipments when the total volume of all such shipments will not exceed 10 cubic yards.

(1) Settling Defendant shall include in the written notification the following information, where available: (1) the name and location of the facility to which the Waste Material is to be shipped; (2) the type and quantity of the Waste Material to be shipped; (3) the expected schedule for the shipment of the Waste Material; and (4) the method of transportation. Settling Defendant shall notify the state in which the planned receiving facility is located of major changes in the shipment plan, such as a decision to ship the Waste Material to another facility within the same state, or to a facility in another state.

(2) The identity of the receiving facility and state will be determined by Settling Defendant following the award of the contract for Remedial Action construction. Settling Defendant shall provide the information required by Paragraph 13.a. above as soon as practicable after the award of the contract and before the Waste Material is actually shipped.

b. Before shipping any hazardous substances, pollutants, or contaminants from the Site to an off-site location, Settling Defendant shall obtain EPA's certification that the proposed receiving facility is operating in compliance with the requirements of CERCLA Section 121(d)(3) and 40 C.F.R. 300.440. Settling Defendant shall only send hazardous substances, pollutants, or contaminants from the Site to an off-site facility that complies with the requirements of the statutory provision and regulations cited in the preceding sentence.

VII. REMEDY REVIEW

14. Periodic Review. Settling Defendant shall conduct any studies and investigations as requested by EPA, in order to permit EPA to conduct reviews of whether the Remedial Action is protective of human health and the environment at least every five years as required by Section 121(c) of CERCLA and any applicable regulations.

15. EPA Selection of Further Response Actions. If EPA determines, at any time, that the Remedial Action is not protective of human health and the environment, EPA may select further response actions for the LSSOU and/or the Site in accordance with the requirements of CERCLA and the NCP.

16. Opportunity To Comment. Settling Defendant and, if required by Sections 113(k)(2) or 117 of CERCLA, the public, will be provided with an opportunity to comment on any further response actions proposed by EPA as a result of the review conducted pursuant to Section 121(c) of CERCLA and to submit written comments for the record during the comment period.

17. Settling Defendant's Obligation To Perform Further Response Actions. If EPA selects further response actions for the LSSOU, Settling Defendant shall undertake such further response actions to the extent that the reopener conditions in Paragraph 80 or Paragraph 81 (United States' reservations of liability based on unknown conditions or new information) are satisfied. Settling Defendant may invoke the procedures set forth in Section XIX (Dispute Resolution) to dispute (1) EPA's determination that the reopener conditions of Paragraph 80 or Paragraph 81 of Section XXI (Covenants Not To Sue by Plaintiffs) are satisfied, (2) EPA's determination that the Remedial Action is not protective of human health and the environment, or (3) EPA's selection of the further response actions. Disputes pertaining to the whether the Remedial Action is protective or to EPA's selection of further response actions shall be resolved pursuant to the Record Review Paragraph.

18. Submissions of Plans. If Settling Defendant is required to perform the further response actions pursuant to the preceding Paragraph, it shall submit a plan for such work to EPA for approval in accordance with the procedures set forth in Section VI (Performance of the Work by Settling Defendant) and shall implement the plan approved by EPA in accordance with the provisions of this Decree.

VIII. QUALITY ASSURANCE, SAMPLING, AND DATA ANALYSIS

19. Settling Defendant shall use quality assurance, quality control, and chain of custody procedures for all treatability, design, compliance and monitoring samples in accordance with "EPA Requirements for Quality Assurance Project Plans (QA/R5)" (EPA/240/B-01/003, March 2001) "Guidance for Quality Assurance Project Plans (QA/G-5)" (EPA/600/R-98/018, February 1998), and subsequent amendments to such guidelines upon notification by EPA to Settling Defendant of such amendment. Amended guidelines shall apply only to procedures conducted after such notification. Prior to the commencement of any monitoring project under this Consent Decree, Settling Defendant shall submit a Quality Assurance Project Plan ("QAPP") to EPA for approval that is consistent with the SOW, the NCP and applicable guidance documents. If relevant to the proceeding, the Parties agree that validated sampling data generated in accordance with the QAPP(s) and reviewed and approved by EPA shall be admissible as evidence, without objection, in any proceeding under this Decree. Settling Defendant shall ensure that EPA personnel and its authorized representatives are allowed access at reasonable times to all laboratories utilized by Settling Defendant in implementing this Consent Decree. In addition, Settling Defendant shall ensure that such laboratories shall analyze all samples submitted by EPA pursuant to the QAPP for quality assurance monitoring. Settling Defendant shall ensure that the laboratories they utilize for the analysis of samples taken pursuant to this Decree perform all analyses according to accepted EPA methods. Accepted EPA methods consist of those methods which are documented in the "Contract Lab Program Statement of Work for Inorganic Analysis" and the "Contract Lab Program Statement of Work for Organic Analysis," dated February 1988, and any amendments made thereto during the course of the implementation of this Decree; however, upon approval by EPA, Settling Defendant may use other analytical methods which are as stringent as or more stringent than the CLP- approved methods. Settling Defendant shall ensure that all laboratories they use for analysis of samples

taken pursuant to this Consent Decree participate in an EPA or EPA-equivalent QA/QC program. Settling Defendant shall only use laboratories that have a documented Quality System which complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995), and "EPA Requirements for Quality Management Plans (QA/R-2)," (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA. EPA may consider laboratories accredited under the National Environmental Laboratory Accreditation Program (NELAP) as meeting the Quality System requirements. Settling Defendant shall ensure that all field methodologies utilized in collecting samples for subsequent analysis pursuant to this Decree will be conducted in accordance with the procedures set forth in the QAPP approved by EPA.

20. Upon request, Settling Defendant shall allow split or duplicate samples to be taken by EPA or its authorized representatives. Settling Defendant shall notify EPA not less than 28 days in advance of any sample collection activity unless shorter notice is agreed to by EPA. In addition, EPA shall have the right to take any additional samples that EPA deems necessary. Upon request, EPA shall allow Settling Defendant to take split or duplicate samples of any samples it takes as part of Plaintiff's oversight of Settling Defendant's implementation of the Work.

21. Settling Defendant shall submit 5 copies to EPA of the results of all sampling and/or tests or other data obtained or generated by or on behalf of Settling Defendant with respect to the LSSOU and/or the implementation of this Consent Decree unless EPA agrees otherwise.

22. Notwithstanding any provision of this Consent Decree, the United States hereby retains all of its information gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, RCRA and any other applicable statutes or regulations.

IX. ACCESS AND INSTITUTIONAL CONTROLS

23. To the extent that Settling Defendant has control of the LSSOU, Settling Defendant shall:

a. commencing on the date of lodging of this Consent Decree, provide the United States and its representatives, including EPA and its contractors, with access at all reasonable times to the LSSOU, or such other property, for the purpose of conducting any activity related to this Consent Decree including, but not limited to, the following activities:

(1) Monitoring the Work;

(2) Verifying any data or information submitted to the United States;

(3) Conducting investigations relating to contamination at or near the Site;

(4) Obtaining samples;

(5) Assessing the need for, planning, or implementing additional response actions at or near the Site;

(6) Assessing implementation of quality assurance and quality control practices as defined in the approved Quality Assurance Project Plans;

(7) Implementing the Work pursuant to the conditions set forth in Paragraph 84 of this Consent Decree;

(8) Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by Settling Defendant or its agents, consistent with Section XXIV (Access to Information);

(9) Assessing Settling Defendant's compliance with this Consent Decree; and

(10) Determining whether the LSSOU or other property is being used in a manner that is prohibited or restricted, or that may need to be prohibited or restricted, by or

pursuant to this Consent Decree;

b. commencing on the date of lodging of this Consent Decree, refrain from using the Site, or such other property, in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of the remedial measures to be performed pursuant to this Consent Decree. Such restrictions include, but are not limited to, restrictions which are or shall become restrictions of record in the LSSOU remedial process, and all measures included in the EPA-approved Operations and Maintenance Plan to be submitted for EPA approval by Settling Defendant pursuant the outstanding Administrative Order for Remedial Design for the LSSOU.

24. If the LSSOU, or any other property where access and/or land/water use restrictions are needed to implement this Consent Decree, is owned or controlled by persons other than Settling Defendant, Settling Defendant shall use best efforts to secure from such persons:

25. an agreement to provide access thereto for Settling Defendant, as well as for the United States on behalf of EPA, as well as its representatives (including contractors), for the purpose of conducting any activity related to this Consent Decree;

a. an agreement, enforceable by Settling Defendant and the United States, to refrain from using the LSSOU, or such other property, in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of the remedial measures to be performed pursuant to this Consent Decree. Such restrictions include, but are not limited to all restrictions which are or shall become restrictions of record in the LSSOU remedial process, and all measures included in the EPA-approved Operations and Maintenance Plan to be submitted for EPA approval by Settling Defendant pursuant the outstanding Administrative Order for Remedial Design for the LSSOU; and

b. the execution and recordation in the Recorder's Office [or Registry of Deeds or other appropriate land records office] of King County, State of Washington , of an

easement, running with the land, that (i) grants a right of access for the purpose of conducting any activity related to this Consent Decree, and (ii) grants the right to enforce the land/water use restrictions listed in Paragraph 23.b. of this Consent Decree, or other restrictions that EPA determines are necessary to implement, ensure non-interference with, or ensure the protectiveness of the remedial measures to be performed pursuant to this Consent Decree. The access rights and/or rights to enforce land/water use restrictions shall be granted to (i) the United States, on behalf of EPA, and its representatives, (ii) the State and its representatives, and (iii) the Settling Defendant and its representatives. Within 45 days of entry of this Consent Decree, Settling Defendant shall submit to EPA for review and approval with respect to such property:

(1) A draft easement that is enforceable under the laws of the State of Washington, and

(2) a current title insurance commitment, or some other evidence of title acceptable to EPA, which shows title to the land described in the easement to be free and clear of all prior liens and encumbrances (except when those liens or encumbrances are approved by EPA or when, despite best efforts, Settling Defendant is unable to obtain release or subordination of such prior liens or encumbrances)

Within 15 days of EPA's approval and acceptance of the easement and the title evidence, Settling Defendant shall update the title search and, if it is determined that nothing has occurred since the effective date of the commitment to affect the title adversely, the easement shall be recorded with the Recorder's Office [or Registry of Deeds or other appropriate office] of King County. Within 30 days of the recording of the easement, Settling Defendant shall provide EPA with a final title insurance policy, or other final evidence of title acceptable to EPA, and a certified copy of the original recorded easement showing the clerk's recording stamps. If the easement is to be conveyed to the United States, the easement and title evidence (including final title evidence) shall be prepared in accordance with the U.S. Department of Justice Title Standards 2001, and approval of the sufficiency of title must be obtained as required by 40 U.S.C. § 255.

26. For purposes of this Section, "best efforts" includes the payment of reasonable sums of money in consideration of access, access easements, land/water use restrictions, restrictive easements, and/or an agreement to release or subordinate a prior lien or encumbrance. If (a) any access or land/water use restriction agreements required by this Consent Decree are not obtained within 45 days of the date of entry of this Consent Decree, (b) or any access easements or restrictive easements required by this Consent Decree are not submitted to EPA in draft form within 45 days of the date of entry of this Consent Decree, or (c) Settling Defendant is unable to obtain an agreement from the holder of a prior lien or encumbrance to release or subordinate such lien or encumbrance to the easement being created pursuant to this consent decree within 45 days of the date of entry of this consent decree, Settling Defendant shall promptly notify the United States in writing, and shall include in that notification a summary of the steps that Settling Defendant has taken to attempt to comply with the Section. The United States may, as it deems appropriate, assist Settling Defendant in obtaining access or land/water use restrictions, either in the form of contractual agreements or in the form of easements running with the land, or in obtaining the release or subordination of a prior lien or encumbrance. Settling Defendant shall reimburse the United States in accordance with the procedures in Section XVI (Reimbursement of Response Costs), for all costs incurred, direct or indirect, by the United States in obtaining such access, land/water use restrictions, and/or the release/subordination of prior liens or encumbrances including, but not limited to, the cost of attorney time and the amount of monetary consideration paid or just compensation.

27. Notwithstanding any provision of this Consent Decree, the United States retains all of its access authorities and rights, as well as all of its rights to require land/water use restrictions, including enforcement authorities related thereto, under CERCLA, RCRA and any other applicable statute or regulations.

X. REPORTING REQUIREMENTS

28. In addition to any other requirement of this Consent Decree, Settling Defendant shall submit 5 copies of written monthly progress reports to EPA that: (a) describe the actions which have been taken toward achieving compliance with this Consent Decree during the previous month; (b) include a summary of all results of sampling and tests and all other data received or generated by Settling Defendant or its contractors or agents in the previous month; (c) identify all work plans, plans and other deliverables required by this Consent Decree completed and submitted during the previous month; (d) describe all actions, including, but not limited to, data collection and implementation of work plans, which are scheduled for the next six weeks and provide other information relating to the progress of construction, including, but not limited to, critical path diagrams, Gantt charts and Pert charts; (e) include information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the Work, and a description of efforts made to mitigate those delays or anticipated delays; (f) include any modifications to the work plans or other schedules that Settling Defendant has proposed to EPA or that have been approved by EPA; and (g) describe all activities undertaken in support of the Community Relations Plan during the previous month and those to be undertaken in the next six weeks. Settling Defendant shall submit these progress reports to EPA by the tenth day of every month following the lodging of this Consent Decree until EPA notifies Settling Defendant pursuant to Section XIV (Certification of Completion). If requested by EPA, Settling Defendant shall also provide briefings for EPA to discuss the progress of the Work.

29. Settling Defendant shall notify EPA of any change in the schedule described in the monthly progress report for the performance of any activity, including, but not limited to, data collection and implementation of work plans, no later than seven days prior to the performance of the activity.

30. Upon the occurrence of any event during performance of the Work that Settling Defendant is required to report pursuant to Section 103 of CERCLA or Section 304 of the

Emergency Planning and Community Right-to-know Act (EPCRA), Settling Defendant shall within 24 hours of the onset of such event orally notify the EPA Project Coordinator or the Alternate EPA Project Coordinator (in the event of the unavailability of the EPA Project Coordinator), or, if neither the EPA Project Coordinator or Alternate EPA Project Coordinator is available, the Emergency Response Section, Region 10. United States Environmental Protection Agency. These reporting requirements are in addition to the reporting required by CERCLA Section 103 or EPCRA Section 304.

31. Within 20 days of the onset of such an event, Settling Defendant shall furnish a written report to EPA signed by Settling Defendant's Project Coordinator, setting forth the events which occurred and the measures taken, and to be taken, in response thereto. Within 30 days of the conclusion of such an event, Settling Defendant shall submit a report setting forth all actions taken in response thereto.

32. Settling Defendant shall submit 10 copies of all plans, reports, and data required by the SOW, the Remedial Design Work Plan, the Remedial Action Work Plan, or any other approved plans to EPA in accordance with the schedules set forth in such plans. Upon request by EPA, Settling Defendant shall submit in electronic form all portions of any report or other deliverable Settling Defendant is required to submit pursuant to the provisions of this Consent Decree.

33. All reports and other documents submitted by Settling Defendant to EPA (other than the monthly progress reports referred to above) which purport to document Settling Defendant's compliance with the terms of this Consent Decree shall be signed by an authorized representative of Settling Defendant.

XI. EPA APPROVAL OF PLANS AND OTHER SUBMISSIONS

34. After review of any plan, report or other item which is required to be submitted for approval pursuant to this Consent Decree, EPA, shall: (a) approve, in whole or in part, the

submission; (b) approve the submission upon specified conditions; (c) modify the submission to cure the deficiencies; (d) disapprove, in whole or in part, the submission, directing that Settling Defendant modify the submission; or (e) any combination of the above. However, EPA shall not modify a submission without first providing Settling Defendant at least one notice of deficiency and an opportunity to cure within 30 days, except where to do so would cause serious disruption to the Work or where previous submission(s) have been disapproved due to material defects and the deficiencies in the submission under consideration indicate a bad faith lack of effort to submit an acceptable deliverable.

35. In the event of approval, approval upon conditions, or modification by EPA, pursuant to (a), (b), or (c) of the preceding Paragraph, Settling Defendant shall proceed to take any action required by the plan, report, or other item, as approved or modified by EPA subject only to their right to invoke the Dispute Resolution procedures set forth in Section XIX (Dispute Resolution) with respect to the modifications or conditions made by EPA. If EPA modifies the submission to cure the deficiencies pursuant to this Consent Decree and the submission has a material defect, EPA retains its right to seek stipulated penalties, as provided in Section XX (Stipulated Penalties).

36. Resubmission of Plans.

a. Upon receipt of a notice of disapproval, Settling Defendant shall, within 30 days or such longer time as specified by EPA in such notice, or such longer time as agreed upon by Settling Defendant and EPA, correct the deficiencies and resubmit the plan, report, or other item for approval. Any stipulated penalties applicable to the submission, as provided in Section XX, shall accrue during the 30-day period or otherwise specified period but shall not be payable unless the resubmission is disapproved or modified due to a material defect as provided in this Section.

b. Notwithstanding the receipt of a notice of disapproval, Settling Defendant shall proceed, at the direction of EPA, to take any action required by any non-deficient portion of

the submission. Implementation of any non-deficient portion of a submission shall not relieve Settling Defendant of any liability for stipulated penalties under Section XX (Stipulated Penalties).

37. If a resubmitted plan, report or other item, or portion thereof, is disapproved by EPA, EPA may again require Settling Defendant to correct the deficiencies, in accordance with this Section. EPA also retains the right to modify or develop the plan, report or other item. Settling Defendant shall implement any such plan, report, or item as modified or developed by EPA, subject only to their right to invoke the procedures set forth in Section XIX (Dispute Resolution).

38. If upon resubmission, a plan, report, or item is disapproved or modified by EPA due to a material defect, Settling Defendant shall be deemed to have failed to submit such plan, report, or item timely and adequately unless Settling Defendant invokes the dispute resolution procedures set forth in Section XIX (Dispute Resolution) and EPA's action is overturned pursuant to that Section. The provisions of Section XIX (Dispute Resolution) and Section XX (Stipulated Penalties) shall govern the implementation of the Work and accrual and payment of any stipulated penalties during Dispute Resolution. If EPA's disapproval or modification is upheld, stipulated penalties shall accrue for such violation from the date on which the initial submission was originally required, as provided in Section XX.

39. All plans, reports, and other items required to be submitted to EPA under this Consent Decree shall, upon approval or modification by EPA, be enforceable under this Consent Decree. If EPA approves or modifies a portion of a plan, report, or other item required to be submitted to EPA under this Consent Decree, the approved or modified portion shall be enforceable under this Consent Decree.

XII. PROJECT COORDINATORS

40. Within 20 days of lodging this Consent Decree, Settling Defendant and EPA will

notify each other, in writing, of the name, address and telephone number of their respective designated Project Coordinators and Alternate Project Coordinators. If a Project Coordinator or Alternate Project Coordinator initially designated is changed, the identity of the successor will be given to the other Parties at least 5 working days before the changes occur, unless impracticable, but in no event later than the actual day the change is made. Settling Defendant's Project Coordinator shall be subject to disapproval by EPA and shall have the technical expertise sufficient to adequately oversee all aspects of the Work. Settling Defendant's Project Coordinator shall not be an attorney. He or she may assign other representatives, including other contractors, to serve as a LSSOU representative for oversight of performance of daily operations during remedial activities.

41. Plaintiff may designate other representatives, including, but not limited to, EPA employees, and federal contractors and consultants, to observe and monitor the progress of any activity undertaken pursuant to this Consent Decree. EPA's Project Coordinator and Alternate Project Coordinator shall have the authority lawfully vested in a Remedial Project Manager (RPM) and an On-Scene Coordinator (OSC) by the National Contingency Plan, 40 C.F.R. Part 300. In addition, EPA's Project Coordinator or Alternate Project Coordinator shall have authority, consistent with the National Contingency Plan, to halt any Work required by this Consent Decree and to take any necessary response action when s/he determines that conditions at the Site constitute an emergency situation or may present an immediate threat to public health or welfare or the environment due to release or threatened release of Waste Material.

42. EPA's Project Coordinator and Settling Defendant's Project Coordinator will meet, at a minimum, on a monthly basis or other agreed upon time interval.

XIII. Assurance of Ability to Complete Work

43. Within 30 days of entry of this Consent Decree, Settling Defendant shall establish and maintain financial security in the amount of $12,500,000 in one or more of the following forms:

a. A surety bond guaranteeing performance of the Work;

b. One or more irrevocable letters of credit equaling the total estimated cost of the Work;

c. A trust fund;

d. A guarantee to perform the Work by one or more parent corporations or subsidiaries, or by one or more unrelated corporations that have a substantial business relationship with Settling Defendant;

e. A demonstration that Settling Defendant satisfies the requirements of 40 C.F.R. 264.143(f). For these purposes, references in 40 C.F.R. 264.143 (f) to the "sum of current closure and post-closure costs estimates and the current plugging and abandonment costs estimates" shall mean the amount of financial security specified above. If Settling Defendant seeks to provide a demonstration under 40 C.F.R. 264.143(f) and has provided a similar demonstration at other RCRA or CERCLA sites, the amount for which it was providing financial assurance at those other sites should generally be added to the estimated costs of the Work from this paragraph.); or

44. If Settling Defendant seeks to demonstrate the ability to complete the Work through a guarantee by a third party, Settling Defendant shall demonstrate that the guarantor satisfies the requirements of 40 C.F.R. Part 264.143(f). If Settling Defendant seeks to demonstrate its ability to complete the Work by means of the financial test or the corporate guarantee, it shall resubmit sworn statements conveying the information required by 40 C.F.R. Part 264.143(f) annually, on the anniversary of the Effective Date. If EPA determines at any time that the financial assurances provided pursuant to this Section are inadequate, Settling Defendant shall, within 30 days of receipt of notice of EPA's determination, obtain and present to EPA for approval one of the other forms of financial assurance listed in the preceding Paragraph. Settling Defendant's inability to demonstrate financial ability to complete the Work shall not excuse performance of any activities required under this Consent Decree.

45. If Settling Defendant can show that the estimated cost to complete the remaining Work has diminished below the amount set forth in Paragraph 43 above after entry of this Consent Decree, Settling Defendant may, on any anniversary date of entry of this Consent Decree, or at any other time agreed to by the Parties, reduce the amount of the financial security provided under this Section to the estimated cost of the remaining work to be performed. Settling Defendant shall submit a proposal for such reduction to EPA, in accordance with the requirements of this Section, and may reduce the amount of the security upon approval by EPA. In the event of a dispute, Settling Defendant may reduce the amount of the security in accordance with the final decision resolving the dispute.

46. Settling Defendant may change the form of financial assurance provided under this Section at any time, upon notice to and approval by EPA, provided that the new form of assurance meets the requirements of this Section. In the event of a dispute, Settling Defendant may change the form of the financial assurance only in accordance with the final decision resolving the dispute.

XIV. CERTIFICATION OF COMPLETION

47. Completion of the Remedial Action.

a. Within 90 days after Settling Defendant concludes that the Remedial Action has been fully performed and the Performance Standards have been attained, Settling Defendant shall schedule and conduct a pre-certification inspection to be attended by Settling Defendant and EPA. If, after the pre-certification inspection, Settling Defendant still believes that the Remedial Action has been fully performed and the Performance Standards have been attained, it shall submit a written report requesting certification to EPA for approval pursuant to Section XI (EPA Approval of Plans and Other Submissions) within 30 days of the inspection. In the report, a registered professional engineer and Settling Defendant's Project Coordinator shall state that the Remedial Action has been completed in full satisfaction of the requirements of this

Consent Decree. The written report shall include as-built drawings signed and stamped by a professional engineer. The report shall contain the following statement, signed by a responsible corporate official of Settling Defendant or its Project Coordinator:

> To the best of my knowledge, after thorough investigation, I certify under penalty of perjury that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If, after completion of the pre-certification inspection and receipt and review of the written report, EPA determines that the Remedial Action or any portion thereof has not been completed in accordance with this Consent Decree or that the Performance Standards have not been achieved, EPA will notify Settling Defendant in writing of the activities that must be undertaken by Settling Defendant pursuant to this Consent Decree to complete the Remedial Action and achieve the Performance Standards, provided, however, that EPA may only require Settling Defendant to perform such activities pursuant to this Paragraph to the extent that such activities are consistent with the remedy selected in the ROD. EPA will set forth in the notice a schedule for performance of such activities consistent with the Consent Decree and the SOW or require Settling Defendant to submit a schedule to EPA for approval pursuant to Section XI (EPA Approval of Plans and Other Submissions). Settling Defendant shall perform all activities described in the notice in accordance with the specifications and schedules established pursuant to this Paragraph, subject to its right to invoke the dispute resolution procedures set forth in Section XIX (Dispute Resolution).

b. If EPA concludes, based on the initial or any subsequent report requesting Certification of Completion that the Remedial Action has been performed in accordance with this Consent Decree and that the Performance Standards have been achieved, EPA will so certify in writing to Settling Defendant. This certification shall constitute the Certification of Completion of the Remedial Action for purposes of this Consent Decree, including, but not limited to, Section XXI (Covenants Not to Sue by Plaintiff). Certification of Completion of the Remedial

Action shall not affect Settling Defendant's obligations under this Consent Decree.

XV. EMERGENCY RESPONSE

48. In the event of any action or occurrence during the performance of the Work which causes or threatens a release of Waste Material from the LSSOU that constitutes an emergency situation or may present an immediate threat to public health or welfare or the environment, Settling Defendant shall immediately take all appropriate action to prevent, abate, or minimize such release or threat of release, and shall immediately notify the EPA's Project Coordinator, or, if the Project Coordinator is unavailable, EPA's Alternate Project Coordinator. If neither of these persons is available, Settling Defendant shall notify the EPA Emergency Response Unit, Region 10. Settling Defendant shall take such actions in consultation with EPA's Project Coordinator or other available authorized EPA officer and in accordance with all applicable provisions of the Health and Safety Plans, the Contingency Plans, and any other applicable plans or documents developed pursuant to the SOW. In the event that Settling Defendant fails to take appropriate response action as required by this Section, and EPA takes such action instead, Settling Defendant shall reimburse EPA all costs of the response action not inconsistent with the NCP pursuant to Section XVI (Payments for Response Costs).

49. Nothing in the preceding Paragraph or in this Consent Decree shall be deemed to limit any authority of the United States: a) to take all appropriate action to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Site, or b) to direct or order such action, or seek an order from the Court, to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Site, subject to Section XXI (Covenants Not to Sue by Plaintiff).

XVI. PAYMENTS FOR RESPONSE COSTS

50. Payments for Past Response Costs.

a. Within 30 days of the Effective Date, Settling Defendant shall pay to EPA $154,587.57 in payment for Past Response Costs. Payment shall be made by FedWire Electronic Funds Transfer ("EFT") to the U.S. Department of Justice account in accordance with current EFT procedures, referencing USAO File Number 2003Z00425 EPA Site/Spill ID Number 109W, and DOJ Case Number 90-11-2-970/2. Payment shall be made in accordance with instructions provided to Settling Defendant by the Financial Litigation Unit of the United States Attorney's Office for the Western District of Washington following lodging of the Consent Decree. Any payments received by the Department of Justice after 4:00 p.m. (Eastern Time) will be credited on the next business day.

b. At the time of payment, Settling Defendant shall send notice that payment has been made to the United States, to EPA and to the Regional Financial Management Officer, in accordance with Section XXVI (Notices and Submissions).

c. The total amount to be paid by Settling Defendant pursuant to this Paragraph shall be deposited in the EPA Hazardous Substance Superfund.

51. Payments for Future Response Costs.

a. Settling Defendant shall pay all Future Response Costs not inconsistent with the National Contingency Plan to EPA. On a periodic basis the United States will send Settling Defendant a bill requiring payment that includes an EPA Superfund Cost Recovery Package Imaging and On-Line System (SCORPIOS) cost summary and a Department of Justice cost summary, as appropriate. Settling Defendant shall make all payments within 30 days of Settling Defendant's receipt of each bill requiring payment, except as otherwise provided below. Settling Defendant shall make all payments required by this Paragraph by a certified or cashier's check or checks made payable to "EPA Hazardous Substance Superfund," referencing the name and address of the party making the payment, EPA Site/Spill ID Number 109W, and DOJ Case Number 90-11-2-970/2. Settling Defendant shall send the check(s) to: United States Attorney, Financial Litigation Unit, 601 Union Street, Suite 5100, Seattle, WA 98101.

b. At the time of payment, Settling Defendant shall send notice that payment has been made to the United States, to EPA and to the Regional Financial Management Officer, in accordance with Section XXVI (Notices and Submissions).

c. The total amount to be paid by Settling Defendant pursuant to this Paragraph shall be deposited in the EPA Hazardous Substance Superfund.

52. Settling Defendant may contest payment of any Future Response Costs if it determines that the United States has made an accounting error or if they allege that a cost item that is included represents costs that are inconsistent with the NCP. Such objection shall be made in writing within 30 days of receipt of the bill and must be sent to the United States pursuant to Section XXVI (Notices and Submissions). Any such objection shall specifically identify the contested Future Response Costs and the basis for objection. In the event of an objection, Settling Defendant shall within the 30-day period pay all uncontested Future Response Costs to the United States in the manner described in the preceding Paragraph. Simultaneously, Settling Defendant shall establish an interest-bearing escrow account in a federally-insured bank duly chartered in the State of Washington and remit to that escrow account funds equivalent to the amount of the contested Future Response Costs. Settling Defendant shall send to the United States, as provided in Section XXVI (Notices and Submissions), a copy of the transmittal letter and check paying the uncontested Future Response Costs, and a copy of the correspondence that establishes and funds the escrow account, including, but not limited to, information containing the identity of the bank and bank account under which the escrow account is established as well as a bank statement showing the initial balance of the escrow account. Simultaneously with establishment of the escrow account, Settling Defendant shall initiate the Dispute Resolution procedures in Section XIX (Dispute Resolution). If the United States prevails in the dispute, within 5 days of the resolution of the dispute, Settling Defendant shall pay the sums due (with accrued interest) to the United States in the manner described in the preceding Paragraph. If

Settling Defendant prevails concerning any aspect of the contested costs, Settling Defendant shall pay that portion of the costs (plus associated accrued interest) for which they did not prevail to the United States in the manner described in the preceding Paragraph; Settling Defendant shall be disbursed any balance of the escrow account. The dispute resolution procedures set forth in this Paragraph in conjunction with the procedures set forth in Section XIX (Dispute Resolution) shall be the exclusive mechanisms for resolving disputes regarding Settling Defendant's obligation to reimburse the United States for its Future Response Costs.

53. If any Past or Future Response Costs payments required by this Consent Decree are not timely made, Settling Defendant shall pay Interest on the unpaid balance. The Interest to be paid on Past Response Costs under this Paragraph shall begin to accrue on the Effective Date. The Interest on Future Response Costs shall begin to accrue on the date of receipt of the bill. The Interest shall accrue through the date of Settling Defendant's payment. Payments of Interest made under this Paragraph shall be in addition to such other remedies or sanctions available to Plaintiff by virtue of Settling Defendant's failure to make timely payments under this Section including, but not limited to, payment of stipulated penalties pursuant to Section XX. Settling Defendant shall make all payments required by this Paragraph in the manner described in this Section.

XVII. INDEMNIFICATION AND INSURANCE

54. Settling Defendant's Indemnification of the United States.

a. The United States does not assume any liability by entering into this agreement or by virtue of any designation of Settling Defendant as EPA's authorized representative under Section 104(e) of CERCLA. Settling Defendant shall indemnify, save and hold harmless the United States and its officials, agents, employees, contractors, subcontractors, or representatives for or from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Settling Defendant, its officers, directors,

employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Consent Decree, including, but not limited to, any claims arising from any designation of Settling Defendant as EPA's authorized representative under Section 104(e) of CERCLA. Further, Settling Defendant agrees to pay the United States all costs it incurs including, but not limited to, attorneys fees and other expenses of litigation and settlement arising from, or on account of, claims made against the United States based on negligent or other wrongful acts or omissions of Settling Defendant, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Consent Decree. The United States shall not be held out as a party to any contract entered into by or on behalf of Settling Defendants in carrying out activities pursuant to this Consent Decree. Neither Settling Defendant nor any such contractor shall be considered an agent of the United States.

b. The United States shall give Settling Defendant notice of any claim for which the United States plans to seek indemnification pursuant to this Consent Decree, and shall consult with Settling Defendant prior to settling such claim.

55. Settling Defendant waives all claims against the United States for damages or reimbursement or for set-off of any payments made or to be made to the United States arising from or on account of any contract, agreement, or arrangement between Settling Defendant and any person for performance of Work on or relating to the LSSOU, including, but not limited to, claims on account of construction delays. In addition, Settling Defendant shall indemnify and hold harmless the United States with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between Settling Defendant and any person for performance of Work on or relating to the LSSOU, including, but not limited to, claims on account of construction delays.

56. No later than 15 days before commencing any on-site Work, Settling Defendant shall secure, and shall maintain until the first anniversary of EPA's Certification of Completion

of the Remedial Action pursuant to Section XIV (Certification of Completion), comprehensive general liability insurance with limits of $5 million dollars, combined single limit, and automobile liability insurance with limits of $1 million dollars, combined single limit, naming the United States as additional insured. In addition, for the duration of this Consent Decree, Settling Defendant shall satisfy, or shall ensure that their contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the Work on behalf of Settling Defendant in furtherance of this Consent Decree. Prior to commencement of the Work under this Consent Decree, Settling Defendant shall provide certificates of such insurance and a copy of each insurance policy to EPA. Settling Defendant shall resubmit such certificates and copies of policies each year on the anniversary of the Effective Date. If Settling Defendant demonstrates by evidence satisfactory to EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, then, with respect to that contractor or subcontractor, Settling Defendant need provide only that portion of the insurance described above which is not maintained by the contractor or subcontractor.

XVIII. FORCE MAJEURE

57. "Force majeure," for purposes of this Consent Decree, is defined as any event arising from causes beyond the control of Settling Defendant, of any entity controlled by Settling Defendant, or of Settling Defendant's contractors, that delays or prevents the performance of any obligation under this Consent Decree despite Settling Defendant's best efforts to fulfill the obligation. The requirement that Settling Defendant exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure event and best efforts to address the effects of any potential force majeure event (1) as it is occurring and (2) following the potential force majeure event, such that the delay is minimized to the greatest extent possible. "Force Majeure" does not include financial inability to complete the Work or a

failure to attain the Performance Standards.

58. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Decree, whether or not caused by a force majeure event, Settling Defendant shall notify orally EPA's Project Coordinator or, in his or her absence, EPA's Alternate Project Coordinator or, in the event both of EPA's designated representatives are unavailable, the Director of the Office of Environmental Cleanup, EPA Region 10, within 48 hours of when Settling Defendant first knew that the event might cause a delay. Within 5 days thereafter, Settling Defendant shall provide to EPA in writing an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Settling Defendant's rationale for attributing such delay to a force majeure event if they intend to assert such a claim; and a statement as to whether, in the opinion of Settling Defendant, such event may cause or contribute to an endangerment to public health, welfare or the environment. Settling Defendant shall include with any notice all available documentation supporting its claim that the delay was attributable to a force majeure. Failure to comply with the above requirements shall preclude Settling Defendant from asserting any claim of force majeure for that event for the period of time of such failure to comply, and for any additional delay caused by such failure, unless good cause is shown by Settling Defendant with regard to such failure to comply. Settling Defendant shall be deemed to know of any circumstance of which Settling Defendant, any entity controlled by Settling Defendant or Settling Defendant's contractors knew or should have known.

59. If EPA agrees that the delay or anticipated delay is attributable to a force majeure event, the time for performance of the obligations under this Consent Decree that are affected by the force majeure event will be extended by for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure event shall not, of itself, extend the time for performance of any other obligation. If

EPA does not agree that the delay or anticipated delay has been or will be caused by a force majeure event, EPA will notify Settling Defendant in writing of its decision. If EPA agrees that the delay is attributable to a force majeure event, EPA will notify Settling Defendant in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure event.

60. If Settling Defendant elects to invoke the dispute resolution procedures set forth in Section XIX (Dispute Resolution), it shall do so no later than 15 days after receipt of EPA's notice. In any such proceeding, Settling Defendant shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that Settling Defendant complied with the requirements of this Section. If Settling Defendant carries this burden, the delay at issue shall be deemed not to be a violation by Settling Defendant of the affected obligation of this Consent Decree identified to EPA and the Court.

XIX. DISPUTE RESOLUTION

61. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States to enforce obligations of Settling Defendant that have not been disputed in accordance with this Section. The fact that dispute resolution is not specifically referenced in a Section of this Consent Decree does not bar Settling Defendant from invoking the procedures herein with respect to any matter in dispute.

62. Any dispute which arises under or with respect to this Consent Decree shall in the first instance be the subject of informal negotiations between the parties to the dispute. The

period for informal negotiations shall not exceed 20 days from the time the dispute arises, unless it is modified by written agreement of the parties to the dispute. The dispute shall be considered to have arisen when one party sends the other parties a written Notice of Dispute.

63. Statement of Position.

a. If the parties cannot resolve a dispute by informal negotiations under the preceding Paragraph, then the position advanced by EPA shall be considered binding unless, within 14 days after the conclusion of the informal negotiation period, Settling Defendant invokes the formal dispute resolution procedures of this Section by serving on the United States a written Statement of Position on the matter in dispute, including, but not limited to, any factual data, analysis or opinion supporting that position and any supporting documentation relied upon by Settling Defendant. The Statement of Position shall specify Settling Defendant's position as to whether formal dispute resolution should proceed under the following Paragraph or the Paragraph thereafter.

b. If there is disagreement between EPA and Settling Defendant as to whether dispute resolution should proceed under the following Paragraph or the Paragraph thereafter, the parties to the dispute shall follow the procedures set forth in the Paragraph determined by EPA to be applicable. However, if Settling Defendant ultimately appeals to the Court to resolve the dispute, the Court shall determine which Paragraph is applicable in accordance with the standards of applicability set forth in this Section.

64. Formal dispute resolution for disputes pertaining to the selection or adequacy of any response action and all other disputes that are accorded review on the administrative record under applicable principles of administrative law shall be conducted pursuant to the procedures set forth in this Paragraph. For purposes of this Paragraph, the adequacy of any response action includes, without limitation: (1) the adequacy or appropriateness of plans, procedures to implement plans, or any other items requiring approval by EPA under this Consent Decree; and (2) the adequacy of the performance of response actions taken pursuant to this Consent Decree.

Nothing in this Consent Decree shall be construed to allow any dispute by Settling Defendant regarding the validity of the ROD's provisions.

a. An administrative record of the dispute shall be maintained by EPA and shall contain Settling Defendant's Statement of Position and any responses by EPA, including supporting documentation. Where appropriate, EPA may allow submission of supplemental statements of position by Settling Defendant.

b. The Director of the Office of Environmental Cleanup ("ECL Director"), EPA Region 10, will issue a final administrative decision resolving the dispute based on the administrative record described in this Paragraph. This decision shall be binding upon Settling Defendant, subject only to the right to seek judicial review pursuant to this Paragraph.

c. Any administrative decision made by EPA pursuant to this Paragraph shall be reviewable by this Court, provided that a motion for judicial review of the decision is filed by Settling Defendant with the Court and served on the United States within 30 days of receipt of EPA's decision. The motion shall include a description of the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Consent Decree. The United States may file a response to Settling Defendant's motion.

d. In proceedings on any dispute governed by this Paragraph, Settling Defendant shall have the burden of demonstrating that the decision of the ECL Director is arbitrary and capricious or otherwise not in accordance with law. Judicial review of EPA's decision shall be on the administrative record compiled pursuant to this Paragraph.

65. Formal dispute resolution for disputes that neither pertain to the selection or adequacy of any response action nor are otherwise accorded review on the administrative record under applicable principles of administrative law, shall be governed by this Paragraph.

a. Following receipt of Settling Defendant's Statement of Position, the ECL Director, will issue a final decision resolving the dispute. The ECL Director's decision shall be

binding on Settling Defendant unless, within 30 days of receipt of the decision, Settling Defendant files with the Court and serves on the United States a motion for judicial review of the decision setting forth the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of the Consent Decree. The United States may file a response to Settling Defendant's motion.

b. Judicial review of any dispute governed by this Paragraph shall be governed by applicable principles of law.

66. The invocation of formal dispute resolution procedures under this Section shall not extend, postpone or affect in any way any obligation of Settling Defendant under this Consent Decree, not directly in dispute, unless EPA or the Court agrees otherwise. Stipulated penalties with respect to the disputed matter shall continue to accrue but payment shall be stayed pending resolution of the dispute as provided in this Section. Notwithstanding the stay of payment, stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of this Consent Decree. If Settling Defendant does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XX (Stipulated Penalties).

XX. STIPULATED PENALTIES

67. Settling Defendant shall be liable for stipulated penalties in the amounts set forth in this Section below to the United States for failure to comply with the requirements of this Consent Decree specified below, unless excused under Section XVIII (Force Majeure). "Compliance" by Settling Defendant shall include completion of the activities under this Consent Decree or any work plan or other plan approved under this Consent Decree identified below in accordance with all applicable requirements of law, this Consent Decree, the SOW, and any plans or other documents approved by EPA pursuant to this Consent Decree and within the

specified time schedules established by and approved under this Consent Decree.

68. Stipulated Penalty Amounts - Work.

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in this Paragraph:

Penalty Per Violation Per Day	Period of Noncompliance
$1,000	1st through 14th day
$3,000	15th through 30th day
$7,500	31st through 90th day

b. Compliance Milestones.

(1) Remedial Action Work Plan for Phase I - Bulkhead Reconstruction and Pier Demolition and for Phase II for Dredging and Capping

(2) Initiate Construction of Phase 1 Remedial Action and Phase II Remedial Action

(3) Completion of Phase I and Phase II RA construction

(4) Remedial Action Construction Report

(5) Remedial Action Completion Report

69. Stipulated Penalty Amounts - Reports.

a. The following stipulated penalties shall accrue per violation per day for failure to submit timely or adequate reports or other written documents pursuant to this ConsentDecree:

Penalty Per Violation Per Day	Period of Noncompliance
$500	1st through 14th day
$1,500	15th through 30th day
$5,000	31st through 90th day

70. All penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs, and shall continue to accrue through the final day of the

correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: (1) with respect to a deficient submission under Section XI (EPA Approval of Plans and Other Submissions), during the period, if any, beginning on the 31st day after EPA's receipt of such submission until the date that EPA notifies Settling Defendant of any deficiency; (2) with respect to a decision by the ECL Director pursuant to Section XIX (Dispute Resolution), during the period, if any, beginning on the 31st day after the submission of Settling Defendant's Statement of Position is received until the date that the ECL Director issues a final decision regarding such dispute; or (3) with respect to judicial review by this Court of any dispute under Section XIX (Dispute Resolution), during the period, if any, beginning on the 31st day after the Court's receipt of the final submission regarding the dispute until the date that the Court issues a final decision regarding such dispute. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Decree.

71. Following EPA's determination that Settling Defendant has failed to comply with a requirement of this Consent Decree, EPA may give Settling Defendant written notification of such failure and describe the noncompliance. EPA may send Settling Defendant a written demand for the payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether EPA has notified Settling Defendant of a violation.

72. All penalties accruing under this Section shall be due and payable to the United States within 30 days of Settling Defendant's receipt from EPA of a demand for payment of the penalties, unless Settling Defendant invokes the Dispute Resolution procedures under Section XIX (Dispute Resolution). All payments to the United States under this Section shall be paid by certified or cashier's check(s) made payable to "EPA Hazardous Substances Superfund," shall be mailed to Mellon Bank, EPA Region 10, ATTN: Superfund Accounting, P.O. Box 360903M, Pittsburgh, PA 15251, shall indicate that the payment is for stipulated penalties, and shall reference the EPA Region and Site/Spill ID #109W, the DOJ Case Number 90-11-2-970/2, and the name and address of the party making payment. Copies of checks paid pursuant to this

Section, and any accompanying transmittal letters, shall be sent to the United States as provided in Section XXVI (Notices and Submissions).

73. The payment of penalties shall not alter in any way Settling Defendant's obligation to complete the performance of the Work required under this Consent Decree.

74. Penalties shall continue to accrue as provided above during any dispute resolution period, but need not be paid until the following:

a. If the dispute is resolved by agreement or by a decision of EPA that is not appealed to this Court, accrued penalties determined to be owing shall be paid to EPA within 30 days of the agreement or the receipt of EPA's decision or order;

b. If the dispute is appealed to this Court and the United States prevails in whole or in part, Settling Defendant shall pay all accrued penalties determined by the Court to be owed to EPA within 60 days of receipt of the Court's decision or order, except as provided in Subparagraph c below;

c. If the District Court's decision is appealed by any Party, Settling Defendant shall pay all accrued penalties determined by the District Court to be owing to the United States into an interest-bearing escrow account within 60 days of receipt of the Court's decision or order. Penalties shall be paid into this account as they continue to accrue, at least every 60 days. Within 15 days of receipt of the final appellate court decision, the escrow agent shall pay the balance of the account to EPA or to Settling Defendant to the extent that it prevails.

75. If Settling Defendant fails to pay stipulated penalties when due, the United States may institute proceedings to collect the penalties, as well as interest. Settling Defendant shall pay Interest on the unpaid balance, which shall begin to accrue on the date of the demand made in accordance with this Section.

76. Nothing in this Consent Decree shall be construed as prohibiting, altering, or in any way limiting the ability of the United States to seek any other remedies or sanctions available by virtue of Settling Defendant's violation of this Decree or of the statutes and regulations upon

which it is based, including, but not limited to, penalties pursuant to Section 122(l) of CERCLA, provided, however, that the United States shall not seek civil penalties pursuant to Section 122(l) of CERCLA for any violation for which a stipulated penalty is provided herein, except in the case of a willful violation of the Consent Decree.

77. Notwithstanding any other provision of this Section, the United States may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Consent Decree.

XXI. COVENANTS NOT TO SUE BY PLAINTIFF

78. In consideration of the actions that will be performed and the payments that will be made by Settling Defendant under the terms of the Consent Decree, and except as specifically provided below, the United States covenants not to sue or to take administrative action against Settling Defendant pursuant to Sections 106 and 107(a) of CERCLA relating to the LSSOU. Except with respect to future liability, these covenants not to sue shall take effect upon the receipt by EPA of the payments required by Section XVI (Payments for Response Costs). With respect to future liability, these covenants not to sue shall take effect upon Certification of Completion of Remedial Action by EPA pursuant to Section XIV (Certification of Completion). These covenants not to sue are conditioned upon the satisfactory performance by Settling Defendant of its obligations under this Consent Decree. These covenants not to sue extend only to Settling Defendant and do not extend to any other person.

79. United States' Pre-certification Reservations. Notwithstanding any other provision of this Consent Decree, the United States reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, or to issue an administrative order seeking to compel Settling Defendant

a. to perform further response actions relating to the LSSOU, or

b. to reimburse the United States for additional costs of response if, prior to

Certification of Completion of the Remedial Action:

(1) conditions at the LSSOU, previously unknown to EPA, are discovered, or

(2) information, previously unknown to EPA, is received, in whole or in part, and EPA determines that these previously unknown conditions or information together with any other relevant information indicates that the Remedial Action is not protective of human health or the environment.

80. United States' Post-certification Reservations. Notwithstanding any other provision of this Consent Decree, the United States reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, or to issue an administrative order seeking to compel Settling Defendant

a. to perform further response actions relating to the LSSOU, or

b. to reimburse the United States for additional costs of response if, subsequent to Certification of Completion of the Remedial Action:

(1) conditions at the LSSOU, previously unknown to EPA, are discovered, or

(2) information, previously unknown to EPA, is received, in whole or in part, and EPA determines that these previously unknown conditions or this information together with other relevant information indicate that the Remedial Action is not protective of human health or the environment.

81. For purposes of Paragraph 80, the information and the conditions known to EPA shall include only that information and those conditions known to EPA as of the date the ROD was issued and set forth in the ROD for the former SSOU (as modified by the ESD for the LSSOU), and the administrative record supporting the ROD and ESD. For purposes of Paragraph 81, the information and the conditions known to EPA shall include only that information and those conditions known to EPA as of the date of Certification of Completion of

the Remedial Action and set forth in the ROD, the administrative record supporting the ROD, the post-ROD administrative record, or in any information received by EPA pursuant to the requirements of this Consent Decree prior to Certification of Completion of the Remedial Action.

82. General reservations of rights. The United States reserves, and this Consent Decree is without prejudice to, all rights against Settling Defendant with respect to all matters not expressly included within Plaintiff's covenant not to sue. Notwithstanding any other provision of this Consent Decree, the United States reserves all rights against Settling Defendant with respect to:

a. claims based on a failure by Settling Defendant to meet a requirement of this Consent Decree;

b. liability arising from the past, present, or future disposal, release, or threat of release of Waste Material outside of the LSSOU;

c. liability based upon Settling Defendant's ownership or operation of the LSSOU, or upon Settling Defendant's transportation, treatment, storage, or disposal, or the arrangement for the transportation, treatment, storage, or disposal of Waste Material at or in connection with the Site, other than as provided in the ROD, the Work, or otherwise ordered by EPA, after signature of this Consent Decree by Settling Defendant;

d. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

e. criminal liability;

f. liability for violations of federal or state law which occur during or after implementation of the Remedial Action; and

g. liability, prior to Certification of Completion of the Remedial Action, for additional response actions that EPA determines are necessary to achieve Performance Standards, but that cannot be required pursuant to Paragraph 11 (Modification of the SOW or Related Work

Plans);

h. liability for additional operable units at the Site;

i. liability for costs that the United States will incur related to the Site but are not within the definition of Future Response Costs;

j. liability for costs incurred or to be incurred by the Agency for Toxic Substances and Disease Registry related to the Site.

83. Work Takeover If EPA determines that Settling Defendant has ceased implementation of any portion of the Work, is seriously or repeatedly deficient or late in its performance of the Work, or is implementing the Work in a manner which may cause an endangerment to human health or the environment, EPA may assume the performance of all or any portions of the Work as EPA determines necessary. Settling Defendant may invoke the procedures set forth in Section XIX (Dispute Resolution), to dispute EPA's determination that takeover of the Work is warranted under this Paragraph. Costs incurred by the United States in performing the Work pursuant to this Paragraph shall be considered Future Response Costs that Settling Defendant shall pay pursuant to Section XVI (Payment for Response Costs).

84. Notwithstanding any other provision of this Consent Decree, the United States retains all authority and reserves all rights to take any and all response actions authorized by law.

XXII. COVENANTS BY SETTLING DEFENDANT

85. Covenant Not to Sue. Subject to the reservations below, Settling Defendant hereby covenants not to sue and agrees not to assert any claims or causes of action against the United States with respect to the LSSOU, and Past and Future Response Costs as defined herein, or this Consent Decree, including, but not limited to:

a. any direct or indirect claim for reimbursement from the Hazardous Substance Superfund (established pursuant to the Internal Revenue Code, 26 U.S.C. § 9507) through CERCLA Sections 106(b)(2), 107, 111, 112, 113 or any other provision of law;

b. any claims asserted under common law or state law; and

c. any other claim not expressly reserved below.

86. a. Settling Defendant reserves, and this Consent Decree is without prejudice to, claims against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States while acting within the scope of his office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, any such claim shall not include a claim for any damages caused, in whole or in part, by the act or omission of any person, including any contractor, who is not a federal employee as that term is defined in 28 U.S.C. § 2671; nor shall any such claim include a claim based on EPA's selection of response actions, or the oversight or approval of Settling Defendant's plans or activities. The foregoing applies only to claims which are brought pursuant to any statute other than CERCLA and for which the waiver of sovereign immunity is found in a statute other than CERCLA.

b. Settling Defendant further reserves, and this Consent Decree is without prejudice to, claims against the United States under CERCLA Sections 107 or 113 for costs incurred at the LSSOU.

c. Settling Defendant further reserves, and this Consent Decree is without prejudice to, claims against the United States under federal law for costs incurred at the LSSOU based upon any contract with the United States regarding activities at the former shipyard at Harbor Island.

87. Nothing in this Consent Decree shall be deemed to constitute preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

88. Settling Defendant agrees not to assert any claims and to waive all claims or causes of action that they may have for all matters relating to the LSSOU, including for

contribution, against any person where the person's liability to Settling Defendant with respect to the LSSOU is based solely on having arranged for disposal or treatment, or for transport for disposal or treatment, of hazardous substances at the Site, or having accepted for transport for disposal or treatment of hazardous substances at the Site, if:

a. the materials contributed by such person to the Site containing hazardous substances did not exceed the greater of (i) 0.002% of the total volume of waste at the Site, or (ii) 110 gallons of liquid materials or 200 pounds of solid materials.

b. This waiver shall not apply to any claim or cause of action against any person meeting the above criteria if EPA has determined that the materials contributed to the LSSOU by such person contributed or could contribute significantly to the costs of response at the LSSOU. This waiver also shall not apply with respect to any defense, claim, or cause of action that Settling Defendant may have against any person if such person asserts a claim or cause of action relating to the LSSOU against Settling Defendant.

XXIII. EFFECT OF SETTLEMENT; CONTRIBUTION PROTECTION

89. Except as provided in the preceding Paragraph (Waiver of Claims Against De Micromis Parties), nothing in this Consent Decree shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Consent Decree. The preceding sentence shall not be construed to waive or nullify any rights that any person not a signatory to this decree may have under applicable law. Except as provided in the Waiver of Claims Against De Micromis Parties, each of the Parties expressly reserves any and all rights (including, but not limited to, any right to contribution), defenses, claims, demands, and causes of action which each Party may have with respect to any matter, transaction, or occurrence relating in any way to the LSSOU against any person not a Party hereto.

90. The Parties agree, and by entering this Consent Decree this Court finds, that Settling Defendant is entitled, as of the Effective Date, to protection from contribution actions or

claims as provided by CERCLA Section 113(f)(2), 42 U.S.C. § 9613(f)(2) for matters addressed in this Consent Decree. Matters addressed in this Consent Decree include implementation of the remedial action at the LSSOU in accordance with the ROD and ESD, as well as the payment of Past, Interim and Future response costs to EPA pursuant to this Consent Decree.

91. Settling Defendant agrees that with respect to any suit or claim for contribution brought by it for matters related to this Consent Decree it will notify the United States in writing no later than 60 days prior to the initiation of such suit or claim.

92. Settling Defendant also agrees that with respect to any suit or claim for contribution brought against it for matters related to this Consent Decree it will notify the United States in writing within 10 days of service of the complaint on it. In addition, Settling Defendant shall notify the United States within 10 days of service or receipt of any Motion for Summary Judgment and within 10 days of receipt of any order from a court setting a case for trial.

93. In any subsequent administrative or judicial proceeding initiated by the United States for injunctive relief, recovery of response costs, or other appropriate relief relating to the LSSOU, Settling Defendant shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States in the subsequent proceeding were or should have been brought in the instant case; provided, however, that nothing in this Paragraph affects the enforceability of the covenants not to sue set forth in Section XXI (Covenants Not to Sue by Plaintiff).

XXIV. ACCESS TO INFORMATION

94. Settling Defendant shall provide EPA upon request with copies of all documents and information within its possession or control or that of its contractors or agents relating to activities at the LSSOU or to the implementation of this Consent Decree, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts,

reports, sample traffic routing, correspondence, or other documents or information related to the Work. Settling Defendant shall also make available to EPA for purposes of investigation, information gathering, or testimony, its employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

95. Business Confidential and Privileged Documents.

a. Settling Defendant may assert business confidentiality claims covering part or all of the documents or information submitted to Plaintiff under this Consent Decree to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Documents or information determined to be confidential by EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies documents or information when they are submitted to EPA, or if EPA has notified Settling Defendant that the documents or information are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such documents or information without further notice to Settling Defendant.

b. Settling Defendant may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Settling Defendant asserts such a privilege in lieu of providing documents, it shall provide Plaintiff with the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of the author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the contents of the document, record, or information: and (6) the privilege asserted by Settling Defendant. However, no documents, reports or other information created or generated pursuant to the requirements of the Consent Decree shall be withheld on the grounds that they are privileged.

96. No claim of confidentiality shall be made with respect to any data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or

engineering data, or any other documents or information evidencing conditions at or around the Site.

XXV. RETENTION OF RECORDS

97. Until 10 years after Settling Defendant's receipt of EPA's notification pursuant to Section XIV (Certification of Completion of the Work), Settling Defendant shall preserve and retain all non-identical copies of records and documents (including records or documents in electronic form) now in its possession or control or which come into its possession or control that relate in any manner to its liability under CERCLA with respect to the LSSOU. Settling Defendant must also retain, and instruct its contractors and agents to preserve, for the same period of time specified above all non-identical copies of the last draft or final version of any documents or records (including documents or records in electronic form) now in its possession or control or which come into its possession or control that relate in any manner to the performance of the Work, provided, however, that Settling Defendant (and its contractors and agents) must retain, in addition, copies of all data generated during the performance of the Work and not contained in the aforementioned documents required to be retained. Each of the above record retention requirements shall apply regardless of any corporate retention policy to the contrary.

98. At the conclusion of this document retention period, Settling Defendant shall notify the United States at least 90 days prior to the destruction of any such records or documents, and, upon request by the United States, Settling Defendant shall deliver any such records or documents to EPA. Settling Defendant may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Settling Defendant asserts such a privilege, it shall provide the Plaintiff with the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of the author of the document,

record, or information; (4) the name and title of each addressee and recipient; (5) a description of the subject of the document, record, or information; and (6) the privilege asserted by Settling Defendant. However, no documents, reports or other information created or generated pursuant to the requirements of the Consent Decree shall be withheld on the grounds that they are privileged.

99. Settling Defendant hereby certifies under penalty of perjury that, to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information (other than identical copies) relating to its potential liability regarding the LSSOU since notification of potential liability by the United States or the filing of suit against it regarding the Site and that it has fully complied with any and all EPA requests for information pursuant to Section 104(e) and 122(e) of CERCLA, 42 U.S.C. 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. 6927.

XXVI. NOTICES AND SUBMISSIONS

100. Whenever, under the terms of this Consent Decree, written notice is required to be given or a report or other document is required to be sent by one Party to another, it shall be directed to the individuals at the addresses specified below, unless those individuals or their successors give notice of a change to the other Parties in writing. All notices and submissions shall be considered effective upon receipt, unless otherwise provided. Written notice as specified herein shall constitute complete satisfaction of any written notice requirement of the Consent Decree with respect to the United States, EPA, and Settling Defendant, respectively.

As to the United States:

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
Re: DJ # 90-11-2-970/2

and

Director, Environmental Cleanup Office
United States Environmental Protection Agency
Region 10 (ECL-117)
1200 Sixth Avenue
Seattle, WA 98101

As to EPA:

Lynda Priddy
EPA Project Coordinator
United States Environmental Protection Agency
Region 10 (ECL-112)
1200 Sixth Avenue
Seattle, WA 98101

As to the Regional Financial Management Officer:

Financial Management Officer
United States Environmental Protection Agency
Region 10 (OMP-146)
1200 Sixth Avenue
Seattle, WA 98101

As to the Settling Defendant:

Gene S. Matsushita
Lockheed Martin Corporation
Energy, Enivronment, Safety & Health
2550 N. Hollywood Way, Suite 301
Burbank, CA 91505-1055

XXVII. EFFECTIVE DATE

101. The effective date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court, except as otherwise provided herein.

XXVIII. RETENTION OF JURISDICTION

102. This Court retains jurisdiction over both the subject matter of this Consent Decree and Settling Defendant for the duration of the performance of the terms and provisions of this

Consent Decree for the purpose of enabling any of the Parties to apply to the Court at any time for such further order, direction, and relief as may be necessary or appropriate for the construction or modification of this Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XIX (Dispute Resolution) hereof.

XXIX. APPENDICES

103. The following appendices are attached to and incorporated into this Consent Decree:

"Appendix A" is the SOW.

"Appendix B" is the ROD and ESDs.

XXX. COMMUNITY RELATIONS

104. Settling Defendant shall propose to EPA their participation in the community relations plan to be developed by EPA. EPA will determine the appropriate role for Settling Defendant under the Plan. Settling Defendant shall also cooperate with EPA in providing information regarding the Work to the public. As requested by EPA, Settling Defendant shall participate in the preparation of such information for dissemination to the public and in public meetings which may be held or sponsored by EPA to explain activities at or relating to the LSSOU.

XXXI. MODIFICATION

105. Schedules specified in this Consent Decree for completion of the Work may be modified by agreement of EPA and Settling Defendant. All such modifications shall be made in writing.

106. Except as provided in Paragraph 11 (Modification of the SOW or Related Work Plans), no material modifications shall be made to the SOW without written notification to and written approval of the United States, Settling Defendant, and the Court, if such modifications

fundamentally alter the basic features of the selected remedy within the meaning of 40 C.F.R. 300.435(c)(2)(B)(ii). Prior to providing its approval to any modification, the United States will provide the State with a reasonable opportunity to review and comment on the proposed modification. Modifications to the SOW that do not materially alter that document, or material modifications to the SOW that do not fundamentally alter the basic features of the selected remedy within the meaning of 40 C.F.R.300.435(c)(2)(B)(ii), may be made by written agreement between EPA and Settling Defendant.

107. Nothing in this Decree shall be deemed to alter the Court's power to enforce, supervise or approve modifications to this Consent Decree.

XXXII. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT

108. This Consent Decree shall be lodged with the Court for a period of not less than thirty (30) days for public notice and comment in accordance with Section 122(d)(2) of CERCLA, 42 U.S.C. § 9622(d)(2), and 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations which indicate that the Consent Decree is inappropriate, improper, or inadequate. Settling Defendant consents to the entry of this Consent Decree without further notice.

109. If for any reason the Court should decline to approve this Consent Decree in the form presented, this agreement is voidable at the sole discretion of any Party and the terms of the agreement may not be used as evidence in any litigation between the Parties.

XXXIII. SIGNATORIES/SERVICE

110. The undersigned representative of Settling Defendant and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice certify under penalty of perjury respectively, that he or she is fully authorized to enter into this Consent Decree and to execute and legally bind such Party to this document.

111. Settling Defendant hereby agrees not to oppose entry of this Consent Decree by

this Court or to challenge any provision of this Consent Decree unless the United States has notified Settling Defendant in writing that it no longer supports entry of the Consent Decree.

112. Settling Defendant shall identify, on the attached signature page, the name, address and telephone number of an agent who is authorized to accept service of process by mail on its behalf with respect to all matters arising under or relating to this Consent Decree. Settling Defendant hereby agrees to accept service in that manner and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure and any applicable local rules of this Court, including, but not limited to, service of a summons. The parties agree that Settling Defendant need not file an answer to the complaint in this action unless or until the court expressly declines to enter this Consent Decree.

XXXIV. Final Judgment

113. This Consent Decree and its appendices constitute the final, complete, and exclusive agreement and understanding between the parties with respect to the settlement embodied in the Consent Decree. The parties acknowledge that there are no representations, agreements or understandings relating to the settlement other than those expressly contained in this Consent Decree.

114. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment between the United States and Settling Defendant. The Court finds that there is no just reason for delay and therefore enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

SO ORDERED THIS __ DAY OF _____, 20__.

_____

United States District Judge

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of United States v. Lockheed Martin Corporation, relating to the Lockheed Shipyard Sediment Operable Unit of the Harbor Island Superfund Site.

FOR THE UNITED STATES OF AMERICA

5.15.03
Date

Tom Sansonetti
Thomas L. Sansonetti
Assistant Attorney General
Environment and Natural Resources Division
U.S. Department of Justice
Washington, D.C. 20530

5/21/03
Date

James L. Nicoll
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
NOAA GC-DOJ DARC
7600 Sand Point Way, NE
Seattle, WA 98115

Date

L. John Iani
Regional Administrator, Region X
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of United States v. Lockheed Martin Corporation, relating to the Lockheed Shipyard Sediment Operable Unit of the Harbor Island Superfund Site.

FOR THE UNITED STATES OF AMERICA

_____
Date

_____
Thomas L. Sansonetti
Assistant Attorney General
Environment and Natural Resources Division
U.S. Department of Justice
Washington, D.C. 20530

_____
Date

_____
James L. Nicoll
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
NOAA GC-DOJ DARC
7600 Sand Point Way, NE
Seattle, WA 98115

_____
Date

_____
L. John Iani
Regional Administrator, Region X
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

FOR LOCKHEED MARTIN CORPORATION

May 9.03
Date

Signature: Kenneth H. Measley
Name (print): Kenneth H. Measley
Title: Vice President, CEESH
Address: 6801 Rockledge Drive
Bethesda, MD 20817

Agent Authorized to Accept Service on Behalf of Above-signed Party:

Name (print): Ronald N. Helgerson
Title: Director of Remediation
Address: 6801 Rockledge Drive
Bethesda, MD 20817

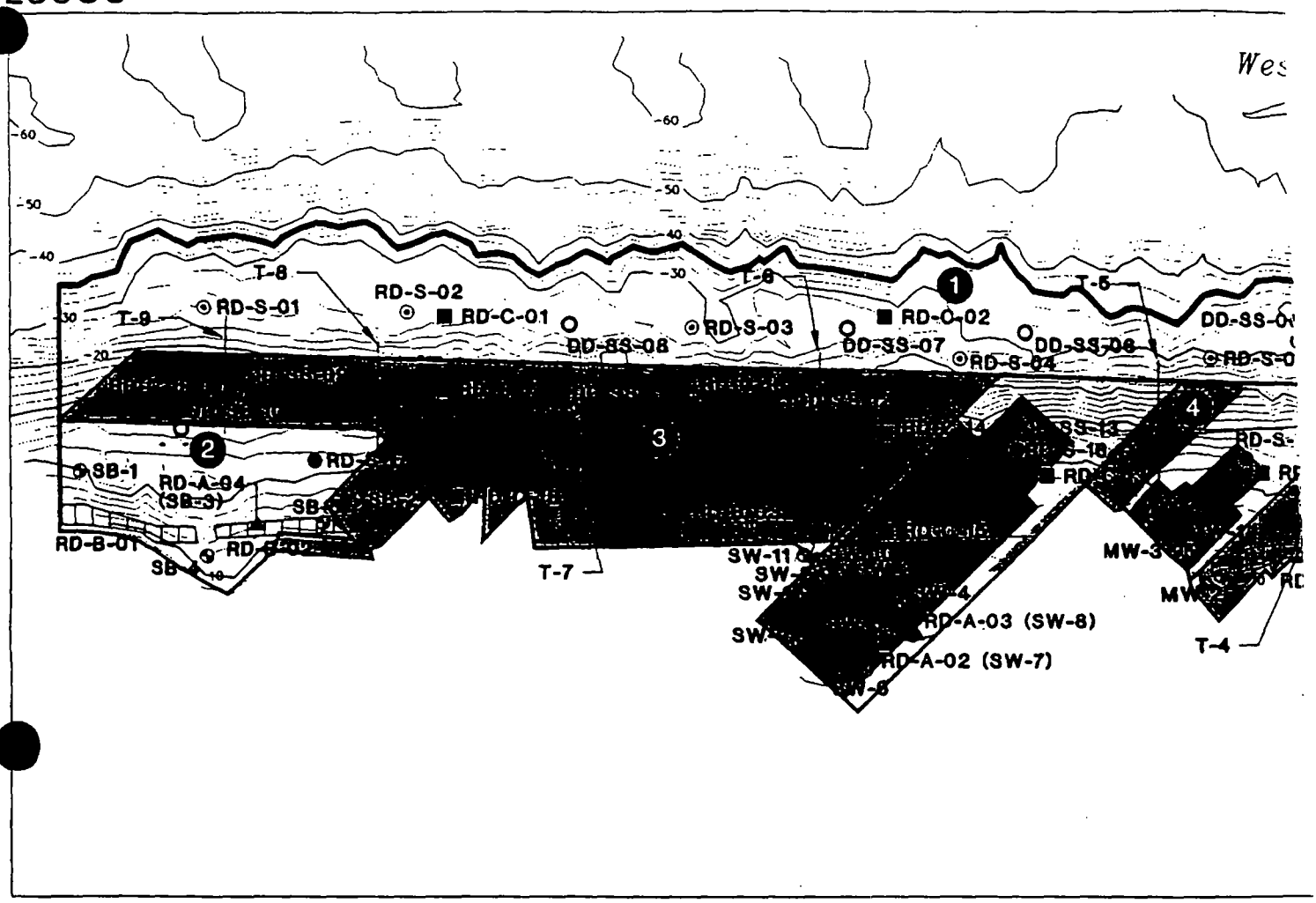
Ph. Number: (301) 214-9958

APPENDIX A

FIGURES

Sediment Management Units (SMUs) Map

LSSOU



Sample Type, Location, and Number

Remedial Design Investigation

▲ RD-A-01	Hand–Auger Chemistry Sample
■ RD-C-01	Subsurface Sediment Exploration
RD-B-01	Bank Composite
⊙ RD-S-01	Surface Chemistry/ Bioassay
● RD-S-09	Surface Chemistry
⊕ RD-S-10	Surface Chemistry (Mercury Only)
MW-2 SW-1 SB-1	Hand–Auger Exploration

Due Diligence Study

O DD-SS-01	Surface Chemistry
T-1	Diver Survey Transect

1	Sedim Locat
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	LSSOU (–36

Note: Base map pre Corp. entitled "Lockh

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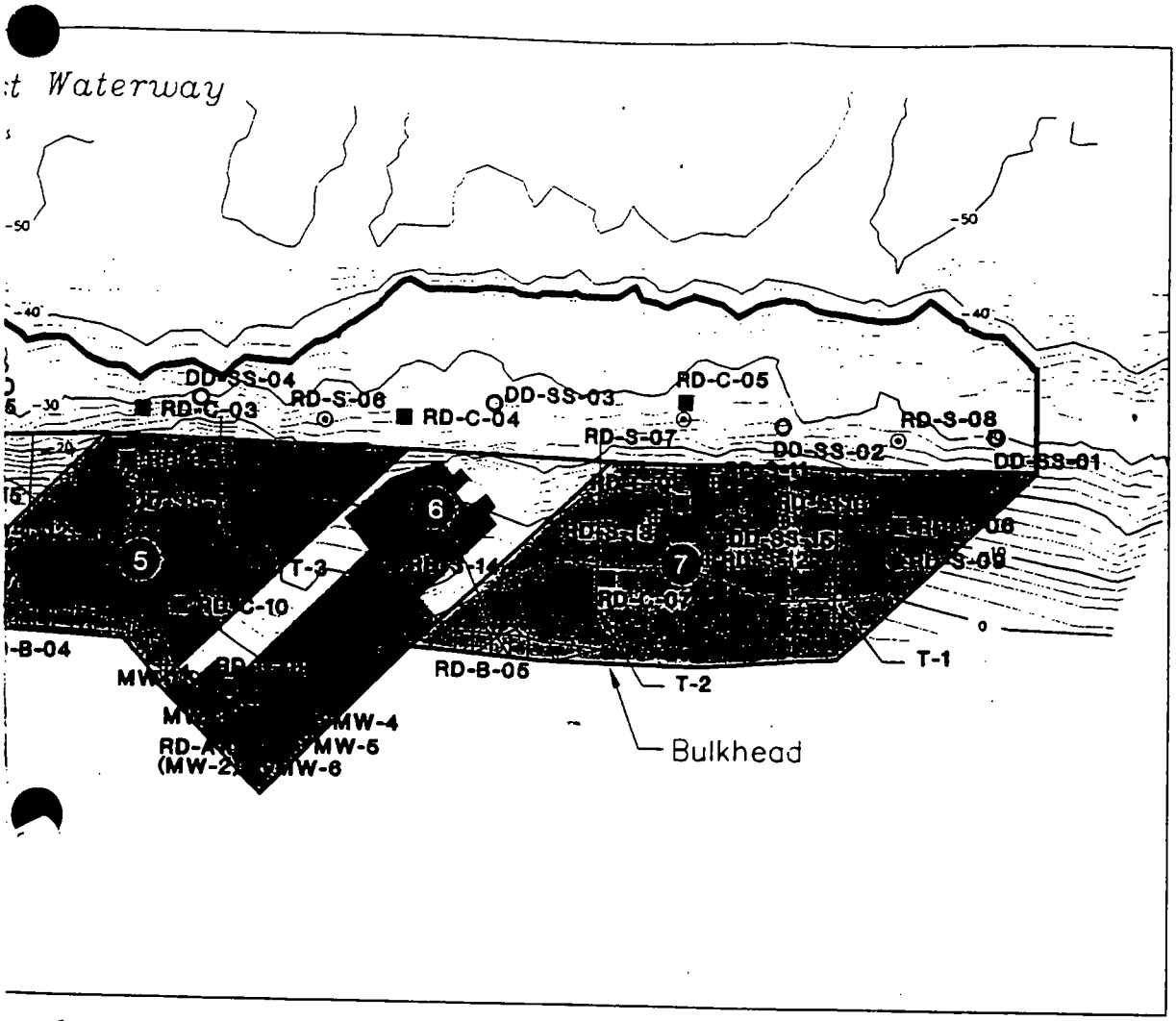


N

0 120 240

Scale in Feet

ıent Management Unit
ion and Number

ent Management Unit Boundary

structure

ay Structure

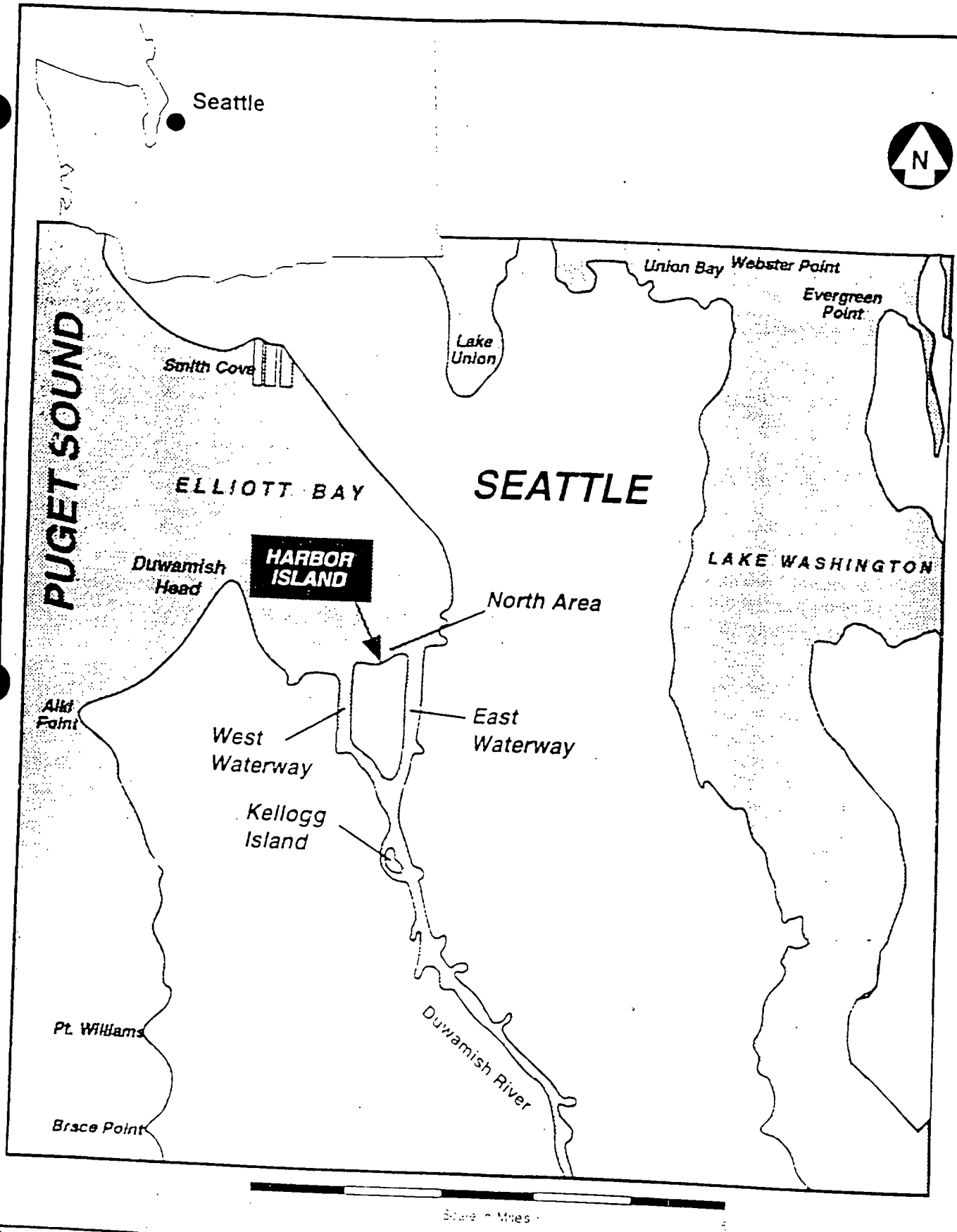
Boundary
Feet MLLW Port of Seattle Datum)

pared from drawing provided by Hartman Consulting
ee Ward", dated September 2, 1997.

HARTCROWSER

J-4249-18 1/00

Figure 3-1



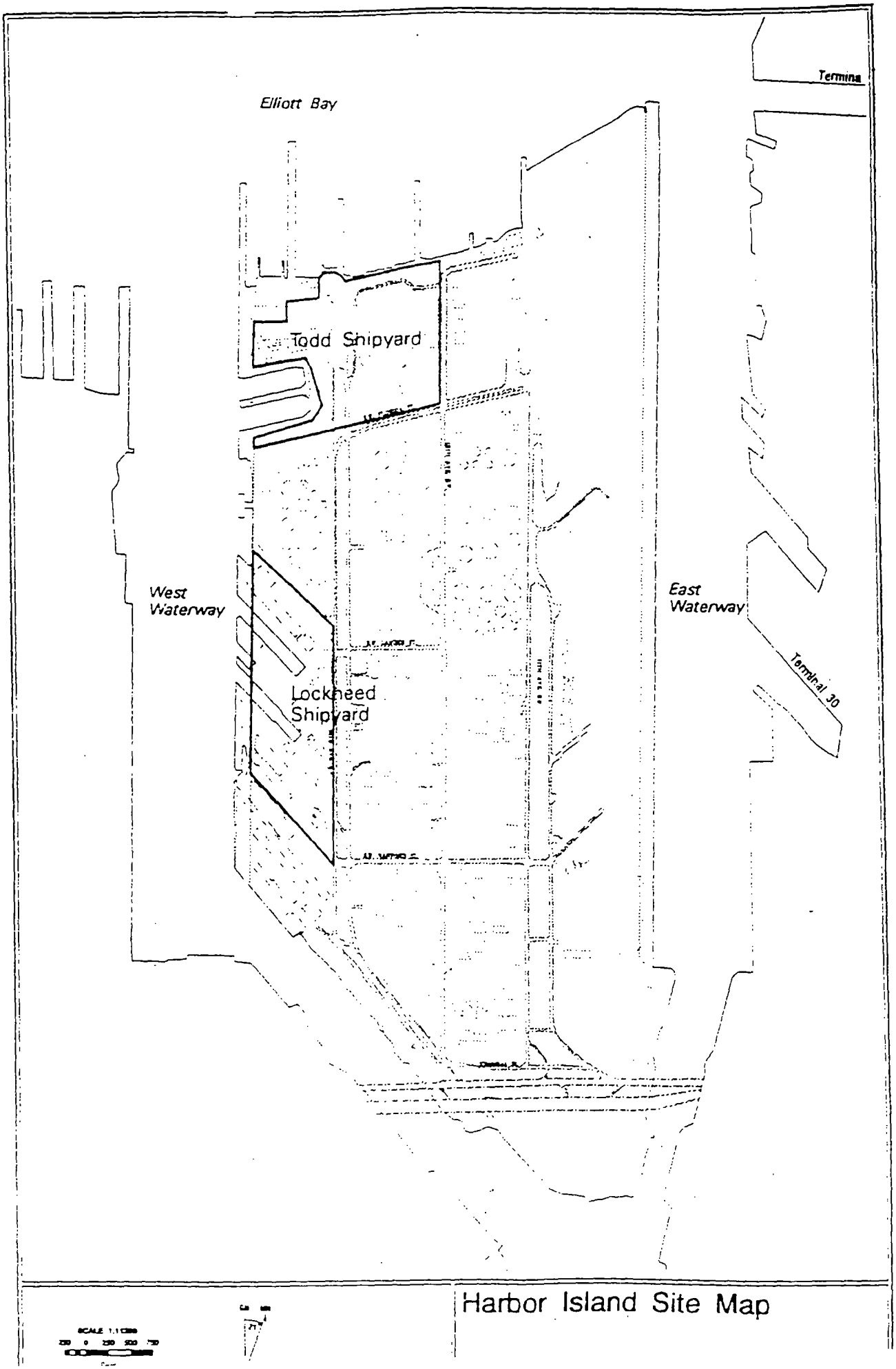
Vicinity Map

WESTON

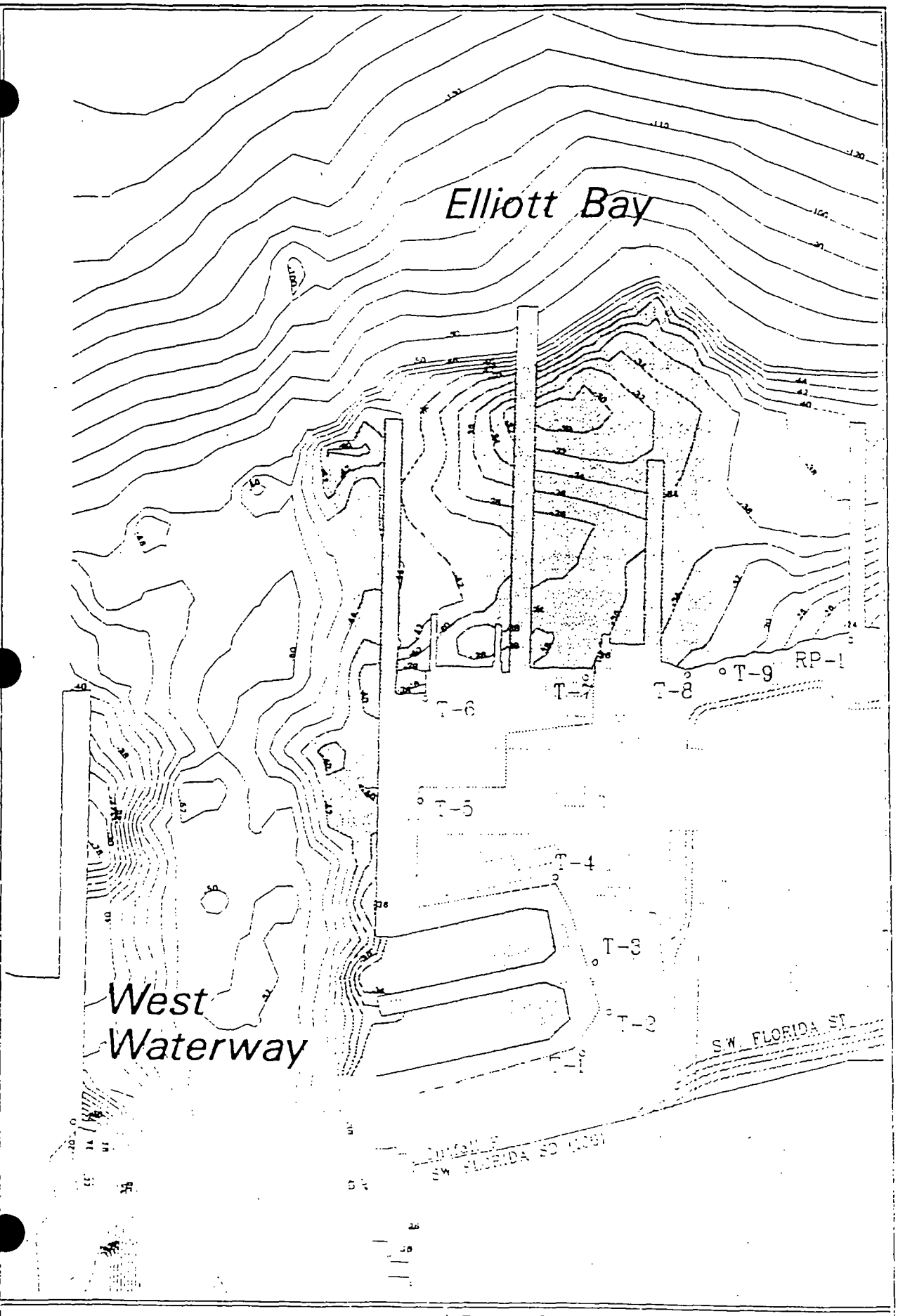
JOB NUMBER

DATE August 1994

FIGURE 1

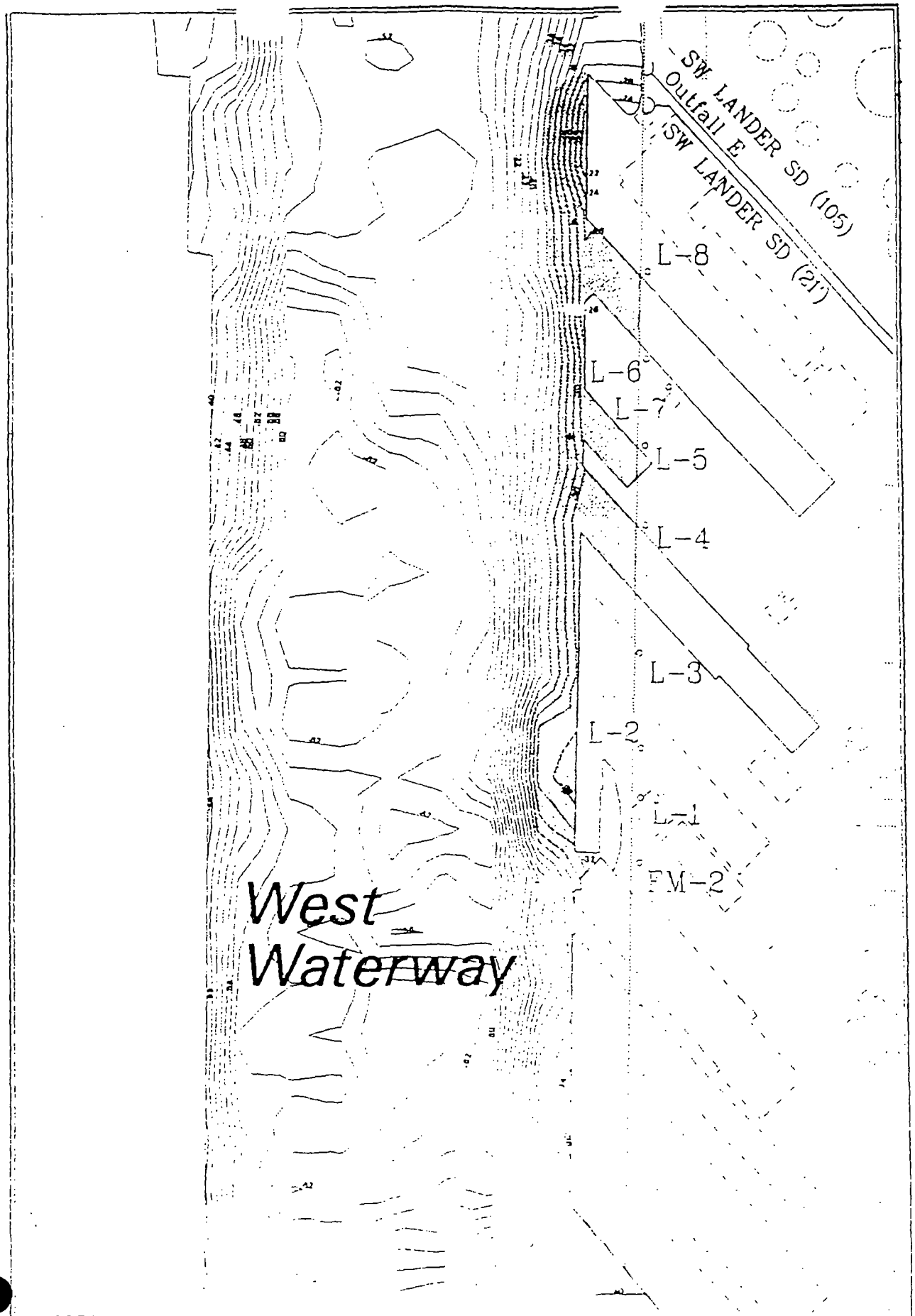


Harbor Island Site Map



Areas to be Remediated

Todd Shipyard Cleanup Area



Areas to be Remediated

Contour in Feet

Lockheed Shipyard
Cleanup Area

TABLES

Table 1. SMU 1 Subsurface Chemical Exceedances by Depth and Contaminant

Open Water Subsurface Sediments – SMU 1		
Sample No. and Interval in Feet of Depth Below the Mudline	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-C-01		
0.0 - 2.5	As, Cu, Hg, Zn, tPCBs	Cu, Hg
2.5 - 5.0	Cu, Hg, Zn, tPCBs	Cu, Hg
5.0 - 7.5		
RD-C-02		
0.0 - 2.5	Hg, Zn, tPCBs, LPAHs	Hg
2.5 - 5.0		
5.0 - 7.5	Hg, tPCBs	
7.5 - 10.0		
RD-C-03		
0.0 - 2.5	As, Cu, Pb, Hg, Zn, tPCBs	Cu, Pb, Hg, Zn
2.5 - 5.0	As, Cu, Pb, Hg, Zn, LPAHs	
5.0 - 7.5		As, Cu, Pb, Hg, Zn
RD-C-04		
0.0 - 2.5	Cu, Hg, Pb, Zn, tPCBs	Cu, Pb
2.5 - 5.0	As, Cu, Pb, Hg, Zn, tPCBs	As, Cu, Pb, Hg, Zn
5.0 - 7.5	As, Hg, Zn	Hg
RD-C-05		
0.0 - 2.5	Pb, Hg, Zn, tPCBs	Pb, Hg
2.5 - 5.0	Hg	Hg
7.5 - 10.0		

As - arsenic
Cu - copper
Hg - mercury
Pb - lead
Zn - zinc
tPCBs - total polychlorinated biphenyls
LPAHs - light polycyclic aromatic hydrocarbons
HPAHs - heavy polycyclic aromatic hydrocarbons

Blank line indicates that no exceedance was detected.

Table 2. SMUs 3, 5 and 7 Subsurface Chemical Exceedances by Depth and Contaminant

Under-Pier Subsurface Sediments – SMUs 3, 5 and 7		
Sample No. and Interval in Feet of Depth Below the Mudline	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-C-06		
0.0 - 2.5	Cu, Pb, Hg, Zn, tPCBs, HPAHs	Cu, Pb, Hg, Zn
2.5 - 5.0	As, Cu, Pb, Hg, Zn, tPCBs, HPAHs	As, Cu, Pb, Hg, Zn
5.0 - 7.5	Cu, Pb, Hg, Zn	Cu, Pb, Hg, Zn
RD-C-08		
0.0 - 2.5	As, Hg, Pb, Zn, tPCBs	As, Hg, Pb, Zn
2.5 - 5.0	As, Hg, Pb, Zn, tPCBs	Hg, Pb
5.0 - 7.5	As, Hg, Pb, Zn, tPCBs	As
RD-C-11		
0.0 - 2.5	As, Pb, Zn, tPCBs, HPAHs	Pb
2.5 - 5.0	As, Cu, Zn, tPCBs, LPAHs, HPAHs	As, Cu, Zn, LPAHs
5.0 - 7.5	As, Hg, tPCBs, HPAHS	Hg
RD-C-14		
0.0 - 2.5	As, Cu, Zn, LPAHs, HPAHs	As, Cu, Zn, LPAHs, HPAHs
2.5 - 5.0	As, Cu, Pb, Zn, tPCBs, LPAHs, HPAHs	As, Cu, Pb, Zn, LPAHs, HPAHs
5.0 - 7.5	As, Cu, PB, Zn, tPCBs, SVOCs	As, Cu, PB, Zn, SVOCs
RD-C-17		
0.0 - 2.5	As, Cu, Zn, HPAHs	As, Cu
2.5 - 5.0	As, Cu, Zn, LPAHS, HPAHS, tPCBs	As, Cu, Zn, LPAHS, HPAHS, tPCBs
5.0 - 7.5	As, Cu, Pb, Hg, Zn, tPCBs, LPAHs, HPAHs	Cu, Zn, LPAHS, HPAHS, tPCBs
10.0-12.5	Cu, Zn, tPCBs, LPAHs, HPAHs	Cu, Zn, tPCBs, LPAHs, HPAHs
RD-C-19		
7.5 - 10.0	As, Zn	As, Zn
10.0-12.5	As, Pb, Zn, tPCBs tPCBs	As, Pb, Zn

As - arsenic
Cu - copper
Hg - mercury
Pb - lead
Zn - zinc
tPCBs - total polychlorinated biphenyls
LPAHs - light polycyclic aromatic hydrocarbons
HPAHs - heavy polycyclic aromatic hydrocarbons

Table 3. SMUs 4 and 6 Subsurface Chemical Exceedances by Depth and Contaminant

Shipway Subsurface Sediments – SMU 4 and 6		
Sample No. and Interval in Feet of Depth Below the Mudline	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-C-09		
0.0 - 2.5	As, Cu, Zn, SVOCs	As, Cu, SVOCs
2.5 - 5.0	Cu, tPCBs, LPAHs, HPAHs	LPAHs, HPAHs, Cu
5.0 - 7.5	Pb, SVOCs	Pb, SVOCs
7.5 - 10.0	As, Cu, Zn, SVOCs	Cu, SVOCs
RD-C-12		
0.0 - 2.5	As, Cu, Zn	As, Cu, Zn
2.5 - 5.0	As, Cu, Pb, Zn	As, Cu, Zn
5.5 - 8.0	As, Cu, Hg, Pb, Zn, tPCBs, LPAHs, HPAHs	As, Cu, Zn, LPAHs, HPAHs
8.5 - 11.0	As, Cu, Hg, Pb, Zn, tPCBs, SVOCs	As, Cu, Pb, Zn, SVOCs
RD-C-13		
0.0 - 2.5	As, Cu, Pb, Zn, LPAHs, HPAHs	LPAHs, HPAHs
2.5 - 5.0	As, Cu, Hg, Pb, Zn	As, Cu, Hg, Pb, Zn
5.0 - 7.5	As, Cu, Pb, Zn, tPCBs, LPAHs, HPAHs	As, Cu, Pb, Zn
8.5 - 11.0	Hg, LPAHs, HPAHs	SVOCs
RD-C-15		
5.0 - 7.5	LPAHs, HPAHs	
7.5 - 10.0	SVOCs	SVOCs

As - arsenic
Cu - copper
Hg - mercury
Pb - lead
Zn - zinc
tPCBs - total polychlorinated biphenyls
LPAHs - light polycyclic aromatic hydrocarbons
HPAHs - heavy polycyclic aromatic hydrocarbons

Table 4. SMU 1 Surface Chemical Exceedances by Contaminant

Open Water – SMU 1		
Sample	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-S-01	tPCBs	
RD-S-02	Hg, tPCBs	
RD-S-03	tPCBs	
RD-S-04		
RD-S-05		
RD-S-06	tPCBs	
RD-S-07	Hg, tPCBs	
RD-S-08	Hg, Zn	Hg

Hg - mercury
tPCBs - total polychlorinated biphenyls

Blank line indicates that no exceedance was detected.

Table 5. SMU 1 Surface Biological Exceedances

Open Water - SMU 1	
Sample ID	**Bioassay Evaluation**
RD-S-01	Fails SQS
RD-S-02	Fails SQS
RD-S-03	Fails SQS
RD-S-04	Pass
RD-S-05	Fails SQS and CSL
RD-S-06	Fails SQS and CSL
RD-S-07	Fails SQS and CSL
RD-S-08	Fails SQS

Table 6. SMU 2 Surface Chemical Exceedances by Contaminant

Enclosed Water – SMU 2		
Sample	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-A-04	As, Cu, Pb, Zn, tPCBs	As, Cu, Pb, Zn
RD-B-01	As, Cu, ZN, tPCBs	As, Cu
RD-B-02	As, Cu, Pb, Zn	As, Cu, Pb, Zn
RD-S-17	As, Cu, Pb, Zn, tPCBs, LPAHs	As, Cu, Pb, Zn

As - arsenic
Cu - copper
Hg - mercury
Pb - lead
Zn - zinc
tPCBs - total polychlorinated biphenyls
LPAHs - light polycyclic aromatic hydrocarbons
HPAHs - heavy polycyclic aromatic hydrocarbons

Table 7. SMUs 3, 5 and 7 Surface Chemical Exceedances by Contaminant

Under-Pier Surface Sediments – SMU 3		
Sample	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-B-03	As, Pb, Zn	Pb, Zn
Under-Pier Surface Sediments – SMU 5		
Sample	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-B-05	As, Cu, Zn	As, Cu
Under-Pier Surface Sediments – SMU 7		
Sample	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-B-05	no exceedances	no exceedances
RD-S-9	As, Cu. Hg, Pb, Zn, tPCBs	As, Cu. Hg, Pb, Zn, tPCBs
RD-S-10 (only sampled for Hg)	Hg	Hg
RD-S-11 (only sampled for Hg)	Hg	Hg
RD-S-12 (only sampled for Hg)		
RD-S-13 (only sampled for Hg)	Hg	Hg

Blank line indicates that no exceedance was detected.

Table 8. SMUs 4 and 6 Surface Chemical Exceedances by Contaminant

Shipway Surface Sediments – SMUs 4 and 6		
Sample	Contaminant Exceeding Chemical SQS	Contaminant Exceeding Chemical CSL and SQS
RD-S-14	Cu, Zn	Cu
RD-S-15	As, Cu, Zn, SVOCs	As, Cu, Zn, SVOCs
RD-S-16	As, Cu, Zn, HPAHs	As, Cu, Zn
RD-A-01	As, Zn, SVOCs, tPCBs	SVOCs
RD-A-02	As, Cu, Zn, LPAHs, HPAHs	As, Cu, Zn, LPAHs, HPAHs
RD-A-03	As, Zn	As, Zn

As - arsenic
Cu - copper
Hg - mercury
Pb - lead
Zn - zinc
tPCBs - total polychlorinated biphenyls
LPAHs - light polycyclic aromatic hydrocarbons
HPAHs - heavy polycyclic aromatic hydrocarbons

Table 9. Comparison of Bioaccumulation Test Concentrations and Concentration of Analytes at RD-S-04

Open Water Surface Sediment – SMU 1 – Station RD-S-04		
Analyte	**Range of Bioaccumulation Test Concentrations**	**Concentration of Analytes at RD-S-04**
mercury	1.42 to 2.30 mg/kg DW[11]	0.41 mg.kg DW
tPCBs	0.10 to 87.90 mg/kg OC[12]	10.5 mg/kg OC
TBT (cation)	17.33 to 218.75 mg/kg OC[13]	112.9 mg/kg OC

[11] Applicable only to range of concentrations for the West Waterway Sediment Operable Unit.

[12] Same as footnote 11.

[13] Range of concentrations tested for bulk sediment in the West Waterway Sediment Operable Unit and the open water SMU at the Lockheed Shipyard Sediment Operable Unit and selected for bioaccumulation testing.

Table 10. Strategies Considered by EPA for Cost, Benefit, Technical Feasibility Evaluation

Strategy	Under-Pier (SMUs 3, 5 and 7)	Shipways (SMUs 4 and 6)	Enclosed Water (SMU2)	Open Water (SMU 1)
1	dredge to CSL/max. feasible depth[14] and cap surface areas > SQS	dredge to CSL/max. feasible depth[15] and cap surface areas > SQS	dredge to CSL/max. feasible depth[16] and cap surface areas > SQS	dredge to CSL/max. feasible depth[17] and cap surface areas > SQS
16	cap across SMUs	cap across SMUs	cap across SMU	cap across SMU
18A	dredge 3.5 ft and cap across SMUs[18]	dredge 3.5 ft and cap across SMUs[19]	dredge 3.5 ft and cap across SMU[20]	dredge 3.5 ft and cap across SMU
18B	" "	" "	" "	3.5 ft cap across SMUs
18C	" "	" "	" "	dredge to SQS; no cap required
18D	" "	" "	" "	dredge to CSL, cap surface areas > SQS

[14] The "maximum feasible depth" assumes that sediments can be dredged to a maximum 2H:1V slope perpendicular to the bulkhead, beginning at an elevation of 10 feet at the bulkhead. For SMUs 2-7, some sediments exceeding the CSL probably would remain in place because the depth of contamination > CSL is deeper than the maximum feasible dredge depth.

[15] Same as 14

[16] Same as 14

[17] The dredge depth obtainable in the open water (SMU 1) adjacent to the pier face may be limited by the remedial option applied to the under-pier area. EPA assumes that all sediments > CSL will be dredged in the open water SMU.

[18] Explorations indicate that surficial waste and AGB are generally limited to the upper 3 feet and upper 5 feet, respectively, in the nearshore areas of the enclosed water and the under-pier/shipway SMUs. Therefore, a 3.5-foot dredge cut in these SMUs should remove most surficial waste and AGB.

[19] Same as 18.

[20] Same as 18

Table 11. Estimated Remedial Cost by Strategy Compared with Dredge and Cap Volumes

Strategy	Dredge Volume (cy)	Cap Volume (tons)	Remedial Cost ($ million in (1999 Dollars)
1	209,800	85,120	$23.7
16	n/a	85,120	$7.0
18A	47,388	85,119	$13.0
18B	26,288	85,119	$10.9
18C	46,625	53,429	$12.0
18D	40,329	85,212	$12.3

Table 12. Comparison of Benefits by Strategy

Benefit	Strategy					
	1	16	18A	18B	18C	18D
Largest % of contamination and waste are removed	X					
Significant amounts of contaminated sediments and waste are removed from the marine environment	X		X	X	X	X
All contaminated sediments and waste are removed in the open water area					X	
All CSL exceedances are removed in the open water area					X	X
Least costly strategy		X				
Lowest long-term monitoring costs (due to off-site confinement of all contaminated sediment and waste)	X					
Lowest long-term monitoring costs in open water area					X	
Least short-term impact due to no dredging		X				
Shortest time for implementation due to no dredging requirement		X				
Increases existing water column/depth in the open water area with inherent positive effect on navigational issues					X	
Maintains existing water column depth in the enclosed water, shipway, and under-pier areas			X	X also in open water	X	X
Maintains existing bathymetry in the enclosed water, shipway, and under-pier areas			X	X also in open water	X	X
Maintains options for marine commerce	X		X	X	X	X

Table 13. Comparison of Estimated Depth of Contamination and Estimated Volume to Dredge and Cap in the 1996 ROD and the 2001 ESD

Lockheed Shipyard Sediment Operable Unit (LSSOU)	1996 ROD estimated depth of contamination	2001 ESD estimated depth of contamination	1996 ROD estimated volume to dredge/cap	2001 ESD estimated volume to dredge/cap
	3-5 feet below the mudline	2.5 - 12.5 + feet below the mudline	18,000 cubic yards to dredge; 11,000 cubic yards of capping material (Note: The ROD only provides quantities and cost estimates for the open water area.)	46,625 cubic yards to dredge; 11,100 cubic yards of surficial debris removal; 53,429 cubic yards of capping material

Table 14. Comparison of Estimated Remedial Cost in the 1996 ROD and the 2001 ESD

Lockheed Shipyard Sediment Operable Unit (LSSOU)	1996 ROD estimated design and construction cost (1996 $ million)	2001 ESD estimated design and construction cost (1999 $ million)
	$ 1.5 (incomplete estimate)	$12.0

CSL EXCEEDANCE RATIO

Appendix A

EXPLANATION OF SIGNIFICANT DIFFERENCES

LOCKHEED SHIPYARD SEDIMENT OPERABLE UNIT
HARBOR ISLAND SUPERFUND SITE

FEBRUARY 2002

U.S. Environmental Protection Agency
Region 10
Office of Environmental Cleanup

Table Of Contents

I. Introduction 1
- A. Purpose 1
- B. Lead and Support Agencies 1
- C. Statutory Authorities for the Explanation of Significant Differences 1
- D. Administrative Record 2

II. Background 2
- A. Site Name, Location and History 2
- B. Nature and Extent of Contamination 3
- C. Shipyard Sediment Operable Unit Record of Decision. 4

III. Pre-Remedial Design Data Collection, Interpretation and Evaluation 5
- A. Delineation of Sediment Management Units and Location and Depth of Chemical and Biological Exceedances 5
  - 1. Subsurface Data 6
  - 2. Surface Data 7
  - 3. Bioaccumulation Data 7
  - 4. Summary 9
- B. Shipyard Waste, Abrasive Grit Blast and Shipyard Debris Definitions 9
- C. Dredge and Cap Strategies Considered for Cost, Benefit and Technical Feasibility Evaluation 10
  - 1. Technical Feasibility 12
  - 2. Costs 12
  - 3. Benefits 13

IV. Description of and Basis for the Significant Differences 14
- A. Introduction 14
- B. Definitions for Shipyard Waste, Abrasive Grit Blast and Shipyard Debris 14
  - 1. Abrasive Grit Blast 15
  - 2. Shipyard Debris and Other Shipyard Waste 15
- C. EPA Proposed Strategy: Dredge Depths and Cap Locations by SMU 16
  - 1. In the Under-pier, Shipway and Enclosed Water Areas 16
  - 2. In the Open Water Areas 17
- D. Remedial Costs 17
- E. Future Site Use 18

F. Upland Groundwater Assessment of Source Control..... 19
G. Summary and Basis of Remedial Strategy, 18C, Selection..... 19

V. Affirmation of Statutory Determinations..... 23

VII. Public Participation Activities..... 23

Bibliography..... 25

Figures

- Figure 1 - Harbor Island Vicinity Map..... F1
- Figure 2 - Harbor Island Site Map..... F2
- Figure 3 - Lockheed Shipyard Cleanup Area..... F3
- Figure 4 - Lockheed Shipyard Sediment Management Units... F4
- Figure 5 - Sampling Location Map..... F5

Tables

- Table 1 - SMU 1 Subsurface Chemical Exceedances by Depth and Contaminant..... T1
- Table 2 - SMUs 3, 5 and 7 Subsurface Chemical Exceedances by Depth and Contaminant..... T2
- Table 3 - SMUs 4 and 6 Subsurface Chemical Exceedances by Depth and Contaminant..... T3
- Table 4 - SMU 1 Surface Chemical Exceedances by Contaminant..... T4
- Table 5. SMU 1 Surface Biological Exceedances..... T5
- Table 6. SMU 2 Surface Chemical Exceedances by Contaminant..... T6
- Table 7. SMUs 3, 5 and 7 Surface Chemical Exceedances by Contaminant..... T7
- Table 8. SMUs 4 and 6 Surface Chemical Exceedances by Contaminant..... T8
- Table 9. Comparison of Bioaccumulation Test Concentrations and Concentration of Analytes at RD-S-04..... T9
- Table 10. Strategies Considered by EPA for Cost, Benefit, Technical Feasibility Evaluation..... T10
- Table 11. Estimated Remedial Costs by Strategy Compared with Dredge and Cap Volumes..... T11
- Table 12. Comparison of Benefits by Strategy..... T12

- Table 13. Comparison of Estimated Depth of Contamination and Estimated Volume to Dredge and Cap in the 1996 ROD and the 2001 ESD..... T13
- Table 14. Comparison of Estimated Remedial Cost in the 1996 ROD and the 2001 ESD..... T14

Appendices

- Appendix A. CSL Exceedance Ratio..... A1
- Appendix B. Technical Feasibility..... B1
- Appendix C. Cost Tables by Strategy..... C1
- Appendix D. Responsiveness Summary..... D1

EXPLANATION OF SIGNIFICANT DIFFERENCES TO THE LOCKHEED SHIPYARD SEDIMENT OPERABLE UNIT SEATTLE, WASHINGTON

SELECTED REMEDIAL STRATEGY

I. Introduction

A. Purpose

The purposes of this Explanation of Significant Differences (ESD) are: (1) to further define, update and expand upon the remedial parameters for the Shipyard Sediment Operable Unit (SSOU)[1] of the Harbor Island Superfund Site described in the November 1996 Record of Decision (ROD), based on additional information gathered during pre-remedial design activities[2] associated with Lockheed Shipyard sediments; (2) to select a strategy for implementing the remedy; and (3) document those instances where the ESD-selected strategy to implement the remedy differs from the remedy selected in the ROD.

B. Lead and Support Agencies

U.S. Environmental Protection Agency (EPA) – Lead Agency for sediment remediation

State of Washington, Department of Ecology – Support Agency for sediment remediation; Lead Agency for upland remediation

C. Statutory Authorities for the Explanation of Significant Differences

Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9617(c), and Section 300.435(c)(2) of the National Oil and Hazardous Substances Contingency Plan (NCP), authorize changes to the selected remedial action after issuance of a ROD. This ESD documents refinements to the selected remedial action for the Lockheed Shipyard Sediment Operable Unit.

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[1] Since divided into the Lockheed Shipyard Sediment Operable Unit and Todd Shipyard Sediment Operable Unit. This ESD addresses the Lockheed Shipyard Sediment Operable Unit only.

[2] Pre-remedial design activities refer to data gathering and analysis performed post-ROD to define the nature and extent of contamination. The pre-remedial design data supplements the remedial investigation and feasibility data for the Harbor Island Superfund Site.

D. Administrative Record

This ESD with Response to Public Comments, the draft ESD, the Fact Sheet announcing the public comment period for the ESD, the Record of Decision, the Remedial Design Data Investigation Report, draft Final Basis of Design Report and draft Final Basis of Design Technical Memorandum, and other reports and information related to the Lockheed Shipyard Sediment Operable Unit are part of the administrative record for the Site. The administrative record is available for public review at the following location:

Environmental Protection Agency
1200 Sixth Avenue, 7th floor
Seattle, Washington
(206) 553-4494

II. Background

A. Site Name, Location and History:

Harbor Island is located approximately one mile southwest of downtown Seattle, in King County, Washington, and lies at the mouth of the Duwamish River on the southern edge of Elliott Bay (Figure 1). The island is man-made and has been used for industrial purposes since about 1912. The island is approximately 430 acres in size and is bordered by the East Waterway and West Waterway of the Duwamish River and by Elliott Bay to the north. Major features of Harbor Island, including the locations of the Todd and Lockheed shipyards, are shown in Figure 2.

Prior to 1885, the area that is currently Harbor Island consisted of tideflats and a river mouth delta with some piling-supported structures. Initial construction of the island began between 1903 and 1905 when dredging of the East and West waterways and the main navigational channel of the Duwamish River occurred. Dredged sediment was spread across the present island area to form a fill 5 to 15 feet thick. This dredged sediment was later covered with soil and demolition debris from Seattle regrade projects.

Since its construction, the island has been used for commercial and industrial activities. Major activities have included ocean and rail transport operations, bulk petroleum storage and transfer, a secondary lead smelter, metal fabrication, and shipbuilding and repair. Warehouses, laboratories, and office buildings also have been located on the island. The Harbor Island Superfund Site was listed on the National Priorities List (NPL) in 1983, due to the release of lead from a secondary lead smelter on the island, as well as the release of other hazardous substances from other industrial operations on the island.

The Harbor Island Superfund Site is divided into seven operable units: (1) the petroleum storage tank facilities operable unit (OU), (2) the Soil/Groundwater OU, (3) the Lockheed Shipyard OU, (4) the Lockheed Shipyard Sediment Operable Unit[3], (5) the Todd Shipyard Sediments Operable Unit, (6) the East Waterway Sediment OU, and (7) the West Waterway Sediment OU. The Todd Shipyard Sediment Operable Unit includes nearshore sediments at Todd Shipyards out to the edge of the steep slopes of Elliott Bay (to the north) and the West Waterway (to the west), which occur approximately at the minus 42 (-42) foot Mean Lower Low Water (MLLW) contour, as shown in Figure 3. The Lockheed Shipyard Sediment Operable Unit includes nearshore sediments at Lockheed Shipyard out to the edge of the steep slope of the West Waterway, which occurs at approximately the minus 36 (-36) foot MLLW contour, as shown in Figure 4. These sediments are distinct from other contaminated sediments at Harbor Island because they are predominantly contaminated with hazardous substances and shipyard wastes (primarily abrasive grit blast (AGB)) released by shipbuilding and maintenance operations at Todd and Lockheed shipyards. Hazardous substances released from these shipyards include arsenic, copper, lead, mercury, tributyltin (TBT), and zinc, which were additives to marine paints used on ships. Other hazardous substances potentially associated with shipyard activities include polychorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs).

B. Nature and Extent of Contamination

An initial investigation of marine sediments around Harbor Island was completed by EPA in 1988 as part of the Elliott Bay Action Program. The nature and extent of contamination in Harbor Island sediments was characterized in a Remedial Investigation (RI) Report issued by EPA in September 1994. A Supplementary RI Report conducted by a group of Potentially Responsible Parties (PRPs) in 1995 further characterized the extent of chemical contamination in Harbor Island sediments and reported results of biological effects tests conducted on these sediments.

Evidence for adverse effects in benthic organisms due to contaminants in the SSOU have been demonstrated by exceedances of effects-based chemical thresholds, bioassays, and a mussel bioaccumulation study. The mussel study results further indicated that copper, lead, zinc, and TBT in the SSOU sediments are biologically available and bioaccumulate in mussels, causing adverse effects on these organisms.

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[3] At the time of the ROD, Todd and Lockheed Shipyard Sediment Operable Units were part of the Shipyards Sediments Operable Unit (SSOU). EPA created the Lockheed and Todd Shipyard Sediment Operable Units from the SSOU because they have different remedial issues that are better addressed as separate OUs.

The average risk from consumption of Elliott Bay fish was found to be 3 in 10,000 (3.0E-04) and high risk was found to be 4 in 1,000 (4.0E-03). Both of these risk levels exceed the acceptable excess cancer risk of 1 in 10,000 (1.0E-04) identified in the National Contingency Plan. The primary contaminant of concern for the human fish consumption risk is PCBs.

C. Shipyard Sediment Operable Unit Record of Decision

The ROD concluded that actual or threatened releases of hazardous substances from the SSOU may present an imminent and substantial endangerment to human health and the environment. The cleanup objective for the Lockheed Shipyard Sediment Operable Unit is to reduce concentrations of hazardous substances to levels which will have no adverse effect on marine organisms. The ROD further states that "current standards for PCBs are not intended to be protective of human health from bioaccumulation of PCBs in seafood. Also, there are no standards for TBT, which is toxic to marine organisms. The ROD does not establish TBT or PCB bioaccumulation cleanup goals" for the Lockheed Shipyard Sediment Operable Unit.

EPA's November 1996 ROD for the SSOU for the Harbor Island Superfund Site selected a remedy involving five essential elements:

(1) dredging to remove shipyard waste and contaminated sediments exceeding the cleanup screening level (CSL) of the State of Washington Sediment Management Standards (SMS);
(2) capping contaminated sediments exceeding the sediment quality standards (SQS) of the SMS;
(3) identification of acceptable disposal options;
(4) specification of design criteria for acceptable habitat and to prevent future recontamination; and
(5) institution of long-term monitoring and maintenance of the remedy.

The ROD also identified eight remedial design objectives which are to:

(1) identify sediment contamination exceeding the CSL and SQS;
(2) conduct confirmatory biological effects tests (optional);
(3) characterize dredged sediments;
(4) evaluate armoring of any caps;
(5) conduct habitat inventory;
(6) evaluate potential disposal sites;
(7) evaluate physical separation technologies for shipyard waste; and
(8) determine the extent of dredging under-pier sediments.

Additionally, the ROD notes that "(t)he extent of dredging of contaminated sediments and waste under piers at .... Lockheed Shipyard will be determined during remedial design based on cost, benefit and technical feasibility."

Therefore, prior to the start of 30 percent remedial design, additional data gathering and analyses were conducted to determine the extent of contamination. This additional information was used to further refine capping and/or dredging locations based on criteria outlined in the ROD. EPA presented this data with six responsive strategies in a draft of this ESD. A 30-day public comment period yielded comments and EPA responses are attached to this ESD as Appendix D.

Also, the cost estimated in the ROD to implement the remedy is low. The cost estimate only included the cost of remediating the open water sediment management unit (SMU) and did not include costs for remediation of the majority of the Lockheed Shipyard Sediment Operable Unit. EPA concluded in the ROD that remediation parameters for the remainder of the Lockheed Shipyard Sediment Operable Unit would be determined during remedial design based on information gathered post-ROD. Consequently, the vast majority of the costs of remediation were not known at the time of the ROD.

III. Pre-Remedial Design Data Collection, Interpretation and Evaluation

The purpose of this section is to summarize data that was gathered and analyzed after the ROD was issued. In the ROD, EPA concluded that additional information is required to more fully define the dredge and cap remedies. For example, a more detailed understanding of the locations of CSL exceedances was needed before a dredging plan could be developed. Also, as stated in the ROD, the extent of under-pier remediation was not determined and was left to later in remedial design work based on consideration of cost, benefits, and technical feasibility.

Some of the remedial design objectives (1, 2, and 8 above) also describe some of the types of pre-remedial design information to be collected and evaluated before remedial design could begin. Specifically, more detailed information concerning surface and subsurface contamination, the locations of CSL and SQS exceedances, the definition of shipyard waste including AGB, the future use of the former Lockheed Shipyard, the technical feasibility of deep dredging and pier and piling removal, and benefits and costs associated with technically feasible remedial strategies for implementing the dredge and cap remedy. This information was gathered, evaluated and presented in several documents: Data Investigation Report (Hart Crowser, February 1999), Basis of Design Report (BDR; Hart Crowser, January 2000) and the Basis of Design Technical Memorandum (BDR TM; Hart Crowser, April 2000). This information is summarized in the following sections.

A. Delineation of Sediment Management Units and Location and Depth of Chemical and Biological Exceedances

The purpose of this subsection is to provide data that characterizes the nature and extent of contamination at the Lockheed Shipyard Sediment Operable Unit.

This data provides more information about the contaminants, depth of contamination, and the location of contamination. The area identified as contaminated and subject to remediation is often broken up into Sediment Management Units (SMUs) for remedial design and action purposes. An SMU is an area that has similar remedial characteristics or problems. The Lockheed Shipyard Sediment Operable Unit was delineated into seven SMUs. The various SMUs at the Lockheed Shipyard Sediment Operable Unit are illustrated in Figure 5.

The open water SMU, identified as SMU 1, is the area running the length of the piers, outward from the pier face to the edge of the steep slope of the West Waterway at approximately -36 feet (MLLW). SMU 1 consists of unobstructed open water. The enclosed water SMU, SMU 2, is behind Pier 9. This is also an unobstructed area of open water that is bounded by the bank or bulkhead on one side and pier structures on two sides. SMUs 3, 5 and 7 designate sediment areas under the pier structure. Sediments under the shipways are designated as SMUs 4 and 6. Shipways are ramps that are used to move ships out of the water. These ramps contain decking like the pier structures and are held up by a highly dense concentration of pilings.

Site-specific data delineating areas of the Lockheed Shipyard Sediment Operable Unit exceeding the CSL and SQS is summarized in Tables 1 through 8. Figure 5 shows sampling locations. These data are summarized below for the various SMUs.

1. Subsurface Data

The concentrations of chemical constituents exceeding the CSL and SQS are generally distributed homogeneously throughout the under-pier, shipways, enclosed water and open water areas. For example, generally all contaminants are found throughout a SMU or the OU in general without any one contaminant being associated with any particular area.

The locations of the CSL exceedances in the open water SMU are not as deep as the CSL exceedances in the under-pier or shipway SMUs. CSL exceedances in the open water SMU generally extend to 5 feet below the mudline for 3 of 5 core samples (Table 1). The fourth core sample shows an exceedance of the CSL at 2.5 feet. The fifth core sample exceeds the CSL to at least 7.5 feet[4]. Also, in the open water SMU, 4 of the 5 core samples have CSL exceedances at depths that coincide generally with the depth of SQS exceedances.

[4] The depth of contamination is known for all cores in the open water SMU except sampling station RD-C-04. Analysis of the deepest core sample for C-04 showed an exceedance of the CSL for mercury.

Some of the CSL exceedances in the under-pier areas (SMUs 3, 5 and 7) extend to greater than 12.5 feet below the mudline (Table 2). Sediments under the two northernmost sections of Pier 11 have contamination to at least 7.5 feet for both CSL and SQS exceedances. Sediments under the shipways (SMUs 4 and 6) exceed the CSL to at least 10 feet below the mudline (Table 3).

Data was not provided to characterize the depth of contamination in the enclosed water SMU. EPA will assume that the nature and extent of contamination in the subsurface enclosed water SMU is the same as the nature and extent of contamination in the subsurface under-pier SMU 3 surrounding the enclosed water SMU which was sampled at 12.5 feet and 10.0 feet below mudline (i.e., stations RD-C-17 and RD-C-19).

Appendix A provides a detailed summary of contaminant concentrations relative to depth of sample interval at each sampling station. The data also include the CSL Exceedance Ratio, which illustrates the magnitude of CSL exceedances.

2. Surface Data

Surface sediment chemistry data for the open water SMU indicates that the CSL is exceeded at 1 of 8 sample locations and the SQS at 6 of 8 sample locations (see Table 4). Biological tests were performed using surface samples from the 8 sample sediment locations. Of the 8 biological tests, 3 failed the CSL and 7 failed the SQS (see Table 5). One station in the open water SMU, RD-S-04, passed both the chemical and biological SQS and CSL.

The biological CSL failures were for sediments located in the northern half of the open water SMU 1. Sample locations for SQS biological test failures were in the southern third of the open water SMU 1.

All surface sediment samples in the enclosed water SMU 2 and shipway SMUs 4 and 6 exceed the CSL as did 4 of the 5 surface sediment samples for the under-pier SMUs 3, 5 and 7. One station in the under-pier SMU, RD-S-12, passed both the chemical SQS and CSL; however, this station was sampled only for mercury. Tables 6, 7 and 8 summarize the surface sediment chemistry data for these SMUs.

3. Bioaccumulation Data

The West Waterway Operable Unit sediment data gathering for assessing human and marine ecological effects associated with exposure to bioaccumulative chemicals (i.e., TBT, PCBs, and mercury) included

sample locations in the open water SMU at the Lockheed Shipyard Sediment Operable Unit. The TBT field and laboratory study evaluated ecological impacts associated with exposure to TBT in sediments. Sediments at 30 stations in West Waterway, including some stations within the Lockheed Shipyard Sediment Operable Unit, were collected and analyzed for bulk sediment and porewater concentrations of TBT. Next, sediments from 20 were submitted for bioaccumulative tests. Laboratory bioaccumulation tests were performed using clams and worms exposed to selected West Waterway and Lockheed Shipyard Sediment Operable Units' sediments. The resulting concentrations of TBT in the tissues of both test organisms were measured. None of the measured concentrations of TBT in tissue exceeded the EPA Superfund site-specific tissue trigger value of 0.6 ug/g wet weight (3.0 ug/g dry weight) (EVS, 1999). Certain investigators had concerns regarding the TBT results. These concerns are discussed in USEPA, 1999.

As a second component of the assessment of bioaccumulative potential, a literature review of tissue residue effects data for PCBs and mercury was completed to determine whether tissue concentrations determined to be protective of human health from seafood consumed would also be protective of aquatic invertebrates and fish. The human health-based criteria values were compared to measured tissue residue effects concentrations for mercury and PCBs and it was found that human health-based criteria values were lower than tissue concentrations associated with ecological endpoints (EVS, 1998).

In 1999, a human health risk assessment was completed to evaluate risks associated with three bioaccumulative compounds – PCBs, TBT and mercury – that may potentially bioaccumulate from sediments to fish and shellfish. For this assessment, seafood was collected from the West Waterway, and the concentrations of PCBs, TBT and mercury in the animals' tissue were measured. Based on these assessments, the cumulative risk to an individual based on reasonable maximum exposure for both current and future risk is 1 x 10-4. This level of risk is within EPA's acceptable risk range. The non-cancer health effects estimated for PCBs was a Hazard Quotient of 6.5, which is within the range of uncertainty of the PCB toxicity criterion, and thus, adverse health effects are unlikely to result from exposure to PCBs at this site. Hazard Quotient estimates for mercury and TBT are below 1, so non-cancer effects are not expected from exposures to mercury and TBT at this site (Environmental Solutions Group, 1999).

4. Summary

All surface sediment sample stations in the under-pier, shipway, enclosed water and open water SMUs fail either the CSL or SQS, except one open water station, RD-S-04. Based on the bioaccumulation results developed by analysis of data gathered from the West Waterway Operable Unit sediments and Lockheed Shipyard Sediment Operable Unit open-water SMU sediments, TBT, mercury and PCBs do not appear to pose an unreasonable risk to human health or aquatic invertebrates and fish at the tested concentrations. Concentrations of TBT, mercury and PCBs in sediments at RD-S-04 are within the range of concentrations included in the West Waterway Operable Unit assessment of bioaccumulative chemicals. The range of sediment concentrations selected for the West Waterway Operable Unit risk evaluation and the concentrations of mercury, PCBs and TBT at the Lockheed Shipyard Sediment Operable Unit station RD-S-04 are listed in Table 9. Section IV, particularly IV.C. and IV.G., of this ESD describe the remedy and how the remedy addresses physical, chemical and biological site data.

B. Shipyard Waste, Abrasive Grit Blast and Shipyard Debris Definitions

This subsection describes the information and rationale used to propose a definition for shipyard waste. The ROD required that shipyard waste be dredged because shipyard waste may adversely affect habitat value, dredging operations, or the implementation or efficacy of a cap. The ROD also refers to removal of sandblast grit and debris. None of these terms were defined in the ROD. Definitions for these terms are proposed in Section IV.B. of this ESD. Shipyard waste, abrasive grit blast (AGB) and debris definitions were based on information concerning work performed at the shipyards over time, the chemicals and materials used, side-scan sonar, and field surveys. The following discussion in this subsection provides background information and rationale supporting the proposed definitions.

Based on information received from the shipyards regarding the potential sources and physical characteristics of AGB (e.g., Asarco slag), EPA concluded that AGB probably consists of a coarse-grained material with high metals concentrations. Next, additional specific AGB characteristics, based on an examination of surface sediment data from both shipyards, were identified for use in developing an AGB definition. Chemical (metals, TBT, total organic carbon) and physical characteristics (grain size) of samples from the shipyards were compiled. This information was paired with observations by field personnel during pre-remedial design investigations regarding the presence of grit or coarse-grained black material. Graphical plots were examined to identify potential AGB characteristics. The spatial distribution of the exceedances of the Sediment Management Standards Cleanup Screening Levels (CSLs) was also

reviewed. After examining site data. EPA considered the following as characteristic of AGB:

- sediment containing more than 60 percent sand (60 percent sand was used to ensure that material was primarily coarse-grained)
- copper concentrations greater than the CSL, 390 mg/kg
- arsenic concentrations greater than the CSL, 937 mg/kg
- zinc concentrations greater than the CSL, 960 mg/kg
- tributyltin concentrations greater than 200 mg/kg (normalized to organic carbon)

TBT co-occurred frequently with characteristic AGB chemicals. However, unused AGB does not contain TBT and environmental transport and fate processes distributed TBT over a broader area where other AGB characteristics were not prevalent. Therefore, EPA decided that the presence of TBT was not reliable as an AGB characteristic[5].

Based on these criteria and using the definitions in Section IV.B. of this ESD, significant deposits of AGB and shipyard waste were identified as primarily located along the bulkhead and nearshore portions of the under-pier, shipways and enclosed water areas, specifically SMUs 2, 3, 4, 5, 6 and limited areas of SMU 7. Nearshore AGB and shipyard waste deposits are typically surficial ranging to:

- 2 feet in depth in the enclosed water area (SMU 2)
- 2 to 5 feet in depth under Pier 9 (SMU 3)
- 2 feet in depth under Pier 10 (SMU 5)
- 2 to 5 feet in depth under the shipways (SMUs 4 and 6), and
- 4 to 6 feet in depth under the northern portion of Pier 11 (SMU 7)

C. Dredge and Cap Strategies Considered for Cost, Benefit and Technical Feasibility Evaluation

The ROD specified a generic dredge and cap remedy for the Lockheed Shipyard Sediment Operable Unit as described in Section II.C. above. EPA concluded in the ROD that the open water area should be dredged to the CSL and sediments exceeding the SQS should be capped but that the extent that the remedy could be implemented in the under-pier, shipway and enclosed water areas would be based on consideration of cost, benefit and technical feasibility factors. To this end, Lockheed identified and evaluated 16 dredge and/or cap strategies by which the remedy would be implemented. These strategies are presented and

[5] EPA decided that TBT would be addressed within the context of other remedial action decisions for individual sediment management units within each shipyard.

evaluated by Lockheed in the BDR. Lockheed recommended adoption of Strategy 16 for implementation at the Lockheed Shipyard Sediment Operable Unit, which is a cap-only remedy.

EPA reviewed and commented on the 16 strategies developed by Lockheed. EPA rejected Lockheed's recommended Strategy 16 because it would not fulfill the requirements of the ROD. EPA requested that Lockheed "evaluate a strategy that evaluates dredging in the under-pier, shipway and open water areas coupled with capping such that existing grade is restored..." and that the evaluation include an analysis of cost, benefit, and technical feasibility. Lockheed, in the BD TM, developed and evaluated this additional strategy, referred to as Strategy 17.

Lockheed's Strategy 17 did not consider the cost, benefit and technical feasibility of piling removal as a way to increase the effectiveness of dredging in the under-pier areas. For this ESD, EPA has modified Lockheed's Strategy 17 into four similar substrategies, referred to as Strategies 18A, 18B, 18C and 18 D. Table 10 summarizes and compares the components of Strategies 1, 16, 18A, 18B, 18C and 18D. (Note: Strategies 2 through 15 are not presented in this ESD for further consideration. Descriptions of those strategies are available in the BDR.)

In place of Strategy 17, EPA considered piling removal; a minimal dredge for the under-pier, shipway and enclosed water SMUs; and four substrategies (18A through 18D) for a dredge and/or cap remedy for the open water area. Each of the four sub-strategies is based on the same remedial concept for the under-pier, shipway, and enclosed water SMUs – pier decking and piling removal, dredge 3.5 feet, and cap to restore original bathymetry. The only difference among the substrategies is the treatment of the open water SMU. These strategies and substrategies have been analyzed further by EPA on a cost, benefit and technical feasibility basis.

For comparison purposes, EPA has also included Lockheed's Strategies 1 and 16 in this ESD. Strategy 1 is a dredge and cap strategy where the dredge depth is determined by technical feasibility. Strategy 16, Lockheed's recommended remedy, is a capping remedy that does not include any dredging. Note that EPA slightly modified Strategies 1 and 16 so that all strategies could be evaluated based on similar assumptions, i.e., reconstruction of the pier and/or removal of piling as well as pier and shipway decking.

In this ESD, EPA assumed, based on best professional judgement, the cap would be 3.5 feet thick for cost analysis purposes. In most strategies, dredging is also assumed to be 3.5 feet deep. Dredging to 3.5 feet is required to accommodate a cap of 3.5 feet while maintaining the original bathymetry and water column. The depth of this dredging activity may be modified during remedial design based on benefits, costs and technical site constraints and

practicality (e.g., primarily geotechnical considerations regarding slope and bulkhead stability). Also, actual design parameters for the cap will be determined during remedial design. The cap must be physically and chemically confining. Dredging depth will be adjusted during remedial design to take into account cap design specifications. Table 10 summarizes the components of Strategies 1, 16, 18A, 18B, 18C and 18D.

1. Technical Feasibility

All strategies evaluated in this ESD were considered to be technically feasible. However, none would result in the removal of all sediment contaminated above the CSL. Strategy 1 assumed that dredging would only be conducted to a depth that would not compromise the bulkhead or slope stability. All other strategies assumed a more shallow dredge depth or no dredge at all.

EPA concluded in the ROD that a technical feasibility, cost and benefit evaluation would be conducted to determine the extent of a cap and dredge remedy in the under-pier, shipway and enclosed water SMUs. Implicit in this is the idea that a dredge of all sediments contaminated above the CSL may not be possible, as it was assumed to be in the open water SMU. Therefore, dredge depths will be limited by technical feasibility, cost and benefits. Data indicates that sediment contamination exceeding the CSL in the under-pier and shipway SMU is at least 10 feet below the mudline. Lockheed assumed that to maintain bulkhead and slope stability, a maximum 2H:1V slope perpendicular to the bulkhead would be necessary. Consequently, Lockheed concluded that a maximum feasible dredge, Strategy 1, would not remove all sediments exceeding the CSL.

All strategies assumed that the Lockheed Shipyard Sediment Operable Unit pier and shipway decking and piling would be removed. A demonstration project at the Olympic View Superfund Site confirmed that aged pilings could be removed by current technology. For details, see Appendix B.

Some piles may be left in place to ensure bulkhead or slope stability, as necessary. However, these piles must be cut or broken off below the mudline to accommodate dredging. The number and location of piles to be left in place will be determined during remedial design.

2. Costs

For cost evaluation purposes, all strategies assumed complete pier and shipway decking and piling removal and included no pier replacement

costs. Pier removal is a viable strategy for the Lockheed Shipyard Sediment Operable Unit because LSSOU is not presently a working shipyard and the pier structure is in a degraded condition. The remedial cost for each strategy is summarized in Table 11. Costs were developed almost entirely using the assumptions, quantities and unit pricing provided by Lockheed in the BDR and BDR TM. EPA adopted Lockheed's assumptions, quantities and unit prices because they seemed reasonable and allow for comparison among candidate strategies (as well as those in the BDR and BDR TM) to be made on equivalent terms. For further details, see Appendix C.

3. Benefits

All strategies in this ESD were analyzed for benefits derived if that strategy were implemented and compared by listing the benefits. The range of anticipated benefits is summarized below:

- largest percent of contamination removed from the aquatic environment
- lowest implementation cost
- lowest O&M cost
- maintenance of existing bathymetry preserves benthic habitat
- maintenance of water column depth/habitat
- effectiveness/protectiveness of the remedy
- meets ROD criteria
- does not restrict future use options
- maintains options for marine commerce
- increases existing water column/depth in the open water area with inherent positive effect on navigational issues
- overall habitat improvement

Some strategies present more or higher-priority benefits than other strategies. Higher priority benefits include protectiveness of remedy, satisfaction of the most ROD criteria, maintenance of water column for habitat and navigation, and lower remedial costs.

All strategies are protective to some degree. Strategy 1, removal of the largest amount of sediment exceeding the CSL, is the most protective strategy because it leaves the least amount of contamination in the environment. Costs among strategies are similar (Strategy 16 is the least costly), with the exception of Strategy 1, which is 2 to 4 times more costly than other remedies. Strategies 1, 18C and 18D satisfy the ROD criteria of dredging to the CSL in the open water SMU, maintaining the water

column depth/habitat in all SMUs, and being consistent with current and future site uses. Table 12 summarizes the benefits identified for each strategy.

IV. Description of and Basis for the Significant Differences

A. Introduction

The general cleanup approach specified in the ROD requires, in accordance with the Washington Sediment Management Standards (SMS): (1) all sediment exceeding the CSL of the SMS and shipyard waste be dredged and disposed of in an appropriate in-water or upland disposal facility, (2) all sediments exceeding the chemical and/or biological SQS of the SMS be capped with a minimum of 2 feet of clean sediment, and (3) long-term monitoring to be conducted for any capped areas. In addition, the ROD concluded that the "extent of dredging of contaminated sediments and waste under piers at the Todd and Lockheed shipyards will be determined during remedial design based on cost, benefit, and technical feasibility." (See ROD, Section K, The Selected Remedy in U.S. EPA 1996).

Subsequent to the ROD, pre-remedial design studies for the Lockheed Shipyard Sediment Operable Unit have better defined the nature and extent of contamination. This sediment characterization has been further used by EPA to determine the most technically feasible, cost-effective approach for implementing the dredge and cap remedy. During this pre-remedial design phase EPA has also developed definitions for "shipyard waste," including definitions for AGB and shipyard debris. The Port of Seattle, the current owner of the Lockheed Shipyard Sediment Operable Unit, has identified future uses for the Lockheed operable unit (See Section E).

This ESD documents the following changes for the Lockheed Shipyard Sediment Operable Unit:

(1) the definition of shipyard waste, including AGB;
(2) the dredge depths and cap locations by SMU;
(3) the size of the contaminated area requiring remediation, the approximate volume of sediment to be dredged and the cost of the remedial action;
(4) future site uses and remedial action time frames; and
(5) potential for recontamination from upland groundwater.

B. Definition for Shipyard Waste, Abrasive Grit Blast and Shipyard Debris.

Definitions for shipyard waste, AGB and shipyard debris are defined (see below) based on the rationale and information summarized in Section III.B. The

definition for AGB consists of a physical and a chemical component which when combined are a "signature" for AGB. Based on activities associated with shipyards, field observations, seabed characterization work (including bathymetry and sidescan sonar) and other site investigation data, EPA has determined that shipyard waste shall be defined as consisting of 1 or 2:

1. **Abrasive Grit Blast (AGB)**

Identification of AGB may be made by one of two means: visible evidence, or chemical and physical evidence. Visual identification alone is sufficient to identify AGB (see a. below). The second means (see b. below) of identification is a combination of chemical and physical evidence. The criteria for determining AGB are:

a. Visual identification: EPA and Lockheed agree that the material is predominantly AGB.

OR

b. Chemical and physical evidence: Data indicating that the grain size of the material is greater than (or equal to) 60 percent total sand;

AND AT LEAST TWO OF THE FOLLOWING:

i. Copper concentration greater than the CSL of 390 mg/kg;
ii. Zinc concentration greater than the CSL of 960 mg/kg;
iii. Arsenic concentration greater than the CSL of 93 mg/kg.

2. **Shipyard Debris and Other Shipyard Waste**

Wood, concrete, sheet steel, steel cables, tires, welding rods, and various other debris or shipyard waste that will impede dredging activities or compromise the integrity of the cap.

The above AGB definition is a generic definition developed solely for the Todd and Lockheed Shipyard Sediment Operable Units at the Harbor Island Superfund Site. However, the definition may be refined further based on additional site-specific data. For example, additional data was provided to EPA by Todd Shipyards to refine the grain size criterion cited in 1.b above. Specifically, Todd Shipyards conducted a grain size analysis on samples of spent AGB from the Todd Shipyards facility, and grain size fractions characteristic of AGB were identified. Based on the grain size characteristics of-

the spent AGB. EPA modified the AGB definition for the Todd Shipyard Sediment Operable Unit by replacing 1.b of the generic AGB definition with:

> "Greater than (or equal to) 50 percent coarse material typically associated with spent grit blast (i.e., 0.15 to 2.0 mm in size)."

Some of the AGB used at the Lockheed Shipyard Sediment Operable Unit was from a different source and may, therefore, have a different grain size profile than the AGB used at the Todd Shipyard Sediment Operable Unit. If Lockheed wishes to refine the generic AGB definition further to be specific for the Lockheed Shipyard Sediment Operable Unit AGB, Lockheed should provide a rationale and supporting data to substantiate a modification.

C. EPA Remedial Strategy: Dredge Depths and Cap Locations by SMU

In accordance with the ROD requirement that additional information be obtained to further define the cleanup of under-pier areas, Lockheed collected, analyzed and reported information in the Remedial Design Data Investigation Report, the draft Final BDR, and the draft Final BDR TM. In the BDR and the BDR TM, Lockheed proposed 17 strategies for implementing the remedy. The strategies considered by EPA are slight modifications of strategies evaluated by Lockheed in the BDR and BDR TM. Based on this analysis, EPA selects Strategy 18C to further refine the dredge and cap remedy selected in the ROD. This strategy is described as follows:

1. **In the under-pier, shipway and enclosed areas:**
   (a) remove the shipway pier and decking; remove or modify pilings to the maximum extent practicable so as not to compromise the stability of the existing bulkhead or existing slope but to permit dredging and capping as defined below;
   (b) remove any shipyard debris that will impede dredging activities or compromise the integrity of the cap to be placed in these areas;
   (c) dredge AGB to a sufficient depth to accommodate the cap without any loss of the present water column[6];
   (d) dredge all sediments exceeding CSL to a depth sufficient depth to accommodate the cap without any loss of the present water column [7];

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[6] For purposes of the cost analysis, EPA assumed the cap would be 3.5 feet thick. In most strategies, dredging is also assumed to be 3.5 feet deep. Dredging to 3.5 feet is required to accommodate a cap of 3.5 feet while maintaining the original bathymetry and water column.

[7] For purposes of the cost analysis, EPA assumed the cap would be 3.5 feet thick. In most strategies, dredging is also assumed to be 3.5 feet deep. Dredging to 3.5 feet is required to accommodate a cap of 3.5 feet while maintaining the original bathymetry and water column. The depth of this dredging activity may be modified

(e) cover all sediments exceeding SQS with a cap that shall physically and chemically contain and confine contaminants of concern; and
(f) dispose of contaminated dredged material at an appropriate upland landfill.

2. **In the open water areas:**
   (a) remove any shipyard debris that will impede dredging activities or compromise the integrity of the cap to be placed in these areas;
   (b) dredge all sediments exceeding SQS; and
   (c) dispose of contaminated dredged material at an appropriate upland landfill.

D. Remedial Costs

The ROD concluded that in areas with shipyard waste and exceedances of the CSL and SQS, the volume of contaminated sediment to be dredged and the associated costs would be refined during remedial design. Since the ROD was issued, additional investigations and studies have been undertaken by Lockheed at the Lockheed Shipyard Sediment Operable Unit. Pre-remedial design studies at the Lockheed Shipyard Sediment Operable Unit identified a higher volume of sediment requiring dredging and disposal than was estimated in the ROD. The investigative studies demonstrate that sediment contamination extends to greater depths than was believed when the 1996 ROD was issued. The ROD provided quantities and cost estimates for dredging and disposal for only the open water SMU because there was not sufficient information to estimate these quantities for the under-pier, shipway and enclosed water SMUs. A comparison of assumed depths and volume estimates in the 1996 ROD with the refined volume estimates for the strategy proposed by EPA is provided in Table 13.

EPA has selected Strategy 18C for implementing the ROD. Estimates cited for this ESD in Table 13 are based on the dredge volumes of contaminated sediments exceeding the SQS in open water SMU and the CSL in under-pier, shipway and enclosed water SMUs; and the volume of capping material required to cover contaminated sediments exceeding the SQS in under-pier, shipway and enclosed water SMUs.

The ROD provided estimated costs for a remedy at the Lockheed Shipyard Sediment Operable Unit that included dredging and/or capping contaminated sediment and upland disposal of dredged material. Table 14 provides a comparison of the cost estimates in the ROD to the estimates for this ESD. The

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during remedial design based on technical site constraints and practicality (e.g., primarily geotechnical considerations regarding slope and bulkhead stability).

cost estimated to implement the ROD remedy is low because the 1996 cost estimate included only the cost of remediating the open water SMU and did not include costs for remediation of the majority of the Lockheed Shipyard Sediment Operable Unit. EPA concluded in the ROD that remediation parameters for the remainder of the Lockheed Shipyard Sediment Operable Unit would be determined during remedial design. Consequently, the vast majority of the costs of remediation were not known at the time of the ROD. Detailed cost estimates are provided in the BDR, BDR TM and in Appendix C of this ESD.

E. Future Site Use

EPA regulations and policy specify that EPA should take into consideration probable future uses of a cleanup area when defining and selecting a remedy. Since 1959, the Lockheed Shipyard Sediment Operable Unit has been used as a shipyard for construction and maintenance of Naval ships. Shipyard activities ceased in 1986, and the property was purchased by the Port of Seattle[8] in 1996. Presently, the Lockheed Shipyard Sediment Operable Unit consists of four piers and three shipways in declining condition built upon Washington State marine sediments leased to Lockheed from the Washington Department of Natural Resources. The overwater structures are supported by about 6,000 piles. Piers 9 and 9a (or 9.5) comprise the largest pier and are approximately 61,000 square feet (sq. ft.) and are supported by about 1,100 piles. Piers 9 and 9a occur on the southern end of the property and are the oldest in-water structures. Piers 10 and 11 are to the north of Pier 9 and are 24,000 sq. ft and 36,000 sq. ft. respectively. About 1,300 piles support these piers. The remainder of the piling supports the decking in the three shipways.

EPA conducted a cost, benefit and technical feasibility analysis on various strategies for implementing the ROD. From that analysis, EPA determined that removal of the pier and piling significantly improved the remediation of the Lockheed Shipyard Sediment Operable Unit without a significant increase in cost. Removal of the piling will enable Lockheed to dredge and cap the under-pier area without loss of the water column habitat. Removal of the piers, including most of the 6000 piles, will allow for the implementation of a more cost-effective, protective and permanent remedy than attempting to dredge and cap around existing piles, many of which are past or nearly past their service life. Additionally, many piles are so close together that remedial action would be nearly impossible if they were left in place. Therefore, the old Lockheed pier will be taken down to accommodate the timing of a speedy and improved remediation of the Lockheed Shipyard Sediment Operable Unit.

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[8] The sediments at the Lockheed Shipyard Sediment Operable Unit are owned by the State of Washington and managed by the Washington Department of Natural Resources.

It is EPA's understanding that the Port of Seattle acquired the Lockheed uplands and docks from Lockheed in 1997. Following acquisition, the Port has allowed a tenant's contractor to use the northern docks in conjunction with bringing over 500,000 tons of aggregate to Harbor Island for use in the redevelopment and expansion of Terminal 18. The uplands area of the former Lockheed property has been used as a staging and storage area for this project, which is now nearing completion. Absent demolition of the docks for cleanup for the Lockheed Shipyard Sediment Operable Unit, the Port reasonably anticipates continued use of the upland property and the dock areas for maritime commerce subject to necessary repair, replacement and/or upgrade of the docks and pier structure. By removing the docks and pier structure for sediment remedial action, EPA does not intend to impair the value of the Port's property or the Port's ability to use its property for maritime commerce. EPA will consider the Port's plans for future use of the site and how these plans may be implemented in conjunction with the remedial design and remedial action for the site and will ensure that these plans are consistent with the remedy and schedule for the Lockheed Shipyard Sediment Operable Unit. Remedial work for the Lockheed Shipyard Sediment Operable Unit is in the early design phases and EPA expects that remedial action will start as early as mid-year 2003 and be completed in early 2004.

F. Upland Groundwater Assessment of Source Control

During remedial design, EPA will evaluate the groundwater flowing from the Lockheed uplands. If this groundwater is contaminated, and EPA determines the groundwater may recontaminate a clean dredged/capped area, EPA will require source control efforts to address the contaminants of concern. If this groundwater is not contaminated at levels of concern but EPA determines that the groundwater may mobilize sediment contamination that is left in place at depth, EPA may require sediments in these areas to be dredged deeper than the point of contact with the groundwater. This issue should be resolved as part of 30 percent design.

G. Summary and Basis of Remedial Strategy, 18C, Selection

The data indicates that contaminated sediments exceeding the CSL at LSSOU are deeper in all areas – the under-pier area, shipways, enclosed water and open water areas – than presumed in the ROD. Generally, the contamination in the open water area is about 5 feet deep for both CSL and SQS exceedances. The actual depth of CSL and SQS exceedances in the under-pier, shipways and enclosed water areas has not been determined because at least one chemical, in each core, exceeded the CSL at the furthest extent of the core samples. The core depths vary from 7.5 feet to 12.5 feet in depth. However, based on the data, the extent and depth of sediments with CSL exceedances is similar to the extent and depth of sediments with SQS exceedances across the Lockheed

Shipyard Sediment Operable Unit. CSL and SQS exceedances consist primarily of metals, specifically arsenic, copper, lead, mercury and zinc.

Surface sediment chemistry data for the open water SMU indicates that the CSL is exceeded at 1 of 8 sample locations and the SQS at 6 of 8 sample locations. Biological toxicity tests were performed using open water surface samples from the 8 sample sediment locations. Of the 8 biological tests, 3 failed the CSL and 7 failed the SQS. Given these results, 7 of the 8 open water stations failed SMS and one station, S-04, passed SMS. Surface sample data results from the under-pier, shipway and enclosed water SMUs all exceed the CSL.

Field observations indicate that the Lockheed Shipyard Sediment Operable Unit has AGB contamination in the under-pier, shipway and enclosed water SMUs at depths that vary between 2 and 6 feet; however, AGB has not been observed in the open water SMU. Determination as to the presence of shipyard debris will be made at the time of remedial action; any debris will be removed at that point.

The only station EPA assessed for bioaccumulation for the purposes of this ESD is RD-S-04 because it is the only station that passed SMS and AGB criteria for remediation. Bioaccumulation data indicate that the concentrations of TBT, mercury and PCBs present in the area represented by RD-S-04 do not pose an unreasonable risk to human health or aquatic invertebrates and fish.

After analysis of numerous alternatives by Lockheed which were presented in the BDR and BDR TM, EPA further evaluated six remedial strategies for implementing the dredge and cap remedy based on cost, benefit and technical feasibility as specified in the ROD. All strategies were considered to be technically feasible. Strategy 1, where the largest amount of sediment exceeding the CSL would be removed, is the most environmentally protective strategy. However, the cost is significantly larger than all the other strategies, and would still result in some sediment contaminated above the CSL remaining in place. This is because dredging depth would be limited by concerns for bulkhead and slope stability. Sediment contamination exceeding the CSL in the under-pier, shipway and enclosed water SMUs is at least 10 feet deep. To maintain bulkhead and slope stability, Lockheed assumed (without extensive geotechnical data) that a maximum 2H:1V slope perpendicular to the bulkhead would be used to determine the maximum feasible dredging depths . Working with this assumption, Lockheed determined that a maximum feasible dredging depth, Strategy 1, would not remove all sediments exceeding the CSL. The other remedial strategies also reflect this limitation on dredging depth by minimizing the dredge depth and as such acknowledge that there are no cost-effective remedial strategies that would result in the certain removal of all contaminated sediments exceeding the CSL.

Strategy 16. Lockheed's recommended cap-only strategy, is the least costly strategy but results in substantial loss of intertidal and subtidal water column habitat and is not consistent with the requirements of the ROD that CSL exceedances be removed and that "to the extent practicable the marine habitat...must also be restored to its most productive condition...". Further, the cost of intertidal and subtidal habitat mitigation was not determined and included in the cost estimate. so the cost of implementing Strategy 16 is artificially low. Finally. Strategy 16 is also not consistent with current or future site uses since raising the elevation of the intertidal and subtidal zones will interfere with navigation while endangering the integrity of the cap and require more extensive long-term monitoring and maintenance than the other strategies.

Strategies 18A through 18D were all developed using the same assumptions of limited dredging sufficient to accommodate a cap without loss of water column (assumes a 3.5-foot dredge) in the under-pier, shipway and enclosed water SMUs. This was because, as discussed above, removal of all CSL exceedances was not considered to be technically feasible. Consequently, the differences between Strategies 18A through 18D are the remedial strategies for the open water SMU.

In Strategy 18A, sediments in the open water SMU would be dredged 3.5 feet and capped to restore original bathymetry and thus prevent water column loss. Strategy 18A would not satisfy the ROD requirement for the open water SMU because 1.5 feet of sediment exceeding the CSL would remain undredged in a large portion of the open water SMU. The cost for Strategy 18A is estimated to be $13.2 million.

In Strategy 18B. sediments in the open water SMU would not be dredged but a 3.5-foot cap would be placed across the open water SMU. Strategy 18B does not satisfy the ROD requirements because no sediments exceeding the CSL would be removed from the open water SMU and placement of the cap would result in a loss of the water column depth/habitat. While this loss of water column may not significantly impact marine habitat, a more shallow water column would adversely affect the use of the area for commercial marine traffic in a consistently high-traffic volume environment. Further, given that the open water SMU is adjacent to a primary navigation channel, the potential for impacts to the cap due to prop wash and scouring will be high, thus leading to higher operation and maintenance (O&M) costs than areas that are relatively protected or where there is no cap. The remedial cost for Strategy 18B is estimated to be $11.0 million.

Strategy 18C would involve dredging contaminated sediments to the SQS in the open water thus making a cap unnecessary. The remedial cost for Strategy 18C is estimated to be $12.1 million. Strategy 18D would involve dredging to the CSL and capping SQS exceedances in the open water SMU. The remedial cost for

Strategy 18D is estimated to be $12.4 million. Both Strategies 18 C and D would satisfy the requirements of the ROD.

EPA selected Strategy 18C over Strategy 18D because the open water SMU will be dredged to the SQS instead of the CSL which is clearly beneficial and is less costly than 18D. While the ROD requires dredging only to the CSL, dredging to the SQS instead of the CSL will remove substantially more contamination. While the dredging will deepen the mudline by approximately 5 feet (and since capping is not required, the mudline will not be brought back to the original bathymetry), the change in the water column will occur at depths from -20 ft MLLW to -36 ft MLLW. This change should not have a significant adverse impact on the marine habitat in that area. Other significant benefits are:

(1) a permanent remedy for the open water SMU;
(2) no long-term monitoring and maintenance for a cap;
(3) increased confidence in the integrity and efficacy of the remedy; e.g., no additional releases of contamination from cap breach, failure or demise;
(4) consistency with current and future site uses; and
(5) increased volume of contaminated sediment removal.

The remedial strategy proposed in this ESD requires dredging to the SQS of all sediments in the open water SMU even thought the surface sediments represented by RD-S-04 do not exceed cleanup criteria. EPA has decided to include sediments represented by surface sediment station, RD-S-04, for the following reasons:

(1) the concentration of mercury in RD-S-04 does not exceed the SQS of 0.41 mg/kg but is borderline at 0.41 mg.kg;
(2) sediments in the core composite sample closest to RD-S-04, RD-C-02, exceed the SQS and CSL in the 0.0 to 2.5-foot interval[9];
(3) the nearsurface exceedances and the surface mercury concentration, if not removed, may serve as a source of future recontamination of remediated areas;
(4) satisfaction of the ROD requirement for a flat, smooth surface will be difficult to obtain if the sediments represented by RD-S-04 remain as is;
(5) additional sampling would be required to define the area to be represented by RD-S-04; and

[9] The open water SMU surface chemical and biological samples were not co-located with core samples and in 7 of 8 cases, the core and surface sample locations were far apart relative to the area they represent. Chemistry data from the core samples was obtained, as composites, at 2.5-foot intervals starting with the interval 0 to 2.5 feet below the mudline. Of the 5 open water core sample locations, 5 exceeded the CSL at the 0 to 2.5-foot interval.

(6) overall, the benefits of dredging all contaminated sediment in the open water SMU to the SQS overweigh additional costs associated with dredging to the SQS instead of the CSL[10].

This ESD is consistent with the requirements and considerations for remediation established in the ROD. It requires removal of pier and shipway decking and piling: dredging to accommodate a cap in the under-pier, shipway, and enclosed water SMU; and dredging to the SQS in the open water SMU without subsequent capping. Dredging to the SQS without capping in the open water SMU is consistent with the ROD's direction to consider the cost-benefit of implementing the alternative of dredging to the SQS instead of the CSL. Dredging and capping of the Lockheed Shipyard Sediment Operable Unit shall be conducted in such a way that the cap restores the existing bathymetry in the under-pier, shipway and enclosed water SMUs, thus resulting in a natural bathymetric surface (i.e., smooth without holes).

V. Affirmation of Statutory Determinations

Strategy C for implementation of the selected remedy at the LSSOU will be protective of human health and the environment, complies with federal and state requirements that were identified in the ROD as applicable or relevant and appropriate to this remedial action, and is cost-effective. The remedy continues to utilize permanent solutions and alternative treatment technologies to the maximum extent possible.

VI. Public Participation Activities

EPA provided a 30-day public comment period for this ESD. Copies of the Fact Sheet were distributed to the Harbor Island mailing list of approximately 250 individuals. EPA received 9 comment letters from Natural Resource Trustees, several federal and state resource and regulatory agencies, the Muckleshoot Indian Tribe, Lockheed Martin and several other interested parties. EPA responses to public comments are in Appendix D.

Feb 22, 2002

Michael F. Gearheard — Date
Director, Office of Environmental Cleanup

[10] The cost associated with Strategy 18C, which requires dredging to the SQS, is less costly than Strategy 18D, which requires dredging to the CSL.

BIBLIOGRAPHY

Environmental Solutions Group, 1999. Assessing Human Health Risk From the Consumption of Seafood: Human Health Risk Assessment Report. Prepared for Port of Seattle, Lockheed Martin and Todd Pacific Shipyards. September 1999.

EVS. 1999. Tributyltin in Marine Sediments and the Bioaccumulation of Tributyltin: Combined Data Report. Prepared for Port of Seattle, Lockheed Martin and Todd Pacific Shipyards. May 1999.

EVS. 1998. Review of Tissue Residue Effects Data for Tributyltin, Mercury, and Polychlorinated Biphenyls. Prepared for Port of Seattle, Lockheed Martin and Todd Pacific Shipyards. December 1998.

General Construction Company. 2001. Olympic View Resource Area Pile Pull Demonstration, Summary Report. Prepared for the City of Tacoma, Tacoma, WA. Submitted to U.S. EPA Region 10 as Attachment B-1 to the Pre-Final (60 percent) Design Documents for the Non-Time-Critical Removal Action at the Olympic View Resource Area, Tacoma, WA.

Hart Crowser. 1997. Remedial Design Investigation Work Plan. Lockheed Shipyard No. 1 Sediment Operable Unit, Seattle, Washington. Prepared for Lockheed Martin. August 26, 1997.

Hart Crowser. 1998. Source Control Report. Lockheed Shipyard No. 1 Sediment Operable Unit, Seattle, Washington. Prepared for Lockheed Martin. March 25, 1998.

Hart Crowser. 1999. Final Remedial Design Investigation Data Report. Lockheed Shipyard No. 1 Sediment Operable Unit, Seattle, Washington. Prepared for Lockheed Martin. February 19, 1999.

Hart Crowser. 2000a. (Draft) Final Basis of Design Report. Lockheed Shipyard No. 1 Sediment Operable Unit, Seattle, Washington. Prepared for Lockheed Martin. January 2000.

Hart Crowser. 2000b. Technical Memorandum Basis of Design Report. Lockheed Shipyard No. 1 Sediment Operable Unit, Seattle, Washington. Prepared for Lockheed Martin. April 14, 2000.

Management of Environmental Resources. 2001. Support Documentation for Shipyard Waste, Abrasive Grit Blast and Shipyard Debris Definitions. Prepared for U.S. EPA by Nancy Musgrove.

U.S. EPA. 1996. Record of Decision - Declaration, Decision Summary and Responsiveness Summary for The Shipyard Sediment Operable Unit, Harbor Island, Seattle, Washington. November 1996.

U.S. EPA. 1997. Administrative Order on Consent for Remedial Design, Lockheed Martin Portion, Shipyard Sediment Operable Unit. Seattle, Washington. July 1997.

U.S. EPA. 1999. Technical Memorandum: Topics Related to the Tributyltin Study at the harbor Island Superfund Site, Waterway Sediment Operable Unit. Seattle, Washington. 1999.

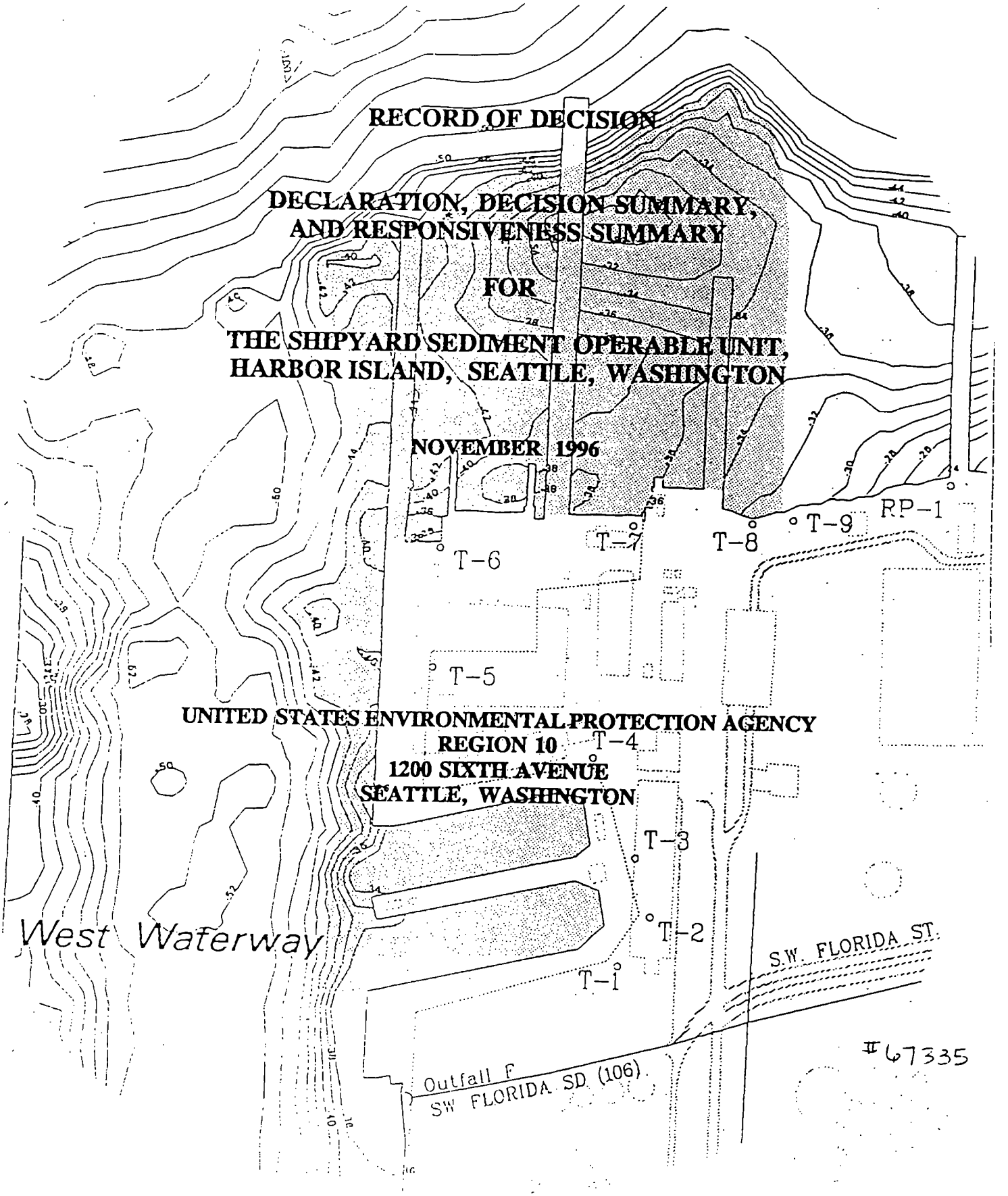
RECORD OF DECISION

DECLARATION, DECISION SUMMARY, AND RESPONSIVENESS SUMMARY

FOR

THE SHIPYARD SEDIMENT OPERABLE UNIT, HARBOR ISLAND, SEATTLE, WASHINGTON

NOVEMBER 1996



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON

#67335

TABLE OF CONTENTS

Section	Page
I. Declaration	
II. Decision Summary	
A. Introduction	1
B. Site Name, Location and Description	1
C. Site History	3
D. Highlights of Community Participation	5
E. Scope and Role of Response Action	6
F. Summary of Site Characteristics	6
G. Summary of Risks for the Shipyard Sediment OU	16
H. Cleanup Objective and Sediment Standards	19
I. Description of Remedial Alternatives	21
J. Summary of the Comparative Analysis of Alternatives	25
K. The Selected Remedy	29
L. Statutory Determinations	35
M. Documentation of Significant Changes	40

APPENDICIES

Appendix A: Responsiveness Summary

Appendix B: Alternative Cost Estimate Tables

Appendix C: Administrative Record Index

List of Figures

Figure 1: Harbor Island Location Map 2

Figure 2: Harbor Island Site Map 4

Figure 3: Todd Shipyards Cleanup Area 7

Figure 4: Lockheed Shipyard Cleanup Area 8

Figure 5: Surface Sediment Sampling Locations 13

List of Tables

Table 1: EBAP Sediment Contaminant Concentrations 14

Table 2: RI Sediment Contaminant Concentrations 14

Table 3: SRI Sediment Contaminant Concentrations 14

Table 4: Chemical Cleanup Standards 22

Table 5: Alternative Cost Estimates 28

DECLARATION

SHIPYARD SEDIMENT OPERABLE UNIT, HARBOR ISLAND, SEATTLE, WASHINGTON

SITE NAME AND LOCATION

Shipyard Sediment Operable Unit, Harbor Island

Seattle, King County, Washington

STATEMENT OF BASIS AND PURPOSE

The Harbor Island Superfund Site (Site) is located in Seattle, King County, Washington. The U.S. Environmental Protection Agency (EPA) has divided this Site into five operable units (OUs), which are: 1) the petroleum storage tank OU, 2) the Soil/Groundwater OU, 3) the Lockheed Shipyard OU, 4) the Shipyard Sediment OU, and 5) the Waterway Sediment OU. The Shipyard Sediment OU includes contaminated nearshore sediments at the Todd and Lockheed Shipyards. This Record of Decision (ROD) presents the selected remedial action for the Shipyard Sediment OU. This remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §§ 9601-96), as amended, and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record for the Shipyard Sediment OU which is available in EPA's Record Center, 7th Floor, 1200 Sixth Avenue, Seattle, Washington. 98101.

The Washington State Department of Ecology (Ecology) concurs with the selected remedy for the Shipyard Sediment OU.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Shipyard Sediment OU, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to human health and the environment.

DESCRIPTION OF THE SELECTED REMEDY

Based on CERCLA, the NCP, the Administrative Record, the comparative analysis of the alternatives, and public comment, EPA has selected Alternative 4, Dredge to the Chemical

Cleanup Screening Level (CSL) and Cap, as the remedy for the Harbor Island Shipyard Sediment OU. Alternative 3, Dredge to the Chemical Sediment Quality Standard (SQS), is identified as a contingent remedy if sediment sampling conducted during remedial design indicates that Alternative 3 provides a better cost-benefit than Alternative 4.

The essential elements of the selected remedy for the Shipyard Sediment OU are:

1) All sediments exceeding the chemical CSL and shipyard waste must be dredged. This also applies to sediments and shipyard waste in the shipways at Lockheed Shipyard. The extent of dredging of contaminated sediments and waste under piers at Todd and Lockheed Shipyards will be determined during remedial design based on cost, benefit, and technical feasibility;

2) Dredged sediments must be disposed in appropriate confined nearshore disposal (CND) or confined aquatic disposal (CAD) facilities. Appropriate CND or CAD sites will be selected during remedial design. If suitable CND or CAD sites are not identified, dredged sediments must be taken to an appropriate upland disposal facility. Any dredged material which is predominately shipyard waste must be disposed in a solid waste disposal facility. Sandblast grit may be recycled as feedstock for cement production;

3) After dredging, all remaining areas which exceed the chemical and/or biological SQS must be capped with a minimum two feet of clean sediment. The cap will meet the SQS cleanup objective by isolating remaining contaminants and preventing release of these contaminants to the environment. The cap is also intended to be protective of any future cleanup goals for TBT and PCB bioaccumulation by eliminating the exposure pathways associated with residual concentrations of these contaminants. The cap may require armoring with gravel or small rocks if analyses conducted during remedial design demonstrate that armoring is necessary;

4) Dredging and capping must be conducted with the objective of creating a flat surface out to the boundary of the Shipyard Sediment OU to minimize the potential for recontamination of the cap by resuspended contaminated sediments from other sources. Dredging, capping and disposal methods must also minimize adverse impacts to the existing habitat. In particular, the selected dredging and disposal methods shall minimize the release and resuspension of contaminated sediments to the environment. To the extent practicable, the marine habitat in the Shipyard Sediment OU must also be restored to its most productive condition; and

5) Long-term monitoring of contaminant concentrations in the cap, and monitoring of cap thickness, must be periodically conducted. Long-term maintenance of the cap, which involves adding supplemental clean sediment to the cap, must periodically be performed to maintain the cap at a minimum 2-foot thickness. Future maintenance dredging in the Shipyard Sediment OU would be allowed only if it maintains the protectiveness of the selected remedy.

The estimated volume of sediment to be dredged at Todd Shipyards is 116,000 cubic yards, and approximately 80,000 cubic yards of clean sand would be needed for the cap. The estimated volume to be dredged at Lockheed Shipyard is 18,000 cubic yards, and the estimated volume of clean sand required for the cap is about 11,000 cubic yards. The estimated cost of the selected remedy is based on the assumption that all dredged sediment can be placed in a CND facility. The estimated cost to design and implement this remedy at Todd Shipyards is $4.5-6.9 Million (M), with an additional cost of about $1.0 M for the first ten years of cap monitoring and maintenance after construction is complete. The estimated cost to design and implement this remedy at Lockheed Shipyard is $1.5 M, with an additional cost of about $0.5 M for the first ten years of cap monitoring and maintenance. It is estimated that it would take approximately 28-34 months to design and implement the selected remedy at Todd Shipyards, and 22-28 months to design and implement this remedy at Lockheed Shipyard.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with state and federal requirements that are legally applicable or relevant and appropriate to the remedial actions, and is cost effective. This remedy uses permanent solutions to the maximum extent practicable. The statutory preference for treatment will be satisfied by evaluating during remedial design the technical feasibility, implementability, and cost-effectiveness of physical separation technologies to separate sandblast grit from dredged sediments.

Because this remedy will leave some hazardous substances on site above cleanup goals, a review of the site and its remedy will be conducted within five years after initiation of the remedial action to ensure the remedy continues to provide adequate protection of human health and the environment.

Chuck Clarke

Chuck Clarke
Regional Administrator, Region 10
U.S. Environmental Protection Agency

11/27/96
Date

DECISION SUMMARY
RECORD OF DECISION
SHIPYARD SEDIMENT OPERABLE UNIT, HARBOR ISLAND, SEATTLE, WASHINGTON

A. INTRODUCTION

The Shipyard Sediment Operable Unit (OU) consists of nearshore sediments at the Todd and Lockheed Shipyards, which contain shipyard hazardous substances and wastes. The Shipyard Sediment OU is within the Harbor Island Superfund Site (Site), in Seattle, King County, Washington. The Site was listed on the National Priorities List (NPL) in 1983, due to the release of lead from a secondary lead smelter on the island, as well as the release of other hazardous substances from other industrial operations on the island. A Remedial Investigation (RI) and Feasibility Study (FS) of Harbor Island sediments was initiated by the United States Environmental Protection Agency (EPA) in 1991, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9604, as amended, (CERCLA).

The Site has been divided into five OUs: 1) the petroleum storage tank facilities OU, 2) the Soil/Groundwater OU, 3) the Lockheed Shipyard OU, 4) the Shipyard Sediment OU, and 5) the Waterway Sediment OU. EPA is the lead agency for the Lockheed, Shipyard Sediment, Waterway Sediment, and Soil/Groundwater OUs. A cleanup action was selected for the Soil/Groundwater OU in a Record of Decision (ROD) issued in September 1993. A cleanup action was subsequently selected for the Lockheed Shipyard OU in a ROD issued in June 1994. EPA intends to issue a ROD for the Waterway Sediment OU after further studying these sediments. This decision document addresses only the Shipyard Sediment OU.

EPA has designated the Washington Department of Ecology (Ecology) as the lead agency for the petroleum storage tank OU because the primary contaminant there is petroleum, which is excluded from CERCLA but is a specifically included hazardous substance under the State's Model Toxic Control Act (MTCA). A cleanup decision for the petroleum storage tank OU is expected to be made by Ecology in late 1996.

B. SITE NAME, LOCATION, AND DESCRIPTION

Harbor Island is located approximately one mile southwest of downtown Seattle, in King County, Washington, and lies at the mouth of the Duwamish River on the southern edge of Elliott Bay (Figure 1). The island is man-made and has been used for industrial purposes

since about 1912. The island is approximately 430 acres in size and is bordered by the East Waterway and West Waterway of the Duwamish River and by Elliott Bay to the north. Major features of Harbor Island, including the locations of the Todd and Lockheed Shipyards, are shown in Figure 2.

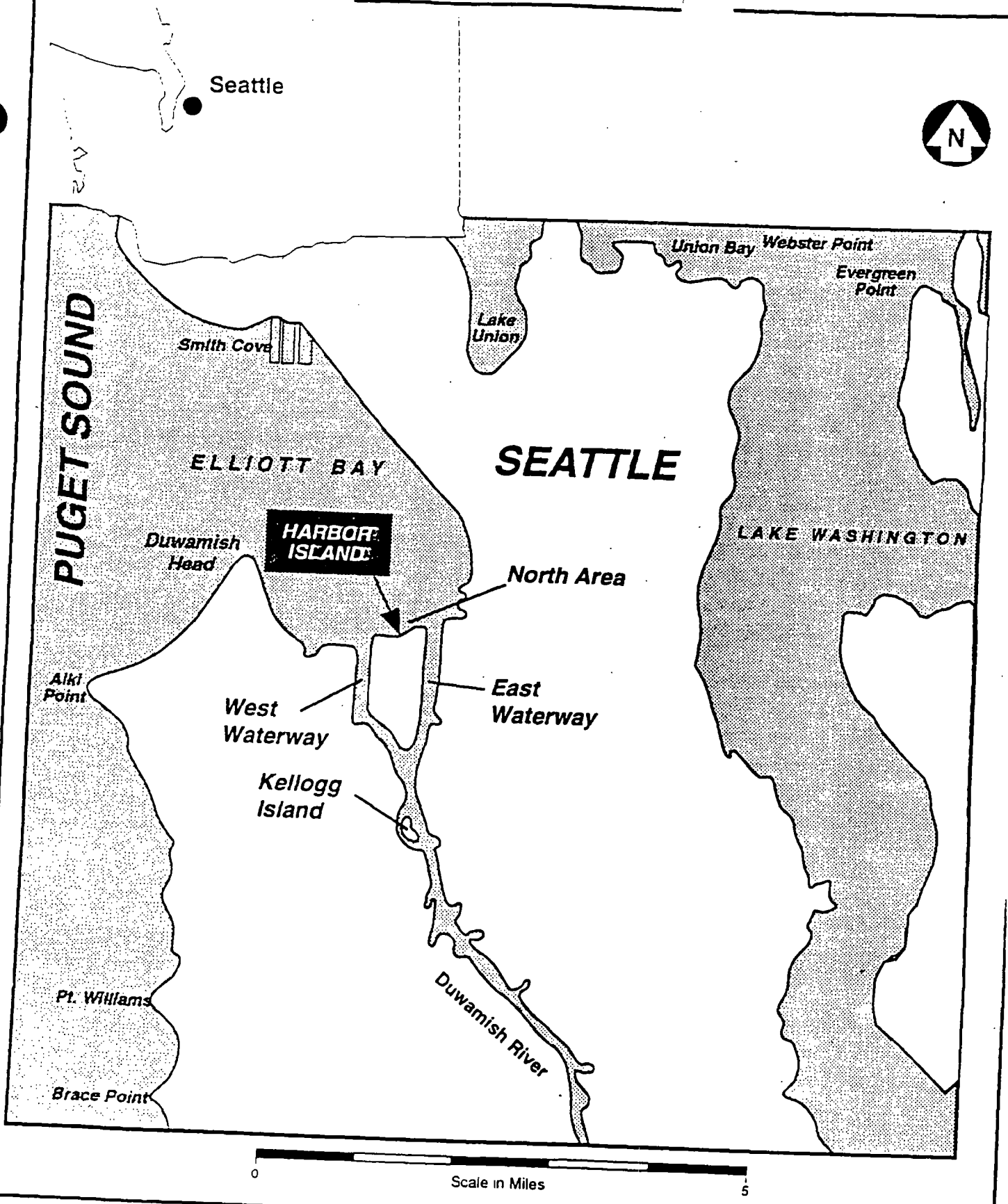
C. SITE HISTORY

Prior to 1885, the area which is currently Harbor Island consisted of tideflats and a river mouth delta with some piling-supported structures. Initial construction of the island began between 1903 and 1905 when dredging of the East and West Waterways and the main navigational channel of the Duwamish River occurred. Dredged sediment was spread across the present island area to form a fill 5 to 15 feet thick. This dredged sediment was later covered with soil and demolition debris from Seattle regrade projects. Since its construction, the island has been used for commercial and industrial activities. Major activities have included ocean and rail transport operations, bulk petroleum storage and transfer, a secondary lead smelter, metal fabrication, and shipbuilding and repair. Warehouses, laboratories, and office buildings also have been located on the island.

Concern over the levels of lead in the air, due to the operation of the lead smelter, prompted several air monitoring studies during the 1970s. A study conducted in 1979 by the Puget Sound Air Pollution Control Agency (PSAPCA) showed that the quarterly average ambient air concentration of lead exceeded the federal standard for lead of 1.5 $\mu g/m^3$ 95% of the time. Subsequently, a site inspection conducted by EPA in 1982 identified a significant volume of lead contaminated soil at the lead smelter facility. As a result of this site inspection, the island was listed on the National Priority List (NPL) in 1983.

In 1985, Ecology performed a preliminary investigation of the Site to further define the nature and extent of contamination on the island. This investigation, and subsequent investigations, revealed numerous types of contaminants in the soil including: cadmium, chromium, arsenic, copper, zinc, mercury, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and petroleum products. A summary of enforcement activities conducted by EPA in regard to cleanup actions for the Soil/Groundwater and Lockheed Shipyard OUs is provided in the RODs for these two OUs.

An initial investigation of marine sediments around Harbor Island was completed by EPA in 1988 as part of the Elliott Bay Action Program (EBAP). The nature and extent of contamination in Harbor Island sediments was characterized in an RI Report issued by EPA in September 1994. A Supplementary RI conducted by a group of Potentially Responsible Parties (PRPs) in 1995 further characterized the extent of chemical contamination in Harbor Island sediments and reported results of biological effects tests conducted on these sediments.

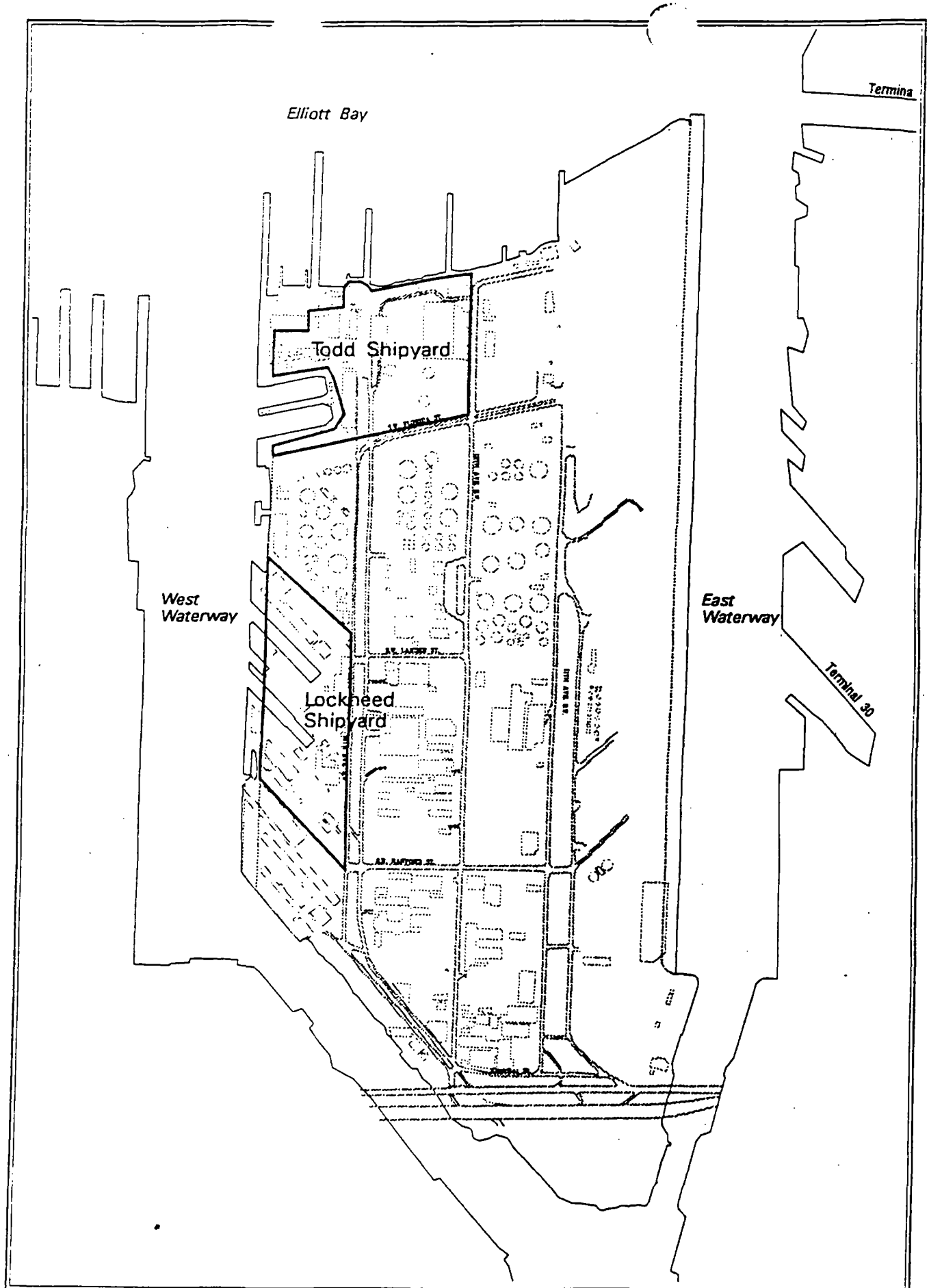


Vicinity Map

WESTON

JOB NUMBER 4000-02-46-2110 DATE: August 1994

FIGURE 1



SCALE 1:11280

250 0 250 500 750

Feet

Harbor Island Site Map

MAP 2

D. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requirements for public participation include releasing the RI and FS Reports and the Proposed Plan to the public and providing a public comment period on the these documents. EPA met these requirements for the Shipyard Sediment OU by placing the RI, Supplementary RI, and FS Reports in the public information repository and issuing the Proposed Plan on October 31, 1995, to individuals on the mailing list. EPA published a notice of the release of the RI, FS, and Proposed Plan in the Seattle Times in the morning edition on November 3, 1995. Notice of the 60 day public comment period and the public meeting discussing the proposed plan were included in the newspaper notice. The public meeting was held on December 6, 1995, at the EPA Region 10 Office at 1200 Sixth Avenue, Seattle, WA. Public comments received are located in the Responsiveness Summary section of the ROD. The remedy selected in this ROD is based on the Administrative Record for this OU, which is located in the Record Center at EPA's Region 10 Office at 1200 Sixth Avenue, Seattle, WA.

To date, the most important community relations activities conducted by EPA at the Harbor Island site have been:

March 1988- EPA updated the 1985 Community Relations Plan.

December 1988- EPA released a fact sheet announcing the beginning of the Remedial Investigation.

November 1989- A fact sheet is released explaining the work being conducted by the City of Seattle to clean and sample the storm drain system on the island.

June 23, 1993- EPA releases the Proposed Plan for the cleanup of the Soil/Groundwater operable unit.

November 3, 1993- EPA releases fact sheet announcing cleanup decision for the Soil/Groundwater.

April 22, 1994- EPA releases a Proposed Plan summary fact sheet and the Proposed Plan for cleanup of the Lockheed Shipyard facility.

August 3, 1994- EPA releases fact sheet announcing cleanup decision for the Lockheed Shipyard.

January 4, 1995- EPA releases fact sheet announcing public comment period on the Lockheed Shipyard Consent Decree.

August 23, 1995- EPA issues fact sheet announcing public comment period on proposed amendment to the Soil/Groundwater ROD.

October 31, 1995- EPA releases the Proposed Plan for cleanup of the Shipyard Sediment OU.

November 3, 1995- Ad runs in the Seattle Times announcing the public comment period for the Shipyard Sediment OU.

December 6, 1995- Public meeting on the Shipyard Sediment OU Proposed Plan.

January 11, 1996- EPA issues fact sheet announcing public comment period on the Soil/Groundwater Consent Decree.

E. SCOPE AND ROLE OF RESPONSE ACTION WITHIN THE REMEDIAL STRATEGY

Contaminated media at the Harbor Island Site consist primarily of soil, groundwater, petroleum products floating on groundwater, and sediments. The overall remedial strategy for the Site is to first remediate contaminant sources on Harbor Island, which include soil, groundwater, and floating petroleum products, before initiating sediment cleanup actions, because sources on the island could recontaminate cleaned sediments.

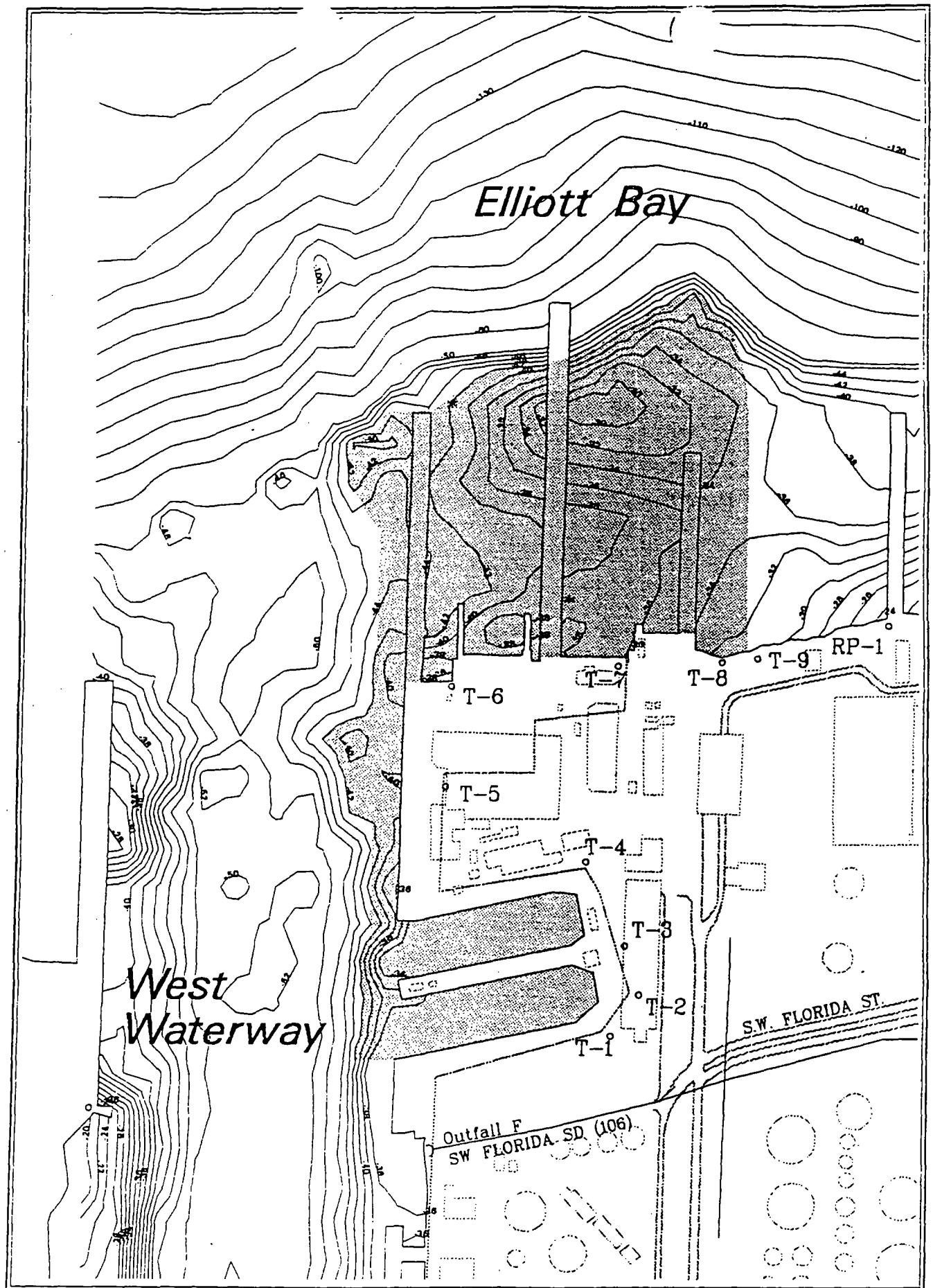
The Shipyard Sediment OU includes nearshore subtidal sediments at Todd Shipyards out to the edge of the steep slopes of Elliott Bay (to the north) and the West Waterway (to the west), which occur approximately at the minus 42 (-42) foot Mean Low Low Water (MLLW) contour, as shown in Figure 3. The Shipyard Sediment OU also includes nearshore subtidal sediments at Lockheed Shipyard out to the edge of the steep slope of the West Waterway, which occurs at approximately the minus 36 (-36) foot MLLW contour, as shown in Figure 4. These sediments are distinct from other contaminated sediments at Harbor Island because they are predominately contaminated with hazardous substances and shipyard wastes (primarily sandblast grit) released by shipbuilding and maintenance operations at Todd and Lockheed Shipyards. Hazardous substances released from these shipyards include copper, lead, mercury, tributyl tin (TBT), and zinc, which were additives to marine paints. The Shipyard Sediment OU is selected for the first Harbor Island sediment remedial action because: 1) sediments in this OU contain the highest concentrations of shipyard hazardous substances, and 2) hazardous substances in this OU likely are a source of contamination to other sediments around Harbor Island.

The remedial action selected in this ROD only addresses contaminated sediment in the Shipyard Sediment OU. The remedial action selected in this ROD is intended to be the final remedy for the Shipyard Sediment OU. EPA intends to further study the remaining contaminated sediments around Harbor Island to determine if additional remedial actions are required on these sediments. Any actions required for sediments outside of the Shipyard Sediment OU will be addressed in a future ROD.

F. SUMMARY OF SITE CHARACTERISTICS

1. Physical Characteristics of the Duwamish River

Harbor Island is situated in a geographic area known as the Puget Lowlands, a trough



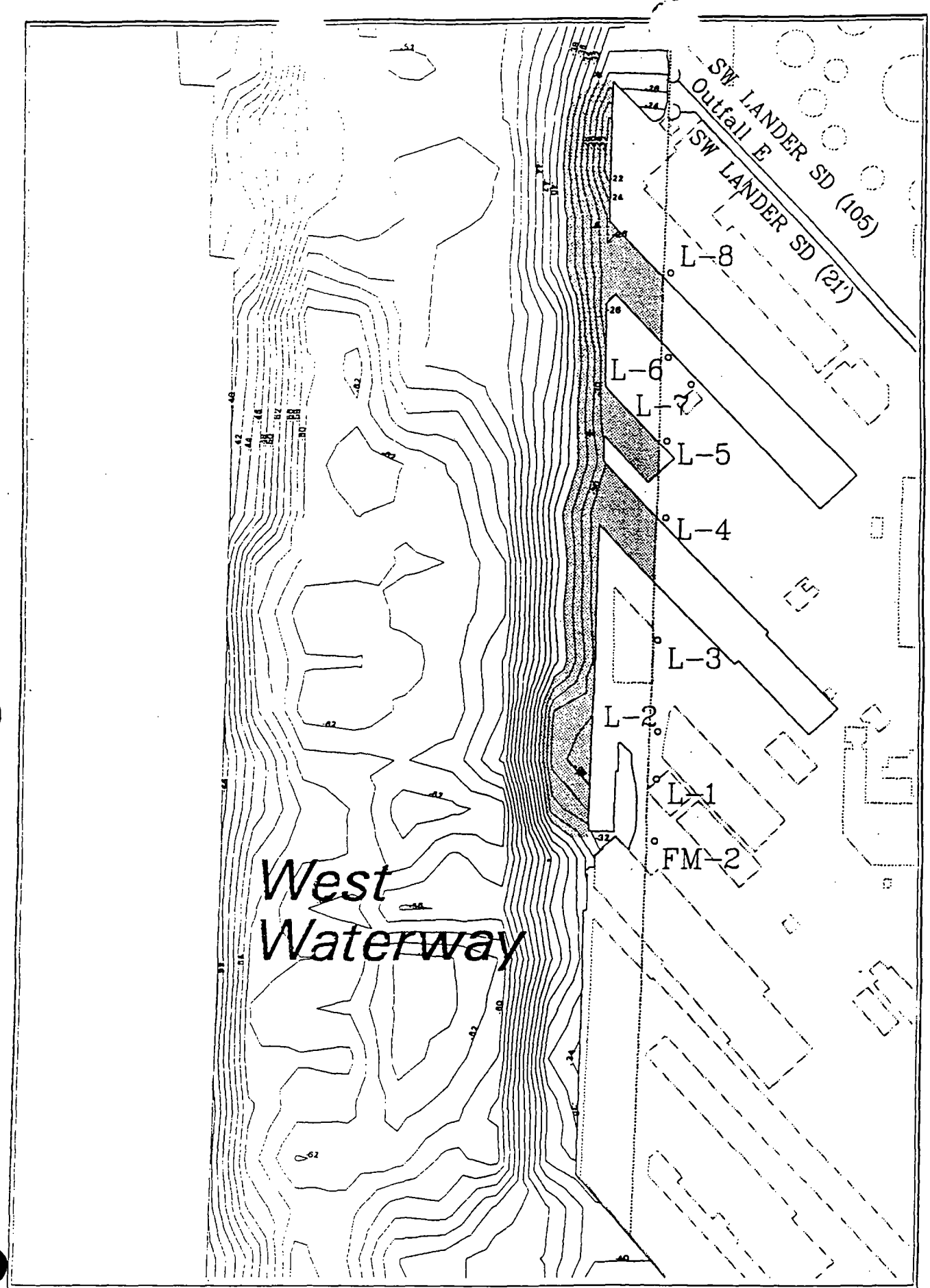
Areas to be Remediated

Contour in Feet

GN MN

Todd Shipyard Cleanup Area

MAP 3



Areas to be Remediated

Contour in Feet

Lockheed Shipyard Cleanup Area

4

characterized by low relief, with glacially shaped bluffs and low rising hills, and a vast area of intertidal and tidal flats. Harbor Island is located on the former delta of the Duwamish River, which flows into Elliott Bay and Puget Sound from the Duwamish-Green River valley. The historical drainage basin of the Duwamish River was approximately 300 percent greater than it is today, prior to modifications of the river channel morphology and flow. Discharges prior to the mid-1800s have been estimated at 2,500 to 9,000 cfs, in contrast to the present average of flow of 1,500 to 1,800 cfs. The sediment of the Duwamish River typically consists of slightly sandy silt with variable to abundant organic detritus (e.g., wood fragments). The bottom sediment in the East and West Waterways is dark brown to black and is characterized as slightly sandy silt in low-flow summer months, and as silty fine sand during high-flow months. Tidal influence in the lower river alters density gradients and river flows, affecting the settlement and movement of sediment in the river. Because of this tidal influence, approximately 80 percent of the Duwamish River suspended sediment load is deposited upstream of Harbor Island. A portion of the remaining sediment is deposited in the nearshore areas of the East and West Waterways, and in the Kellogg Island area, which is about 2 km upstream of Harbor Island.

Transport of suspended and bed sediment in the lower Duwamish River appears to be a function of complex riverine and estuarine processes. River flows and sediment loads (both suspended and bedload) from upstream sources vary seasonally. The amount of natural sediment supplied to the river from upland sources has been limited by anthropogenic changes to the river, including dam construction and shoreline stabilization. The sediment supply to the waterways is further depleted by the periodic maintenance dredging of bed sediment from the turning basin (upriver of Harbor Island), as well as construction of an upriver sediment trap by the Corps.

Although volumes are postulated to be small by comparison, some of the fine-grained muds around Harbor Island are supplied by transport processes in Elliott Bay that carry bed material into the Duwamish River estuary. Evidence exists for seasonal transport and deposition of Elliott Bay sediment upriver as far as the turning basin.

2. Ecological Characteristics of the Shipyard Sediment OU

a. Intertidal and Subtidal Habitat

The aquatic environment surrounding Harbor Island is part of the ecologically important Duwamish River estuary. In the last century, development and dredging have severely reduced intertidal habitats in Elliott Bay and the Duwamish River estuary. Prior to 1895, Elliott Bay included approximately 2,091 acres of intertidal sand and mudflats. This area has been reduced to 54.1 acres through filling, dredging, and bulkheading, eliminating most shallow intertidal habitats. The present shoreline of Harbor Island is generally composed of riprap, pier aprons, or sheet piling.

The Shipyard Sediment OU is mostly a shallow subtidal habitat, with a small amount of intertidal habitat. Sediment in this area reflects riverine inputs as well as intrusion of bay sediment. The natural sediment in the Shipyard Sediment OU is composed of organic detritus and sand which is dark brown to black. The shallow subtidal habitat within the slips of Todd

Shipyards is regularly disturbed by propeller wash, which disrupt colonization and succession of benthic and epibenthic organisms.

b. Intertidal and Shallow Subtidal Biota

The intertidal and subtidal habitat of the Shipyard Sediment OU supports diverse biota, including polychaetes, bivalves, gastropods, ostracods, and amphipods. In general, subtidal macroinvertebrate populations show weak seasonal trends with peaks in abundances in summer and early fall. Stress-tolerant species were found .o be abundant in sediment samples collected from the shipyard sediments during the EBAP investigation. Such species are able to adapt to organic enrichment, changes in salinity, physical disturbance, and chemical contamination. In general, high silt and clay content in the sediment and periodic fast currents tend to preclude long-term stable populations of infaunal filter-feeding species. Deposit-feeding polychaetes, including the cirratulid *Tharyx multifilis* and members of the families Capitellidae, Maldanidae, Spionidae, and Paraonidae, tend to be numerically dominant. The most abundant clam species are *Axinopsida serricata* and *Macoma carlottensis*.

c. Fish

The Duwamish estuary is home to migratory and resident fishes. Elliott Bay and the Duwamish River serve as a migratory route and nursery for coho, chinook, and chum salmon. The estuary also provides an important osmoregulatory transition zone for out-migrating juvenile anadromous fish (e.g., salmonids). Steelhead, cutthroat trout, and Dolly Varden are the most abundant species to use the Duwamish estuary as a migratory route. The most abundant resident fish are Pacific herring, shiner perch, and several demersal species, including English sole, Pacific staghorn sculpin, and starry flounder. Twenty nine resident and seasonal species of demersal fish have been observed in the Duwamish estuary.

d. Marine Mammals

The most common sightings of marine mammals within Elliott Bay are of the harbor seal, California sea lion, and the harbor porpoise. Little information exists regarding marine mammal use of the lower Duwamish River, although there have been sightings of marine mammals in the estuary. Elliott Bay primarily serves as an adult foraging area. It is assumed that the lower Duwamish River would serve a similar function.

e. Avian Species

The small amount of intertidal habitat in the Shipyard Sediment OU may be occasionally used by aquatic birds and shore birds. Such aquatic birds may include a number of summer resident or migratory species of dabbling or diving birds (e.g., horned grebe, hooded merganser, gadwall, wigeon, common murre). Shore birds may include dowitcher, dunlin, yellowlegs, and sandpipers.

3. Contamination Sources for the Shipyard Sediments

Sources of contamination on Harbor Island which have potentially contaminated sediments in the Shipyard Sediment OU include: public and private storm drains, non-point surface runoff from contaminated soil, direct waste disposal, floating petroleum product on groundwater, and contaminated groundwater.

Public storm drains on Harbor Island, owned by the City of Seattle, were cleaned by the City in 1990 and are no longer considered to be a significant source of contamination to sediments. Private storm drains on Harbor Island, some of which release permitted industrial discharges (treated and untreated industrial process wastewater) to the surface water, were sampled in 1993 by EPA and were found not to contain significant contaminant concentrations. These private storm drains are therefore not considered to be significant sources of contamination to sediments.

In the past, contaminated surface soil on Harbor Island has been a significant non-point source to storm drains and surface water. Paving of exposed soil areas over the past two decades by the City and other entities has caused some reduction in the amount of contaminated surface runoff. It is expected that the remedies selected for the Soil/Groundwater and Lockheed Shipyard OUs, which require treatment of petroleum hot spot soil and asphalt paving for soil contaminated above cleanup levels, will eliminate the further release of contamination to surface runoff from both of these OUs.

Contamination groundwater from most of the island, except at Todd Shipyards and the petroleum storage tank OU, have been found to be insignificant. However, floating petroleum product and associated contaminated groundwater at Todd Shipyards is considered to be a source of contamination to sediments at the north end of Harbor Island. This source should be adequately controlled when the remedy selected in the ROD for the Soil/Groundwater OU, which requires pumping and treating floating product and associated contaminated groundwater at Todd Shipyards, is implemented.

Shipbuilding and ship maintenance activities at Todd and Lockheed Shipyards on Harbor Island have resulted in the direct disposal of waste into sediments adjacent to these shipyards. Much of the waste is believed to have originated from sandblasting, which is the process used to remove paint and paint preparations containing copper, lead, mercury, zinc, and TBT. Todd Shipyards has been an active facility since about 1918 and the Lockheed Shipyard began operating in the mid-1930's. Direct discharge of waste is no longer an issue at the Lockheed Shipyard because it is not an active shipyard. It is intended that direct discharge of waste at Todd Shipyards will be eliminated through best management practices, as defined by Washington State solid waste regulations, before the shipyard sediment remedy is implemented.

4. Summary of the Nature and Extent of Contamination

Three independent investigations of Harbor Island sediments have been conducted. The first was conducted in 1986 during the EBAP, the second in 1991 during the RI, and a third in 1995 during a Supplementary Remedial Investigation. Surface sediment locations sampled during the EBAP investigation, the RI, and the SRI are all shown in Figure 5. During the EBAP investigation, contaminants and areas of concern were determined based on exceedance of Puget Sound Apparent Effects Thresholds (AET). An AET is the contaminant concentration in sediment above which specific adverse biological effects have always been observed in Puget Sound studies. Generally, for any one contaminant, different benthic organisms demonstrate biological responses at different concentrations, leading to a range of AETs (e.g., for benthic abundance, amphipod acute toxicity, oyster larvae acute toxicity, and microtox responses). In this investigation, most sediments sampled at Harbor Island exceeded the lowest AET (LAET). Contaminants which were frequently found to exceed the LAET value throughout the entire study area were arsenic, copper, lead, mercury, zinc, polychlorinated biphenyls (PCBs), low molecular weight polynuclear aromatic hydrocarbons (LPAHs), and high molecular weight polynuclear aromatic hydrocarbons (HPAHs).

The EBAP investigation found the highest concentrations of copper, lead, mercury, and zinc, in nearshore sediments at Todd and Lockheed Shipyards. These contaminants were used for many years in marine paints, and were found to be associated with sandblast grit released from the shipyards, further indicating that the shipyards were the major source of these contaminants found in the nearshore sediments. Other contaminants found in shipyard sediments and potentially associated with shipyard activities included PCBs and PAHs. The highest concentrations of contaminants found in two samples taken at Todd Shipyards, and in three samples taken at Lockheed Shipyards, and the comparison to the LAET value for each contaminant, are shown in Table 1.

In order to determine the acute and chronic toxicity to marine organisms of contaminants in Harbor Island sediments, the EBAP investigation also conducted sediment bioassays and determined the abundance of major benthic taxa in sediment samples. The results of these biological tests are summarized in the "Ecological Assessment" section of this ROD.

The RI of Harbor Island sediments was initiated by EPA in 1991. In this investigation surface (0-2 cm) sediment samples were collected from 96 locations and analyzed for contaminant concentrations. For the RI, the screening level used to identify contaminant concentrations of concern was the Sediment Quality Standard (SQS) of the Washington State Sediment Management Standards. The surface sediment samples collected during the RI indicated that contaminants exceeding the chemical SQS at Todd and Lockheed Shipyards were copper, mercury, PCBs, HPAHs, and LPAHs. The highest concentrations of these contaminants found at Todd (ten samples) and Lockheed Shipyards (six samples), and the comparison to the chemical SQS for each contaminant, are shown in Table 2. Since there is currently no cleanup standard for TBT, the highest TBT concentrations (as tin) found at the shipyards are compared to the Puget Sound Dredge Disposal Agencies (PSDDA) screening level.

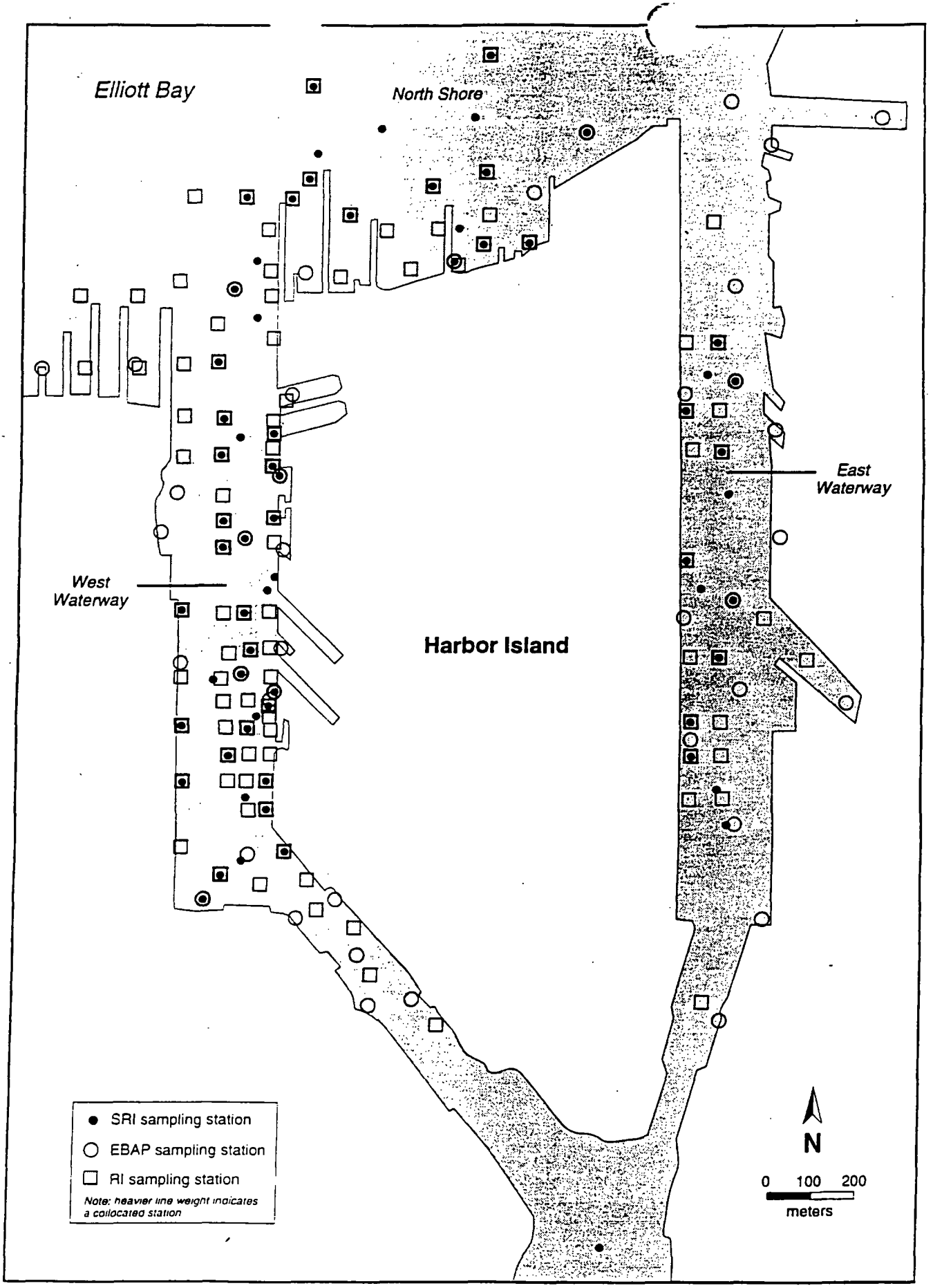


Figure 5. Locations of sediment sampling stations for the EBAP, RI, and SRI

TABLE 1

EBAP Sediment Contaminant Concentrations (mg/kg, dry weight)

Contaminant	(LAET)	Todd Shipyards	Lockheed Shipyard
Arsenic	(85)	119	239
Copper	(310)	2050	618
Lead	(300)	550	1180
Mercury	(0.41)	10	0.8
Zinc	(260)	1300	1170
PCBs	(0.13)	109	537
LPAHs	(5.2)	273	316
HPAHs	(12)	1674	1453

TABLE 2

RI Contaminant Concentrations (mg/kg*) Exceeding Chemical SQS

Contaminant	(SQS)	Todd Shipyards	Lockheed Shipyard
Copper	(390)	788	ne
Mercury	(0.41)	4.2	0.47
TBT	(0.03)**	35	0.99
PCBs	(12)	141	14.6
LPAHs	(370)	1928	ne
HPAHs	(960)	8574	ne

TABLE 3

SRI Contaminant Concentrations (mg/kg*) Exceeding Chemical SQS

Contaminant	(SQS)	Todd Shipyards	Lockheed Shipyard
Arsenic	(57)	ne	99
Copper	(390)	909	394
Lead	(450)	ne	651
Mercury	(0.41)	4.6	2.2
Zinc	(410)	ne	1160
TBT	(0.03)**	15	1.5
PCBs	(12)	177	ne

* Metals and TBT (as tin) are in dry weight, organics are organic-carbon normalized.
ne = no exceedance
** The PSDDA Screening Level (mg/kg, dry weight)

In the RI, subsurface sediment samples were also collected to depths of 4 feet from 8 locations in nearshore areas of Harbor Island and analyzed for contaminant concentrations. Two of these subsurface cores were located at Todd Shipyards and two were located at the Lockheed Shipyard. In the subsurface samples taken at the shipyards, arsenic, copper, lead, mercury, and zinc exceeded their SQS levels at depths up to 4 feet below the surface. In fact, the concentrations of these contaminants in the subsurface at the shipyards actually increased with depth, reaching maximum concentrations at depths of 3 or 4 feet below the surface. These data indicate that copper, lead, mercury, and zinc were released in greater quantities prior to the mid-1980s when the shipyards began implementing controls to reduce the release of sandblast grit to the environment.

In February 1995, subsequent to completion of EPA's remedial investigation, a group of potentially responsible parties (PRPs), under an Administrative Order issued by EPA, conducted a Supplementary Remedial Investigation (SRI) of Harbor Island sediments to verify contaminant concentrations in these sediments and to determine if these contaminants are causing adverse biological effects in benthic organisms. In this investigation, surface (0-10 cm) sediment samples were collected from a total of 61 locations around the island, including ten samples collected within the Shipyard Sediment OU. The results of this investigation showed that contaminants exceeding the chemical SQS at Todd and Lockheed Shipyards were arsenic, copper, lead, mercury, zinc, and PCBs. The highest concentrations of these contaminants found during the SRI at Todd and Lockheed Shipyards, and the comparison to the chemical SQS for each contaminant, are shown in Table 3.

During the SRI, biological effects tests (bioassays) were conducted on sediment samples collected from 35 stations around Harbor Island. However, the PRPs elected to conduct bioassays on sediments from only three stations at Todd Shipyards and three stations at Lockheed Shipyard within the Shipyard Sediment OU. The results of these bioassays are summarized in the "Ecological Assessment" section of this ROD.

5. Routes of Potential Contaminant Migration in Sediments

Harbor Island shipyard contaminants (copper, lead, mercury, TBT, zinc, PAHs, and PCBs) all have high affinity for sediment and organic matter found in sediment. However, these contaminants also bind to suspended particulates and dissolved organic macromolecules. Depending on the physical and chemical properties of each contaminant, they are also dissolved in water to a small degree.

When bound to suspended particulates or dissolved in water, these contaminants can be transported away from the site in the water column. The ultimate fate of contaminants are dependent on the rate of freshwater flow in the Duwamish River and tidal exchange with Elliott Bay. Under conditions of low flow (i.e., during the summer months), the majority of the suspended particulate matter leaving Harbor Island settles into the sediment in the East and West Waterways. However, during months of heavy rainfall, a large fraction of the particulates is transported in a buoyant plume to Elliott Bay, where settlement likely takes place.

Sediment-bound contaminants are also transported as bedload, driven by both tidal movement within the salt wedge, and riverine flows. Mobile bottom sediment tends to settle out in areas of null current (i.e., the vicinity of the toe of the salt wedge). Under conditions of low flow, this process could cause bedload sediment around Harbor Island to be transported several miles up the Duwamish River. Under higher flow conditions, deposition of bedload sediment extends out into Elliott Bay. The ultimate sink for bedload sediment may be the submarine canyon that connects to the central Puget Sound basin.

G. SUMMARY OF RISKS FOR THE SHIPYARD SEDIMENT OU

1. Ecological Assessment

Evidence of Historical Biological Impacts

Biological effects data were collected at stations around Harbor Island during the EBAP study in 1986. In this study, sediment acute toxicity was determined using the amphipod *Rhepoxynius abronius*, and chronic toxicity was determined by observing the abundance of three major benthic taxa, *polychaeta*, *crustacea*, and *mollusca* (measured as abundance of *pelecypoda* and *gastropoda*). At one station (NH-03) located near the shoreline on the north side of Todd Shipyards, the mean amphipod mortality was 94%, which was significantly higher than mortality measured at the reference station and was the highest mortality measured at any Harbor Island station. Since the amphipod mortality for NH-03 was 30% higher than the reference station, this station fails the biological CSL of the Sediment Management Standards. At this station *gastropods* were depressed by 94% relative to the reference station, *pelecypods* were depressed by 87%, and *crustaceans* were depressed by 77%. Since the benthic abundance for NH-03 was significantly different from the reference station and depressed by greater than 50% for two major benthic taxa, this station also fails the biological CSL for benthic abundance. At another EBAP station (WW-19) located near the shore on the west side of Todd Shipyards, there was a significant depression in *pelecypods* and *crustaceans*. At this station *pelecypods* were depressed by 93% relative to the reference station, and *crustaceans* were depressed by 65%. Since the benthic abundance for WW-19 was depressed by greater than 50% for two major benthic taxa, this station fails the biological CSL for benthic abundance.

Biological effects were also measured at three sediment stations located near the shoreline at the Lockheed Shipyard (WW-09, WW-11, and WW-12) during the EBAP investigation. At these stations the mean amphipod mortality was 60%, 41%, and 33%, respectively. The amphipod mortality for stations WW-09 and WW-11 was significantly higher ($P < .05$) than the reference station, and the mortality at station WW-09 was more than 30% higher than the reference station, which is a failure of the biological CSL. The abundance of *pelecypods* each at WW-09, WW-11, and WW-12 was depressed 85%, 90%, and 57%, respectively, relative to the abundance at the reference station. Since the abundance of *pelecypods* at each of these three stations was significantly different and depressed by more than 50% relative to the reference station, these stations fail the biological SQS for benthic abundance. The abundance of *crustaceans* at WW-12 was also significantly different and depressed 81% relative to the abundance at the reference station. Since the abundance of two major benthic taxa was

depressed by more than 50% at station WW-12, this station also fails the biological CSL for benthic abundance.

Evidence of Ongoing Biological Impacts

A mussel bioaccumulation study conducted during the RI demonstrated that bioaccumulation of contaminants and adverse biological effects occurred in mussels placed at stations located near the shoreline at Todd and Lockheed Shipyards. Caged mussels were suspended 1 meter above contaminated sediments for 80 days at 12 nearshore locations at Harbor Island, including at Todd and Lockheed Shipyards. The results of this study demonstrated that the highest bioaccumulation of copper and zinc, and the second highest bioaccumulation of TBT, occurred at a station located at Todd Shipyards. The slowest juvenile mussel growth rates also occurred at this station. Relative to the reference station, high bioaccumulations of copper, lead, and TBT, occurred at a station next to the Lockheed Shipyard in the West Waterway, and a significant decrease in mussel growth rates also occurred at this station. This study indicates that contaminants in the shipyard sediments bioaccumulate in mussels and are associated with adverse biological effects in these organisms.

Two acute and one chronic biological tests (bioassays), according to the requirements of the Sediment Management Standards, were conducted on sediments from six stations within the Shipyard Sediment OU during the SRI. Of these six stations, three (NS-09,-10,-14) were located in nearshore sediments at Todd Shipyards, and the other three (WW-12,-13,-18) were located in nearshore sediments at Lockheed Shipyard. Two of the stations (NS-09 and NS-14) at Todd Shipyards failed the biological SQS for juvenile polychaete growth in *Neanthes arenaceodentata*. One of the stations (WW-12) at the Lockheed Shipyard also failed the biological SQS for mortality/abnormality in the bivalve *Mytilus galloprovincialis*.

2. Human Health Risk Due to Consumption of Seafood

A 1988 EPA report titled, "Health Risk Assessment of Chemical Contamination in Puget Sound Seafood", which was based on data collected during the EBAP study, evaluated the potential adverse human health effects associated with regular consumption of recreationally harvested seafood from Puget Sound. The most significant human health risk identified in this study was an elevated cancer risk due to high concentrations of PCBs in fish (English sole) captured in the Elliott Bay/Duwamish River area. Among the trawling locations sampled for English sole in this area, two of them were immediately adjacent to the Shipyard Sediment OU. While the results of this study are not specific to the Shipyard Sediment OU, it is likely that high concentrations of PCBs in sediment at Todd Shipyards contribute to the elevated cancer risk identified in this study.

Contaminant Screening

The contaminants of concern for this seafood risk assessment were selected based on the following criteria: 1) high persistence in the aquatic environment, 2) high bioaccumulation potential, 3) high toxicity to humans, 4) known sources on contamination in the area, and 5) high concentrations in previous samples of seafood from the area. Contaminants of concern

identified in this study included: lead, cadmium, mercury, arsenic, HPAHs, PCBs, alpha-hexachlorohexane, and DDT.

Exposure Assessment

Risks were estimated for a subsistence fisherman consuming average quantities of seafood (12.3 grams fish, 1.1 grams shellfish, and 0.029 grams seaweed per day), and high quantities of seafood (95.1 grams fish, 21.5 grams shellfish, and 20.3 grams seaweed per day).

Mean contaminant concentrations and the average consumption rates for various categories of seafood were used to estimate average lifetime doses for contaminants of concern. The upper 95 percent confidence limit of mean contaminant concentrations in seafood and the high consumption rates for seafood were used to estimate high lifetime doses for each contaminant.

Toxicity Assessment

The dose-response variables used in this risk assessment were potency factors for carcinogens and reference dose (RfD) values for non-carcinogens. The carcinogenic potency factors used in this study were typically the upper 95 confidence limit of slope of the linearized multistage model. The RfDs used were the estimated single daily chemical intake rate which would cause no adverse health effects if ingested over a lifetime. Both carcinogenic potency factors and RfD values used in this assessment were taken from EPA's Integrated Risk Information System (IRIS), dated 1987.

Risk Characterization

The average risk from consumption of Elliott Bay fish was found to be 3 in 10,000 (3.0E-04), and high risk was found to be 4 in 1,000 (4.0E-3). Both these risk levels exceed the acceptable excess cancer risk of 1 in 10,000 (1.0E-04) identified in the National Contingency Plan (NCP). The risk levels for consumption of Elliott Bay fish were among the highest found anywhere in Puget Sound and were driven by the high concentrations of PCBs in fish caught in the upper Duwamish River and around Harbor Island. In particular, fish caught at trawling locations in the West Waterway and North Harbor Island area, immediately adjacent to Todd Shipyards, had tissue concentrations of PCBs which were among the highest in this study area. The mean concentrations of PCBs in fish tissue were 460 ug/kg for the West Waterway, and 350 ug/kg for the North Harbor Island area. In comparison, the mean concentration of PCBs in fish tissue at the reference station was 5.4 ug/kg.

Since English sole are migratory and feed over a large area during their lifetime, the results of this seafood risk assessment cannot be used to identify specific sediment sources responsible for the PCBs detected in English sole. However, it is likely that the high concentrations of PCBs in sediments at Todd Shipyards contribute to the elevated cancer risk identified in this study.

In addition to the seafood risk assessment, an additional human health exposure pathway was evaluated in the RI. This pathway, which was direct contact with and accidental ingestion of

contaminated sediment by local fishermen while pulling up fishing nets, was found to be an insignificant human health risk.

3. Uncertainty Analysis

a. Uncertainties in Analytical Data

Uncertainties in analytical results directly influence uncertainties associated with final risk calculations. All analytical results, not only those flagged as "estimated" during the validation process, possess an inherent variability. This variability or uncertainty is dependent upon the sample matrix, analytical method, and the particular analytical laboratory performing the analysis. Homogeneous samples (i.e., sediment with uniform grain size and water content) typically exhibit higher precision than relatively heterogeneous sediment.

A variability of minus 50 to plus 100 percent is not unreasonable for samples containing contaminants at concentrations less than the contract-required quantitation limit. For samples containing higher concentrations of contaminants, relative percentage differences between duplicates of 35 percent for sediment are considered acceptable.

b. Toxicity-Related Assumptions

The major site-specific uncertainty relating to potential human health risks pertains to the carcinogenicity of PCBs. The cancer slope factor for all PCBs is derived from a chronic rodent bioassay of Aroclor-1260. However, the highly chlorinated PCB mixtures such as Aroclor-1260 are more potent than the lower chlorinated mixtures (e.g., Aroclors 1254 and 1248). Consequently, using the slope factor for Aroclor-1260 to evaluate Aroclors 1248 and 1254 is expected to overestimate the excess cancer risk estimates associated with these lower chlorinated PCBs. The EBAP and RI studies referenced in this ROD measured only total PCBs, and did not determine concentrations of individual PCB Aroclors in sediment or fish tissue.

H. CLEANUP OBJECTIVE AND SEDIMENT CLEANUP STANDARDS

The Shipyard Sediment OU includes nearshore sediments at Todd and Lockheed Shipyards which contain hazardous substances and shipyard waste (primarily sandblast grit) released from these shipyards. Shipyard hazardous substances include: copper, lead, mercury, TBT, and zinc, which were additives to marine paints used at the shipyards. Other hazardous substances potentially associated with shipyard activities include PCBs and PAHs. Evidence for adverse effects in benthic organisms due to contaminants in the Shipyard Sediment OU was initially demonstrated by bioassays and benthic abundance studies conducted during the EBAP investigation. Adverse benthic effects in the Shipyard Sediment OU were also demonstrated by bioassays conducted during the SRI. The RI mussel study results further indicate that copper, lead, zinc, and TBT in the shipyard sediments are biologically available and bioaccumulate in mussels, causing adverse biological effects in these organisms. Actual or threatened releases of hazardous substances from the Shipyard Sediment OU, if not addressed by implementing the remedy selected in this ROD, may present an imminent and substantial endangerment to human health and the environment.

Since the Shipyard Sediment OU is part of a ecologically rich and diverse estuarine habitat where juvenile salmonid feed, the cleanup objective for this OU is to reduce concentrations of hazardous substances to levels which will have no adverse effect on marine organisms. Chemical and biological cleanup standards which will meet this objective are contained in the Washington State Sediment Management Standards, which are the primary applicable or relevant and appropriate requirements (ARARs) for the Shipyard Sediment OU. The Sediment Management Standards define two levels of chemical and biological standards. The more stringent level, the "Sediment Quality Standard" (SQS), is the sediment cleanup objective and corresponds to a sediment quality which has no acute or chronic adverse effects on marine organisms. In other words, contaminant concentrations below the chemical SQS are not expected to cause adverse biological effects in marine organisms. The less stringent level, the "Cleanup Screening Level" (CSL), is the level above which minor adverse effects always occur in marine organisms. The biological standards are based on results of biological tests which demonstrate adverse effects in benthic organisms which dwell in sediments. If both biological and chemical data are obtained at a site, the biological data determine compliance with the Sediment Management Standards.

According to the Sediment Management Standards, sediment cleanup standards are established on a site-specific basis (WAC 173-204-570). The site-specific standard must be between the SQS, which is the cleanup objective, and the CSL, which is also known as the minimum cleanup level (MCUL). Criteria to be considered in the selection of a site-specific standard include technical feasibility, cost, and environmental benefit. The approach used to select the site-specific standard for the Shipyard Sediment OU was to determine the difference in costs and environmental benefits of technically feasible general response actions which achieve the SQS and the MCUL. There are three possible results of this type of evaluation. If neither costs nor benefits are significantly different between response actions which achieve the SQS and the MCUL, the SQS should be selected as the cleanup standard. If greater benefits are gained by achieving the SQS but costs are not significantly different, the SQS should also be selected as the cleanup standard. Finally, if costs are significantly greater to achieve the SQS but benefits are not significantly different, the MCUL should be selected as the cleanup standard.

The only feasible response action which would achieve the MCUL is to dredge to the CSL. The three feasible response actions which would achieve the SQS include: 1) dredging to the SQS, 2) capping contaminated sediments in place without dredging, and 3) dredging to the CSL and then capping (referred to as "dredging and capping"). The net environmental benefit of each method was qualitatively evaluated and ranked as either "low", "medium", or "high". Capping without dredging to achieve the SQS would likely result in a future release of contaminants which exceed the CSL if cap erosion occurs. Because cap erosion could result in the future release of contaminants exceeding the CSL, this method was ranked "low" for environmental benefit and was eliminated from further evaluation. Dredging to achieve the CSL was ranked "medium" for environmental benefit because remaining contaminants between the SQS and CSL are exposed to the environment and capable of causing minor adverse biological effects. Dredging to achieve the SQS was ranked "high" for environmental benefit because all contaminants of concern are removed from the environment. "Dredging and capping" was also ranked "high" because contaminants remaining after dredging to the CSL are isolated from the environment by a clean cap.

The estimated costs of the general response actions are based on the cost estimates of the remedial alternatives identified in this ROD (see, "Description of Remedial Alternatives"). The cost of dredging all sediments exceeding the CSL in the Shipyard Sediment OU, including long-term monitoring costs, would be approximately $9.0 M. The cost of "dredging and capping" to achieve the SQS would cost approximately 15% more than dredging to the CSL. The cost of dredging to the SQS would cost approximately 70% more than dredging to the CSL.

The costs and environmental benefits of the CSL general response action were compared with the two SQS general response actions which provide a greater environmental benefit. Even though dredging to the SQS provides a greater benefit, it is significantly more expensive than dredging to the CSL, and therefore cannot justify selecting the SQS as the cleanup standard. On the other hand, "dredging and capping" to achieve the SQS can provide a greater environmental benefit with only a 15% increase in cost compared to the response of dredging to the CSL. Since the "dredging and capping" response can achieve a greater environmental benefit without a significant cost increase, this justifies selecting the SQS as the site-specific cleanup standard for the Shipyard Sediment OU. Therefore, the SQS is the cleanup standard for the Shipyard Sediment OU.

According to the RI and SRI chemical data, contaminants which exceed the chemical SQS in sediments at Todd Shipyards include copper, mercury, PCBs, LPAHs, and HPAHs. Contaminants which exceed the chemical SQS in sediments at Lockheed Shipyard include arsenic, copper, lead, mercury, and zinc. Biological effects data collected during the SRI from Todd and Lockheed Shipyards indicate that two stations failed the biological SQS at Todd and one station failed the biological SQS at Lockheed. However, in areas not tested during the SRI, the EBAP biological data indicate that two stations failed the biological CSL at Todd, and one station failed the biological CSL at Lockheed. Since there are both chemical and biological data for Todd and Lockheed Shipyard sediments which fail the SQS cleanup standard, remedial action is required for these sediments.

Contaminants which exceed the chemical SQS in the Shipyard Sediment OU, and their corresponding numerical SQS and CSL values, are shown in Table 4. The current standards for PCBs are not intended to be protective of human health from bioaccumulation of PCBs in seafood. Also, there are no standards for TBT, which is toxic to marine organisms. This ROD does not establish TBT or PCB bioaccumulation cleanup goals for the Shipyard Sediment OU. However, EPA intends to establish such cleanup goals in the ROD for the remaining contaminated sediments at Harbor Island.

I. DESCRIPTION OF REMEDIAL ALTERNATIVES

Numerous technologies and techniques for removing, containing, or treating contaminated sediments were screened for their effectiveness, implementability, and cost in the Harbor Island Sediment Feasibility Study. As a result of this screening, three remedial alternatives which best met these criteria were identified for the Harbor Island sediments. These three alternatives are: 1) Capping, 2) Dredge to the Chemical SQS, and 3) Dredge to the Chemical

TABLE 4		
CHEMICAL SQS AND CSL FOR HARBOR ISLAND SEDIMENTS		
CONTAMINANT	SQS (mg/kg)	CSL (mg/kg)
Arsenic	57 d.w.	93 d.w.
Copper	390 d.w.	390 d.w.
Lead	450 d.w.	530 d.w.
Mercury	0.41 d.w.	0.59 d.w.
Zinc	410 d.w.	960 d.w.
PCBs	12 o.c.	65 o.c.
LPAHs**	370 o.c.	780 o.c.
HPAHs***	960 o.c.	5300 o.c.

d.w. =dry weight
o.c. =organic carbon normalized
**low molecular weight polynuclear aromatic hydrocarbons
***high molecular weight polynuclear aromatic hydrocarbons

CSL and Cap. To these three alternatives, a "No Action" alternative was added as a baseline alternative, against which the three active remedial alternatives could be compared.

At the time of this ROD, adequate information does not exist to select specific disposal sites for dredged contaminated sediments from Todd and Lockheed Shipyards. Two conventional disposal options for dredged contaminated sediments are confined nearshore disposal (CND) and confined aquatic disposal (CAD). Specific CND or CAD sites will be selected during remedial design after obtaining adequate information on available CND and CAD sites in the Elliott Bay area. However, since the capacity for CAD is limited in Elliott Bay, CND is considered the most feasible disposal option for the shipyard sediments, and is the option used to develop alternative cost estimates in this ROD. To determine a reasonable cost for disposal in a CND facility, EPA averaged CND costs associated with other dredging projects in Elliott Bay and Commencement Bay. This average CND cost was determined to be about $30 per cubic yard of sediment. Independently, Todd Shipyards conceptually designed a CND facility which could be constructed at one end of the slips which Todd owns on the West Waterway. Todd's cost estimate for disposal in this on-site CND facility was about $16 per cubic yard. Since Todd's on-site CND facility cost is significantly less than EPA's estimated average cost for CND, the cost estimates for Todd Shipyards' alternatives are shown as a range of cost. The lower end of each cost range is based on the estimated cost of disposal in the proposed on-site CND facility, and the higher end of the range is based on the average CND cost.

The cost estimates for Alternatives 2, 3, and 4 do not include the cost of dredging under-pier sediments because the cost, the environmental benefit, and effect on pier stability of dredging under-pier sediments has not been determined. In particular, the cost of under-pier dredging is strongly dependent on site-specific conditions and could be 5 to 10 times the cost of open-water dredging. Therefore, the extent of under-pier dredging necessary to meet the cleanup standard will be determined by EPA during remedial design. The cost estimates for Alternative 2 and 4 also do not include the cost of cap armoring because it is uncertain if armoring will be required until the remedial design is completed. The details of the cost estimates for each alternative are provided in Appendix B of this ROD.

Alternative 1, No Action

This alternative includes no containment, dredging, or institutional controls to reduce the exposure to the contaminated sediments. These sediments would remain in place and continue to act as a source of contaminants to the environment. There would be no further monitoring of biological effects or sediment contaminant concentrations under this alternative. There would be no cost associated with this alternative.

Alternative 2, Capping

This alternative consists of capping the shipyard sediments with up to 4 feet of clean sediment to contain the underlying contaminants and create a suitable benthic habitat. Prior to capping, a moderate amount of dredging would be required in the nearshore areas of the Todd and Lockheed Shipyards to maintain navigation depths and to reduce slopes to a grade of less than 20%, which would ensure cap stability. The cap may require armoring with

gravel or small rocks to protect it from erosion in areas exposed to ship traffic, dry dock activities, or natural forces. Long-term maintenance of the cap would be required to assure the effectiveness of this alternative. This alternative would decrease the water depth in the slips on the north side of Todd Shipyards and would restrict the size of vessels which could access these slips.

Dredging may be performed by either a cutterhead/pipeline dredge, watertight clamshell, or a suction dredge. Depending upon the restrictions to navigation allowable, and the distance to the disposal or holding area, the dredged sediments may be transported by either a pipeline or barge. The clean cap would be put in place either by a spilt-hull barge or by a hydraulic pipeline. In areas to be capped immediately adjacent and under piers, it would be necessary to use a pipeline to accurately place the capping material. Dredging and capping would not be conducted during the period of juvenile salmonid migration, which typically runs from April 1 to June 15.

Daily short-term water quality monitoring would be performed during dredging, capping, and disposal activities to assure that water quality standards are not exceeded. Long-term monitoring, by bathymetric surveys, would be required to verify cap stability and thickness. This monitoring would be performed one year after capping, and then periodically. To verify that the caps provide a suitable habitat for benthic organisms, biennial monitoring for benthic abundance would be conducted in the capped areas until it is demonstrated that a stable benthic community is established.

For this alternative, the estimated volume of sediment to be dredged at Todd Shipyards is 45,000 cubic yards and approximately 160,000 cubic yards of clean sediment would be needed for the cap. The estimated design and construction cost for this alternative at Todd Shipyards is $3.0-3.9 Million (M). After construction is complete, ten years of cap monitoring and maintenance at Todd is estimated to cost $1.0 M. The estimated volume to be dredged at Lockheed Shipyard is 21,000 cubic yards, and the volume of sediment required for the cap is about 23,000 cubic yards. The estimated design and construction cost for this alternative at the Lockheed Shipyard is $1.7 M. Ten years of cap monitoring and maintenance at Lockheed would cost about $0.5 M. It is estimated that it would take approximately 26-32 months to design and construct this remedy at Todd Shipyards, and 22-28 months to design and construct this remedy at the Lockheed Shipyard.

Alternative 3, Dredge to the Chemical SQS

This alternative consists of dredging all shipyard sediments which exceed chemical SQS. No cap would be required in this alternative. Disposal sites for dredged sediments would be selected during the remedial design after the dredged sediments are characterized and available disposal sites are evaluated. Dredging and transport of dredged sediments would occur as described in Alternative 2. Short-term water quality monitoring of dredging and disposal activities would also occur as described in Alternative 2. This alternative would not require any long-term monitoring or maintenance.

Based on RI data, this alternative would require dredging approximately the uppermost 5-7 feet of sediment on the north side and approximately the uppermost 5 feet of sediment on the west side of Todd Shipyards. At the Lockheed Shipyard, approximately the uppermost 6 feet of sediment would have to be dredged. For this alternative, the estimated volume of sediment to be dredged at Todd Shipyards is 205,000 cubic yards, and the estimated design and

construction cost is $6.4-10.7 M. The estimated volume to be dredged at Lockheed Shipyard is 32,000 cubic yards and the estimated design and construction cost is $2.0 M. Monitoring for contaminant concentrations in the shipyard sediment areas would be required after dredging to assure that the cleanup goals are achieved. It is estimated that it would take approximately 30-36 months to design and construct this remedy at Todd Shipyards, and 22-28 months to design and construct this remedy at the Lockheed Shipyard.

Alternative 4, Dredge to the Chemical CSL and Cap
This alternative consists of dredging shipyard sediments which exceed chemical CSL and placing a minimum 2 foot cap of clean sediment to contain remaining contamination and create a suitable benthic habitat. This cap may require armoring with gravel or small rocks to protect it from erosion in areas exposed to ship traffic, dry dock activities, or natural forces. Long-term maintenance of the cap would be required to assure the effectiveness of this alternative. Disposal sites for dredged sediments will be selected during the remedial design after the dredged sediments are characterized and available disposal sites are evaluated. This alternative would maintain present water depth in the slips on the north side of Todd Shipyards and not restrict the size of vessels which could access these slips. Dredging, capping, and transport of dredged sediments would occur as described in Alternative 2. Short-term monitoring of water quality during dredging, capping, and disposal activities would be required as in Alternative 2. Long-term monitoring and maintenance of the cap would also occur as described in Alternative 2.

Based on RI data, this alternative would require dredging approximately the uppermost 2-4 feet of sediment at Todd Shipyards and approximately the uppermost 3-5 feet of sediment at the Lockheed Shipyard. For this alternative, the estimated volume of sediment to be dredged at Todd Shipyards is 116,000 cubic yards, and approximately 80,000 cubic yards of clean sediment would be needed for the cap. The estimated design and construction cost for this alternative at Todd Shipyards is
$4.5-6.9 M. Ten years of cap monitoring and maintenance at Todd is estimated to cost $1.0 M. The estimated volume to be dredged at Lockheed Shipyard is 18,000 cubic yards, and the volume of sediment required for the cap is about 11,000 cubic yards. The estimated design and construction cost for this alternative at the Lockheed Shipyard is $1.5 M. Ten years of cap monitoring and maintenance at Lockheed is estimated to cost $0.5 M. It is estimated that it would take approximately 28-34 months to design and construct this remedy at Todd Shipyards, and 22-28 months to design and construct this remedy at the Lockheed Shipyard.

J. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The above four alternatives for the Todd and Lockheed Shipyard sediments were evaluated using each of the nine criteria outlined in the National Contingency Plan. These criteria are:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, and Volume through Treatment
- Short-Term Effectiveness
- Implementability

- Cost
- State Acceptance
- Community Acceptance

Overall Protection of Human Health and the Environment

For overall protection of human health and the environment, Alternative 3 (Dredge to the Chemical SQS), ranks highest because it requires the removal of all contaminated sediments above the SQS cleanup goals and permanent disposal of the dredged sediments in an appropriate disposal facility. Alternative 4 (Dredge to the Chemical CSL and Cap), provides the next highest degree of protection because it requires removal and disposal of the most toxic sediments (which exceed the chemical CSL) and achieves the chemical SQS by isolating the remaining contamination under a minimum two-foot thick cap. Alternative 2 (Capping), provides the least degree of protection because it leaves the most toxic sediments in place and depends entirely on long-term containment of contamination for protection of human health and the environment. Alternative 1 (No Action) provides no protection of human health or the environment.

Compliance with ARARs

Alternatives 2, 3, and 4 all achieve the site-specific cleanup standard, which is the chemical SQS of the Sediment Management Standards. If properly designed and implemented, these three alternatives would also comply with other ARARs which apply to dredging, capping, and disposal of contaminated sediments. Alternative 1 (No Action) does not comply with the minimum requirements of the Sediment Management Standards. Because Alternative 1 is not protective and does not comply with ARARs, it was eliminated from further consideration as a feasible alternative for the Todd and Lockheed Shipyards.

Long-Term Effectiveness and Permanence

Alternative 3 offers the highest degree of long-term effectiveness and permanence because it requires removal of all sediments exceeding the chemical SQS, which is the level at which adverse biological effects may begin to occur in marine organisms. Alternative 4 ranks next because it requires removal and disposal of the most toxic sediments (exceeding the chemical CSL) which are most likely to cause adverse biological effects in marine organisms. Alternative 2 offers the least amount of permanence because all contaminated sediment remains in place where it may be released to the environment if the cap is damaged or eroded by natural forces or shipping activity. The long-term effectiveness of Alternatives 2 relies heavily on long-term maintenance of the cap to ensure cap integrity and containment of underlying contaminated sediment.

Reduction of Toxicity, Mobility, and Volume through Treatment

As originally described in the Feasibility Study, none of the remedial alternatives included treatment to reduce toxicity, mobility, or volume because it was believed that there were no available full-scale technologies capable of addressing the complex mixture of contaminants found in the shipyard sediments. However, after further consideration, it was decided that a physical separation technology may cost-effectively separate sandblast grit from sediment,

reducing the volume of dredged material requiring expensive upland disposal. The cost-effectiveness of physical separation technologies will be further evaluated during remedial design. Therefore, all three viable remedial alternatives are equally ranked for this criterion.

Short-Term Effectiveness

Alternative 2 offers the highest degree of short-term effectiveness because it involves the minimum amount of disturbance of contaminated sediments, which will minimize the release of these contaminants to the environment and the exposure of workers to contaminants. Alternative 4 provides the next best short-term effectiveness because it requires dredging of only moderate volumes of sediment with slightly increased possibility of release of contaminants to the environment and worker exposure. Alternative 3 provides the least amount of short-term effectiveness because it requires dredging of the largest volumes of sediment and the greatest potential for release of contaminants to the environment and worker exposure.

Short-term adverse environmental impacts would result from the implementation of Alternatives 2, 3, or 4 due to the displacement of bottom dwelling organisms during dredging and capping. It is expected that this disturbance would be temporary and that marine organisms would recolonize the new bottom surface in a relatively short time.

Implementability

All three alternatives can be implemented using conventional dredging and capping technology. However, the primary difficulty in implementing any of the alternatives would be the extent of adverse impact on the operation of Todd Shipyards, which is an active shipyard facility. The extent of adverse impact to Todd Shipyards can best be measured by the duration of in-water dredging and capping activities, and by the degree of restrictions placed on the future use of the facility by each alternative. In terms of in-water activities, it would take approximately 19 weeks of in-water activities to implement alternative 2, approximately 5 weeks to implement alternative 3, and approximately 12 weeks to implement alternative 4. In terms of future use of the Todd Shipyards facility, Alternatives 3 would have the least amount of adverse impact because it would allow for unrestricted maintenance dredging to deepen the slips on the north side of Todd Shipyards for use by deeper draft vessels. Alternative 4 would not require a reduction in the size of vessels which could access the slips, but future maintenance dredging would be allowed only if it maintained the protectiveness of the remedy. Alternative 2 would decrease the water depth in the slips by up to four feet by the placement of a cap, and would likely restrict future use of the slips to vessels smaller than the current maximum size. Based on these considerations of potential adverse impacts during and after remediation, alternative 3 ranks highest for implementability, alternative 4 ranks second, and alternative 2 ranks lowest.

Cost

The alternative cost estimates for Lockheed and Todd Shipyards, not including long-term monitoring and maintenance costs, are shown in Table 5. The cost of disposing dredged sediments is a major portion of the total cost for alternatives 3 and 4. For the purpose of estimating alternative costs in this ROD, it is assumed that all dredged sediments are placed in a CND facility. The cost estimates for Todd Shipyards are a range of costs. The lower

end of each range is based on disposal in a CND facility at Todd Shipyards, and the higher end of the range is based on an average of estimated CND costs for dredging projects in Elliott Bay and Commencement Bay. The cost estimates do not include the costs for cap armoring, habitat mitigation, or under-pier dredging. The need for these additional actions will be determined during remedial design.

For the Lockheed Shipyard, the volumes of dredged sediment for Alternatives 2 and 4 are about the same, resulting in a small cost difference between these two alternatives. However, the volume of dredged sediment associated with Alternative 3 is about 75% greater that Alternative 4, which causes the total cost for Alternative 3 to be about 30% greater than the cost for Alternative 4.

For Todd Shipyards, the volumes of dredged sediment are significantly different for each alternative, resulting in a large cost differential between each of the alternatives. Alternative 2 is the least expensive, alternative 4 is about 50-75% more than alternative 2 depending on whether on-site or off-site CND is used, and alternative 3 is about two to three times as expensive as alternative 2 depending on which disposal option is used.

Table 5

Alternative Cost Estimates ($ M)

Alternative	Lockheed Shipyard	Todd Shipyards
2	1.7	3.0-3.9
3	2.0	6.4-10.7
4	1.5	4.5-6.9

State Acceptance

The remedial alternatives described in this ROD have been developed in coordination with Ecology. Ecology believes that the selected alternative is consistent with the Sediment Management Standards and will provide benefits to the environment and to the public.

Community Acceptance

Several sets of comments were received in response to the Proposed Plan for the Shipyard Sediments Operable Unit. A summary of these comments and EPA's responses to these comments appear in the Responsiveness Summary, Attachment A. None of these comments recommended selecting an alternative other than the preferred alternative. EPA therefore retained the preferred alternative as the selected remedy.

K. THE SELECTED REMEDY

1. Description of the Selected Remedy

Based on CERCLA, the NCP, the Administrative Record, the comparative analysis of the alternatives, and public comment, EPA has selected Alternative 4, Dredge to the Chemical CSL and Cap, as the remedy for the Harbor Island Shipyard Sediment OU. Alternative 3, Dredge to the Chemical SQS, is identified as a contingent remedy if sediment sampling conducted during remedial design indicates that Alternative 3 provides a better cost-benefit than Alternative 4.

Alternative 4 was chosen over Alternative 2 primarily because there would be less adverse effect on the environment if the cap were eroded in the future and underlying contaminants were released to the environment. In addition, Alternative 4 can be implemented with less adverse impact on the operation of Todd Shipyards during remediation, and Alternative 4 would maintain present water depth in the slips on the north side of Todd Shipyards and not restrict the size of vessels which could access these slips.

Alternative 4 was chosen over Alternative 3 because, based on RI data, Alternative 3 would be about 50% more expensive to implement for the Shipyard Sediment OU than Alternative 4. Therefore, Alternative 4 would be more cost-effective in protecting human health and the environment than Alternative 3. However, comprehensive sediment core sampling to be conducted during remedial design will allow a more accurate estimation of sediment volumes exceeding both the chemical SQS and CSL. If this sampling indicates, contrary to RI data, that the volume of sediment exceeding the SQS is not significantly greater than the volume exceeding the CSL, a cost-benefit analysis will be conducted. This cost-benefit analysis will determine: 1) the costs of dredging and disposing the volumes of sediment exceeding the CSL and the SQS, 2) the costs of constructing and maintaining the cap required for Alternative 4, which would be the cost saved if a cap is not necessary, and 3) the incremental environmental benefit of dredging to the SQS instead of dredging to the CSL and capping. Based on the results of this analysis, if Alternative 3 is shown to provide a greater environmental benefit at an equal or marginally increased cost, Alternative 3 will be implemented instead of Alternative 4. If the remedy is changed to Alternative 3, EPA will document this change in the form of an Explanation of Significant Difference.

The essential elements of the selected remedy for the Shipyard Sediment OU are:

1) All sediments exceeding the chemical CSL and shipyard waste must be dredged. This also applies to sediments and shipyard waste in the shipways at Lockheed Shipyard. The extent of dredging of contaminated sediments and waste under piers at Todd and Lockheed Shipyards will be determined during remedial design based on cost, benefit, and technical feasibility;

2) Dredged sediments must be disposed in appropriate confined nearshore disposal (CND) or confined aquatic disposal (CAD) facilities. Appropriate CND or CAD sites will be selected during remedial design. If suitable CND or CAD sites are not identified, dredged sediments must be taken to an appropriate upland disposal facility. Any dredged material which is predominately shipyard waste must be disposed in a solid waste disposal facility. Sandblast grit may be recycled as feedstock for cement production;

3) After dredging, all remaining areas which exceed the chemical and/or biological SQS must be capped with a minimum two feet of clean sediment. The cap will meet the SQS cleanup objective by isolating remaining contaminants and preventing release of these contaminants to the environment. The cap is also intended to be protective of any future cleanup goals for TBT and PCB bioaccumulation by eliminating the exposure pathways associated with residual concentrations of these contaminants. The cap may require armoring with gravel or small rocks if analyses conducted during remedial design demonstrate that armoring is necessary;

4) Dredging and capping must be conducted with the objective of creating a flat surface out to the boundary of the Shipyard Sediment OU to minimize the potential for recontamination of the cap by resuspended contaminated sediments from other sources. Dredging, capping and disposal methods must also minimize adverse impacts to the existing habitat. In particular, the selected dredging and disposal methods shall minimize the release and resuspension of contaminated sediments to the environment. To the extent practicable, the marine habitat in the Shipyard Sediment OU must also be restored to its most productive condition; and

5) Long-term monitoring of contaminant concentrations in the cap, and monitoring of cap thickness, must be periodically conducted. Long-term maintenance of the cap, which involves adding supplemental clean sediment to the cap, must periodically be performed to maintain the cap at a minimum 2-foot thickness. Future maintenance dredging in the Shipyard Sediment OU would be allowed only if it maintains the protectiveness of the selected remedy.

Significant recontamination of the cap required by this remedy is not anticipated because contaminated sediments deposited on this cap will be mixed with clean sediments in the top 10 centimeters of the cap through bioturbation (burrowing of marine organisms). In addition, the periodic addition of clean sediment to the cap, as required by long-term maintenance, is expected to maintain contaminant concentrations below the chemical SQS.

Dredged material which is predominately shipyard waste will be managed as a solid waste. Based on the composition of sediment cores collected during the RI, the volume of such shipyard waste is expected to be a small fraction of the total dredged sediment volume. The two disposal options for shipyard waste are: 1) it can be disposed in a solid waste disposal facility, or 2) pure sandblast grit, and grit which can be separated from sediment, can be recycled as feedstock for cement production. In order to separate sandblast grit from dredged sediment for recycling, a physical separation technology, such as hydrocycloning, will be used in the remedy if during remedial design this technology is found to be technically feasible, practical to implement, and cost-effective.

Subsurface sediment data collected during the RI indicate that the depth to the chemical CSL near the shoreline at Todd Shipyards is about 4 feet below the sediment surface, and about 2 feet below the surface further out from the shoreline. This subsurface sediment data also indicate that the depth to the chemical CSL at Lockheed Shipyard ranges from about 3 to 5 feet below the surface. Based on these data, the selected remedy requires dredging approximately 116,000 cubic yards of sediment at Todd Shipyards and placing approximately 80,000 cubic yards of clean sediment for a cap at that location. The estimated volume to be

dredged at Lockheed Shipyard is about 18,000 cubic yards, and volume of clean sediment required for this cap is about 11,000 cubic yards.

The estimated cost of the selected remedy is based on the assumption that the entire area defined as the Shipyard Sediment OU will be dredged and capped out to the steep slopes of either Elliott Bay or the West Waterway. The cost estimate for the selected remedy also assumes that all dredged sediments can be placed in a CND facility. The estimated cost to design and construct this remedy for Todd Shipyards is $4.5-6.9 M. After construction is complete, ten years of cap monitoring and maintenance at Todd Shipyards is estimated to cost $1.0 M. The estimated cost to design and construct this remedy for the Lockheed Shipyard is $1.5 M. The cost of ten years of cap monitoring and maintenance at Lockheed Shipyard is estimated to be $0.5 M. These cost estimates do not include the costs of habitat mitigation, under-pier dredging, or cap armoring. The need for these additional actions will be determined during remedial design.

It is estimated that it would take approximately 28-34 months to design and construct the selected remedy at Todd Shipyards, and 22-28 months to design and construct this remedy at Lockheed Shipyard. Dredging activities will take approximately 3 weeks at Todd Shipyards, and 1 week at Lockheed Shipyard. Capping activities will take approximately 9 weeks at Todd Shipyards, and 2 weeks at Lockheed Shipyard. EPA will consider the impact on operations at Todd Shipyards when establishing the schedule for remedial action at Todd Shipyards.

Source Control Prior to Remedial Action

The first step of the remedy is to ensure that source identification and source control have been adequately implemented at Todd and Lockheed Shipyards. Source control is implemented to eliminate or reduce, to the extent practicable, the release of contaminants to the marine sediments, such that sediments are not recontaminated after remediation. Source control includes the application of regulatory mechanisms and remedial technologies to be implemented according to applicable or relevant and appropriate requirements (ARARs), including the application of all known, available, and reasonable methods of treatment (AKART) for NPDES-permitted discharges, as necessary to achieve and maintain sediment cleanup objectives, and to ensure compliance with environmental regulations.

Source identification efforts will focus on identifying any potential sources of contaminants from the shipyards to the Shipyard Sediment OU. Source identification includes an assessment of all potential pathways (e.g., soil, groundwater, stormwater, storm drain sediments), as well as any permitted or non-permitted direct discharges related to on-site practices (e.g., active shipyard work in upland areas, along piers, and in marine ways/dry docks). Source control efforts will focus on implementing methods to adequately control any ongoing sources to ensure that sediments will not be recontaminated after remediation. Source control documentation, including certification that adequate source control efforts have been achieved such that sediment recontamination is not expected, will be summarized in a Source Control Report to be submitted by both Todd and Lockheed Shipyards for EPA approval prior to sediment remediation.

Monitoring During Remedial Action

Monitoring during dredging, disposal, and capping must be conducted to assure that the cleanup is constructed as designed, and that there are no unavoidable environmental impacts. During dredging, bathymetric surveys or other appropriate techniques shall be employed to verify that dredging occurs to the depths necessary to remove all contaminated sediments exceeding the chemical CSL. This should include a baseline survey of the targeted dredging areas and a post-dredge survey. Monitoring during placement of the cap will verify that the cap is placed as designed, and that the proper thickness is achieved. *In-situ* markers, bathymetric surveys, or other appropriate techniques shall be conducted during capping to monitor placement location and thickness. Cap thickness will also be verified by sediment core samples collected immediately after construction.

Water quality monitoring must also be performed during dredging to measure contaminant release to the water and assure that the marine acute water quality criteria are not exceeded. This monitoring will consist of grab samples at various depths throughout the water column and at various distances from the dredge activity. Analyses will include real-time conventional analyses of dissolved oxygen and turbidity, and chemical analyses for contaminants of concern in the shipyard sediments.

In-water disposal monitoring must be conducted to verify that sediment disposal is occurring as designed, and evaluate sediment loss at the disposal site. Positioning equipment on board disposal barges will be used to verify navigation position prior to disposal. Bathymetric surveys will then be used to verify where placement occurred on the bottom.

Long-term Monitoring and Cap Maintenance

Long-term monitoring and maintenance of the cap is expected to be performed for a minimum of 30 years. Techniques such as bathymetric surveys, *in-situ* markers, side-scan sonar, or sediment vertical profile camera will be used to verify cap thickness and stability after the remedy is constructed. This monitoring must be performed one year after capping, and then periodically, as determined by the stability of the cap. In addition, prop-wash related erosion should be evaluated by spot monitoring of limited areas that are exposed to potential erosion by prop-wash. Spot monitoring should be conducted in areas where berthing operations occur and in areas where ships and/or tugs navigate close to or over the cap. To assure that the cap is not recontaminated by other sources, surface grab samples (0-10 cm) will be collected from the cap and analyzed for contaminants of concern. The frequency of this type of sampling will be determined during remedial design. To verify that the caps provide a suitable habitat for benthic organisms, biennial monitoring for benthic abundance must be conducted in the capped areas until it is demonstrated that recolonization is occurring at a reasonable rate, and that a diverse benthic community is established comparable to a suitable reference location.

It is anticipated that an additional 1-foot thickness of clean sediment will need to be added to the cap every five years to maintain the cap thickness at the minimum 2-foot thickness. However, long-term monitoring will identify the rate of cap erosion and will determine the frequency at which supplemental clean sediment must be added to the cap to maintain its minimum thickness. If the cap is not initially armored, erosion rates determined by long-term monitoring will be used to reevaluate the need to armor the cap.

2. Remedial Design Objectives

a. Identify Sediment Contamination Exceeding the CSL and SQS

The area and depth of sediment exceeding the chemical CSL and SQS throughout the Shipyard Sediment OU, including the areas under the piers, will be determined by collecting sediment cores during remedial design. These data will be used to determine the depth of dredging required in each area, and will also be used to accurately determine the volume of sediment to be dredged. Each sediment core will be divided into several samples including a surface sample (0-10 cm), and samples at 2-foot increments to a depth of 10 feet, or until native sediment is reached. Sediment samples will be analyzed for arsenic, copper, lead, mercury, zinc, PCBs, and PAHs. Analytical techniques will be sufficiently sensitive to detect chemical concentrations at or below SQS concentrations. Sediment core samples will also be visually inspected to identify areas containing significant concentrations of sandblast grit.

b. Conduct Confirmatory Biological Effects Tests

Although not required, confirmatory biological effects tests may be conducted by the Potentially Responsible Parties (PRPs) during remedial design in order to determine the acute and chronic toxicity of sediments to marine organisms, and to evaluate potential adverse effects associated with bioaccumulation of PCBs, TBT, and mercury. The suite of biological tests which will be allowed include two acute tests and one chronic test as specified in the Sediment Management Standards (WAC 173-204-315), and alternative biological tests designed to assess bioaccumulation and associated adverse effects. If the PRPs decide to conduct biological effects tests, EPA will determine which specific biological tests are appropriate for the Shipyard Sediment OU after consultation with Ecology. It is anticipated that the allowed suite of biological tests will be similar to that recently completed by the Port of Seattle for the Terminal 18 maintenance dredging project in the East Waterway. If confirmatory biological tests are not conducted, exceedance of the chemical SQS will determine which areas require remediation.

c. Characterize Dredged Sediments

Sediment to be dredged will be characterized to predict sediment behavior during dredging and disposal, and to support the design of a CND or CAD facility. The characterization may include: leach tests to determine the ability of contaminants to migrate from a the disposal site, determination of grain size distribution, Atterberg limits, bulk density, shear strength, total organic carbon, and *in situ* and post-dredging density/water content. Potential contaminant migration pathways will also be evaluated, including release of leachate to surface water during dredging and disposal, and migration of contaminants through containment materials at the aquatic disposal site.

If it is necessary to dredge sediment which does not exceed the chemical CSL in order to construct a flat cap, such sediment may be eligible for PSDDA open-water disposal. To determine if this sediment is suitable for PSDDA disposal, additional tests must be conducted according to PSDDA guidance, including: core sample densities, compositing strategies, biological tests to determine sediment toxicity, and biological tests to determine potential bioaccumulation of contaminants in marine organisms.

d. Evaluate Armoring of the Cap

The potential for the cap to be eroded as a result of prop wash, dry dock activity, or natural forces will be evaluated during remedial design. Current velocities will be measured throughout the areas to be capped and modeling will be conducted to determine if a sandy sediment cap will experience unacceptable erosion. If it is determined that a sandy cap is not adequate, methods of armoring the cap, such as using gravel or small rocks, will be evaluated and the most appropriate method will be used to protect the cap from erosion.

e. Conduct Habitat Inventory

It is important that cleanup activities do not cause additional adverse impacts to the habitat in the Shipyard Sediment OU, and to the extent possible, contribute to restoration of productive habitat in this area. In order to accomplish this objective, a habitat inventory of the Shipyard Sediment OU will be conducted during the remedial design. This inventory will include evaluation of the physical characteristics of the habitat (e.g., bathymetry, grain size) as well as biological characteristics of the habitat (e.g., benthic community structure and prey base use, aquatic vegetation, and salmonid and forage fish use). Land use, structures, and other attributes of the habitat that may affect its productivity will also be noted. This habitat inventory will serve as a baseline for evaluating the success of remedial and mitigation activities carried out for the shipyard sediments.

In order to minimize and mitigate adverse impacts of remediation identified in this ROD, EPA intends to ask the natural resource trustees for Harbor Island to assist in reviewing the remedial design. The trustees may also independently develop a habitat restoration plan for the Duwamish estuary. If such a habitat restoration plan is developed after this ROD is issued, the relevant criteria in the restoration plan shall be incorporated into the shipyard sediment remedial design to the maximum extent practical.

f. Evaluate Potential Disposal Sites

At the time of this ROD, adequate information does not exist on potential CND or CAD sites in the Elliott Bay area to support the selection of specific disposal sites. The appropriate disposal sites will be selected during the remedial design after all feasible CND and CAD sites in Elliott Bay are evaluated. If the selected disposal sites are within the Harbor Island Superfund Site, EPA will elicit public comment on the disposal sites through an Explanation of Significant Differences, which is a modification to the ROD. If the selected disposal sites are outside of the Harbor Island Superfund Site, the public will be allowed to comment on the disposal sites through the dredged disposal permit process required under Section 404 of the Clean Water Act, which is administered by the Army Corps of Engineers.

Criteria which will be used to evaluate potential disposal sites include: location; rate and extent of groundwater discharge in project area; proximity to Harbor Island; effectiveness in containing contaminated sediment; impacts to the marine habitat; the potential for habitat mitigation; implementability; long- and short-term harbor area and aquatic land use impacts, with consideration to commerce, navigation, and existing business; and cost. Determination of physical characteristics such as sedimentation rates, current velocities, and bottom depth, grain size, and a habitat assessment of the potential disposal sites may also be needed to assist EPA in the selection of the best disposal sites.

g. Evaluate Physical Separation Technologies

Physical separation methods, such as hydrocycloning, have the potential to separate sandblast grit, the primary component of shipyard waste, from dredged sediment. If sandblast grit can be successfully separated from dredged sediment, this sandblast grit could be recycled as cement feedstock and the amount of dredged material requiring expensive upland disposal could be reduced. There is also the potential that physical separation could reduce the volume of dredged sediment requiring placement in a CND or CAD facility. To determine if a physical separation technology should be used in the remedy, the technical feasibility, implementability, and cost-effectiveness of all applicable physical separation technologies will be evaluated in the remedial design. If a separation technology is found which meets these criteria, it will be implemented as part of the remedy.

h. Determine the Extent of Dredging Under-Pier Sediments

Adequate under-pier sediment data does not exist to determine the extent of under-pier dredging required to achieve the chemical CSL at Todd and Lockheed Shipyards. Also, the cost of under-pier dredging may be several times more expensive than open water dredging. Therefore, the cost of dredging to the chemical CSL under piers at Todd and Lockheed Shipyards will be determined during the remedial design. This cost will be compared to the environmental benefit gained by dredging to the CSL. If the benefit gained is disproportionate to the cost of dredging under piers, EPA may select an alternate method for achieving the cleanup standard in the under-pier sediments. In addition, dredging under piers may not be feasible if it were to cause the piers to become unstable. To determine the potential effect of dredging on pier stability, a structural analysis of the piers will be conducted during remedial design. The results of this structural analysis will be factored into EPA's decision on the extent of dredging required under the piers.

L. STATUTORY DETERMINATIONS

The selected remedy for the Shipyard Sediment OU will comply with CERCLA Section 121 as follows:

1. Overall Protection of Human Health and the Environment

Long term protection of marine organisms, which are exposed to contaminated shipyard sediments, is obtained by dredging and disposing all contaminated sediment which exceeds the chemical CSL and capping the remaining contaminated sediment with a minimum 2 foot cap of clean sediment. These actions remove the most contaminated sediment from the shipyard sediments and reduce the mobility of the remaining contamination by containing it underneath a cap. The selected remedy may also incrementally reduce the overall risk to human health from consumption of Harbor Island seafood by eliminating sources of PCBs in the shipyard sediments. PCBs are of concern, from a human health perspective, because of their ability to bioaccumulate in seafood.

Existing aquatic habitat and biota would be destroyed in areas where dredging occurs. However, after placement of the cap, the cap will be recolonized by opportunistic species that are available as larvae in adjacent habitats. The rate of colonization will be dependent

upon the time of year when the cap is placed. Larval recruits may be present year round, but are more abundant in the spring and summer. As organic material becomes incorporated into the cap, the benthic community will likely diversify with a concomitant increase in overall abundance. Additional shifts in community composition may occur, as opportunistic species are displaced by other, more competitive community members. The abundance and diversity of benthic organisms on the cap will likely reach a maximum in 3 to 5 years, based on similar capping projects in Commencement Bay.

To protect migrating species of juvenile salmon, the dredging activities will be performed outside of the fisheries closure period of April 1 through June 15. Tribal fishing areas and fisheries are located near the areas to be dredged. Therefore, dredging will be performed at times which minimize the impact on Tribal fishing activities.

Protection to the environment will also be achieved during dredging and disposal by using methods which minimize the release of contaminants to the surface water. Surface water samples will be collected during dredging and disposal of sediments to ensure that water quality standards are not exceeded. Any release of contaminated sediments would be of short duration and would be minimized by the use of appropriate dredging equipment and engineering controls. Any activities which cause the water quality standards to be exceeded would be stopped until appropriate corrective actions were implemented.

The potential for workers to be exposed to contaminated sediment would be short-term and would pose a low risk. Activities that would results in worker exposer include handling of dredged sediment, transport of sediment, and disposal of sediment. Protection of workers during remediation will be achieved through compliance with OSHA and WISHA requirements, the use of personnel protective equipment, and other safety measures and engineering controls.

2. Compliance With ARARs

The selected remedy will comply with all chemical, action, and location specific ARARs.

Federal Water Quality Standards, (33 U.S.C. 1251 et seq.; 40 C.F.R. 131)
Ambient water quality criteria have been published as a requirement of the Clean Water Act in order to protect aquatic organisms and human health. CERCLA requires the attainment of water quality criteria where relevant and appropriate. Criteria for the protection of marine aquatic life are relevant and appropriate requirements for discharges to surface water during sediment remediation.

Washington State Sediment Management Standards (Chapters 43.21C, 70.105D, 90.48, 90.52, 90.54, and 90.70 RCW; Chapter 173-204 WAC)
Numerical and narrative criteria for chemicals and biological effects are specified for sediment, and are applicable to Harbor Island shipyard sediments. For the Shipyard Sediment OU, the chemical Cleanup Screening Levels (CSLs) are the levels which trigger a remedial action. Once a remedial action is required, the chemical Sediment Quality Standards (SQS) are the long-term cleanup objectives and the CSLs are the minimum cleanup objectives.

Washington State Water Quality Standards for Surface Waters (Chapter 173-201-045,-047 WAC)
Narrative and quantitative limitations for surface water protection are provided in these regulations. Criteria are established for each water classification, including such items as fecal coliform, total dissolved gas, total dissolved oxygen, temperature, pH, and turbidity. The criteria do not apply within dilution zones near point sources. However, within dilution zones, fish and shellfish should not be killed, nor should aesthetic quality be diminished. The requirements for marine water are applicable for discharges to surface water during sediment remediation.

Washington State Water Pollution Control Act (90.48 RCW), Water Resources Act (90.54 RCW)
Requirements for the use of all known, available and reasonable technologies (AKART) for treating wastewater prior to discharge to state waters are applicable to remedial actions involving discharges to surface water during dredging, disposal, or dewatering activities.

Hydraulics Code Rules on Dredging (Chapter 220-110-130,-320 WAC)
Permits must be obtained from the Department of Fish and Wildlife for any project that may interfere with the natural flow of surface water. On-site actions must achieve substantive permit requirements.

National Pollutant Discharge Elimination System (40 C.F.R. 122, 125); State Discharge Permit Program; NPDES Program (Chapter 173-216,-220 WAC)
Conditions to authorizing direct discharges to surface water are specified under 40 CFR 122. Criteria and standards for discharges are specified in 40 CFR 125. The state of Washington has been authorized by the EPA to implement the NPDES permit program (Chapter 173-216, -220 WAC). These requirements are applicable to direct discharges to surface water conducted as part of the remedial action. Substantive permit requirements would be met for on-site activities.

Solid Waste Disposal Act (42 U.S.C. 3251 et seq.; 40 C.F.R. 257, 258); Washington State Minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC)
Requirements for the management of solid wastes may be applicable to dredged sediment which is predominately shipyard waste and to sandblast grit which is separated from dredged sediment. Such separated sandblast grit may be suitable for recycling as feedstock for cement production.

Washington State Dangerous Waste Regulations (Chapter 173-303 WAC)
This regulation is applicable to any dredged shipyard waste which is determined to be a dangerous waste. Such shipyard waste must be treated, stored, and disposed in accordance with the sections of these regulations. Section 173-303-070 describes the procedures for testing shipyard waste to determine if it is a dangerous waste.

Clean Water Act, Dredge and Fill Requirements Under Sections 401 and 404 (33 U.S.C. 1251 et seq.; 40 C.F.R. 230, 231; 33 C.F.R. 320-330)
These applicable regulations specify requirements for the discharge of dredged or fill material to waters of the U.S., including wetlands. Dredge and fill activities, such as will occur during remediation of the Shipyard Sediment OU, are specifically regulated by requirements outlined in Section 404. These regulations also provide guidelines for the

specification of disposal sites, and define permit requirements for dredge and fill operations which would apply to the remedial action.

Seattle Shoreline Master Plan: State Shoreline Management Act (RCW 90.58)
Filling, dredging, and other remedial activities conducted within 200 feet of the shoreline will comply with the promulgated substantive requirements of this plan, which was developed pursuant to the State Shoreline Management Act.

Rivers and Harbors Appropriations Act (33 U.S.C. 403, 33 C.F.R. 322)
Section 10 of this statute requires a permit from the U.S. Army Corps of Engineers for construction of marinas, piers, and outfall pipes, and for dredging and filling below the mean high-water line in navigable waters of the United States. Dredging and filling which occur within the Harbor Island site as part of the selected remedy must meet the substantive requirements of the permit.

Executive Order 11990, Protection of Wetlands (40 C.F.R. 6 Appendix A)
Applicable to open waters and estuarine intertidal emergent and unconsolidated shore located in and near the site. Remedial activities must be performed so as to minimize the destruction, loss, or degradation of wetlands. Mitigation would be performed to ensure that no net loss of wetlands occurred.

Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 50 C.F.R. 200, 402)
Applicable to surface water around Harbor Island which is used as a salmonid migratory route. Remedial actions must be performed so as to conserve endangered or threatened species, including consultation with the Department of the Interior.

U.S. Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.)
This Act is an applicable requirement because the site surface water is used as a salmonid migratory route and includes potential use by bald eagles, etc. This act prohibits water pollution with any substances deleterious to fish, plant life, or bird life and requires consultation with the U.S. Fish and Wildlife Service and appropriate state agencies.

Items to Be Considered (TBCs)

Additional policies, guidance, and other laws and regulations which will be considered for the Shipyard Sediment OU remedy include:

Dredge Disposal Analysis (PSDDA), which includes requirements and guidelines for evaluating dredged material, disposal site management, disposal site monitoring, and data management.

EPA Wetland Action Plan, which describes the National Wetland Policy and primary goal of "no net loss".

Water Quality Management Plan, which sets water quality objectives relating to confined disposal of contaminated sediments.

Stormwater Management Program, (pursuant to 40 CFR Parts 122-24, and RCW 90.48), which describes stormwater management objectives which may apply to stormdrains at Todd and Lockheed Shipyards on Harbor Island.

Puget Sound Estuary Program Protocols (1987), as amended, which provides sample collection, laboratory analysis, and QA/QC procedures for sampling and analyzing sediment samples.

Standards for Confined Disposal of Contaminated Sediments (1990), which includes standards and guidance developed by Ecology for confined disposal of dredged contaminated sediments.

3. Cost-Effectiveness

The selected remedy provides protection of human health and the environment proportionate to its costs. Alternative 4, the selected remedy, is more cost effective than Alternative 3 in protecting human health and the environment. The selected remedy also provides better protection to human health and the environment, in proportion to its cost, than Alternative 2.

4. Preference for Treatment as a Principal Element

Treatment of contaminated sediment to reduce toxicity or mobility of contaminants was not considered feasible for the shipyard sediments. Such technologies were eliminated either because they would not be effective on the mixture of organics and inorganics present in the sediment, had not been demonstrated at full-scale operation, or were difficult to implement because they would require additional handling, storage, and processing of a large volume of contaminated sediment. However, physical separation technology, such as hydrocycloning, is capable of reducing dredged sediment volume requiring upland disposal. If a physical separation technology is demonstrated to be technically feasible and cost-effective to use on the shipyard sediments during remedial design, it will be incorporated into the selected remedy.

5. Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practical

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost effective manner for remediation of the Harbor Island shipyard sediments. The selected remedy provides the best balance in terms of protection of human health and environment, long-term effectiveness and permanence, short-term effectiveness, implementability, and cost.

Dredging of the most contaminated sediments and disposal of these sediments in a CND or CAD facility will permanently confine the contaminants responsible for the highest human health and environmental risks at this site. Physical separation technology, such as hydrocycloning, has the potential to reduce the volume of dredged sediment requiring upland

disposal. Such technology will be evaluated during the remedial design for potential incorporation into the selected remedy.

M. DOCUMENTATION OF SIGNIFICANT CHANGES

The area of the Shipyard Sediment OU in this ROD is about 25% larger than the area identified in the Proposed Plan because the outer boundaries of the OU have been expanded to the steep slopes of Elliott Bay and the West Waterway. At Todd Shipyards the outer boundary is located approximately at the -42 foot MLLW contour of Elliott Bay (to the north), and at the -42 foot contour of the West Waterway (to the west). At Lockheed Shipyard the outer boundary is located approximately at the -36 foot MLLW contour of the West Waterway. This change is a logical outgrowth of the Proposed Plan and was made because the sediments within these boundaries are distinct from other contaminated sediments at Harbor Island because they are predominately contaminated with hazardous substances and shipyard wastes released by shipbuilding and maintenance operations at Todd and Lockheed Shipyards.

The cost estimates for remedial alternatives in this ROD are revised from the cost estimates which appeared in the Proposed Plan because: 1) the 25% increase in area of the Shipyard Sediment OU increases costs of dredging, capping, and sediment disposal required for each alternative in proportion to the increase in area and associated dredged sediment volumes, 2) the alternative contingency allowance is reduced from 25% to 10% for each alternative, reducing alternative cost estimates by about 15%, and 3) alternative cost estimates are based on disposal of dredged sediments in a CND facility, which is now considered to be the most feasible and cost effective disposal method for disposing the sediments dredged from Todd and Lockheed Shipyards.

APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
HARBOR ISLAND SHIPYARD SEDIMENT
RECORD OF DECISION

Overview

From 1903 to 1905, Harbor Island was created from marine sediments dredged from the Duwamish River. Harbor Island has been used for commercial and industrial activities including shipping, railroad transportation, bulk fuel storage and transfer, secondary lead smelting, lead fabrication, shipbuilding and metal plating. Warehouses, laboratories and office buildings have been located on the island. Approximately 70% of Harbor Island is covered with buildings, roads or other impervious surfaces.

The site was placed on the National Priorities List in 1983, due to elevated lead concentrations in soil, as well as elevated levels of other hazardous substances. The lead concentrations were due to a lead smelter on the island, which ceased operations in 1984.

In 1994, EPA completed a remedial investigation (RI) of Harbor Island sediments. In 1995 a group of Potentially Responsible Parties conducted a Supplementary Remedial Investigation (SRI) of Harbor Island Sediments. On October 31, 1995, EPA began the public comment period on the cleanup alternatives for the contaminated sediments at the Todd and Lockheed Shipyards. The Proposed Plan, as well as the reports of the investigation, were released for public comment. The preferred remedy in the Proposed Plan is to dredge the most highly contaminated sediments and cap the remaining contaminants. The dredged sediments would be contained in an appropriate confined aquatic disposal site.

Background on Community Involvement

As described above, the Proposed Plan for the cleanup of the shipyard sediments at the Harbor Island Superfund site was released on October 31, 1995. The public comment period ran from October 31 until January 2, 1996.

As part of the comment period, a public meeting was held on December 6, 1995. About 5 people attended the meeting. No one gave public comment. A copy of the transcript is available at the Region 10 Records office in the Park Place Building, 1200 West 6th Avenue.

Comments received in writing are included in the following summary.

Comments and Responses

1. Comment: For the proposed cleanup action, a site-specific cleanup standard must be defined in consideration of the net environmental benefit, cost, and the engineering feasibility of different clean up alternatives, according to the provisions of the State Sediment Management Standards.

Response: The environmental benefits, costs, and feasibility of achieving both the SQS and the CSL for the Shipyard Sediment OU were estimated in the ROD. After comparing the cost-benefit of the SQS to the CSL, EPA selected the SQS as the site-specific cleanup standard. EPA believes that the selection of the SQS as the cleanup standard is justified because it provides the highest environmental benefit by reducing contaminant concentrations to levels which have no adverse effects on marine organisms, it is feasible to achieve the SQS using conventional dredging and capping technology, and the SQS can be achieved at a minimal cost increase compared to the cost of dredging to the CSL.

2. Comment: Capping aquatic lands of an active shipyard, such as Todd, present unique logistical concerns. The effects of prop scour, recontamination and future construction activities on the cap integrity will need evaluation. We ask that EPA consider the long and short-term land use plans of Todd and Lockheed property in designing the dredge and cap alternative. All effort must be made to limit the amount of material that may require disposal on state-owned aquatic land. Cap placement and design must take into account recolonization and habitat diversity to ensure that a functional habitat will develop.

Response: EPA agrees and will ensure that these concerns will be addressed during the remedial design.

3. Comment: If a nearshore disposal facility is constructed to contain dredged sediments, a habitat mitigation site would be required to replace habitat lost for the construction of this disposal facility. The current cost estimates for the remedial alternatives do not take into consideration the expense of mitigating for habitat loss due to remedial activities or habitat destruction due to the creation of a near shore disposal site. In addition, there is a limited number of areas in the Elliott Bay/Duwamish River system where mitigation of a near shore habitat can occur. Therefore, we would like to impress upon EPA the need for integration of remedial activities and habitat mitigation/restoration in the remedial design.

Response: At a minimum, the remedy will be fully compliant with the requirements of the Clean Water Act (CWA) Section 404. Also, one of the objectives of the remedial design will be to ensure that adverse impacts to the existing habitats due to remediation are minimized. Where required under the CWA Section 404, restoration, in addition to mitigation for remedial impacts, will be incorporated into the remedial design. If construction of a nearshore disposal facility is the selected disposal option, potential off-site habitat mitigation areas will evaluated during the remedial design and the cost of required habitat mitigation will be determined. The cost of any off-site habitat mitigation will be in addition

to the current cost estimate for remediation. Prior to completing the remedial design, a habitat inventory in the shipyard sediments will also be conducted which will serve as a baseline for evaluating the success of the remedial and mitigation actions.

4. Comment: The Washington Department of Natural Resources leases several parcels of submerged aquatic lands within the proposed cleanup area and manages several parcels proposed for use as aquatic disposal sites. The loss of current or future revenue from aquatic lands at Harbor Island could impact the state's ability to fund habitat enhancement projects and other activities that benefit aquatic lands. As such, the remedial actions should be designed and implemented in a manner that allows state aquatic lands to continue functioning in the interest of the public trust and not preclude future water-dependent uses.

Response: The remedial actions will be designed and implemented in a manner that allows state aquatic lands to continue functioning in the interest of the public trust. The selected remedy would not impact navigation or other water-dependent uses because it would not decrease water depth on submerged aquatic land leased by the Department of Natural Resources to Todd Shipyards. In fact, over most of the cleanup area, the water depth would be increased because a minimum of 3 feet of sediment would be dredged and replaced by only 2 feet of clean sediment for the cap. If future use of these areas requires additional dredging to increase water depths, such dredging would have to comply with proper handling, testing, and disposal procedures necessary as required by all applicable state and federal environmental regulations.

5. Comment: Who will assume responsibility for monitoring and maintaining the containment cap and aquatic disposal site? What legal tool, consent decree or other, will EPA enter into with the responsible parties to ensure compliance and protect the state from assuming an unreasonable financial risk from future cleanup costs?

Response: EPA intends to negotiate a Consent Decree with the Potentially Responsible Parties (PRPs) which would require these PRPs to monitor and maintain the cap within the Shipyard Sediment OU and the confined disposal facility in which the dredged sediments are placed.

6. Comment: The placement of a cap could require land use restrictions and institutional controls which may limit actions to repair and maintain existing piers or conduct maintenance dredging. The department (DNR) may be statutorily limited in the types of restrictions it can place on state-owned lands.

Response: Restrictions on maintenance dredging may be necessary to prevent damage to the cap. EPA will work with DNR to identify the most appropriate type of restriction on state-owned lands.

7. Comment: The placement of a nearshore disposal facility in the nearshore area north of Todd Shipyards would prevent the use of this area by water-dependent uses and may impede

treaty protected fishing. Future dredging of the West Waterway to accommodate deeper draft vessels may be impeded by the placement of a confined aquatic disposal site in that waterway. However, if nearshore disposal facilities are sited at Terminal 91 or Slip 27 (owned by the Port of Seattle), there would be no impact to the current or future water-dependent uses in the Todd Shipyards area or in the West Waterway.

Response: EPA expects the PRPs to evaluate all potential disposal sites in the Elliott Bay area during the remedial design, including Terminal 91 and Slip 27.

8. Comment: The preferred alternative appears environmentally protective provided that adequate source control is achieved for operations at the Todd and Lockheed Shipyards. We are particularly concerned with the NPDES permitted discharges at Todd Shipyards and ensuring that sufficient source control has been achieved through the NPDES program.

Response: The selected remedy requires that a Source Control Report be submitted to EPA which certifies that all potential contaminant sources at Todd and Lockheed Shipyards, including those covered under NPDES permits, are adequately controlled prior to implementing the remedy.

9. Comment: In order to verify that a suitable habitat for benthic organisms is available, periodic monitoring for benthic abundance should be conducted in the shipyard sediments after placing the cap to ensure that a healthy benthic community is developing. Additionally, cap placement and engineering design must take into account recolonization and habitat diversity concerns to maximize the development of on-site habitat function, thus minimizing the need for off-site mitigation.

Response: Periodic monitoring of the benthic community after placement of the cap is required by this Record of Decision (ROD). The design and placement of the cap, including any required armoring, will take recolonization and habitat diversity into consideration to the maximum extent practical.

10. Comment: Biological effects data are available from the Supplementary Remedial Investigation (SRI) and from NPDES baseline sediment monitoring for portions of the area around Todd Shipyards identified in the proposed plan. One SRI station (HI-NS-14), which passed the biological criteria of the Sediment Management Standards, has been included within the Shipyard Sediment Operable Unit (OU). The SRI and NPDES data indicate that a significant portion of the Todd Shipyards sediment area identified for remediation in the Proposed Plan complies with the SMS and should not require cleanup according to these standards. These data demonstrate that collection of additional sediment characterization information is required before a defensible remediation plan can be established.

Response: The EBAP biological data demonstrated that the highest amphipod mortality and a decrease abundance in all four major benthic taxa occurred at a nearshore station at Todd Shipyards. The RI mussel results indicate that the highest bioaccumulation of

copper and zinc and the slowest growth rate in juvenile mussels also occurred at a nearshore station at Todd Shipyards. Two SRI stations sampled for biological effects at Todd Shipyards failed the biological SQS, which is the site-specific cleanup standard for the Shipyard Sediment OU. EPA believes the EBAP, RI, and SRI biological data, together with the RI and SRI chemical data for Todd and Lockheed Shipyard sediments, support the decision to select a remedial action for the Shipyard Sediment OU without collecting additional data prior to issuing this ROD. However, since SRI biological tests did not provide comprehensive coverage of the Shipyard Sediment OU, additional biological tests will be allowed during remedial design to more accurately define the areas which require remediation.

11. Comment: EPA attempts to support the proposed cleanup action by using the results of a mussel study described in the RI report. Although copper and zinc were found in mussels from the Todd Shipyards area, and juvenile mussel growth was relatively slow in this area, the data do not provide direct evidence that the sediment was the source of the accumulated constituents, that the measured growth effects were caused by the sediment, or that the constituents in the sediment were actually bioavailable.

Response: The shipyard sediment areas were identified for remediation because RI and SRI sediment chemical data demonstrate that these areas exceeded the chemical CSL for several contaminants, and because EBAP and SRI biological data demonstrate that several stations within the Shipyard Sediment OU fail the biological SQS. Furthermore, the RI mussel study found a strong correlation between sediment contaminant concentrations, tissue contaminant concentrations, and mussel growth, as stated in this passage from the study:

> "By using transplanted mussels, we demonstrated that combining mussel growth, tissue chemistry, and sediment chemistry was effective in differentiating areas of contamination and potential bioeffects. . . . We were able to show an association between toxicity-normalized tissue and sediment concentrations. There was a statistically significant relationship between mussel growth and both tissue and sediment chemistry, and mussels accumulated many of the contaminants measured in sediments."

12. Comment: The need for a separate shipyard sediment operable unit or immediate action in those areas cannot be supported for the following reasons:

a) EPA is unable to quantify or attribute risk to human health via the most significant exposure pathway (seafood ingestion) to any specific location around Harbor Island, including Todd Shipyards.

b) The RI demonstrates that cancer and non-cancer risks to human health by ingestion of and dermal contact with contaminated sediment are not significant,

c) Available site-specific ecological effects data, if interpreted consistently, do not justify remedial action in the Shipyard Sediment OU, and

d) The mussel study results have some acknowledged inherent weaknesses that nullify their usefulness for preparing a site-specific risk assessment.

Response: a) Demonstration of an increased human health risk or adverse biological effects in marine organisms can trigger a remedial action for sediments. Evidence for adverse biological effects occurring in the shipyard sediments was found during the EBAP study and the RI mussel study (see response #10). The potential for increased human health risk due to consumption of Elliott Bay/Harbor Island seafood is documented in the study, "Health Risk Assessment of Chemical Contamination in Puget Sound Seafood" (Tetra Tech, 1988). Although this risk assessment was not specific to the shipyard sediments, it demonstrated that high concentrations of carcinogenic contaminants (primarily PCBs) in seafood caught around Harbor Island can cause increased human health cancer risks. Since concentrations of PCBs are especially high in the sediments at Todd Shipyards, it is likely that these sediments contribute to the overall elevated human health risk due to seafood consumption.

b) The human health risk due to ingestion and dermal contact with contaminated sediment was found to be insignificant and was not used to determine areas of remediation.

c) EPA believes that the EBAP biological data and the RI mussel data together provide adequate preponderance of evidence that contaminants in the shipyard sediments are associated with adverse biological effects in marine organisms (see responses to #10 and #11).

d) EPA does not agree that there are weaknesses in the mussel study results which would nullify their usefulness in assessing adverse biological effects due to sediment contamination. In fact, the mussel study found a strong correlation between sediment contaminant concentrations, tissue contaminant concentrations, and mussel growth (see response to #11).

13. Comment: The proposed plan does not take into account the available information from the RI and SRI on natural recovery of contaminated sediment areas around Harbor Island. Incorporation of natural recovery processes into the development of cleanup standards may significantly reduce sediment areas that exceed the CSLs.

Response: The RI sediment accumulation rate data (Pb-210 profile) from the Todd Shipyards area were inconclusive and can not be used to determine sediment accumulation rates. The natural recovery modeling conducted in the SRI Base Level Data Interpretation Report relies on an optimistic assumption (50% reduction in contaminants in particulates from off-site sources) which is not realistic. Without this assumption, there would be no significant natural recovery over a ten year period (as required by the Sediment Management Standards) of mercury and PCB, which are two contaminants of primary concern in Harbor Island shipyard sediments.

14. Comment: Sources of contamination around Harbor Island are not adequately controlled to justify the immediacy of the proposed plan. Any cleanup of sediment around Todd Shipyards, if ultimately necessary, should be appropriately integrated with the timing of cleanup actions in the remainder of the sediment operable unit.

Response: EPA believes that the primary source of contaminants to the shipyard sediments is direct discharge of waste as a result of past operations at Todd and Lockheed Shipyards. As such, the most immediate concern will be to assure that all contaminant sources at the shipyards are adequately controlled before implementing the shipyard sediment remedy. The remedy requires that a Source Control Report for Todd and Lockheed Shipyards be submitted to EPA verifying that all potential contaminant sources at these shipyards are controlled prior to implementing the remedy. EPA intends to further evaluate the need for remedial action in the surrounding contaminated Harbor Island sediments. However, EPA is convinced that contaminants in the Shipyard Sediment OU are associated with significant adverse biological effects in marine organisms, and therefore, EPA does not want to delay remediation of the shipyard sediments until a remedial action is selected for the remainder of the Harbor Island sediments.

15. Comment: As a point of clarification, the highest concentration of PCBs in sediments reported in the RI is in the East Waterway, not near Todd Shipyards as stated in the Proposed Plan.

Response: EPA agrees. The second highest concentration of PCBs occurs in the West Waterway next to Todd Shipyards.

16. Comment: Although it is recognized that the cost estimates provided in the Proposed Plan and supporting technical memorandum are general and for purposes of alternative comparison, certain components of the estimates may be high. Two of the assumptions (rapid sediment settling and no treatment necessary for dredging water) appear unrealistic and significantly higher costs would result if either assumption turns out to be incorrect. Sediment disposal costs, which are already a significant component of the cost estimates, are understated because neither confined aquatic disposal nor nearshore disposal is available now or in the foreseeable future, and upland disposal is expected to be more costly than identified in the Proposed Plan due to the lack of potentially available sites near Harbor Island.

Response: If assumptions for sediment settling and treatment for dredged water are not correct, EPA agrees that costs for these components of the remedy will be higher. However, EPA disagrees that potential confined aquatic disposal sites are available near Harbor Island. In the Harbor Island Sediment Feasibility Study, several potential confined nearshore and aquatic disposal sites were identified. In addition, Todd Shipyard has recently proposed using a portion of the slips at its shipyard as a site for a confined nearshore disposal facility. It is EPA's expectation that the PRPs will further investigate and evaluate these potential sites during remedial design.

17. Comment: The mechanics of dredging will inevitably result in resuspension and spreading of contaminated sediment if dredging is performed according to the Proposed Plan. Because the more recent sediment accumulations are less contaminated, the issue of sediment resuspension during dredging must be seriously evaluated against the perceived benefit of sediment removal versus natural recovery of contaminated areas.

Response: It is anticipated that a variety of dredging technologies will be evaluated in the remedial design. Minimizing the release and resuspension of contaminated sediment will be a major factor in the selection of the dredging technology which will be used for dredging hot spot sediments. EPA does not agree that natural recovery will accomplish reduction of shipyard contaminants within a reasonable timeframe (see response #13).

18. Comment: While EPA acknowledges that there are not enough data at this time to properly evaluate human health risks, the Proposed Plan nevertheless identifies human health protection as one of the primary goals of the proposed remediation. It is arbitrary and capricious for EPA to base a cleanup on human health risk in the absence of sufficient data to evaluate such risk.

Response: Protecting marine organisms from adverse biological effects is the primary objective for cleaning up the shipyard sediments. EPA believes that the EBAP biological effects data and the RI mussel study provide a preponderance of evidence that shipyard sediments are associated with adverse biological effects. Some protection of human health may also be achieved by eliminating high levels of PCBs found in sediments at Todd Shipyards (see response to #12a).

19. Comment: Source evaluation data presented in EPA's Remedial Investigation and Feasibility Study of the Harbor Island Site, along with more recent data collected as part of the Supplementary Remedial Investigation, suggest that there are ongoing inputs of contaminants to the Site which could potentially recontaminate sediments following a remedial action. There are insufficient data available to conclude that adequate source control of contamination resulting from resuspension of upstream sediments, discharges from storm drains and outfalls, and release of bottom paint chemicals from vessels during berthing and other in-waterway activities, is in place at this time to move ahead with remedial action, either within the Shipyard Sediments OU or in the marine sediment portion of the Site as a whole.

Response: Sediment data indicate that most of the contamination found in the shipyard sediments is due to the direct release of waste containing copper, lead, mercury, TBT, and zinc from shipyard operations. As such, the most immediate concern prior to implementing the remedy will be the assurance that potential sources at Todd and Lockheed Shipyards have been adequately controlled. In regard to other sources:

a) EPA does not regard stormdrains on Harbor Island to be a significant ongoing source of contamination. All public stormdrains on Harbor Island were cleaned by the City of Seattle in 1990 and stormdrain catch basins are periodically cleaned by the City. The City will also be expected to monitor ongoing discharges from these stormdrains under the requirements of an NPDES permit to assure that ongoing discharges meet water quality standards and are protective of marine sediments. In addition, EPA sampled all private stormdrains on Harbor Island and found that there was no significant loading of contaminants from these drains.

b) Based on EBAP and RI sediment data, contaminant concentrations in upstream sediments are generally below the chemical SQS, and are significantly below contaminant concentrations in sediments around Harbor Island. Therefore, the only contaminated sediments with the potential to recontaminate the cap in the Shipyard Sediment OU are remaining contaminated sediments around Harbor Island. EPA is evaluating the need to take remedial action on these remaining contaminated sediments at Harbor Island, and will issue its decision in a future Record of Decision.

c) As for release of contaminants from vessels, it is possible that some of the contamination in Harbor Island sediments is due to hazardous substances in paint chips released from vessels during berthing and other in-water activities. However, data indicate that most of the contamination found in the shipyard sediments is due to the direct release of waste from shipyard operations.

20. Comment: The need for remedial action at the Shipyard Sediments OU, as set forth by EPA in the Proposed Plan, is apparently based on determinations by EPA that contaminants present in the shipyard sediments are bioaccumulating in marine organisms at concentrations which can cause adverse biological effects. Our evaluation suggest that contaminant bioaccumulation observed in the caged mussel study was relatively limited and attributable to ongoing inputs from upland or over-water activities. Transfer of contaminants from surface sediments does not appear to have been a significant factor contributing to observed bioaccumulation.

Response: EPA acknowledges that there may be ongoing upstream and over-water sources of bioaccumulating contaminants. However, EPA does not regard upstream and over-water sources to be a significant source of ongoing contamination (see response #19). EPA believes that the contaminants in the shipyard sediments are a likely source of bioaccumulating contaminants due to a correlation between contaminants in sediments, mussel tissue, and mussel growth rates (see response #11).

21. Comment: There are a number of critical deficiencies associated with EPA's segregation of operable units which will substantially limit the overall effectiveness of site-wide remediation because: a) risk management of contaminated sediments within the Harbor Island Site is more appropriately addressed on a Site-wide basis, and b) remedial design in either the channel or nearshore areas will require an understanding of the design approach being taken in the other sediment areas.

Response: a) The Shipyard Sediment OU is distinct from other contaminated Harbor Island sediments because it has the highest concentrations of copper, lead, mercury, TBT, and zinc, all of which are hazardous substances released from the shipyards. The high concentrations of these contaminants in the Shipyard Sediment OU are likely associated with the most significant adverse biological effects in marine organisms at Harbor Island. Also, contaminants in the Shipyard Sediment OU may be a source of contamination to surrounding sediments. Establishing the Shipyard Sediment OU as a separate OU, and remediating this

OU, will allow an incremental reduction in the adverse biological effects, and will prevent further release of contamination from this OU. The concept of reducing risks incrementally by establishing separate OUs to address unique wastes or hot spots, is consistent with the definition of an operable unit in the National Contingency Plan (NCP).

b) EPA intends to further study the surrounding Harbor Island contaminated sediments and determine if these sediments require remediation before completion of the shipyard sediment remedial design. To the extent practical, the remedy for the shipyard sediments will be consistent with the remedy required for the surrounding Harbor Island sediments.

22. Comment: EPA should take a comprehensive and coordinated approach to disposal facility siting and habitat mitigation so as to meet Superfund objectives throughout Elliott Bay. Such an approach would result in cost savings through economics of scale and reduced monitoring requirements.

Response: EPA is working with the Corps of Engineers, Ecology, and other agencies to identify a multi-user disposal facility in the Elliott Bay area. However, it not anticipated that a such a multi-user facility, if a suitable site if found in Elliott Bay, would be available until the year 2001, at the earliest. Since dredging and disposal of the Harbor Island shipyard sediments could occur as soon as 1998 or 1999, a multi-user disposal facility may not be available soon enough to receive these sediments.

23. Comment: EPA's Technical Memorandum states that the non-under pier sediments will be removed hydraulically. We believe that unless a nearshore fill site is the confined disposal site, mechanical dredging may be the more economical and environmental preferred means of removal.

Response: The dredging methods will be selected during remedial design based on criteria which include: minimal adverse impacts to water quality, cost-effectiveness, dredging depths, and accessibility to dredging equipment.

24. Comment: To effectively remove 3 feet of sediments at the Lockheed Shipyard, the dredging contractor will need to overdredge up to 1 foot, based on the accuracy of their equipment. This will increase the estimated dredging volume from 16,000 cubic yards (CY) to roughly 19,000 CY. If underpier sediments are also impacted, it would be reasonable to expect a 50 to 80 percent increase in overall removal volumes.

Response: Current estimated dredging depths are conservative but some overdredging may be required. Such overdredging may increase dredged sediment volume by as much as 15-20%. The extent of dredging under piers will be determined during remedial design after considering the depth to the chemical CSL under the piers, effects of dredging on pier stability, the potential environmental benefit of dredging under piers, and the cost of dredging under piers.

25. Comment: The most cost-effective means to accomplish sediment removal or confinement of under-pier sediments will vary depending on sediment thickness and extent beneath the pier, pier construction, and long-term plans for the pier. Currently, there are four options available, including:
a) Hydraulic dredging between the piling and under the pier,
b) Removing the pier decking, mechanically dredging the sediments, and replacing the decking,
c) Jetting the sediments from under the pier to open water and mechanically removing the sediments, and
d) Capping the sediments in place.

Response: All feasible methods of removing or containing contaminated under-pier sediments, including the above four methods, will be evaluated during the remedial design. The method which can remove the under-pier sediments most cost-effectively, and minimize release of contaminants to the surrounding environment, would be selected by EPA after the evaluation is completed.

26. Comment: We believe that the selection of a preferred alternative is, in fact, premature pending clarification of Todd Shipyards's future dredging plans. Todd Shipyards may desire to dredge within the proposed remediation area in order to accommodate larger vessels. It would seem reasonable to design an alternative which would accommodate future needs and avoid additional disturbances within the remediated area.

Response: The selected alternative (alternative 4) would not have an adverse impact on current operations at Todd Shipyards because it would maintain current sediment depths in the slips and would not require a reduction in the size of vessels which enter these slips. After the selected remedy is constructed, the only future disturbances of the habitat in the Shipyard Sediment OU would be periodic maintenance of the cap, which is expected to have a minor, short-term impact on the habitat. One of the alternatives considered for Todd Shipyards, Alternative 3, would have required dredging all contaminated sediments above the SQS cleanup goals and would not have required a containment cap. This alternative was considered to be the most compatible with future shipyard use because it would allow Todd Shipyards to service vessels larger than the current maximum size. Based on remedial investigation data, Alternative 3 is the least cost-effective alternative because it would require dredging a significantly larger volume of sediments than the preferred alternative. However, Alternative 3 has been identified as a contingent remedy if it is demonstrated to be more cost-effective than Alternative 4 based on remedial design data.

27. Comment: It appears that the best way to predict what will happen to the remaining contaminants after capping under Alternatives 2 and 4 is to study core samples of what is currently in place. It may be that capping the existing sediments without performing any major excavation is a better, long term, solution than exposing the materials to aerobic waters that will liberate more metal ions. A preferable scenario is to decompose the organic

constituents of the sediment by land farming followed by suitable additives and anoxic conditions to promote heavy metal insolubility.

Response: Capping sediments without major excavation was evaluated in Alternative 2 of the Proposed Plan. This alternative was rejected because it leaves the highest levels of contaminants in place with the potential for future release to the environment if the cap is eroded by ship traffic, storms, or other natural forces. This alternative would not work well at Todd Shipyards where ships are constantly docking and there is a potential for cap erosion due to prop-wash. Also, capping alone would potentially require restriction on future use of slips on the north side of Todd Shipyards because it would increase bottom depths in this area.

Landfarming may work well for decomposing organic contaminants in the sediments but would require a large open area on the site for several months to spread out and aerate the sediments. Such an open area is not available on Harbor Island. Also, landfarming has been demonstrated not to be very effective at decomposing more complex organics such as PCBs, which are present in the shipyard sediments. As for metals, the shipyard sediments contain copper, lead, mercury, tributyl tin, and zinc. The use of additives and anoxic conditions may not be successful in converting all these metals to insoluble forms. Also, this technique is experimental in nature and has not yet been proven in a full-scale application.

28. Comment: It appears that additional sediment testing of mercury species, concentration, and bioaccumulation effects may be required to determine the sources of mercury contamination, the significance of anthropogenic contributions, and the effect upon marine organisms of the bioaccumulation of sediment mercury.

Response: EPA does not intend to further investigate sources of mercury contamination because evidence indicates that mercury in Harbor Island sediments comes primarily from marine paints used on ships. In particular, sediment data indicate that the highest concentration of mercury in Harbor Island sediments occur at Todd Shipyards. Ship repair and maintenance activities at Todd Shipyards, which involved removing paint by sandblasting, were likely the source of mercury found in sediments at Todd Shipyards.

As for the bioaccumulation of mercury in marine organisms, the mussel bioaccumulation study conducted during the Harbor Island RI showed that mercury concentrations in all mussel samples were at or below the detection level, indicating that mercury does not significantly bioaccumulate in mussels. In addition, benthic bioassay methods required by the Sediment Management Standards are intended to test for acute and chronic toxicity due to mercury.

29. Comment: The National Contingency Plan (NCP) requires that EPA identify operable units during the scoping stage early on in the RI/FS process. The NCP requires that EPA adequately address source control prior to any active remediation. The NCP also provides that operable units should not be inconsistent with nor preclude implementation of the final remedy.

Response: a) The NCP does not require that EPA identify operable units during the scoping stage.

b) Evidence indicates that Todd and Lockheed Shipyards were the most significant sources of contamination to the shipyard sediments. Sources at these shipyards will be adequately controlled prior to cleaning up the shipyard sediments (see response to #19).

c) The remedy selected in this ROD will be the final remedy for the Shipyard Sediment OU. To the extent possible, the remedy for this OU will be designed so that it does not preclude any appropriate remedies for the surrounding Harbor Island sediments.

30. Comment: Counsel for Todd Shipyards Corporation (Todd) submitted lengthy comments arguing the Proposed Plan violates the National Environmental Policy Act (NEPA) and is inconsistent with the National Contingency Plan (NCP), the regulations promulgated by EPA under CERCLA. Todd noted that the U.S. Army Corps of Engineers (Corps) announced its intent in December 1995, as a lead agency, to prepare a Programmatic Environmental Impact Statement (EIS) in accordance with NEPA, to assess the environmental impacts of one or more multiuser disposal facilities in Puget Sound for the disposal of contaminated sediments. Todd then argued that until that EIS is completed, any and all dredging and disposal of contaminated sediments for environmental cleanup, navigational, or other purposes, with narrow exceptions, should be delayed because it will be inconsistent with, and consequently undermine, the Corps' effort. Todd stated that "EPA staff have indicated that it may be 2002 before the analysis is complete."

It should be noted that since the submittal of these comments, Todd has proposed using a portion of the slips it owns in the West Waterway for a confined nearshore disposal facility. Such a facility could contain all sediments dredged from the Todd Shipyards portion of the Shipyard Sediment OU. If this disposal facility is implemented, and all indications are that it should be implementable, off-site disposal of sediments dredged from Todd Shipyards may no longer be an issue. However, counsel for Todd indicated that the comments were not being withdrawn, notwithstanding that issues to which they are primarily addressed seem likely not to be reached.

Response: EPA believes that Todd's arguments regarding any alleged violation of NEPA, or inconsistency with the NCP, are without merit. The establishment of one or more large multiuser disposal facilities in Puget Sound for contaminated sediments is a joint goal of the Corps, which is responsible for navigational dredging of navigable waters of the United States, many of which are contaminated, EPA, the Washington State Departments of Ecology and Natural Resources, and others in both the public and private sectors, including the Washington Public Ports Association, who have been meeting and working regularly in a spirit of partnership to resolve the complex issues facing the kind of multiuser facility the EIS will analyze for environmental impacts. It should be emphasized that such a multiuser disposal facility does not exist anywhere in the United States, despite a recognized need in many areas, including Puget Sound, the Great Lakes, the Mississippi Delta and Gulf of

Mexico generally, the Florida Everglades, and East Coast major port cities such as New York, Boston, and others, which have very large quantities of contaminated sediments and billions of dollars in water dependent industries. There is no guarantee that funding, management, technical design and feasibility, siting, environmental, and other issues related to the realization of one or more large multiuser disposal facilities in Puget Sound or any other major American waterway be resolved in the next ten, twenty, or even fifty years. At the very least, operational capacity for such a facility is certain not to occur for several years.

Todd has argued that cleanup of significantly contaminated sediments adjacent to its shipyard on Harbor Island, which come from its sandblasting and other shipbuilding activities, must await the result of what Todd readily acknowledges will be a very lengthy study, or the hopes and plans of the Corps and others, including EPA, for Puget Sound will be compromised and undermined. Todd's apparent interest in deferring its cleanup expenses has led its counsel to argue that NEPA, whose purpose is to evaluate environmental effects of major federal activities, can be used to block a comparatively small scale, uncomplicated environmental cleanup under Superfund. It has argued that the dredging and disposal of its infinitesimal percentage of total Puget Sound contaminated sediments, is not only "directly contrary" to the grand design of a large multiuser disposal facility, but will "make a mockery (and) charade" of the public comment process under NEPA, notwithstanding that every remedial action decision by EPA, including this ROD, has been subject to public comment.

Todd counsel's hyperbole continued in the NCP inconsistency arguments. For example, it is stated on Todd's behalf that; "Incredibly, the agency's sole rationale for creating a new operable unit is that remedial action can now proceed within the Shipyard Sediment Operable Unit because no biological data exist to override the existing chemical data." This argument makes reference to the Washington State Sediment Management Standards under which chemical concentration data for contaminants in sediments above specified levels triggers the need for sediment cleanup action, unless biological data from such sediments indicates that the chemical concentrations are not having biological impacts (perhaps, for example, because the contaminants are bound together in a manner which makes them unavailable to marine organisms in the sediment environment).

As has been described elsewhere above, in 1995, after EPA completed its remedial investigation of Harbor Island sediments, a group of potentially responsible parties, including Todd, entered into a Consent Order with EPA to conduct biological testing of many Harbor Island sediment areas where chemical data EPA had collected indicated cleanup might be necessary. Todd elected not to perform such biological tests on the sediments next to its shipyard (which are the subject of this ROD as it would affect Todd) because, as Todd's representatives told EPA, they did not think the biological tests would remove these sediments from the areas needing remediation. Todd felt the expense of the biological tests would be wasted.

Todd may have made this decision not to perform further biological tests because there are, in fact, biological effects data indicating that adverse biological effects occur in these sediments. The EBAP investigation revealed two stations at Todd Shipyards which failed the biological CSL. In addition, two test stations in the area of Todd Shipyards which were tested by responsible parties in 1995, failed the biological SQS, which is the site-specific cleanup standard for the Shipyard Sediment OU. Based on the combined EBAP and SRI biological data, EPA believes there is adequate evidence of adverse biological effects at Todd Shipyards to include this area in the Shipyard Sediment OU. However, because the current biological effects data within the Shipyard Sediment OU are not comprehensive, EPA will allow Todd to conduct additional biological testing during the remedial design phase of the cleanup to more accurately define sediment areas which requiring remediation.

With respect to other sediments around Harbor Island, as a result of the biological data collected in 1995, which revealed less biological impact than EPA and Ecology anticipated, and other factors, EPA has decided more study is needed to determine what remedial action, if any, should be taken. Ecology, among others, has vigorously urged more study of bioaccumulation effects of sediment contaminants in the food chain within Puget Sound, and EPA is evaluating the best ways to address these concerns. There remained, however, no basis to delay cleanup of the shipyard sediments. Consequently, EPA decided to make separate operable units for sediments warranting further evaluation before the expense of remediation would be undertaken, and those where delay for further study was not warranted. Todd's argument that: "At the risk of stating the obvious, the NCP does not include 'lack of data' as a rationale for the creation of new operable units or accelerated cleanup schedules," misstates EPA's rationale. While it may well be understandable that Todd would like to defer if not eliminate its cleanup costs, EPA finds that no valid argument has been presented for allowing it to do so.

APPENDIX B

ALTERNATIVE COST ESTIMATE TABLES

Table 1- Northwest Harbor Island Alternative 2- Containment

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Dredging				
A. Dredging				
Dredging Mobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	45198	$1.50	$67,797
Dredging, Hydraulic Volume	CY	45198	$2.00	$90,396
B. Disposal				
Disposal Volume (20% expansion)	CY	54238		
Nearshore Disposal	CY	54238	$30.00	$1,627,128
C. Short-term Monitoring				
Water Quality Monitoring	DAY	4	$3,300.00	$13,200
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
2. Nearshore Capping				
A. Cap				
Silty Sand	CY	160022	$3.00	$480,066
Transport and Placement	CY	160022	$3.00	$480,066
B. Short-term Monitoring				
Water Quality Monitoring	DAY	13	$900.00	$11,700
Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1 and 2)				$3,140,353
Engineering Costs (% of Construction Costs)	%	15		$471,053
Contingency Allowances (% of Construction Costs)		10		$314,035
Total Construction Costs				$3,925,441
3 Long-term Monitoring	LS	1	$342,974.00	$342,974
4 Maintenance	LS	1	$500,064.60	$500,065
Subtotal O&M Costs (Items 3 and 4)				$843,039
Administrative Costs (% of O&M Costs)	%	15		$126,456
Total O&M Costs				$969,494
		SUBTOTAL		$4,894,936
TOTAL PRESENT WORTH VALUE				$4,895,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 2- West Waterway Alternative 2-Containment

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Areas				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	20512	$1.50	$30,768
Volume (hydraulic)	CY	20512	$2.00	$41,024
B. Cap				
Silty Sand	CY	22791	$3.00	$68,373
Transport and Placement	CY	22791	$3.00	$68,373
C. Disposal				
Disposal Volume (20% expansion)	CY	24614		
Nearshore Disposal	CY	24614	$30.00	$738,432
D. Short-term Monitoring - Dredging				
Water Quality Monitoring	DAY	2	$3,300.00	$6,600
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
E. Short-term Monitoring - Capping				
Water Quality Monitoring	DAY	2	$900.00	$1,800
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1)				$1,325,370
Engineering Costs (% of Construction Costs)	%	15		$198,806
Contingency Allowances (% of Construction Costs)		10		$132,537
Total Construction Costs				$1,656,713
2. Long-term Monitoring	LS	1	$342,974.00	$342,974
3. Maintenance	LS	1	$113,910.08	$113,910
Subtotal O&M Costs (Items 2 and 3)				$456,884
Administrative Costs (% of O&M Costs)	%	15		$68,533
Total O&M Costs				$525,417
		SUBTOTAL		$2,182,129
TOTAL PRESENT WORTH VALUE				$2,182,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 3- Northwest Harbor Island Alternative 3- Dredge to SQS

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Areas				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	204978	$1.50	$307,467
Dredging, Hydraulic Volume	CY	204978	$2.00	$409,956
Confirmation Sampling	1/4000 CY	51	$1,000.00	$51,000
B. Disposal				
Disposal Volume (20% expansion)	CY	245974		
Nearshore Disposal	CY	245974	$30.00	$7,379,208
C. Short-term Monitoring				
Water Quality Monitoring	DAY	17	$3,300.00	$56,100
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1)				$8,538,731
Engineering Costs (% of Construction Costs)	%	15		$1,280,810
Contingency Allowances (% of Construction Cost)		10		$853,873
Total Construction Costs				$10,673,414
		SUBTOTAL		$10,673,414
TOTAL PRESENT WORTH VALUE				$10,673,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 4- West Waterway Alternative 3- Dredge to SQS

Description	Unit	Quantity	Unit Cost	Cost
1. Entire Cleanup Area				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	31817	$1.50	$47,726
Dredging, Hydraulic Volume	CY	31817	$2.00	$63,634
Confirmation Sampling	1/4000 CY	8	$1,000.00	$8,000
B. Disposal				
Disposal Volume (20% expansion)	CY	38180		
Nearshore Disposal	CY	38180	$30.00	$1,145,412
C. Short-term Monitoring				
Water Quality Monitoring	DAY	3	$3,300.00	$9,900
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1)				$1,609,672
Engineering Costs (% of Construction Costs)	%	15		$241,451
Contingency Allowances (% of Construction Costs)		10		$160,967
Total Construction Costs				$2,012,089
		SUBTOTAL		$2,012,089
TOTAL PRESENT WORTH VALUE				$2,012,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 5- Northwest Harbor Island Alternative 4- Dredge to CSLs and Cap

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Dredging				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	116415	$1.50	$174,623
Volume (hydraulic)	CY	116415	$2.00	$232,830
Confirmation Sampling	1/4000 CY	29	$1,000.00	$29,104
B. Short-term Monitoring				
Water Quality Monitoring	DAY	10	$3,300.00	$33,000
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
C. Disposal				
Disposal Volume (20% expansion)	CY	139698		
Nearshore Disposal	CY	139698	$30.00	$4,190,940
2. Nearshore Area Capping				
A. Cap				
Silty Sand	CY	80011	$3.00	$240,033
Transport and Placement	CY	80011	$3.00	$240,033
B. Short-term Monitoring				
Water Quality Monitoring	DAY	7	$900.00	$6,300
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1 and 2)				$5,516,862
Engineering Costs (% of Construction Costs)	%	15		$827,529
Contingency Allowances (% of Construction Costs)		10		$551,686
Total Construction Costs				$6,896,078
3 Long-term Monitoring	LS	1	$342,974.00	$342,974
4 Maintenance	LS	1	$500,064.60	$500,065
Subtotal O&M Costs (Items 3 and 4)				$843,039
Administrative Costs (% of O&M Costs)	%	15		$126,456
Total O&M Costs				$969,494
		SUBTOTAL		$7,865,572
TOTAL PRESENT WORTH VALUE				$7,866,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 6- West Waterway Alternative 4- Dredge to CSLs and Cap

Description	Unit	Quantity	Unit Cost	Cost
1. Cleanup Area - Dredging				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	18153	$1.50	$27,230
Dredging, Hydraulic Volume	CY	18153	$2.00	$36,306
Confirmation Sampling	1/4000 CY	5	$1,000.00	$4,538
B. Short-term Monitoring				
Water Quality Monitoring	DAY	2	$3,300.00	$6,600
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
C. Disposal				
Disposal Volume (20% expansion)	CY	21784		
Nearshore Disposal	CY	21784	$30.00	$653,508
2. Cleanup Area - Capping				
A. Cap				
Silty Sand	CY	11395	$3.00	$34,185
Transport and Placement	CY	11395	$3.00	$34,185
B. Short-term Monitoring				
Water Quality Monitoring	DAY	1	$900.00	$900
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1 and 2)				$1,167,452
Engineering Costs (% of Construction Costs)	%	15		$175,118
Contingency Allowances (% of Construction Costs)		10		$116,745
Total Construction Costs				$1,459,315
3 Long-term Monitoring	LS	1	$342,974.00	$342,974
4 Maintenance	LS	1	$113,910.08	$113,910
Subtotal O&M Costs (Items 3 and 4)				$456,884
Administrative Costs (% of O&M Costs)	%	15		$68,533
Total O&M Costs				$525,417
		SUBTOTAL		$1,984,731
TOTAL PRESENT WORTH VALUE				$1,985,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 8-Northwest Harbor Island Alternative 3- Dredge to SQS with Onsite Nearshore Disposal

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Areas				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	204978	$1.50	$307,467
Dredging, Hydraulic Volume	CY	204978	$2.00	$409,956
Confirmation Sampling	1/4000 CY	51	$1,000.00	$51,000
B. Disposal				
Disposal Volume (20% expansion)	CY	245974		
Onsite Nearshore Disposal	CY	140000	$16.00	$2,240,000
Offsite Nearshore Disposal	CY	105974	$30.00	$3,179,208
C. Short-term Monitoring				
Water Quality Monitoring	DAY	17	$3,300.00	$56,100
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1)				$6,578,731
Engineering Costs (% of Construction Costs)	%	15		$986,810
Contingency Allowances (% of Construction Cost)		10		$657,873
Total Construction Costs				$8,223,414
		SUBTOTAL		$8,223,414
TOTAL PRESENT WORTH VALUE				$8,223,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

Table 7-Northwest Harbor Island Alternative 2- Containment with Onsite Nearshore Disposal

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Dredging				
A. Dredging				
Dredging Mobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	45198	$1.50	$67,797
Dredging, Hydraulic Volume	CY	45198	$2.00	$90,396
B. Disposal				
Disposal Volume (20% expansion)	CY	54238		
Onsite Nearshore Disposal	CY	54238	$16.00	$867,802
C. Short-term Monitoring				
Water Quality Monitoring	DAY	4	$3,300.00	$13,200
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
2. Nearshore Capping				
A. Cap				
Silty Sand	CY	160022	$3.00	$480,066
Transport and Placement	CY	160022	$3.00	$480,066
B. Short-term Monitoring				
Water Quality Monitoring	DAY	13	$900.00	$11,700
Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1 and 2)				$2,381,027
Engineering Costs (% of Construction Costs)	%	15		$357,154
Contingency Allowances (% of Construction Costs)		10		$238,103
Total Construction Costs				$2,976,283
3 Long-term Monitoring	LS	1	$342,974.00	$342,974
4 Maintenance	LS	1	$500,064.60	$500,065
Subtotal O&M Costs (Items 3 and 4)				$843,039
Administrative Costs (% of O&M Costs)	%	15		$126,456
Total O&M Costs				$969,494
		SUBTOTAL		$3,945,778
TOTAL PRESENT WORTH VALUE				$3,946,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

APPENDIX C

ADMINISTRATIVE RECORD INDEX

Table 9-Northwest Harbor Island Alternative 4- Dredge to CSLs (with Onsite Nearshore Disposal) and Cap

Description	Unit	Quantity	Unit Cost	Cost
1. Nearshore Dredging				
A. Dredging				
Dredging Mobilization/Demobilization	LS	1	$300,000.00	$300,000
Transport and Placement (Pipeline)	CY	116415	$1.50	$174,623
Volume (hydraulic)	CY	116415	$2.00	$232,830
Confirmation Sampling	1/4000 CY	29	$1,000.00	$29,104
B. Short-term Monitoring				
Water Quality Monitoring	DAY	10	$3,300.00	$33,000
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
C. Disposal				
Disposal Volume (20% expansion)	CY	139698		
Onsite Nearshore Disposal	CY	139698	$16.00	$2,235,168
2. Nearshore Area Capping				
A. Cap				
Silty Sand	CY	80011	$3.00	$240,033
Transport and Placement	CY	80011	$3.00	$240,033
B. Short-term Monitoring				
Water Quality Monitoring	DAY	7	$900.00	$6,300
Bathymetric/Sed. Profile Surveys	LS	1	$35,000.00	$35,000
Subtotal Construction Costs (Items 1 and 2)				$3,561,090
Engineering Costs (% of Construction Costs)	%	15		$534,164
Contingency Allowances (% of Construction Costs)		10		$356,109
Total Construction Costs				$4,451,363
3 Long-term Monitoring	LS	1	$342,974.00	$342,974
4 Maintenance	LS	1	$500,064.60	$500,065
Subtotal O&M Costs (Items 3 and 4)				$843,039
Administrative Costs (% of O&M Costs)	%	15		$126,456
Total O&M Costs				$969,494
		SUBTOTAL		$5,420,857
TOTAL PRESENT WORTH VALUE				$5,421,000

The cost of this alternative is highly subject to change based on results from future preremedial design investigations. This is provided as a relative measure from which to compare the costs of different alternatives.

HEADING: 1. 0. . . REMEDIAL INVESTIGATION/FEASIBILITY STUDY

SUB-HEAD: 1. 1. . . Vol. 1 - See Harbor Island Sediments AR Section 1.0

SUB-HEAD: 1. 2. . . Vol. 1 - Technical Memoranda

1. 2. . . Vol. 1 - 1050687 DOC ID: 48887
DATE: 11/ 3/95 PAGES: 50
AUTHOR(S): WESTON DESIGNER/CONSULTANTS
ADDRESSEE(S): Unknown Unknown/EPA
DESCRIPTION: TECHNICAL MEMORANDUM, HARBOR ISLAND REVISED SEDIMENT REMEDIAL ALTERNATIVES.

1. 2. . . Vol. 1 - 1050691 DOC ID: 67321
DATE: 11/13/96 PAGES: 7
AUTHOR(S): WILLIAM J. ENKEBOLL/Landau Associates, Inc.
Dennis R. Stettler/Landau Associates, Inc.
ADDRESSEE(S): Roland H. Webb/Todd Pacific Shipyards Corp.
Roland H. Webb/Todd Pacific Shipyards Corp.
DESCRIPTION: TECHNICAL MEMORANDUM REGARDING CONCEPTUAL EVALUATION OF NEARSHORE FILL ALTERNATIVE, TODD SHIPYARDS.

TABLE OF CONTENTS
HARBOR ISLAND - Shipyard Sediments Administrative Record (HIAO5)

November 27, 1996

0. 0 INDEX/TABLE OF CONTENTS

1. 0 REMEDIAL INVESTIGATION/FEASIBILITY STUDY

    1. 1 See Harbor Island Sediments AR Section 1.0

    1. 2 Technical Memoranda

2. 0 PUBLIC PARTICIPATION

    2. 1 Proposed Plan

    2. 2 Public Comments

    2. 3 Public Hearing Proceedings

3. 0 ENFORCEMENT

    3. 1 Administrative Order on Consent

4. 0 RECORD OF DECISION

    4. 1 State Concurrence Letter

    4. 2 Record of Decision

2. 2. . . Vol. 1 - 1050698 DOC ID: 67328
DATE: 1/ 8/96 PAGES: 24
AUTHOR(S): ADDRESSEE(S):
Charles R. Blumenfeld/Bogle & Gates Keith A. Rose/EPA
Leonard H. Sorrin/Bogle & Gates Keith A. Rose/EPA
DESCRIPTION: LETTER REGARDING COMMENTS ON THE SHIPYARD SEDIMENTS OPERABLE UNIT PROPOSED PLAN.

2. 2. . . Vol. 1 - 1050699 DOC ID: 67329
DATE: 1/ 8/96 PAGES: 1
AUTHOR(S): ADDRESSEE(S):
Margaret Duncan/Suquamish Tribe Keith A. Rose/EPA
DESCRIPTION: LETTER REGARDING EPA'S PREFERRED ALTERNATIVE FOR THE SHIPYARD SEDIMENTS OPERABLE UNIT.

2. 2. . . Vol. 1 - 1050700 DOC ID: 67330
DATE: 1/30/96 PAGES: 2
AUTHOR(S): ADDRESSEE(S):
James J. Valenti/United Steelworkers of America Keith A. Rose/EPA
DESCRIPTION: LETTER SUPPLEMENTING PREVIOUS COMMENT ON THE HARBOR ISLAND SUPERFUND SITE DATED 12/18/95 WITH SOME ADDITIONAL INFORMATION RECENTLY LOCATED.

SUB-HEAD: 2. 3. . . Vol. 1 - Public Hearing Proceedings

2. 3. . . Vol. 1 - 1050688 DOC ID: 67306
DATE: 12/ 6/95 PAGES: 17
AUTHOR(S): ADDRESSEE(S):
Clint D. Hutchison/Bayside Reporters Unknown
DESCRIPTION: PROCEEDINGS, PUBLIC HEARING, ENVIRONMENTAL PROTECTION AGENCY, HARBOR ISLAND SUPERFUND SITE.

HEADING: 2. 0. . . PUBLIC PARTICIPATION

SUB-HEAD: 2. 1. . . Vol. 1 - Proposed Plan

2. 1. . . Vol. 1 - 1050690 DOC ID: 67307
DATE: 10/31/95 PAGES: 14
AUTHOR(S): EPA
ADDRESSEE(S): Unknown
DESCRIPTION: PROPOSED PLAN, SHIPYARD SEDIMENTS OPERABLE UNIT, HARBOR ISLAND, SEATTLE, WA.

SUB-HEAD: 2. 2. . . Vol. 1 - Public Comments

2. 2. . . Vol. 1 - 1050692 DOC ID: 67322
DATE: 11/ 8/95 PAGES: 2
AUTHOR(S): Richard J. Brooks/Brooks Rand, Ltd.
ADDRESSEE(S): Keith A. Rose/EPA
DESCRIPTION: LETTER REGARDING HARBOR ISLAND SEDIMENT CLEAN-UP, FOCUSING ON MERCURY LEVELS.

2. 2. . . Vol. 1 - 1050693 DOC ID: 67323
DATE: 12/18/95 PAGES: 24
AUTHOR(S): James J. Valenti/United Steelworkers of America
ADDRESSEE(S): Keith A. Rose/EPA
DESCRIPTION: LETTER SUBMITTING COMMENTS ON THE PROPOSED PLAN FOR REMEDIAL ACTION, HARBOR ISLAND, SHIPYARD SEDIMENTS OPERABLE UNIT.

2. 2. . . Vol. 1 - 1050694 DOC ID: 67324
DATE: 12/21/95 PAGES: 85
AUTHOR(S): R N. HELGERSON/LOCKHEED CORPORATION
ADDRESSEE(S): Keith A. Rose/EPA
DESCRIPTION: LETTER SUBMITTING COMMENTS ON THE PROPOSED PLAN FOR REMEDIAL ACTION, HARBOR ISLAND, SHIPYARD SEDIMENTS OPERABLE UNIT EXPRESSING TWO FUNDAMENTAL CONCERNS WITH EPA'S PROPOSED PLAN.

2. 2. . . Vol. 1 - 1050695 DOC ID: 67325
DATE: 12/27/95 PAGES: 56
AUTHOR(S): Alan B. Jones/Brooks Rand, Ltd.
ADDRESSEE(S): Keith A. Rose/EPA
DESCRIPTION: LETTER REGARDING ADDITIONAL SEDIMENT MERCURY ANALYSIS AT HARBOR ISLAND SEDIMENT OPERABLE UNIT.

2. 2. . . Vol. 1 - 1050696 DOC ID: 67326
DATE: 12/28/95 PAGES: 7
AUTHOR(S): Francis P. Sweeney/Washington State Department of Natural Resources
ADDRESSEE(S): Keith A. Rose/EPA
DESCRIPTION: LETTER TRANSMITTING WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES' COMMENTS ON THE PROPOSED PLAN FOR THE SHIPYARD SEDIMENTS OPERABLE UNIT.

2. 2. . . Vol. 1 - 1050697 DOC ID: 67327
DATE: 1/ 2/96 PAGES: 3
AUTHOR(S): James J. Valenti/United Steelworkers of America
ADDRESSEE(S): Keith A. Rose/EPA
DESCRIPTION: LETTER TRANSMITTING COMMENTS ON THE PROPOSED PLAN FOR REMEDIAL ACTION, SHIPYARD SEDIMENTS OPERABLE UNIT.

HEADING: 4. 0. . . RECORD OF DECISION

SUB-HEAD: 4. 1. . . Vol. 1 - State Concurrence Letter

4. 1. . . Vol. 1 - 1050707 DOC ID: 67334
DATE: 11/26/96 PAGES: 1
AUTHOR(S): Mary E. Burg/Washington Dept. of Ecology
ADDRESSEE(S): Michael F. Gearheard/EPA
DESCRIPTION: CONCURRENCE TO THE REVISED HARBOR ISLAND SHIPYARD SEDIMENT RECORD OF DECISION.

SUB-HEAD: 4. 2. . . Vol. 1 - Record of Decision

4. 2. . . Vol. 1 - DOC ID: 67335
DATE: PAGES: 100
AUTHOR(S):
ADDRESSEE(S):

DESCRIPTION: HARBOR ISLAND SHIPYARD SEDIMENT RECORD OF DECISION. [This entry will be edited when the document is received]

(HIAO5) HARBOR ISLAND - Shipyard Sediments Administrative Record INDEX

HEADING: 3. 0. . . ENFORCEMENT

SUB-HEAD: 3. 1. . . Vol. 1 - **Administrative Order on Consent**

3. 1. . . Vol. 1 - 0001 DOC ID: 67308
DATE: 2/13/95 PAGES: 40

AUTHOR(S):
Unknown Unknown/EPA

ADDRESSEE(S):
Unknown

DESCRIPTION: ADMINISTRATIVE ORDER ON CONSENT FOR ADDITIONAL SAMPLING AND ANALYSIS FOR SEDIMENT OPERABLE UNIT.
This document is included by reference only. The actual document is located in the Harbor Island Sediments Administrative Record section 4.1.

Station RD-C-01			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Cu	390	447	1.15
Hg	0.59	0.8	1.36
Sample Interval: 2.5 - 5.0 feet			
As	390	801	2.05
Cu	0.59	0.6	1.02
Sample Interval: 5.0 - 7.5 feet			
no exceedances			

STATION RD-C-02			
Contamination by Depth	CSL	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Hg	0.59	1.1	1.86
Sample Interval: 2.5 - 5.0 feet			
no exceedances			
Sample Interval: 5.0 - 7.5 feet			
no exceedances			
Sample Interval: 7.5-10.0 feet			
no exceedances			

STATION RD-C-03			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Cu	390	535	1.37
Pb	530	921	1.74
Hg	0.59	0.9	1.53
Zn	960	1650	1.72
Sample Interval: 2.5 - 5.0 feet			
As	93	921	9.90
Cu	390	891	2.28
Pb	530	1150	2.17
Hg	0.59	2.2	3.73
Zn	960	5430	5.66
Sample Interval: 5.0 - 7.5 feet			
no exceedances			

STATION RD-C-04			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Cu	390	630	1.62
Pb	530	989	1.87
Sample Interval: 2.5 - 5.0 feet			
As	93	286	3.08
Cu	390	428	1.10
Pb	530	1040	1.96
Hg	0.59	0.9	1.53
Zn	960	1160	1.21
Sample Interval: 5.0 - 7.5 feet			
Hg	0.59	1.1	1.86

STATION RD-C-05			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Hg	0.59	2.1	3.56
Pb	530	1130	2.13
Sample Interval: 2.5 - 5.0 feet			
As	93	286	3.08
Cu	390	428	1.10
Pb	530	1040	1.96
Hg	0.59	0.9	1.53
Zn	960	1160	1.21
Sample Interval: 7.5-10.0 feet			
no exceedances			

STATION RD-C-06			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Cu	390	817	2.09
Pb	530	928	1.75
Hg	0.59	9.6	16.27
Zn	960	1160	1.21
Sample Interval: 2.5 - 5.0 feet			
As	93	110	1.18
Cu	390	794	2.04
Pb	530	1420	2.68
Hg	0.59	5.7	9.66
Zn	960	1420	1.48
Sample Interval: 5.0 - 7.5 feet			
Cu	390	767	1.97
Pb	530	3150	5.94
Hg	0.59	3.3	5.59
Zn	960	1070	1.11

STATION RD-C-08			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
As	93	120	1.29
Hg	0.59	2.3	3.90
Pb	530	1170	2.21
Zn	960	1050	1.09
Sample Interval: 2.5 - 5.0 feet			
no exceedances			
Sample Interval: 5.0 - 7.5 feet			
As	93	95	1.02

STATION RD-C-09			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
As	93	146	1.57
Cu	390	1140	2.92
Sample Interval: 2.5 - 5.0 feet			
Cu	390	544	1.39
Sample Interval: 5.0 - 7.5 feet			
no exceedances			

STATION RD-C-11			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
Pb	530	1320	2.49
Sample Interval: 2.5 - 5.0 feet			
As	93	192	2.06
Cu	390	994	2.55
Zn	960	986	1.03
Sample Interval: 5.0 - 7.5 feet			
Hg	0.59	0.7	1.19

STATION RD-C-12			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
As	93	547	5.88
Cu	390	1740	4.46
Zn	960	1880	1.96
Sample Interval: 2.5 - 5.0 feet			
As	93	660	7.10
Cu	390	1570	4.03
Zn	960	2100	2.19
Sample Interval: 5.5 - 8.0 feet			
As	93	309	3.32
Cu	390	1280	3.28
Zn	960	1300	1.35
Sample Interval: 8.5 - 11.0 feet			
As	93	317	3.41
Cu	390	1020	2.62
PB	530	569	1.07
Zn	960	2270	2.36

STATION RD-C-13			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
As	93	745	8.01
Cu	390	914	2.34
Pb	530	1330	2.51
Zn	960	5240	5.46
Sample Interval: 2.5 - 5.0 feet			
As	93	159	1.71
Cu	390	579	1.48
Pb	530	917	1.73
Hg	0.59	1.5	2.54
Zn	960	1970	2.05
Sample Interval: 5.0 - 7.5 feet			
As	93	575	6.18
Cu	390	841	2.16
Pb	530	735	1.39
Zn	960	3810	3.97

STATION RD-C-14			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
As	93	127	1.37
Cu	390	886	2.27
Zn	960	1360	1.42
Sample Interval: 2.5 - 5.0 feet			
As	93	554	5.96
Cu	390	554	1.42
Pb	530	737	1.39
Zn	960	2800	2.92
Sample Interval: 5.0 - 7.5 feet			
As	93	426	4.58
Cu	390	861	2.21
Pb	530	918	1.73
Zn	960	4270	4.45

STATION RD-C-17			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 0.0 - 2.5 feet			
As	93	11	0.12
Cu	390	934	2.39
Sample Interval: 2.5 - 5.0 feet			
As	93	143	1.54
Cu	390	1300	3.33
Zn	960	1000	1.04
Sample Interval: 5.0 - 7.5 feet			
Cu	390	869	2.23
Zn	960	1870	1.95
Sample Interval: 10.0 - 12.5 feet			
Cu	390	392	1.01
Zn	960	1650	1.72

STATION RD-C-19			
Contamination by Depth	CSL mg/kg	Sample Result mg/kg	CSL Exceedance Ratio
Sample Interval: 5.0 - 7.5 feet			
As	93	486	5.23
Zn	960	1500	1.56
Sample Interval: 7.5-10.0 feet			
As	93	297	3.19
Pb	530	665	1.25
Zn	960	1940	2.02

NOTE. the above is a compilation of data only for comparsion purposes and only includes metals from Lockh
Sediment Operable Unit

TECHNICAL FEASIBILITY

Appendix B

Feasibility of Pulling Piling at the LSSOU

Sediment Management Units (SMUs) 3 through 7 are located under existing piers and/or shipways. Together these structures encompass over 4.4 acres, or approximately 57 percent of the LSSOU area. The piers and shipways are made up of decking and support structures (i.e., piles, stringers, and pile caps). The decking portion restricts access to contaminated sediments and shipyard waste from above. The support structures hinder access to the sediments from above and from the side.

Lockheed presented various sitewide remedial strategies in the Basis of Design Report (BDR) and the BDR Technical Memorandum. These documents included unit costs for removal of component parts of the pier structures (e.g., removal of individual piles). As implied above, the advantages of removing parts or all of the existing structures include providing better access to the contaminated sediments and shipyard waste, which would facilitate contamination removal (i.e., dredging) and placement and maintenance of the engineered cap.

Access to the sediments is limited because of the location and number of piles supporting the pier structure. The pile spacing varies at different locations within the LSSOU, but the piling is generally quite closely spaced. Pile densities are greater where higher vertical loading was anticipated (e.g., in the shipways) or in areas where greater lateral forces would be encountered (e.g., at the pier face). Additionally, as piles deteriorated and their load-bearing capacity was reduced, they were replaced by driving additional piles adjacent to them rather than by removing the old pile and driving the new pile in its place.

Dredging of contaminated sediment and placement and maintenance of the cap is most difficult when the entire structure (piling and decking) is left in place. Without removing the pier structure, excavation of contaminated sediments would have to be accomplished through the face of the piers and would not be feasible in the shipways. Removing the decking but leaving the piling in place will still interfere with dredging and capping operations by requiring more time to maneuver equipment around the structures and/or requiring smaller equipment that can fit between the support structure elements.

Furthermore, EPA believes that the remedial effectiveness of dredging and capping operations will be compromised to a significant degree with the piling left in place. First, if portions of the pier and shipway structures are not removed (e.g., the piling or both piles and pile caps are left), it will be difficult to remove all of the contaminated sediment. A clamshell would not be able to remove all of the contaminated material because it simply would not fit between the piles in some locations. Additionally, even when the clamshell could be used in between piles, it cannot be used in such a way to effectively remove contaminated sediment, identified

for removal, located next to a pile. On the other end of the spectrum, small diver-controlled suction dredges could probably be fit in between the piles but would face several significant operational problems–stiffer material could not be removed, production rates would be very low, and lower percent solids in the dredged material and even smaller debris could cause significant problems, etc.

The second significant impact of leaving the piling in place would the reduced effectiveness of placing the capping materials. While the difficulties of cap placement are perhaps less challenging than dredging around numerous piles, achieving the desired chemical isolation is far less likely with the piling in place. The presence of about 6,000 "interruptions" to the continuity of the cap would intuitively make it less likely that the desired isolation could be accomplished as effectively as without the piling present. The presence of the piling would also increase the difficulty of placing armor stone that protects the other components of the cap from various erosion forces. EPA believes that the improved access would provide for a considerably more effective dredging and capping remedy.

One concern with piling removal is that the removal of all pile stubs below the mudline could destabilize the slope in the SMUs located under the piers and shipways. Lockheed will be conducting further studies of the effect of piling removal on slope stability. If these studies indicate that slope stability may be jeopardized, some portion of the piles may be broken off at the dredge cut line, leaving some pile stubs in place to reinforce the slope.

The piling has undergone normal deterioration over the years, with some marine borer infestation noted. The piling under locations where building structures used to exist is in much worse condition than piling in other areas. Even without updated condition survey information, historical records would indicate that a significant portion of the piling is near or has exceeded its normal design or service life.

Because of the increased efficacy of the remedy that would be realized and because of the overall condition of the piling, EPA prefers a remedial strategy for SMUs 3 through 7 that includes the removal of the piles to the degree possible without jeopardizing slope stability in the area. However, both the condition of the piling and the pile spacing raise questions about the feasibility of effective piling removal at the LSSOU.

To obtain firsthand information for use in addressing these feasibility questions, EPA observed a demonstration pile pull at the Olympic View Resource Area on July 30. The primary objective of the demonstration was to test alternative means and methods of removing various pile structures using full-size removal equipment. Equipment included a boom crane with clamshell bucket and vibratory extractor. Testing focused on removal methods that have the potential to achieve full pile extraction. Methods included vibratory extraction and direct pulling through the use of a choke collar.

Hart Crowser developed the scope of work for the demonstration pile pull and provided technical oversight of the construction contractor that conducted the test program. Based on observations of the demonstration and the test results, EPA believes that pulling timber piling at the LSSOU is technically feasible. For further information, refer to General Construction Company, 2001.

COST TABLES BY STRATEGY

Appendix C

Validation of PRP's Remedial Cost Estimates

Lockheed presented cost estimates developed by its contractor, Hart Crowser, for various sitewide remedial strategies in the Basis of Design Report (BDR) and the BDR Technical Memorandum. Lockheed had two separate contractors independently review and confirm these cost estimates. EPA also reviewed the cost estimates in the process of reviewing the BDR and BDR TM. EPA offered some minor review comments for refinement of the estimates, while validating the cost estimates as acceptable within "standard of practice" accuracy ranges.

As an additional step of independent verification of unit prices, EPA contacted RABANCO on August 21, 200, to establish current disposal prices for contaminated sediments (like those at the LSSOU) at Roosevelt landfill. EPA verified anecdotal information that there had recently been significant price reductions at Roosevelt. However, prices had increased quite significantly since Hart Crowser did its cost estimates for the BDR (in 1999 dollars), and the net result was that the unit price in the BDR of $42.00 per cubic yard was verified as just about right. RABANCO was quoting approximately $25 per ton for disposal for quantities like Lockheed's in August. Converting that to a price per cubic yard and adding "a couple dollars" for transportation equals approximately $40 per cubic yard, within reasonable accuracy for such estimates at this stage of the project.

STRATEGY 16: pilings removed: no dredging of contaminated sediments: cap all SMUs

Task	Quantity	Unit	Unit Cost	Total Cost
PRE-CONSTRUCTION				
Mobilization				
Dredge equipment-water based	1	LS	$15,000	$15,000
Dredge equipment-land based	1	LS	$10,000	$10,000
Demolition equipment				
Barges	3	LS	$2,500	$7,500
Tugs	1	LS	$2,000	$2,000
Misc. upland equipment	7	LS	$300	$2,100
Specialized capping equipment		LS		$0
Pile drivers		LS	$500	$0
Site prep	1	LS	$25,000	$25,000
DEMOLITION				
Piers				
Deck removal	128,600	SF	$1.90	$244,340
Stringers, cords and cap removal	60,000	LF	$7.34	$440,400
Pile removal	2,130	EA	$130.62	$278,221
Shipways				
Deck removal	8,600	SF	$4.54	$39,044
Stringers, cords and cap removal	20,258	LF	$10.93	$221,420
Pile removal	3,280	EA	$117.52	$385,466
Building and Pavement	1	LS	$50,000	$50,000
DREDGING				$0
Open water		CY	$9.60	$0
Enclosed water		CY	$9.60	$0
Shipways (piles in place)		CY	$39.93	$0
Under pier (piles in place)		CY	$39.93	$0
Land-based		CY	$3.42	$0
Surficial debris removal (pier removed)	3,330	CY	$28.25	$94,073
Silt curtains		LS	$100,000	$0
DISPOSAL-Subtitle D				
Dredged sediment		CY	$42	$0
Debris	3,330	CY	$42	$139,860
Dewatering and handling		CY	$9.14	$0
CAPPING				
Purchase and transport of capping material				
Sand/gravel	37,453	TON	$8.25	$308,987
Armor	38,304	TON	$15.25	$584,136
Habitat mix	9,363	TON	$8.25	$77,245
Place underpier/shipways (w/pier removed)				
Sand/gravel	21,415	TON	$4.21	$90,157
Armor	21,902	TON	$6.32	$138,421
Habitat mix	5,354	TON	$5.47	$29,286
Place in enclosed water area				
Sand/gravel	2,094	TON	$4.21	$8,816
Armor	2,141	TON	$6.32	$13,531
Habitat mix	523	TON	$5.47	$2,861
Place in open water				
Sand/gravel	13,944	TON	$4.21	$58,704

Armor	14,260	TON	$6.32	$90,123
Habitat mix	3,486	TON	$5.47	$19,068
RELATED CONSTRUCTION				
Install sheet pile				
Purchase sheetpile		SF	$10.25	$0
Drive sheetpile		SF	$2.65	$0
Remove sheet pile		SF	$1.60	$0
Misc. site work	0.40	PERC		$0
Timber bulkhead repair	1	LS	$416,027	$416,027
Complete bulkhead reconstruction		LS	$432,254	$0
PIER RECONSTRUCTION				
Complete reconstruction		SF	$60	$0
Deck replacement		SF	$35	$0
TOTAL PURCHASE AND INSTALLATION COSTS				$3,791,785
INDIRECT COSTS				
Contractor overhead and profit	0.18	DEC. PER	PIC	$682,521
Construction observation	15	WKLY	$7,500	$112,500
Surveys				
Pre-dredge and cap	1	EA	$10,000	$10,000
Progress	7	EA	$3,000	$21,000
Post-dredge and cap	1	EA	$10,000	$10,000
Water quality monitoring				
Intensive	5	WKLY	$20,000	$100,000
Routine	10	WKLY	$14,000	$140,000
Confirmational sediment monitoring	1	LS	$35,000	$35,000
SUBTOTAL				$4,902,807
CONSTRUCTION CONTINGENCY	0.20	DEC. PER		$980,561
TOTAL CONSTRUCTION COSTS				$5,883,368
DESIGN ENGINEERING	0.12	DEC. PER	TCC	$706,004
CONSTRUCTION MANAGEMENT	1	LS	$400,000	$400,000
LONG-TERM MONITORING/MAINTENANCE *				
Capped areas	1	LS		$0
TOTAL CAPITAL COST (1999 $$)				$6,989,372

* costs unknown at present

STRATEGY 18A: pilings removed: dredge to 3 1/2 feet in all SMUs (underpier, shipway, enclosed water, and open water); cap all SMUs.

Task	Quantity	Unit	Unit Cost	Total Cost
PRE-CONSTRUCTION				
Mobe/demobe				
Dredge equipment-water based	1	LS	$15,000	$15,000
Dredge equipment-land based	1	LS	$10,000	$10,000
Demolition equipment		LS		$0
Barges	3	LS	$2,500	$7,500
Tugs	1	LS	$2,000	$2,000
Misc. upland equipment	7	LS	$300	$2,100
Specialized capping equipment		LS		$0
Pile drivers		LS	$500	$0
Site prep	1	LS	$25,000	$25,000
DEMOLITION				
Piers				
Deck removal	128,600	SF	$1.90	$244,340
Stringers, cords and cap removal	60,000	LF	$7.34	$440,400
Pile removal	2,130	EA	$130.62	$278,221
Shipways				
Deck removal	8,600	SF	$4.54	$39,044
Stringers, cords and cap removal	20,258	LF	$10.93	$221,420
Pile removal	3,280	EA	$117.52	$385,466
Building and Pavement	1	LS	$50,000	$50,000
DREDGING				$0
Open water	21,100	CY	$9.60	$202,560
Enclosed water	1,050	CY	$9.60	$10,080
Shipways (piles removed)	9,027	CY	$14.13	$127,552
Under pier (piles removed)	16,211	CY	$14.13	$229,061
Land-based		CY	$3.42	$0
Surficial debris removal (pier removed)	11,100	CY	$28.25	$313,575
Silt curtains	1	LS	$100,000	$100,000
DISPOSAL-Subtitle D				$0
Dredged sediment	47,388	CY	$42	$1,990,296
Debris	11,100	CY	$42	$466,200
Dewatering and handling	47,388	CY	$9.14	$433,126
CAPPING				
Purchase and transport of capping material				
Sand/gravel	37,453	TON	$8.25	$308,987
Armor	38,303	TON	$15.25	$584,121
Habitat mix	9,363	TON	$8.25	$77,245
Place underpier/shipways (piers removed)				
Sand/gravel	21,415	TON	$4.21	$90,157
Armor	21,902	TON	$6.32	$138,421
Habitat mix	5,354	TON	$5.47	$29,286
Place in enclosed water area				
Sand/gravel	2,094	TON	$4.21	$8,816
Armor	2,141	TON	$6.32	$13,531
Habitat mix	523	TON	$5.47	$2,861

Place in open water				
Sand/gravel	13,944	TON	$4.21	$58,704
Armor	14,260	TON	$6.32	$90,123
Habitat mix	3,486	TON	$5.47	$19,068
RELATED CONSTRUCTION				
Install sheet pile				
Purchase sheetpile		SF	$10.25	$0
Drive sheetpile		SF	$2.65	$0
Remove sheet pile		SF	$1.60	$0
Misc. site work	0.40	PERC		$0
Timber bulkhead repair	1	LS	$416,027	$416,027
Complete bulkhead reconstruction		LS	$432,254	$0
PIER RECONSTRUCTION				$0
Complete reconstruction		SF	$60	$0
Deck replacement		SF	$35	$0
TOTAL PURCHASE AND INSTALLATION COSTS				$7,430,288
INDIRECT COSTS				
Contractor overhead and profit	0.18	DEC. PER	PIC	$1,337,452
Construction observation	23	WKLY	$7,500	$172,500
Surveys				
Pre-dredge and cap	1	EA	$10,000	$10,000
Progress	21	EA	$3,000	$63,000
Post-dredge and cap	1	EA	$10,000	$10,000
Water quality monitoring				
Intensive	7	WKLY	$20,000	$140,000
Routine	16	WKLY	$14,000	$224,000
Confirmational sediment monitoring	1	LS	$35,000	$35,000
SUBTOTAL				$9,422,240
CONSTRUCTION CONTINGENCY	0.20	DEC. PER		$1,884,448
TOTAL CONSTRUCTION COSTS				$11,306,688
DESIGN ENGINEERING	0.12	DEC. PER	TCC	$1,356,803
CONSTRUCTION MANAGEMENT	1	LS	$400,000	$400,000
LONG-TERM MONITORING/MAINTENANCE *				
Capped areas	1	LS		$0
TOTAL CAPITAL COST (1999 $$)				$13,063,490

* costs unknown at present

STRATEGY 1: pilings removed: dredge to CSL/maximum feasible depth in all SMUs: cap SQS exceedances to original elevation in all SMUs

Task	Quantity	Unit	Unit Cost	Total Cost
PRE-CONSTRUCTION				
Mobe/demobe				
Dredge equipment-water based	1	LS	$15,000	$15,000
Dredge equipment-land based	1	LS	$10,000	$10,000
Demolition equipment				
Barges	3	LS	$2,500	$7,500
Tugs	1	LS	$2,000	$2,000
Misc. upland equipment	7	LS	$300	$2,100
Specialized capping equipment		LS		$0
Pile drivers		LS	$500	$0
Site prep	1	LS	$25,000	$25,000
DEMOLITION				
Piers				
Deck removal	128,600	SF	$1.90	$244,340
Stringers, cords and cap removal	60,000	LF	$7.34	$440,400
Pile removal	2,130	EA	$130.62	$278,221
Shipways				
Deck removal	8,600	SF	$4.54	$39,044
Stringers, cords and cap removal	20,258	LF	$10.93	$221,420
Pile removal	3,280	EA	$117.52	$385,466
Building and Pavement	1	LS	$50,000	$50,000
DREDGING				$0
Open water	25,200	CY	$9.60	$241,920
Enclosed water	1,450	CY	$9.60	$13,920
Shipways (piles removed)	30,036	CY	$14.13	$424,409
Under pier (piles removed)	59,774	CY	$14.13	$844,359
Land-based		CY	$3.42	$0
Surficial debris removal (pier removed)	11,100	CY	$28.25	$313,575
Silt curtains	1	LS	$100,000	$100,000
DISPOSAL-Subtitle D				
Dredged sediment	116,460	CY	$42	$4,891,320
Debris	11,100	CY	$42	$466,200
Dewatering and handling	116,460	CY	$9.14	$1,064,444
CAPPING				
Purchase and transport of capping material				
Sand/gravel	37,453	TON	$8.25	$308,987
Armor	38,304	TON	$15.25	$584,136
Habitat mix	9,363	TON	$8.25	$77,245
Place underpier/shipways (w/pier removed)				
Sand/gravel	21,415	TON	$4.21	$90,157
Armor	21,902	TON	$6.32	$138,421
Habitat mix	5,354	TON	$5.47	$29,286
Place in enclosed water area				
Sand/gravel	2,094	TON	$4.21	$8,816
Armor	2,141	TON	$6.32	$13,531
Habitat mix	523	TON	$5.47	$2,861

Place in open water				
Sand/gravel	13,944	TON	$4.21	$58,704
Armor	14,260	TON	$6.32	$90,123
Habitat mix	3,486	TON	$5.47	$19,068
RELATED CONSTRUCTION				
Install sheet pile				
Purchase sheetpile		SF	$10.25	$0
Drive sheetpile		SF	$2.65	$0
Remove sheet pile		SF	$1.60	$0
Misc. site work	0.40	PERC		$0
Timber bulkhead repair	1	LS	$416,027	$416,027
Complete bulkhead reconstruction		LS	$432,254	$0
PIER RECONSTRUCTION				
Complete reconstruction		SF	$60	$0
Deck replacement		SF	$35	$0
TOTAL PURCHASE AND INSTALLATION COSTS				$11,918,000
INDIRECT COSTS				
Contractor overhead and profit	0.18	DEC. PER	PIC	$4,677,038
Construction observation	20	WKLY	$7,500	$150,000
Surveys				
Pre-dredge and cap	1	EA	$10,000	$10,000
Progress	16	EA	$3,000	$48,000
Post-dredge and cap	1	EA	$10,000	$10,000
Water quality monitoring				
Intensive	4	WKLY	$20,000	$80,000
Routine	14	WKLY	$14,000	$196,000
Confirmational sediment monitoring	1	LS	$35,000	$35,000
SUBTOTAL				$17,124,038
CONSTRUCTION CONTINGENCY	0.20	DEC. PER		$3,424,808
TOTAL CONSTRUCTION COSTS				$20,548,846
DESIGN ENGINEERING	0.12	DEC. PER	TCC	$2,465,861
CONSTRUCTION MANAGEMENT	1	LS	$700,000	$700,000
LONG-TERM MONITORING/MAINTENANCE*				
Capped areas	1	LS		
TOTAL CAPITAL COST (1999 $$)				$23,714,707

* costs unknown at present

STRATEGY 18B: pilings removed: dredge to 3 1/2 feet in underpier, shipway, and enclosed water and cap to orginal elevation: no dredging in open water SMU; cap to original elevation in

Task	Quantity	Unit	Unit Cost	Total Cost
PRE-CONSTRUCTION				
Mobe/demobe				
Dredge equipment-water based	1	LS	$15,000	$15,000
Dredge equipment-land based	1	LS	$10,000	$10,000
Demolition equipment		LS		$0
Barges	3	LS	$2,500	$7,500
Tugs	1	LS	$2,000	$2,000
Misc. upland equipment	7	LS	$300	$2,100
Specialized capping equipment		LS		$0
Pile drivers		LS	$500	$0
Site prep	1	LS	$25,000	$25,000
DEMOLITION				
Piers				
Deck removal	128,600	SF	$1.90	$244,340
Stringers, cords and cap removal	60,000	LF	$7.34	$440,400
Pile removal	2,130	EA	$130.62	$278,221
Shipways				
Deck removal	8,600	SF	$4.54	$39,044
Stringers, cords and cap removal	20,258	LF	$10.93	$221,420
Pile removal	3,280	EA	$117.52	$385,466
Building and Pavement	1	LS	$50,000	$50,000
DREDGING				$0
Open water		CY	$9.60	$0
Enclosed water	1,050	CY	$9.60	$10,080
Shipways (piles removed)	9,027	CY	$14.13	$127,552
Under pier (piles removed)	16,211	CY	$14.13	$229,061
Land-based		CY	$3.42	$0
Surficial debris removal (pier removed)	11,100	CY	$28.25	$313,575
Silt curtains	1	LS	$100,000	$100,000
DISPOSAL-Subtitle D				$0
Dredged sediment	26,288	CY	$42	$1,104,096
Debris	11,100	CY	$42	$466,200
Dewatering and handling	26,288	CY	$9.14	$240,272
CAPPING				
Purchase and transport of capping material				
Sand/gravel	37,453	TON	$8.25	$308,987
Armor	38,303	TON	$15.25	$584,121
Habitat mix	9,363	TON	$8.25	$77,245
Place underpier/shipways (piers removed)				
Sand/gravel	21,415	TON	$4.21	$90,157
Armor	21,902	TON	$6.32	$138,421
Habitat mix	5,354	TON	$5.47	$29,286
Place in enclosed water area				
Sand/gravel	2,094	TON	$4.21	$8,816
Armor	2,141	TON	$6.32	$13,531
Habitat mix	523	TON	$5.47	$2,861

Place in open water				
Sand/gravel	13,944	TON	$4.21	$58,704
Armor	14,260	TON	$6.32	$90,123
Habitat mix	3,486	TON	$5.47	$19,068
RELATED CONSTRUCTION				
Install sheet pile				
Purchase sheetpile		SF	$10.25	$0
Drive sheetpile		SF	$2.65	$0
Remove sheet pile		SF	$1.60	$0
Misc. site work	0.40	PERC		$0
Timber bulkhead repair	1	LS	$416,027	$416,027
Complete bulkhead reconstruction		LS	$432,254	$0
PIER RECONSTRUCTION				$0
Complete reconstruction		SF	$60	$0
Deck replacement		SF	$35	$0
TOTAL PURCHASE AND INSTALLATION COSTS				$6,148,674
INDIRECT COSTS				
Contractor overhead and profit	0.18	DEC. PER	PIC	$1,106,761
Construction observation	17	WKLY	$7,500	$127,500
Surveys				
Pre-dredge and cap	1	EA	$10,000	$10,000
Progress	15	EA	$3,000	$45,000
Post-dredge and cap	1	EA	$10,000	$10,000
Water quality monitoring				
Intensive	4	WKLY	$20,000	$80,000
Routine	13	WKLY	$14,000	$182,000
Confirmational sediment monitoring	1	LS	$35,000	$35,000
SUBTOTAL				$7,744,935
CONSTRUCTION CONTINGENCY	0.20	DEC. PER		$1,548,987
TOTAL CONSTRUCTION COSTS				$9,293,922
DESIGN ENGINEERING	0.12	DEC. PER	TCC	$1,115,271
CONSTRUCTION MANAGEMENT	1	LS	$400,000	$400,000
LONG-TERM MONITORING/MAINTENANCE *				
Capped areas	1	LS		$0
TOTAL CAPITAL COST (1999 $S)				$10,809,193

* costs unknown at present

STRATEGY 18C: pilings removed; dredge to 3 1/2 feet only in underpier, shipway, and enclosed water SMUs and cap to original elevation; dredge to SQS in the open water SMU

Task	Quantity	Unit	Unit Cost	Total Cost
PRE-CONSTRUCTION				
Mobe/demobe				
Dredge equipment-water based	1	LS	$15,000	$15,000
Dredge equipment-land based	1	LS	$10,000	$10,000
Demolition equipment		LS		$0
Barges	3	LS	$2,500	$7,500
Tugs	1	LS	$2,000	$2,000
Misc. upland equipment	7	LS	$300	$2,100
Specialized capping equipment		LS		$0
Pile drivers		LS	$500	$0
Site prep	1	LS	$25,000	$25,000
DEMOLITION				
Piers				
Deck removal	128,600	SF	$1.90	$244,340
Stringers, cords and cap removal	60,000	LF	$7.34	$440,400
Pile removal	2,130	EA	$130.62	$278,221
Shipways				
Deck removal	8,600	SF	$4.54	$39,044
Stringers, cords and cap removal	20,258	LF	$10.93	$221,420
Pile removal	3,280	EA	$117.52	$385,466
Building and Pavement	1	LS	$50,000	$50,000
DREDGING				$0
Open water	20,337	CY	$9.60	$195,235
Enclosed water	1,050	CY	$9.60	$10,080
Shipways (piles removed)	9,027	CY	$14.13	$127,552
Under pier (piles removed)	16,211	CY	$14.13	$229,061
Land-based		CY	$3.42	$0
Surficial debris removal (pier removed)	11,100	CY	$28.25	$313,575
Silt curtains	1	LS	$100,000	$100,000
DISPOSAL-Subtitle D				$0
Dredged sediment	46,625	CY	$42	$1,958,250
Debris	11,100	CY	$42	$466,200
Dewatering and handling	46,625	CY	$9.14	$426,153
CAPPING				
Purchase and transport of capping material				
Sand/gravel	23,509	TON	$8.25	$193,949
Armor	24,043	TON	$15.25	$366,656
Habitat mix	5,877	TON	$8.25	$48,485
Place underpier/shipways (piers removed)				
Sand/gravel	21,415	TON	$4.21	$90,157
Armor	21,902	TON	$6.32	$138,421
Habitat mix	5,354	TON	$5.47	$29,286
Place in enclosed water area				
Sand/gravel	2,094	TON	$4.21	$8,816
Armor	2,141	TON	$6.32	$13,531
Habitat mix	523	TON	$5.47	$2,861

Place in open water				
Sand/gravel		TON	$4.21	$0
Armor		TON	$6.32	$0
Habitat mix		TON	$5.47	$0
RELATED CONSTRUCTION				
Install sheet pile				
Purchase sheetpile		SF	$10.25	$0
Drive sheetpile		SF	$2.65	$0
Remove sheet pile		SF	$1.60	$0
Misc. site work	0.40	PERC		$0
Timber bulkhead repair	1	LS	$416,027	$416,027
Complete bulkhead reconstruction		LS	$432,254	$0
PIER RECONSTRUCTION				$0
Complete reconstruction		SF	$60	$0
Deck replacement		SF	$35	$0
TOTAL PURCHASE AND INSTALLATION COSTS				$6,854,785
INDIRECT COSTS				
Contractor overhead and profit	0.18	DEC. PER	PIC	$1,233,861
Construction observation	18	WKLY	$7,500	$135,000
Surveys				
Pre-dredge and cap	1	EA	$10,000	$10,000
Progress	16	EA	$3,000	$48,000
Post-dredge and cap	1	EA	$10,000	$10,000
Water quality monitoring				
Intensive	6	WKLY	$20,000	$120,000
Routine	12	WKLY	$14,000	$168,000
Confirmational sediment monitoring	1	LS	$35,000	$35,000
SUBTOTAL				$8,614,646
CONSTRUCTION CONTINGENCY	0.20	DEC. PER		$1,722,929
TOTAL CONSTRUCTION COSTS				$10,337,575
DESIGN ENGINEERING	0.12	DEC. PER	TCC	$1,240,509
CONSTRUCTION MANAGEMENT	1	LS	$400,000	$400,000
LONG-TERM MONITORING/MAINTENANCE *				
Capped areas	1	LS		$0
TOTAL CAPITAL COST (1999 $S)				$11,978,084

* costs unknown at present

STRATEGY 18D: pilings removed: dredge to 3 1/2 feet only in underpier, shipway, and enclosed water SMUs and cap to orginal evlation; dredge to CSL and cap to orginal elevation in the open water SMU.

Task	Quantity	Unit	Unit Cost	Total Cost
PRE-CONSTRUCTION				
Mobe/demobe				
Dredge equipment-water based	1	LS	$15,000	$15,000
Dredge equipment-land based	1	LS	$10,000	$10,000
Demolition equipment		LS		$0
Barges	3	LS	$2,500	$7,500
Tugs	1	LS	$2,000	$2,000
Misc. upland equipment	7	LS	$300	$2,100
Specialized capping equipment		LS		$0
Pile drivers		LS	$500	$0
Site prep	1	LS	$25,000	$25,000
DEMOLITION				
Piers				
Deck removal	128,600	SF	$1.90	$244,340
Stringers, cords and cap removal	60,000	LF	$7.34	$440,400
Pile removal	2,130	EA	$130.62	$278,221
Shipways				
Deck removal	8,600	SF	$4.54	$39,044
Stringers, cords and cap removal	20,258	LF	$10.93	$221,420
Pile removal	3,280	EA	$117.52	$385,466
Building and Pavement	1	LS	$50,000	$50,000
DREDGING				$0
Open water	14,041	CY	$9.60	$134,794
Enclosed water	1,050	CY	$9.60	$10,080
Shipways (piles removed)	9,027	CY	$14.13	$127,552
Under pier (piles removed)	16,211	CY	$14.13	$229,061
Land-based		CY	$3.42	$0
Surficial debris removal (pier removed)	11,100	CY	$28.25	$313,575
Silt curtains	1	LS	$100,000	$100,000
DISPOSAL-Subtitle D				$0
Dredged sediment	40,329	CY	$42	$1,693,818
Debris	11,100	CY	$42	$466,200
Dewatering and handling	40,329	CY	$9.14	$368,607
CAPPING				
Purchase and transport of capping material				
Sand/gravel	41,707	TON	$8.25	$344,083
Armor	34,232	TON	$15.25	$522,038
Habitat mix	9,273	TON	$8.25	$76,502
Place underpier/shipways (piers removed)				
Sand/gravel	21,415	TON	$4.21	$90,157
Armor	21,902	TON	$6.32	$138,421
Habitat mix	5,354	TON	$5.47	$29,286
Place in enclosed water area				
Sand/gravel	2,094	TON	$4.21	$8,816
Armor	2,141	TON	$6.32	$13,531

Habitat mix	523	TON	$5.47	$2,861
Place in open water				
Sand/gravel	18,198	TON	$4.21	$76,614
Armor	10,189	TON	$6.32	$64,394
Habitat mix	3,396	TON	$5.47	$18,576
RELATED CONSTRUCTION				
Install sheet pile				
Purchase sheetpile		SF	$10.25	$0
Drive sheetpile		SF	$2.65	$0
Remove sheet pile		SF	$1.60	$0
Misc. site work	0.40	PERC		$0
Timber bulkhead repair	1	LS	$416,027	$416,027
Complete bulkhead reconstruction		LS	$432,254	$0
PIER RECONSTRUCTION				$0
Complete reconstruction		SF	$60	$0
Deck replacement		SF	$35	$0
TOTAL PURCHASE AND INSTALLATION COSTS				$6,965,483
INDIRECT COSTS				
Contractor overhead and profit	0.18	DEC. PER	PIC	$1,253,787
Construction observation	21	WKLY	$7,500	$157,500
Surveys				
Pre-dredge and cap	1	EA	$10,000	$10,000
Progress	19	EA	$3,000	$57,000
Post-dredge and cap	1	EA	$10,000	$10,000
Water quality monitoring				
Intensive	7	WKLY	$20,000	$140,000
Routine	14	WKLY	$14,000	$196,000
Confirmational sediment monitoring	1	LS	$35,000	$35,000
SUBTOTAL				$8,824,770
CONSTRUCTION CONTINGENCY	0.20	DEC. PER		$1,764,954
TOTAL CONSTRUCTION COSTS				$10,589,724
DESIGN ENGINEERING	0.12	DEC. PER	TCC	$1,270,767
CONSTRUCTION MANAGEMENT	1	LS	$400,000	$400,000
LONG-TERM MONITORING/MAINTENANCE *				
Capped areas	1	LS		$0
TOTAL CAPITAL COST (1999 $$)				$12,260,490

* costs unknown at present

RESPONSIVENESS SUMMARY

Appendix D

RESPONSIVENESS SUMMARY FOR LOCKHEED SHIPYARD SEDIMENT OPERABLE UNIT EXPLANATION OF SIGNIFICANT DIFFERENCES

This Responsiveness Summary summarizes and provides responses to comments received by EPA during the 30-day public comment period provided for the draft ESD for Lockheed Shipyard Sediment Operable Unit. The draft ESD described six remedial strategies and proposed one for implementing the remedy selected in the ROD for Lockheed Shipyard Sediment Operable Unit.

The public comment period for the draft ESD ran from December 26, 2001 through January 24, 2002. A fact sheet was mailed to parties on the mailing list for the Lockheed site and a newspaper article announcing the public comment period appeared in the Seattle Times on December 26, 2001.

Comments were received in writing from the following parties:

Lockheed Martin Corporation (LM)
Muckleshoot Indian Tribe (Muckleshoot)
National Oceanic and Atmospheric Administration (NOAA)
Port of Seattle (Port)
TechSolv
Todd Pacific Shipyards Corporation (Todd)
Washington Department of Ecology (Ecology)
Washington Department of Fish and Wildlife (WDFW)
Washington Department of Natural Resource (WDNR)

Significant comments are summarized below, largely verbatim. In some cases, comments are grouped when more than one commentor made a similar comment. The commentor is identified in parenthesis after the comment. EPA's response follows each comment. Comments are organized by subject.

GENERAL COMMENTS ON EPA's PROPOSED STRATEGY FOR IMPLEMENTING THE ROD.

1. **Comment 1:** DNR supports the ESD and concurs with the NOAA's comments for the selection of Strategy 18C of the LSSOU ESD. DNR generally supports EPA's selection of the strategy for clean up of the Lockheed Shipyard Operable Unit. (Department of Natural Resources)

The WDFW agrees with the EPA recommendation of the cleanup efforts in open waters since all contaminants will be removed and disposed of at an upland landfill site. Until more detailed cost estimates are available, WDFW recommends Strategy 1

because it provides the most comprehensive cleanup and may not be as costly as some of the other alternatives. (Washington Department of Fish and Wildlife)

Based on our natural resource trust responsibilities and consultative needs for listed species and their habitats under the Endangered Species Act, we recognize Strategy 18C as being the most protective of the aquatic environment among the more cost-effective strategies. However, NOAA's preference is complete removal of contaminated sediments with non-aquatic disposal. (National Oceanic and Atmospheric Administration)

The Lockheed Shipyard Sediment Operable Unit is an important location where the Tribe exercises its federally-adjudicated fishing rights. The cleanup area is in the Muckleshoot Indian Tribe's Usual and Accustomed Fishing Grounds. Adequate cleanup of the Duwamish River is necessary for the protection of the health of tribal fishers exercising their treaty rights in this area and for the protection of the aquatic ecosystem, which contributes to the health of the fishery itself. The Muckleshoot Tribe prefers "the removal of the maximum contamination possible". (Muckleshoot Indian Tribe)

Response to Comment 1: As determined in the ROD, contamination exceeding the CSL may be left in place if the cost, benefit, technical feasibility analysis indicated that removal instead of capping contamination exceeding the CSL was either not feasible or that the cost outweighed the benefits. EPA concluded in the ESD that the costs exceeded benefits when dredging all sediments exceeding the CSL instead of capping sediments exceeding the CSL. Commentors have not offered additional information for EPA to reconsider its cost, benefit and technical feasibility evaluation. Further discussion on EPA's cost, benefit and technical feasibility analysis is provided in the next section, Cost, Benefit and Technical Feasibility Evaluation.

2. Comment 2: The ESD is inconsistent with the findings of the Basis of Design Report (Hart Crowser, 2000a), which concluded that the capping-only remedy is the most cost-effective and environmentally sound solution for the site. Further, the ESD requires Lockheed to dredge sediments below the CSL thus imposing a higher remedial standard than required by EPA' remedy selected in the 1996 ROD. (Lockheed)

Response to Comment 2: EPA has not approved the Basis of Design Report because EPA disagreed fundamentally with the report including Lockheed's preferred capping only remedy. EPA documented its comments to Lockheed in writing. Lockheed has failed to respond to EPA's comments. EPA opposed the capping only remedy because Lockheed's preferred remedy of capping failed to satisfy ROD remedy requirements such as restoration of marine habitat to its most productive condition (to the extent practicable) and compliance with Clean Water Act Section 404 - to prevent loss of tidal and subtidal marine habitat. Lockheed's preferred remedy, capping without dredging, would fill in nearshore marine habitat. The capping only remedy is incompatible with reasonably anticipated future use for a long-standing working waterfront water-

dependent use facility. Additionally, EPA considered that the process used by Lockheed to evaluate alternatives and to recommend a preferred alternative in its BDR was seriously flawed. EPA's reasons are numerous and are stated in EPA's letter of March 2, 2000. EPA's March letter is available in the Administrative Record for public review.

Lockheed's comment that refers to the ESD requiring remediation of contaminanted sediments to a higher standard than required by the ROD (i.e., dredging sediments contaminated below the CSL level as opposed to capping sediments contaminated below the CSL level) refers to the open water SMU at LSSOU. However, the cost of dredging the open water SMU (as in Strategy 18C) is less than capping part of the open water and dredging and capping other parts of the open water SMU (as in Strategy 18D).

If the part dredge/part cap strategy (Strategy 18D) were to be implemented, the surface of the open water SMU would not be smooth. There would be dredged area that would be 5 feet deeper and there would be capped areas that would be elevated by 3.5 feet, thus making the open water SMU surface consist of hills and valleys. The requirement for smooth surfaces is directed at mitigating recontamination. The costs to satisfy the ROD requirement for smooth surfaces, not hills and valleys, were not included in the cost of Strategy 18D.

COST, BENEFIT AND TECHNICAL FEASIBILITY EVALUATION

1. Comment 3: The document assumed that the dredged depth would be 3.5 feet deep for cost analysis purposes, although this could be modified depending on benefits, costs and technical site constraints. The WDFW recommends that an evaluation be conducted to assess whether or not a 3.5 foot dredge depth is sufficient enough to effectively isolate contaminants at the project site. (Washington Department of Fish and Wildlife).

Response to Comment 3: The ROD states that the "extent of dredging of contaminated sediments and waste under piers...will be determined during remedial design based on cost, benefit and technical feasibility". However, that does not mean that cap thickness will be determined based on a cost, benefit and technical feasibility evaluation. The cap must be chemically and physically confining. Parameters to isolate contaminants, such as cap thickness, will be determined during design. The degree to which the cap confines contaminants can not be reduced by a cost, benefit and technical feasibility evaluation. At present, EPA is only assuming a 3.5 foot thick cap for discussion and cost purposes.

2. Comment 4: Strategy 1, which would remove the largest amount of sediments exceeding the CSL, is estimated to have the highest cleanup costs. The WDFW questions whether this assumption is accurate. Since we do not know the condition of the existing bulkhead, we are unable to assess which is providing more slope stability -

the bulkhead or the pilings. If the bulkhead is in very poor condition, a greater percentage of pilings would need be cut off below the mudline and remain in the sediments in order to protect the integrity of the slope. Cutting off pilings below the mud line can be very labor intensive and time consuming, and it could significantly increase the cost estimates for cleanup. (Washington Department of Fish and Wildlife).

Response to Comment 4: On January 17, 2002, Lockheed submitted to EPA, a preliminary draft of report entitled "Preliminary Bulkhead and Demolition Analysis." EPA has not completed its review, however, based on a preliminary review, this report concludes that the existing timber bulkheads, which comprise the majority of overall length of bulkhead at the site. are in a general state of deterioration. Further, the report concludes that these bulkheads have insufficient capacity (even when in good condition) to allow for any dredging near the base of these structures. Lesser lengths of steel sheet pile bulkhead and concrete bulkhead are assessed as being in fair and good condition. respectively. On the basis of the report, implementation of any of the strategies, with the exception of the capping only strategy (Strategy 16), would likely require replacement of at least the existing timber bulkheads. The cost tables attached to the ESD include (conservatively) the same cost for this replacement for all strategies. However, it is likely, the replacement bulkhead for Strategy 1 would be more costly because of the significantly deeper dredge required near the base of the bulkhead than with other strategies.

Lockheed's report also documents an assessment of the condition of the existing timber piling. Approximately 20% of the piling are judged to be in such poor condition as to potentially break during attempted extraction. However, based on information provided in Lockheed's report, if EPA assumed that all pilings needed to be broken or cut off below the mudline and these costs were added to the cost estimate for the selected strategy, Strategy 18C, the cost of Strategy 1 would still be about two times the cost of Strategy 18C. According to Lockheed's report the cost of cutting off approximately 6000 pilings below the mudline would increase the cost of Strategy 18C by about $785,000 thus increasing the total projected cost for 18C to $12.764 million. The projected total cost for Strategy 1 is $23.72 million assuming that all pilings could be simply extracted (less costly than cutting off pilings at the mudline) and that the bulkhead replacement costs (to accommodate very deep dredging) estimated in the ESD are too low. If pilings were cut off at the mudline instead of extracted the projected total cost for Strategy 1 would be $23.84 million. EPA does not believe that the added cost of significant bulkhead replacement or cutting off pilings offset the cost of deep dredging and the added volume of sediments for disposal. Dredging, disposal of contaminated sediments and capping are the drivers of cost for the Lockheed Shipyard Sediment Operable Unit.

3. **Comment 5:** Monitoring costs. which can be exceedingly high, may not be as high for Strategy 1. If contaminants in some of the SMU areas can be completely removed, monitoring may not need to be as frequent as it would need to be under the other proposed Strategies. (Washington Department of Fish and Wildlife)

Response to Comment 5: EPA agrees that the long-term monitoring costs for Strategy 1 probably would not be as high as for the other strategies. However, reduction in long-term monitoring costs is not of a sufficient cost savings to justify EPA selecting Strategy 1. Also, refer to Response to Comments 1 and 5.

WATER COLUMN AND HABITAT ISSUES

1. Comment 6: As a decision criterion, the blanket statement that water column loss is equivalent to loss of habitat value is inappropriate. A site specific analysis would be needed to determine whether such water column loss is a negative impact or positive benefit to marine habitat. For example, targeting juvenile salmonid habitat enhancement at this location in Elliott Bay would typically encourage construction of additional habitat at intertidal elevations (-10 to +10 MLLW). If existing bathymetry is raised to increase the extent of such preferential elevations (with attendant loss in water column depth) that action could add significant enhancement to the value of marine habitat at the site. The filling of subtidal or intertidal areas to construct such habitat enhancement should not be automatically counted as a negative characteristic of the remedial strategy. (Todd Pacific Shipyards Corporation, Port of Seattle)

Response to Comment 6: EPA agrees with the above comments. In the ESD, EPA's repeated reference to the need for maintaining the existing bathymetry or water column was meant to refer to the shallow nearshore area of -20 feet MLLW and shallower. Restoring the marine habitat to a more productive environment, a remedial action objective cited in the ROD, could be partially satisfied if future use plans allow for habitat enhancement by construction of additional habitat at intertidal elevations (-10 to +10 MLLW).

2. Comment 7: Any areas in water shallower than -10 feet (MLLW) which must use capping as a remedial strategy should have no net loss of water depth, contours, grades, or profiles (i.e., restore to original bathymetry). Excavations shoreward should balance capping and shoreline stabilization installations that would otherwise fill waterward. (NOAA/NMFS)

Final littoral (-10 to+14 feet MLLW) zone surfaces should have a fish-friendly substrate, as defined by the Washington Department of Fish and Wildlife as "2-inch minus, rounded pit-run gravel". If a shoreline requires large-rock stabilization, it could employ riprap under quarry spall (i.e., "rat-rock") immediate void-filling layer, and top-dressed with a suitable finer-grain "fish mix". (NOAA/NMFS)

Response to Comment 7: The cap design and dredging depth should retain the original bathymetry in the nearshore area shallower than -10MLLW. As noted in the ROD, the cap should be of a smooth surface such as to minimize recontamination by suspended contaminated sediments. Also, the ROD specifies that to the extent

practicable, the marine habitat should be restored to its most productive condition. During design, EPA and Lockheed with consultation with Trustees, resource agencies and Tribes, will pursue designs that enhance the marine habitat as required by the ROD

COORDINATION ISSUES

1. **Comment 8:** The WDFW agrees with EPA's assessment that the pier decking and piling and shipway removal is necessary in order to effectively remove contaminants from nearshore areas, although the draft ESD states that some piles may need to be left in place to ensure slope stability. The piles will either be cut or broken off below the mud line. When available, WDFW will be interested in reviewing the slope study analysis to determine what factors are primarily responsible for maintaining the slope stability at the site, (i.e., the bulkhead or the pilings). (Washington Department of Fish and Wildlife)

The Tribe is interested in having coordination meetings with EPA regarding the potential timing of the cleanup action. As you are aware, the action that is being proposed involves significant in-water work that could have short-term impacts on Tribal fishing in the area. Therefore, the Tribe is interested in working with you to develop a cleanup approach that avoids impacting Tribal fishing in the area. Cumulative short-term impacts to Tribal fishing could be significant without appropriate communication and coordination. (Muckleshoot)

Response to Comment 8: EPA plans to coordinate remedial design deliverables with Natural Resource Trustees, Tribes and other regulatory agencies. Points for coordination are review and comment on 30% design and 95% design as well as meetings where policy and technical issues can be reviewed and discussed. EPA will contact Natural Resource Trustees, Tribes and resource and other regulatory agencies to decide coordination points that make sense for remedial design.

2. **Comment 9:** A portion of the former Lockheed property has been transferred to Atlantic Richfield from the Port of Seattle. This parcel is directly adjacent to one of the piers identified for demolition and an area of sediment dredging. Atlantic Richfield would like adequate reassurances that the remedial actions will not compromise the integrity of the shoreline bulkhead in this area. Atlantic Richfield would like to be involved in the design planning/review process to be assured that the selected remedial actions will not impact the terminal or its operations. (TechSolv)

Response to Comment 9: All approved remedial design documents will be available for public scrutiny. Atlantic Richfield is invited to review them and forward any comments or concerns to EPA. EPA is always available to meet concerned neighbors or other citizens regarding remedial action under EPA authority. EPA will not approve any remedial activity it believes may compromise the structural integrity of adjoining or adjacent property.

BIOACCUMULATION DATA

1. Comment 10: EPA relied on data collected and analyzed by EPA to in part support a No Action Proposed Plan for the West Waterway Operable Unit of Harbor Island. It should be noted that the results and recommendations proposed by EPA as part of the human health risk assessment have been opposed by many parties, including the Muckleshoot Tribe. Therefore, it is not appropriate for EPA to use "risk summaries, characterizations, or recommendations from the West Waterway human health risk assessment" until all concerns about the data are resolved. (Muckleshoot)

Response to Comment 10: EPA relied on risk assessment data developed for the No Action Proposed Plan for the West Waterway Operable Unit (WWOU) of Harbor Island. The human health data evaluated for the WWOU is applicable to the Lockheed Shipyard Sediment Operable Unit. Adverse public comments with supporting information were submitted to EPA opposing its risk assessment determination for WWOU. Presently, EPA is reviewing submitted adverse comments and new information. A ROD is scheduled to be issued by the end of September 2002.

ABRASIVE GRIT BLAST DEFINITION

1. Comment 11: Visual identification of abrasive grit blast (AGB) is a more reliable method for identification at the LSSOU than using physical and chemical criteria. EPA's criteria for determining AGB may not be applicable to the LSSOU, for the following reasons:

- The specific chemical and physical characteristics of AGB present at the LSSOU are presently unknown. Chemical or physical data presented for the LSSOU were derived from sediment samples collected throughout the site which may or may not have contained AGB. No testing was performed on samples comprised exclusively of AGB.
- A grain size fraction of sand content greater than 60% is not a unique characteristic for the LSSOU. Data collected as part of the Due Diligence Study and Remedial Design Investigation of the LSSOU indicate that the average sand content for the samples characterized is approximately 68%. The average sand content for surface samples is approximately 59% and the average subsurface sample sand content is approximately 82%.
- Relative to the remedial design investigation field observations, EPA's chemical and physical criteria appear to overestimate the extent of AGB. For example, by EPA's definition the near-surface materials in the open water area near the north shipway (vicinity of RD-C-04) would be characterized as AGB. Lockheed has not observed any AGB in this area.

Response to Comment 11: EPA has given Lockheed the opportunity to review and comment on the AGB definition and to provide information to support a revision of the definition. EPA and Lockheed have discussed the specific points outlined in Comment 11 at several meetings. To date. EPA has not received any data from Lockheed to substantiate their comments concerning ABG (including Comment 11) nor to modify the EPA AGB definition. The EPA AGB definition itself provides for modification of the definition anytime in the future based on EPA's review and acceptance of rationale or data.

PILE REMOVAL

1. Comment 12: Based on the results of the draft supplemental studies, breaking the piles at mudline rather than complete extraction is more favorable to the remediation of the site because the slope and subsequent cap are expected to be more stable. Breaking the piles at the mudline is expected to be less expensive and reduce the chances for incomplete extraction. (Lockheed)

Response to Comment 12: Lockheed did not provide the supplemental studies to EPA until after the draft ESD was released for public comment. EPA's goal is to remove as many of the piles from the Site as possible while preserving slope and cap stability as well as taking into account future use needs. During the design process, EPA and Lockheed will evaluate methods for determining the number and location of piles that may be completely removed. EPA does not expect that the cost differential between the cost of extraction versus the cost of breaking off a piles below the mudline will be of sufficient difference to justify a reconsideration of the strategy for the Site. Based on preliminary EPA review of the supplemental studies, the cost difference between pulling all the piles and breaking or cutting off all the piles is around $790,000. However, these technical and cost factors will be evaluated and review and comment will be sought from Trustees, resource and regulatory agencies, Tribes and appropriate experts.

2. Comment 13: WDFW would recommend that EPA require that an analysis be conducted to determine how many piles, and which piles, are truly necessary to be retained to maintain slope stability at the site. Further concerns related to pile retention include the potential for future development at the project site that may require new piling installation. If the retained pilings need to be removed to accommodate new pilings for project development. the integrity of the cap would likely be compromised as a result of the removal operations. Therefore, WDFW recommends that every effort be made to completely remove existing pilings from the marine environment in order to eliminate or reduce the potential for future recontamination at the site. The WDFW also recommends that EPA examine the feasibility of temporarily installing sheetpile or other structures that would maintain the integrity of the slope during cleanup efforts, and minimize the need for leaving potentially thousands of stub pilings in marine waters. Doing this could also eliminate the problem of having to limit the dredge depth

because of slope stability issues and allow more contaminants to be removed at the project site. (Washington Department of Fish and Wildlife)

Response to Comment 13: Once the ESD is final, Lockheed will start preparing the design for the remedial action. The design process will result in several deliverables, 30% design. 95% design and a final design, for review, comment and EPA approval. There are numerous issues to be addressed in remedial design. EPA's goal is to remove as many piles as technically feasible and to minimize recontamination. In order to determine how many piles and which ones can be removed as opposed to broken off below the mudline, an assessment of bulkhead condition, how that contributes to slope stability, the condition of the approximately 6000 piles and future use plans are some of the issues to be addressed. Preliminary information submitted to EPA on January 17, 2002 indicates that the bulkhead is in varying stage of poor condition and may not by itself be supporting the uplands portion of the Lockheed site. If the presence of the pilings are providing support for slope stability, Lockheed will need to analyze various alternatives about which pilings remain to be broken off at the mudline and which ones are pulled. That analysis should also consider future use plans including the placement of future concrete piles to the extent that that information is available. Regarding piles that are left in place or for future construction activities occurring in the capped area, institutional controls will direct the manner in which piles are pulled or installed in the future and controls to be put in place to minimize release of contamination.

Temporary and permanent support structures such as sheet piling shall be considered in various dredging alternatives. The dredge depth for the under-pier, enclosed water and shipway areas will be based on the thickness of the cap or habitat considerations. Refer to Response to Comment 4 for more information about the cost.

3. Comment 14: DNR understands that EPA concurs with our long standing assertion that any cap design needs to accommodate deep burrowing benthic fauna by providing adequately clean, fully functional habitat greater than 3 feet in thickness. (Department of Natural Resources)

Response to Comment 14: Cap design will take into account numerous objectives and specifications. Some of the cap design objectives include that the cap shall be physically and chemically confining of the contaminated sediment and that according to the ROD "(t)o the extent practicable, the marine habitat ... must be restored to its most productive condition...". DNR will have the opportunity to comment on the cap design at the 30% and 95% design stages.

FUTURE USE

1. Comment 15: It should be noted that the aquatic area of this site is also part of the Muckleshoot Indian Tribe's Usual and Accustomed Fishing Grounds. Institutional

controls that do not interfere with future uses nor Tribal Treaty fishing are needed to ensure that the integrity of the cap is not compromised (NOAA/NMFS, Muckleshoot Tribe).

Response to Comment 15: EPA will coordinate with the Muckleshoot Tribe, as with other interested parties, when discussions on future use and institutional controls are held for the site. These considerations will be taken into account during review of remedial design documents.

2. Comment 16: Future site use(s) should include use of non-treated structures to eliminate the potential for leaching creosote into the environment. (Department of Natural Resources)

Response to Comment 16: Future site development, such as the nature and installation of new piles, will be subject to appropriate Best Management Practices (BMP).

3. Comment 17: DNR continues to be concerned about the long-term liability the state may incur by having a cap on State Owned Aquatic Land. DNR is interested in ensuring that options for productive beneficial use of SOAL are preserved. DNR is therefore concerned about the institutional controls that might be placed to ensure the integrity of a cap; DNR wants to ensure that those controls and the presence of a cap do not constrain future use of the land. (Department of Natural Resources)

Response to Comment 17: The institutional controls that will be placed to preserve the integrity of the cap will not prohibit future uses but they will likely direct how certain activities are carried out. DNR will have the opportunity to review and comment on design plans.

4. Comment 18: The ESD provides that future site uses be considered during remedial design, however, incorporation of the Port's future use plans seems impossible without specific future use plans. What will be the process for incorporating future uses plans in remedial design and how will that affect the schedule for remedial design. EPA should include a provision in the ESD for post-demolition administrative protection of existing over-water coverage for future site plans. (Lockheed)

Response to Comment 18: The Port of Seattle is the owner of the former Lockheed facility. EPA fully expects that Lockheed and the Port will coordinate design discussions and plans to take into account the Port's future use plans. EPA will consider future use as part of the remedy design and implementation as appropriate at the OU.

SOURCE CONTROL

1. Comment 19: We prefer inclusion of source control through plugging or removing adjacent pipes as they may contain suspected sources of contaminants. (Department of Natural Resources)

Response to Comment 19: EPA will evaluate source control documents to be prepared by Lockheed to ensure that uplands surface water (including stormwater) or groundwater does not recontaminate the cap. A number of options for source control will be evaluated if source control is needed. The final determination of the form of source control will be documented in either the Consent Decree for Remedial Action or the final remedial design document.

2. Comment 20: Based on the Seattle Yard 1 groundwater evaluation, the recontamination potential from the adjacent upland is expected to be low. We believe EPA has reviewed this evaluation and agrees with its findings. (Lockheed)

Response to Comment 20: EPA has conducted a preliminary review of the groundwater evaluation but has not finalized its evaluation of this potential source of contamination.

DISPOSAL

1. Comment 21: The Tribe supports EPA's proposal to dispose of all contaminated dredge materials from the open water, under-pier, shipway, and enclosed areas in an appropriate upland landfill. (Muckleshoot Indian Tribe)

NOAA's preference is complete removal of contaminated sediments with non-aquatic disposal. (National Oceanic and Atmospheric Administration)

Response to Comment 21: Several commentors provided written comments supporting upland disposal. No commentors objected to upland disposal or noted a preference for another form of disposal.

SUPERFUND Fact Sheet

HARBOR ISLAND
Seattle, Washington

EPA U.S. ENVIRONMENTAL PROTECTION AGENCY December 2001

Comments Requested on the Harbor Island Lockheed Shipyard Sediments Cleanup Proposal

The U.S. Environmental Protection Agency (EPA) invites you to comment on possible strategies to clean up contaminated sediments at the Lockheed Shipyard. This fact sheet provides information about six possible cleanup strategies and proposes one. This fact sheet also includes an update on the cleanup of petroleum-contaminated soils at the Harbor Island site.

Send your written comments on the Lockheed sediments proposal by January 24, 2002:

Lynda Priddy, Project Manager
U.S. Environmental Protection Agency
1200 Sixth Avenue, ECL-112
Seattle, WA 98101

EPA's complete proposal is presented in the "Explanation of Significant Differences: Lockheed Shipyard Sediments Operable Unit," which is available for review at the Superfund Records Center listed at the end of this fact sheet.

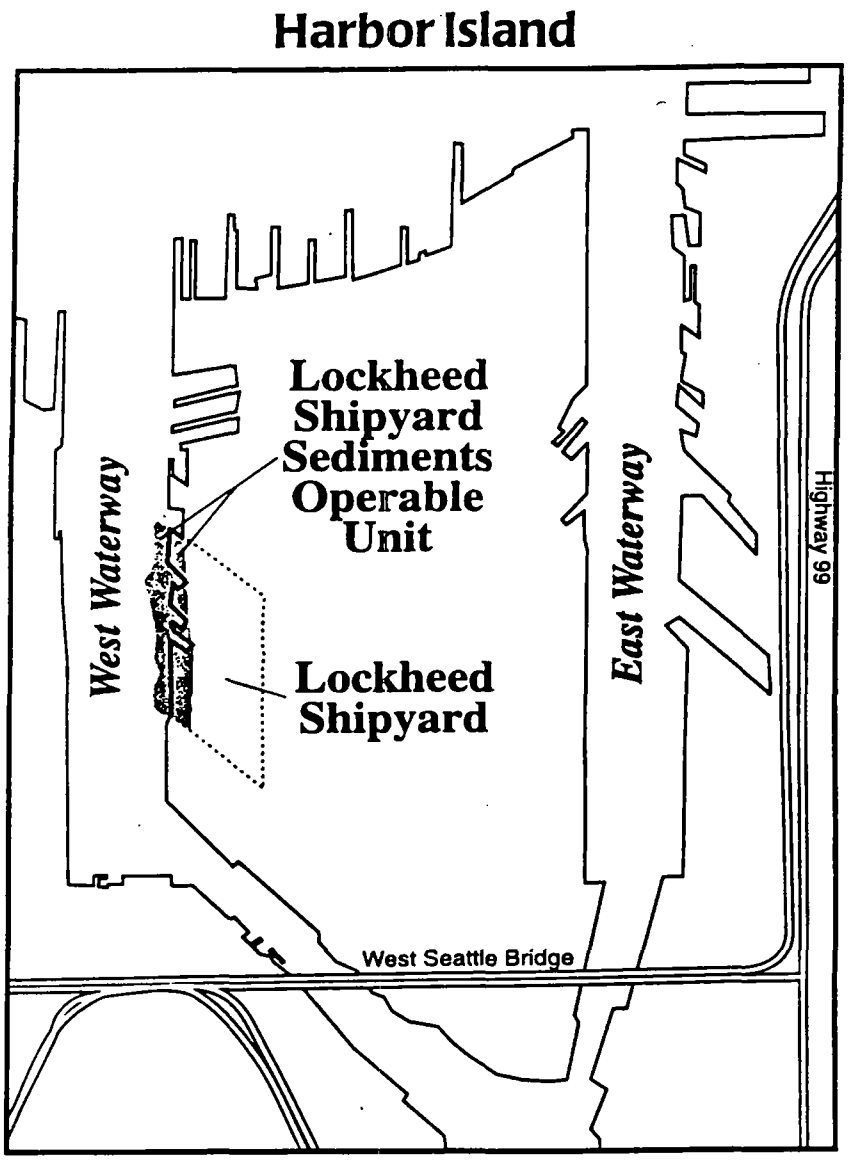
Proposal Refines Earlier Cleanup Plan

During former shipbuilding and maintenance operations, shipyard wastes and hazardous substances were released at the Harbor Island shipyards. The releases included marine paint additives such as arsenic, copper, lead, mercury, tributyl tin, and zinc. These substances contaminated the sediments at the Lockheed site.

EPA's November 1996 Record of Decision (ROD) documented the overall cleanup plan for the contaminated shipyard sediments, which included dredging shipyard waste, and dredging and capping contaminated sediments. However, the ROD specified that the extent of dredging of contaminated sediments and waste under the Lockheed Shipyard pier would be determined during the design of the cleanup. The determination would be based on cost, benefit, and technical feasibility. The Explanation of Significant Differences for the Lockheed Shipyard sediments presents EPA's strategies for the dredging and capping.

Based on the State of Washington Sediment Management Standards, EPA had estimated in the ROD that the uppermost 3 to 5 feet of sediments in the Lockheed open water area would require dredging. The ROD did not include estimates for the contamination under the pier. Subsequent sampling showed that contamination beneath the pier exceeds

the state standards at depths up to 12.5 feet, and contamination in the open water area exceeds the standards generally at depths up to 5 feet. The contaminants exceeding the standards are primarily arsenic, copper, lead, mercury, and zinc.



The proposed cleanup includes the open water area and the under-pier area.

Six Strategies Evaluated for Dredging and Capping

All of the strategies assume the removal of the Lockheed pier and most of the more than 6,000 pilings. The strategies vary in cost, benefit, and technical feasibility. Because the contamination is so deep, none of the strategies would result in the removal of all sediments with contamination levels exceeding the Sediment Management Standards.

Four of the strategies, which are EPA modifications of Lockheed proposals, include dredging to a depth of 3.5 feet under the pier. These four strategies differ from each other in the suggested cleanup for the open water areas. Two require dredging and capping in the open water areas, one requires only capping in these areas, and one requires dredging to State Sediment Management Standards levels, without capping, in these areas. Estimated costs range from $11.2 million to $13 million.

For comparison, EPA included two other strategies developed by Lockheed. One, estimated to cost $32.4 million, includes the removal of the largest amount of sediments exceeding the Sediment Management Standards that is technically feasible. The other, estimated to cost $7.1 million, calls for capping sediments in the under-pier and open water areas, without any dredging. Lockheed recommended the capping only strategy.

Dredging Proposed for Open Water Areas

EPA is proposing to adopt the strategy that includes dredging to State Sediment Management Standards levels, without capping, for the open water areas, and dredging to 3.5 feet and capping for the other areas. This proposal would result in dredging of 46,600 cubic yards of contaminated sediments and placing 85,210 tons of capping material, at an estimated total cost of $12.1 million. EPA believes that this proposed cleanup would protect human health and the environment.

Let us know what you think about this proposal, or any of the other strategies, by writing to us during the public comment period.

Future Activities Planned for Lockheed Shipyard

The Port of Seattle purchased the Lockheed property in 1996 and plans to develop it for commercial marine clients. EPA expects that the Lockheed sediment cleanup work could begin in 2003 and be completed in early 2004.

Cleanup Levels Revised for Soil and Groundwater

Work is continuing at other areas of the Harbor Island site. In October 2001, EPA revised the allowed cleanup levels for certain petroleum-contaminated soils at the site. This change allows an increase in the concentration of total petroleum hydrocarbons (TPHs) that may remain in certain areas at the site from 10,000 to 20,000 parts per million (ppm).

EPA has learned that there are more highly contaminated soils at the site than originally estimated. The cost of removing these soils is higher than expected because they extend under buildings, roads, and buried utilities. Before the cleanup level is increased for any area, that area will be evaluated to ensure that the contamination can be properly controlled and the cleanup will protect people and the environment. An asphalt cap will cover soils with TPH contamination from 10,000 to 20,000 ppm that remain at the site. Groundwater will be monitored for TPH to ensure that the cleanup is protective.

EPA documented this change in the cleanup plan in an "Explanation of Significant Differences #2," which is also available at the Superfund Records Center.

Background

Harbor Island lies at the mouth of the Duwamish River on the southern edge of Elliott Bay. The island was constructed between 1903 and 1905 from sediments dredged from the Duwamish River to create the East and West Waterways and the navigational channel of the upper Duwamish River. The island has been used for shipbuilding and maintenance, lead smelting, and other industrial activities.

In 1983, after finding hazardous substances in soils on the island and in sediments near the island, EPA added Harbor Island to its National Priorities List (NPL). The NPL is a list of sites targeted for further investigation and possible cleanup under EPA's Superfund program.

EPA divided the site into units for investigation and cleanup purposes. The Washington State Department of Ecology (Ecology) is overseeing the work on the tank farms unit. EPA is overseeing the work on the Lockheed, marine sediments, and soil and groundwater units.

For More Informatior

Detailed information about the proposed strategy for the Lockheed Shipyard sediments cleanup, and other site documents, are available at the EPA office at 1200 Sixth Avenue in Seattle. If you would like to review any of these documents, please call the Superfund Records Center at (206) 553-4494 to arrange a time.

Some Harbor Island site documents are available on the EPA Region 10 web site: http://www.epa.gov/r10earth (click on "Index," then "H," and then "Harbor Island").

Questions? If you have questions about the Harbor Island site, please contact one of the following persons:

General information: Cindy Colgate, EPA Community Involvement Coordinator, (206) 553-1815
Soil and Groundwater: Neil Thompson, EPA Project Manager, (206) 553-7177
Lockheed and Todd Shipyard Sediments: Lynda Priddy, EPA Project Manager, (206) 553-1987
East Waterway: Allison Hiltner, EPA Project Manager, (206) 553-2140
West Waterway: Karen Keeley, EPA Project Manager, (206) 553-2141
Tank Farms: Nnamdi Madakor, Ecology Project Manager, (425) 649-7112

To ensure effective communication with everyone, additional services can be made available to persons with disabilities who contact one of the EPA representatives listed above.

EPA

U.S. Environmental Protection Agency
Region 10

Community Involvement and Outreach
1200 Sixth Avenue, ECO-081
Seattle, Washington 98101

PRE-SORTED STANDARD
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PERMIT NO. G-35

EXPLANATION OF SIGNIFICANT DIFFERENCES TO THE HARBOR ISLAND – SHIPYARD SEDIMENT OPERABLE UNIT LOCKHEED SHIPYARD SEDIMENTS SEATTLE, WASHINGTON

SELECTED REMEDIAL ACTION

I. Introduction

A. Purpose

The purpose of this Explanation of Significant Differences (ESD) is: (1) to establish confirmational numbers characteristic of contamination present in the West Waterway for the purpose of defining contamination associated with Lockheed Shipyard as the source; (2) to summarize the long-term monitoring, maintenance and operational parameters for Lockheed Shipyard Sediment Operable Unit (LSSOU), and (3) to identify the disposal option.

B. Site Name and Location

The LSSOU consists of contaminated nearshore sediments within and adjacent to the Lockheed Shipyard on Harbor Island (Figure 1). Harbor Island is located approximately one mile southwest of the Central Business District of Seattle, in King County, Washington, and lies at the mouth of the Duwamish Waterway on the southern edge of Elliott Bay (Figure 2). The island is manmade, approximately 430 acres in size, and used for industrial purposes. Lockheed Shipyard is located on the west side of Harbor Island and faces the West Waterway of the Duwamish Waterway.

C. Lead and Support Agencies

U.S. Environmental Protection Agency (EPA) – Lead Agency for sediment remediation.

State of Washington, Department of Ecology – Support Agency for sediment remediation.

D. Statutory Authorities for the Explanation of Significant Differences (ESD)

Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9617(c), and Section 300.435(c)(2) of the National Oil and Hazardous Substances Contingency Plan (NCP), authorize changes to the selected remedial action after issuance of a ROD. This ESD documents refinements to the selected remedial action for the Lockheed Shipyard Sediment Operable Unit.

E. Administrative Record

This ESD, the Record of Decision, the Conceptual Design Report, various technical memoranda presenting geotechnical characterizations and a marine structures survey, as well as sediment chemical and biological testing results, and other reports and information related to the LSSOU are part of the administrative record. The administrative record is available for public review at the following location:

Environmental Protection Agency
1200 Sixth Avenue, 7th floor
Seattle, Washington
(206) 553-4494

II. Summary of Site History, Nature and Extent of Contamination and Selected Remedy

Harbor Island and the surrounding estuarine environment are highly industrialized. Prior to 1905, the area consisted of tideflats with a few piling-supported structures (mainly railroad trestles). The island was created between 1903 and 1905 with dredged material from straightening of the Duwamish River into the Duwamish Waterway. Since construction, the island has been used for commercial and industrial activities.

Lockheed Shipyards acquired established shipbuilding operations in 1959 and the facility until 1986. In April 1997, Lockheed sold the upland property and its legal rights to the submerged portions of the site to the Port of Seattle. Existing structures on the site include 3 piers, three shipways and one finger pier. The piers and shipways primarily consist of timber superstructures supported by approximately 6000 piles. Portions of the shipways are comprised of partially submerged wooden decks supported on closely spaced pilings.

Harbor Island was listed by EPA as a Superfund site in 1983. EPA issued the SSOU ROD in November 1996, for the remediation of contaminated sediments adjacent to both the Todd and the former Lockheed Shipyards. EPA determined that cleanup

actions were necessary because of unacceptable risks to benthic organisms and to subsistence fishers.

The ROD states: (1) all sediment exceeding the chemical contaminant screening level (CSL) of the State of Washington Sediment Management Standards (SMS) and shipyard waste be dredged and disposed of in an appropriate in-water or upland disposal facility, (2) all sediments exceeding the sediment quality standards (SQS) of the SMS be capped with a minimum of 2 feet of clean sediment, (3) specification of design criteria for acceptable habitat and to prevent future recontamination; and (4) institution of long-term monitoring and maintenance of the remedy. Additionally, the ROD notes that "(t)he extent of dredging of contaminated sediments and waste under piers at .... Lockheed Shipyard will be determined during remedial design based on cost, benefit and technical feasibility."

The LSSOU was established because LSSOU "sediments are distinct from other contaminated sediments at Harbor Island ... they are predominately contaminated with hazardous substances and shipyard wastes (primarily sandblast grit) released by shipbuilding and maintenance operations at Lockheed (and Todd) Shipyards" (see ROD, Section E. Scope and Role of Response Action Within the Remedial Strategy). Hazardous substances released from these shipyards include arsenic, copper, lead, mercury, tributyltin (TBT), and zinc, which were additives to marine paints used on ships. Other hazardous substances potentially associated with shipyard activities include polychorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs).

III. Description of and Basis for the Significant Differences

A. Introduction

Subsequent to the ROD, pre-remedial design studies for the Lockheed Shipyard Sediment Operable Unit have better defined the nature and extent of contamination within the LSSOU. The 2002 Lockheed ESD summarized the sediment characterization data, specified details regarding the dredge and cap remedy, and defined abrasive grit blast. For this ESD, this sediment characterization data has been further used by EPA to develop criteria for identifying contamination associated with the LSSOU as a source.

This ESD documents the following for the Lockheed Shipyard Sediment Operable Unit:

(1) establishes confirmational numbers that will be used to distinguish contaminants characteristic of West Waterway from contamination associated with the LSSOU;
(2) summarizes the long-term monitoring, maintenance and operational parameters for LSSOU; and
(3) identifies the disposal option for contaminated sediments dredged from the LSSOU.

B. Confirmational Numbers

Confirmational numbers have been defined as those concentrations that EPA has determined to be characteristic of contamination present in the adjacent West Waterway. These confirmational numbers have been used to assist EPA in defining the extent of LSSOU remediation; and could also be used in determining potential future recontamination. However, EPA's determination of the extent of LSSOU contamination and remediation is not intended to release Lockheed from whatever liability it may have in the adjacent West Waterway Operable Unit.

Following dredging of the LSSOU, samples will be taken from the post-dredge surface at selected locations along the LSSOU boundary. Sediments on the boundary and inside the LSSOU must meet the SQS cleanup numbers. If any newly exposed surfaces outside the LSSOU result due to remedial action at the LSSOU, then any COC that may be present on the newly exposed surfaces must be below confirmational numbers (see below).

Confirmational Numbers by Chemical of Concern			
Contaminant	**SQS (mg/kg)**	**CSL (mg/kg)**	**Confirmational Number**
Arsenic	57 dw	93 dw	93 (mg/kg) dw
Copper	390 dw	390 dw	390 (mg/kg) dw
Lead	450 dw	530 dw	530 (mg/kg) dw
Zinc	410 dw	960 dw	960 (mg/kg) dw
LPAHs*	370 toc	780 toc	780 (mg/kg) toc 13 mg/kg dw
HPAHs**	960 toc	5300 toc	5300 (mg/kg) toc 69 mg/kg dw
For Bioaccumulants			
PCBs	12 toc	65 toc	39 (mg/kg) toc 591 ug/kg dw
Tributyltin	not available	not available	76 (mg/kg) toc 1335 ug/kg dw
Mercury	0.41 dw	0.59 dw	1.34 (mg/kg) dw

dw = dry weight
toc = total organic carbon normalized

* low molecular weight polynuclear aromatic hydrocarbons
** high molecular weight polynuclear aromatic hydrocarbons

Given the coarse-grained characteristics of some of the LSSOU sediments, EPA will retain use of the dry weight (dw) TBT confirmational number as well as the total organic carbon (TOC) normalized value. Where the TOC is less than 1 percent, the dry weight criterion will be used; otherwise the TOC-normalized version will apply.

C. Long-term Operational, Maintenance, and Monitoring Parameters

A Long-Term Operational, Maintenance and Monitoring Plan (OMMP) is designed to detect any future contamination of the LSSOU as well as the failure to adequately confine the existing underlying contaminated sediments. The OMMP will be submitted with the 95% Remedial Design for the LSSOU. The following will be addressed in detail in the OMMP:

- monitoring of dredged sediments for recontamination with chemicals of concern (COCs) at specified intervals, or based on previous monitoring results and following disruptive events such as significant storm, dredging, earthquake events.

- monitoring for cap integrity to determine compliance with performance requirement, including cap thickness and uniformity via bathymetric surveys, and deposition of sediment or organic materials at specified intervals or based on previous monitoring results and following disruptive events such as significant storm, dredging, earthquake events.

- monitoring to determine compliance with source control performance standards.

All monitoring activities will be subject to EPA's review, approval, oversight and reporting requirements.

D. Disposal of Dredged Sediments

The ROD stated that dredged sediments must be disposed in "appropriate confined nearshore disposal (CND) or confined aquatic disposal (CAD) facilities." The ROD further stated that the appropriate CND or CAD facilities would be selected in remedial design and if a suitable site could not be found, dredged sediments must be taken to an appropriate upland disposal facility. Analysis of disposal options during remedial design, based on the ROD criteria, identified upland disposal facilities as the appropriate disposal option for dredged LSSOU sediments.

IV. Support Agency Comments

The Washington Department of Ecology participated in the review of the new information that led to the preparation of this ESD. and concurs with this

modification to the remedy for the Lockheed Shipyard Sediment Operable Unit. Ecology recognizes that EPA will conduct five year reviews for the Harbor Island Site. The primary purpose of a five year review is to determine whether the selected remedy continues to be protective of human health and the environment. The five year reviews will include the Soil and Groundwater Operable Unit, the two Shipyard Operable Units and the West Waterway Operable Unit. Ecology will have an opportunity to participate in the five year review. Among the issues that will be evaluated for the Shipyard Operable Units will be the contaminants remaining above the State Sediment Management Standards.

V. Affirmation of Statutory Determinations

Considering the new information that has been developed and the changes that have been made to the selected remedy, EPA believes that the remedy remains protective of human health and the environment, complies with federal and state requirements that were identified in the ROD as applicable or relevant and appropriate to this remedial action, and is cost-effective. The remedy continues to utilize permanent solutions and alternative treatment technologies to the maximum extent possible. This ESD is consistent with the requirements and considerations for remediation established in the ROD.

VI. Public Participation Activities

A public notice will be placed in a local newspaper announcing the availablility of the ESD to the public. The Administrative Record, located at the information repository listed in section E of this ESD, contains the ESD and supporting documentation. A listing of the Adminstrative Record documents is attached to this ESD.

3/31/03

Michael F. Gearheard — Date
Director, Office of Environmental Cleanup

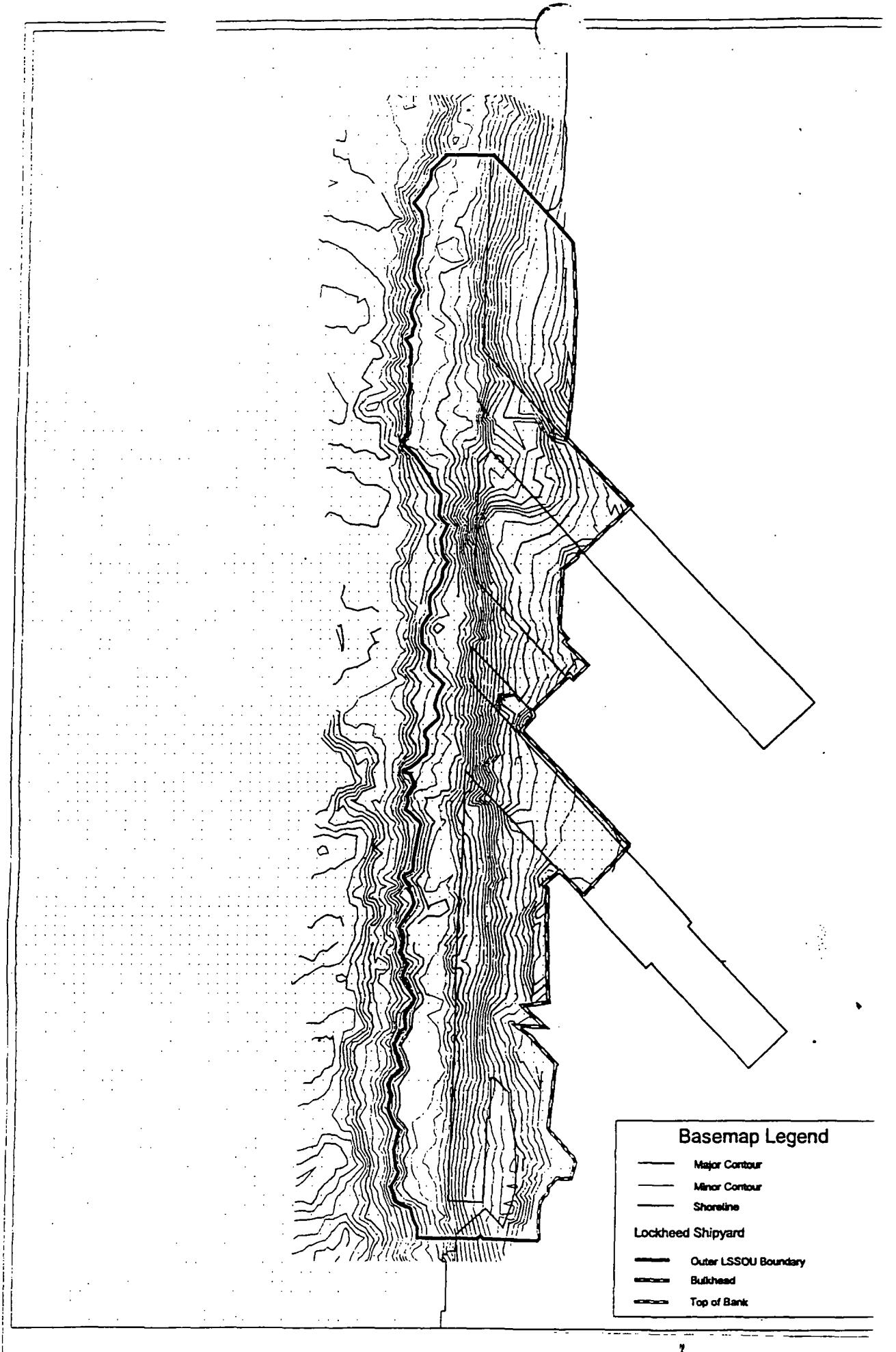

Figure 1 - Lockheed Shipyard Sediment Operable Unit

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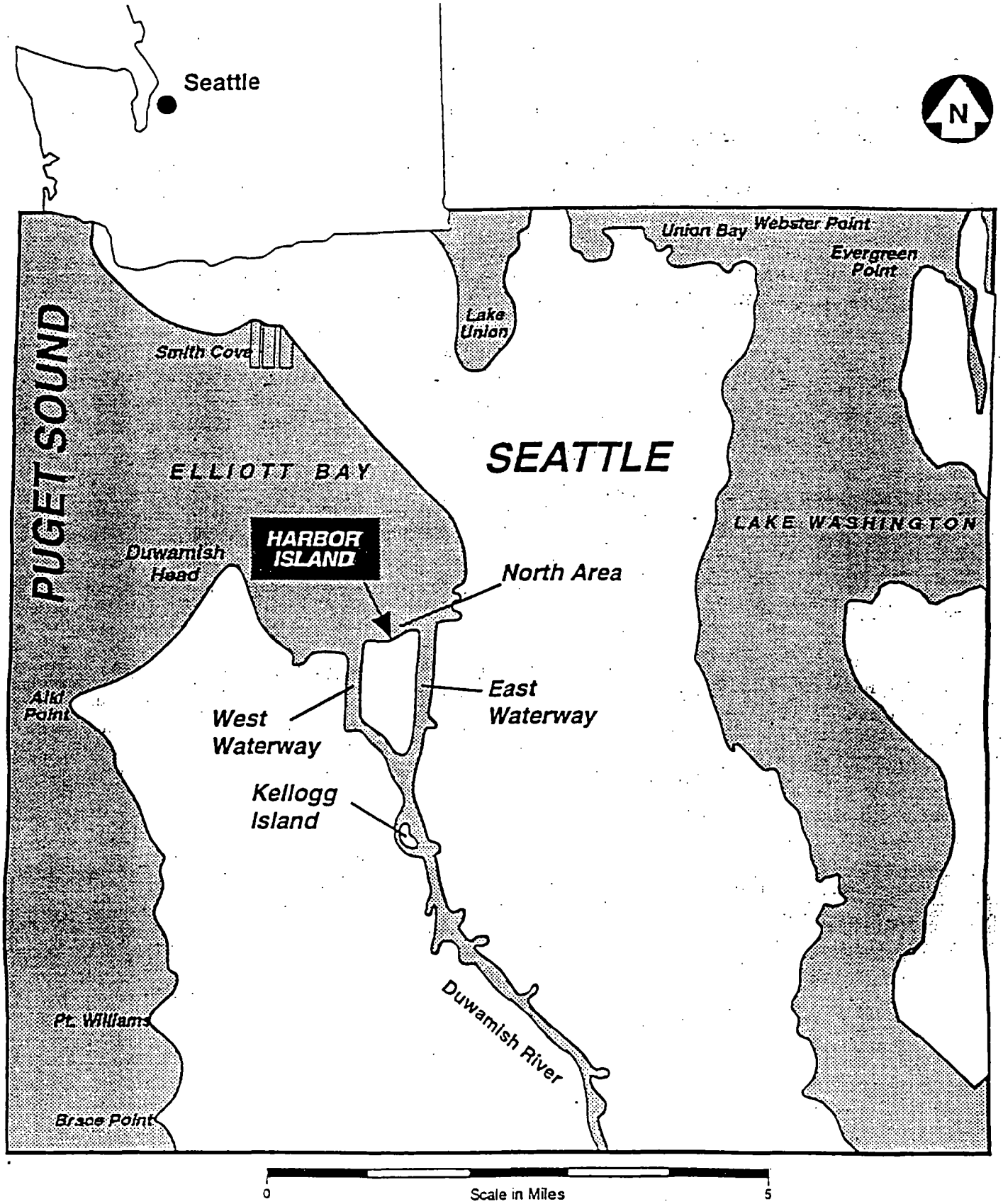

ADAPTED FROM:

Vicinity Map

FIGURE 2

WESTON MANAGERS DESIGNERS & CONSULTANTS

JCB NUMBER: 4000-02-46-2110 DATE: August 1994

Adminstrative Record Index

HEADING: 0. 0. . . TABLE OF CONTENTS/INDEX

HEADING: 1. 0. . . SEDIMENT REMEDIAL INVESTIGATION/FEASIBILITY STUDY

SUB-HEAD: 1. 4. . . Vol. 1 - Supplemental Sediment Investigation

1. 4. . . Vol. 1 - 0001 DOC ID: 48960
DATE: 5/1/1996 PAGES: 214
AUTHOR(S):
EVS Environment Consultants

Harbor Island Sediment Work Group

ADDRESSEE(S):
EPA

DESCRIPTION:
Harbor Island Sediment Operable Unit, Supplementary Remedial Investigation, Volume 1 of 2.

This document is included by reference only. A copy can be found in folder 1.4.6 of the West Waterway Sediments Administrative Record (HIAO4).

1. 4. . . Vol. 1 - 0002 DOC ID: 48961
DATE: 5/1/1996 PAGES: 876
AUTHOR(S):
EVS Environment Consultants

Harbor Island Sediment Work Group

ADDRESSEE(S):
EPA

DESCRIPTION:
Harbor Island Sediment Operable Unit, Supplementary Remedial Investigation - Appendices, Volume 2 of 2.

This document is included by reference only. A copy can be found in folder 1.4.6 of the West Waterway Sediments Administrative Record (HIAO4).

SUB-HEAD: 1. 11. . . Vol. 1 - Supplemental Studies under 1998 AOC

1. 11. . . Vol. 1 - 1088104 DOC ID: 1088104
DATE: 5/1/1999 PAGES: 96
AUTHOR(S):
EVS Environment Consultants

ADDRESSEE(S):
Lockheed Martin Corp.

Port of Seattle

Todd Pacific Shipyards Corp.

DESCRIPTION:
Review of Tissue Residue Effects Data for Tributyltin (TBT), Mercury (Hg), and Polychlorinated Biphenyls (PCBs).

This document is included by reference only. A copy can be found in folder 1.11.1 of the West Waterway Sediments Administrative Record (HIAO4).

1. 11. . . Vol. 1 - 1088107 DOC ID: 1088107
DATE: 5/1/1999 PAGES: 480
AUTHOR(S):
EVS Environment Consultants

ADDRESSEE(S):
Lockheed Martin Corp.

EVS Environment Consultants

Port of Seattle

Todd Pacific Shipyards Corp.

DESCRIPTION:

Waterway Sediment Operable Unit: Tributyltin (TBT) in Marine Sediments and the Bioaccumulation of TBT Combined Data Report.

This document is included by reference only. A copy can be found in folder 1.11.2 of the West Waterway Sediments Administrative Record (HIAO4).

1. 11. . . Vol. 1 - 1088127 DOC ID: 1088127
DATE: 9/1/1999 PAGES: 198

AUTHOR(S):
Environmental Solutions Group

ADDRESSEE(S):
Lockheed Martin Corp.

Port of Seattle

Todd Pacific Shipyards Corp.

DESCRIPTION:

Assessing Human Health Risks from the Consumption of Seafood: Human Health Risk Assessment Report (Final).

This document is included by reference only. A copy can be found in folder 1.11.3 of the West Waterway Sediments Administrative Record (HIAO4).

SUB-HEAD: 1. 11. 1. . Vol. 1 - Comments

1. 11. 1. . Vol. 1 - 1088125 DOC ID: 1088125
DATE: 9/1/1999 PAGES: 14

AUTHOR(S):
Environmental Solutions Group

ADDRESSEE(S):
Unknown

EPA

DESCRIPTION:

Technical Memorandum: Topics Related to the Tributyltin (TBT) Study at the Harbor Island Superfund Site, Waterway Sediment Operable Unit.

This document is included by reference only. A copy can be found in folder 1.11.2.1 of the West Waterway Sediments Administrative Record (HIAO4).

HEADING: 3. 0. . . ENFORCEMENT

SUB-HEAD: 3. 1. . . Vol. 1 - Administrative Order on Consent

3. 1. . . Vol. 1 - DOC ID: 1128029
DATE: 7/11/1997 PAGES: 53
AUTHOR(S): Catherine Krueger/EPA
ADDRESSEE(S): Lockheed Martin Corp.

DESCRIPTION:

Administrative Order on Consent for Remedial Design for the Lockheed Martin Portion, Shipyard Sediment Operable Unit.

This document is included by reference only. A copy can be found in folder 1.3 of the Lockheed Shipyard Explanation of Significant Differences AR (HLESD).

HEADING: 4. 0. . . RECORD OF DECISION

SUB-HEAD: 4. 1. . . Vol. 1 - *State Concurrence Letter*

4. 1. . . Vol. 1 - DOC ID: 1160354
DATE: 3/28/2003 PAGES: 2
AUTHOR(S): James J. Pendowski/Washington State Dept. of Ecology
ADDRESSEE(S): Michael F. Gearheard/EPA

DESCRIPTION: Concurrence letter for the Explanation of Significant Differences (ESD) to the Harbor Island Shipyard Sediment Operable Unit, Lockheed Shipyard Sediments.

SUB-HEAD: 4. 2. . . Vol. 1 - Record of Decision

4. 2. . . Vol. 1 - 1050713 DOC ID: 1050713
DATE: 11/27/1996 PAGES: 79
AUTHOR(S): Charles C. Clarke/EPA
ADDRESSEE(S): Unknown

DESCRIPTION: Record of Decision, Declaration, Decision Summary, and Responsive Summary for the Shipyard Sediment Operable Unit, Harbor Island.

This document is included by reference only. A copy can be found in folder 4.2 of the Shipyard Sediments Administrative Record (HIAO5).

SUB-HEAD: 4. 3. . . Vol. 1 - Explanation of Significant Differences (ESD)

4. 3. . . Vol. 1 - DOC ID: 1146499
DATE: 2/1/2002 PAGES: 78
AUTHOR(S): EPA
ADDRESSEE(S): Unknown

DESCRIPTION: Explanation of Significant Differences (ESD), Lockheed Shipyard Sediment Operable Unit, Harbor Island Superfund Site.

This document is included by reference only. A copy can be found in folder 1.5 of the Lockheed Shipyard Explanation of Significant Differences AR (HLESD).

4. 3. . . Vol. 1 - DOC ID: 1160355
DATE: 3/31/2003 PAGES: 10
AUTHOR(S): Michael F. Gearheard/EPA
ADDRESSEE(S): Unknown

DESCRIPTION: Explanation of Significant Differences (ESD) to the Harbor Island Shipyard Sediment Operable Unit, Lockheed Shipyard Sediments, Selected Remedial Action.

HEADING: 5. 0. . . REMEDIAL DESIGN

SUB-HEAD: 5. 1. . . Vol. 1 - Correspondence

5. 1. . . Vol. 1 - 1110536 DOC ID: 1110536
DATE: 3/2/2000 PAGES: 3
AUTHOR(S): Piper Peterson Lee/EPA
ADDRESSEE(S): Carol A. Yuge/Lockheed Martin Corp.

DESCRIPTION:
Letter indicating EPA has determined that no further revisions to the 1/15/00 Basis of Design Report are necessary and listing issues that should be addressed in a technical memorandum.

This document is included by reference only. A copy can be found in folder 1.1 of the Lockheed Shipyard Explanation of Significant Differences AR (HLESD).

SUB-HEAD: 5. 5. . . Vol. 1 - Sampling and Analysis Plan

5. 5. . . Vol. 1 - 1123574 DOC ID: 1123574
DATE: 4/14/2000 PAGES: 19
AUTHOR(S): Hart Crowser and Associates, Inc.
ADDRESSEE(S): Lockheed Martin Corp.

DESCRIPTION:
Technical Memorandum, Basis of Design report for Lockheed Shipyard No. 1 Operable Unit.

This document is included by reference only. A copy can be found in folder 1.2 of the Lockheed Shipyard Explanation of Significant Differences AR (HLESD).

SUB-HEAD: 5. 6. . . Vol. 1 - Design Reports

5. 6. . . Vol. 1 - 1082808 DOC ID: 1082808
DATE: 2/19/1999 PAGES: 243
AUTHOR(S): Hart Crowser and Associates, Inc.
ADDRESSEE(S): Lockheed Martin Corp.

DESCRIPTION:
Final Remedial Investigation Data Report - Lockheed Shipyard No. 1 Sediment Operable Unit: Volume I (Includes 4/2/99 EPA approval letter, comments on the Final Remedial Design Investigation Report for Lockheed Shipyard No. 1 Sediment Op Unit,

and Lockheed Martin's response to EPA Comments on the Final Remedial Design Investigation Report).

This document is included by reference only. A copy can be found in folder 1.2 of the Lockheed Shipyard Explanation of Significant Differences AR (HLESD).

5. 6. . . Vol. 1 - 1089230 DOC ID: 1089230
DATE: 1/1/2000 PAGES: 427
AUTHOR(S): Hart Crowser and Associates, Inc.
ADDRESSEE(S): Lockheed Martin Corp.

DESCRIPTION:
Final Basis of Design Report, Lockheed Shipyard No. 1 Sediment Operable Unit.

This report was finalized in a letter sent March 2, 2000 (Doc 1110536).

This document is included by reference only. A copy can be found in folder 1.2 of the Lockheed Shipyard Explanation of Significant Differences AR (HLESD).

5. 6. . . Vol. 1 - DOC ID: 1160002
DATE: 6/21/2002 PAGES: 324
AUTHOR(S):
Hart Crowser, Inc.
ADDRESSEE(S):
Lockheed Martin Corp.

DESCRIPTION:
Interim Remedial Design Submittal, Lockheed Shipyard No. 1 Sediment Operable Unit.

5. 6. . . Vol. 1 - DOC ID: 1151975
DATE: 11/6/2002 PAGES: 7
AUTHOR(S):
John Herzog/Hart Crowser, Inc.

Joe Morrice/Hart Crowser, Inc.
ADDRESSEE(S):
Gene S. Matsushita/Lockheed Martin Corp.

DESCRIPTION:
Memorandum: Additional Sediment Cap Attenuation Modeling, Lockheed Shipyard Sediment Operable Unit.

5. 6. . . Vol. 1 - DOC ID: 1160032
DATE: 3/10/2003 PAGES: 24
AUTHOR(S):
EPA
ADDRESSEE(S):
Unknown

DESCRIPTION:
Selection of Confirmational Chemical Criteria for use at the Harbor Island Superfund Site Shipyards Operable Unit (screening level tables and surface sediment maps attached).

This document is included by reference only. A copy can be found in folder 5.6 of the Todd Shipyard Under Pier Remedy ESD (HUPAR)

SUB-HEAD: 5. 6. 1. . Vol. 1 - Comments and Responses

5. 6. 1. . Vol. 1 - DOC ID: 1151630
DATE: 9/6/2002 PAGES: 46
AUTHOR(S):
Lynda E. Priddy/EPA
ADDRESSEE(S):
Gene S. Matsushita/Lockheed Martin Corp.

DESCRIPTION:
Letter transmitting comments on the Interim Remedial Design Analysis report dated 6/21/01.

5. 6. 1. . Vol. 1 - DOC ID: 1151631
DATE: 12/11/2002 PAGES: 3
AUTHOR(S):
Lynda E. Priddy/EPA
ADDRESSEE(S):
Gene S. Matsushita/Lockheed Martin Corp.

DESCRIPTION:
Letter transmitting comments on the Technical Memorandum - Additional Sediment Cap Attenuation Modeling, dated 11/6/02.

5. 6. 1. . Vol. 1 - DOC ID: 1160362
DATE: 3/31/2003 PAGES: 4
AUTHOR(S): EPA
ADDRESSEE(S): Hart Crowser, Inc.

DESCRIPTION:
Review of Hart Crowser Letter dated 3/11/03 regarding the Response to Comments on Cap Attenuation Modeling Technical Memorandum, Lockheed Shipyard Sediment Operable Unit.

APPENDIX B

STATEMENT OF WORK
REMEDIAL ACTION & LONG-TERM MONITORING

LOCKHEED SHIPYARD SEDIMENT OPERABLE UNIT
HARBOR ISLAND SUPERFUND SITE
SEATTLE, WASHINGTON

I. PURPOSE

II. PERFORMANCE STANDARDS

- A. Cap Requirements
- B. Dredge and Disposal Requirements
- C. Subsurface Contamination
- D. Habitat Preservation and Enhancement

III. WORK TO BE PERFORMED

- A. Remedial Action Work Plan
  - 1. Final Construction Quality Assurance Plan
  - 2. Final Water Quality Monitoring Plan
  - 3. Final Quality Assurance Project Plan
    - i. Final Field Sampling Plan
    - ii. Final Health and Safety Plan
    - iii. Final Operation, Maintenance & Monitoring Plan
- B. Remedial Action Construction
- C. Performance Monitoring & Construction Quality Assurance
- D. Operation, Maintenance & Monitoring

IV. SCHEDULE OF DELIVERABLES

I. PURPOSE

The purpose of this Statement of Work (SOW) is to set forth requirements for implementation of the remedial action at the Lockheed Shipyard Sediment Operable Unit (LSSOU) set forth in the Record of Decision (ROD)[1], which was issued by the United States Environmental Protection Agency (U.S. EPA), Region 10 on November 27, 1996, for the Harbor Island Shipyard Sediments Operable Unit, Harbor Island Superfund Site, and in the Explanation of Significant Difference (ESD) issued on February 22, 2002. The February 2002 ESD further defines the remedial parameters in the ROD, based on additional information gathered during pre-remedial design activities[2] associated with the Lockheed Shipyard, specifies the strategy for implementing the ROD and addresses the method for disposal of contaminated sediments and waste.

In conducting work specified in this SOW, Lockheed Martin Corporation (Settling Defendant) shall follow: the ROD as modified by the LSSOU ESD; approved remedial design documents; this SOW; the approved Remedial Action Work Plan; and, U.S. EPA Superfund Remedial Action Guidance and any additional guidance provided by U.S. EPA in submitting deliverables for implementing the remedial action at the LSSOU of the Harbor Island Superfund Site. Implementation of this SOW shall result in achieving the LSSOU cleanup objectives.

II. PERFORMANCE STANDARDS

Settling Defendant shall adhere to the following performance standards for the implementation of the remedial action for LSSOU. These performance standards are consistent with the cleanup objectives and are necessary to ensure that the remedy is protective of human health and the environment, and complies with Applicable or Relevant and Appropriate Requirements (ARARs). Performance standards shall include cleanup standards, standards of control, quality criteria, and other substantive requirements, criteria, or limitations including all ARARs set forth in the ROD and ESD, and approved deliverables under this SOW.

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[1] At the time of the ROD, Todd and Lockheed Shipyard Sediment Operable Units were part of the Shipyards Sediments Operable Unit (SSOU). EPA created the Lockheed and Todd Shipyard Sediment Operable Units from the SSOU because they have different remedial issues that are better addressed as separate OUs.

[2] Pre-remedial design activities refer to data gathering and analysis performed post-ROD to define the nature and extent of contamination. The pre-remedial design data supplements the remedial investigation and feasibility data for the Harbor Island Superfund Site.

A. Cap Requirements

Settling Defendant shall demonstrate that all capped areas are completed in accordance with performance standards. The methods for achieving the objectives for the capped areas will be set forth in the approved Draft Final (95%) Remedial Design Submittal package. Verification of performance standards shall be documented in the Construction Quality Assurance Plan (CQAP), and the Operations, Maintenance & Monitoring Plan (OMMP), as appropriate. As-builts shall be provided for the capped areas.

B. Dredge and Disposal Requirements

Performance standards for dredging shall be consistent with the ROD, and ESD and ARARs specified in the ROD. Under this SOW, LSSOU will be subject to long-term monitoring to ensure that the selected remedy remains protective, including monitoring to ensure that surface sediments do not become recontaminated in the LSSOU, and that marine chronic water quality standards or background concentrations are not exceeded in surface water during in-water activities (e.g., capping or dredging).

Contaminated sediment shall be dredged and disposed of in an appropriate upland disposal facility as specified in approved design documents. As-builts of all dredged surfaces shall be provided to EPA in the Remedial Action Construction Report. Settling Defendant shall document to EPA quantities of contaminated sediments and waste (in-place volumes), and disposal location for materials dredged from LSSOU. Verification that performance standards, including the Sediment Management Standards (SMS), and the Confirmational Numbers, are achieved shall be documented in the pre-final construction reports, and the OMMP reporting, as appropriate.

C. Subsurface Contamination

Exposure of contaminated subsurface sediments may occur during the cleanup by dredging adjacent areas, through physical processes, such as storms or ship scour, or through future dredging or excavation. Consequently, Settling Defendant shall implement the remedial action to ensure that contaminated subsurface sediment is not exposed and that the SQS are achieved at the final sediment surface, either by dredging to uncontaminated sediments, or by capping over dredge cuts with SQS exceedances. If any areas of the OU are not capped or dredged to the SQS but subsurface contamination is significant, long-term monitoring of these areas may be required under this SOW. In order for

subsurface contamination to remain in place without monitoring, it must either be present at such low levels that it would not present a risk if it were exposed, or it must have a very low potential for exposure.

D. Habitat Preservation and Enhancement

Settling Defendant shall take all appropriate measures during remedial design, construction, and site maintenance to avoid and minimize adverse impacts to the aquatic environment. Such measures include, but are not limited to, avoidance of fish-critical activity periods for in-water work, incorporation of best-design features and/or materials into remedial and compensatory mitigation plans that protect or enhance ESA-listed species, or protect, create or restore critical salmonid habitat. Additionally, Settling Defendant shall submit compensatory mitigation plans to offset unavoidable loss and other impacts to aquatic habitat and meet ESA responsibilities, as applicable. For capped areas, Settling Defendant shall provide a capped surface that promotes colonization by aquatic organisms which may incorporate soft or organic-rich substrates beneficial to salmonids (e.g., fish mix or a silt-sand mix) as a final capping material.

III. WORK TO BE PERFORMED

In November 1996, EPA issued a ROD that included the selection of a remedy for LSSOU. In July 1997, an Administrative Order on Consent (AOC) required Settling Defendant to undertake remedial design activities for LSSOU. Under the AOC, Settling Defendant conducted sampling and analysis to further refine the areal extent of contamination, evaluated remedial strategies for implementing the remedy and determined that dredged sediments would be disposed at an acceptable upland disposal facility. In accordance with the AOC, the Remedial Design Investigation Report, the Basis of Design Report and a Basis of Design Technical Memorandum were submitted to EPA in May 1999, in January 2000, and in April 2000, respectively. In February 2002, EPA issued an ESD that elaborated on parameters of the remedy selected in the ROD in November 1996.

Pursuant to the AOC, the following were scheduled to be submitted to EPA for review and approval: (1) Remedial Design Work Plan (including Sampling and Analysis Plan, and Quality Assurance Project Plan); (2) Remedial Design Data Report; (3) Source Control Report; (4) Basis of Design Report; (5) Interim Remedial Design Submittal package; (6) Draft Final (95%) Remedial Design Submittal package; (7) Construction (Contract) Package; (8) Operations and Maintenance Plan; (9) Construction Quality Assurance Plan; (10) Project Schedule; and (11) Cost Estimate.

This SOW requires Settling Defendant to conduct the Remedial Action (RA) according to the approved Draft Final (95%) Remedial Design Submittal and the Construction (Contract) Package. The scope of work for this remedial action includes the following key components:

- Construction of a new bulkhead, or equivalent, along the shoreline;
- Removal of existing shipway and pier structures;
- Dredging of contaminated materials and sediment;
- Installation of a cap, including marine habitat considerations;
- Disposal of contaminated dredge material and sediment;
- Construction and long term monitoring;
- Evaluation of the nature and extent of contamination in the contingency areas (refer to Figure 1 for location of contingency areas);
- Determination of remedial action (dredge and disposal, armored cap, sand cap, natural attentuation, no action), if needed, of the contingency areas; and
- If dredging or capping is required for the contingency area, that work will be coordinated and conducted during other remedial action work covered by this RA SOW for LSSOU or as a separate mobilization by the Settling Defendant and shall not exceed $419,000. Dredging and capping requirements within the contingency area shall be determined by EPA based on the confirmation levels cited in the March '03 ESD. In the event that a dispute arises regarding the contingency determination, the dispute resolution process identified in the Consent Decree shall be applied. Associated costs shall be tracked separately from other LSSOU costs by the Settling Defendant and reported to EPA in the appropriate Monthly Report.

To accomplish this scope of work the remedial action shall consist of the following tasks:

A. Remedial Action Work Plan
    1. Construction Quality Assurance Plan
    2. Water Quality Monitoring Plan
    3. Quality Assurance Project Plans
    4. Field Sampling Plan
    5. Health and Safety Plan
    6. Operations, Maintenance and Monitoring Plan
B. Remedial Action Construction
    1. Preconstruction Inspection and Meeting
    2. Pre-Final Construction Inspection(s) and Reports
    3. RA Progress Meetings and Reports
    4. Final Construction Inspection(s) and Reports
    5. Reports
        a. Remedial Action/Construction Report
        b. Remedial Action Completion Report
C. Performance Monitoring and Construction Quality Assurance, and
D. Long-term Operation, Maintenance & Monitoring

Settling Defendant shall be responsible for implementing additional work elements necessary for successful implementation of the LSSOU remedial action. Additional details on each task are provided below. All deliverables submitted in response to EPA's comments shall include a revised final document that incorporates EPA's modifications and a transmittal that responds directly to each comment, and identifies how the comment was addressed in the deliverable.

A. Remedial Action Work Plan

Settling Defendant shall submit a Remedial Action Work Plan which includes a detailed description of the remediation and construction activities, including how those construction activities are to be implemented by Settling Defendant and coordinated with EPA (e.g., site-monitoring, material staging and handling). When describing implementation of the remedial action, Settling Defendant shall identify discrete elements of the remedial action for purposes of monitoring construction activities as they occur. The following shall be considered examples of discrete elements of the remedial action under this SOW: a specific sediment management unit (SMU); dredging of a specific SMU; capping of a segregable group of SMUs comprising a portion of the waterway, e.g., under-pier SMUs.

The RA Work Plan shall include a project schedule for each major activity and submission of deliverables generated during the remedial action. Settling Defendant shall submit a Remedial Action Work Plan in accordance with Section VI, Paragraph 9 of the Consent Decree and Section IV and V of this SOW.

The documents listed in this section must be prepared and submitted as outlined in Section IV and V of this SOW. The required contents of each of these documents is described below. Settling Defendant shall submit the following deliverables with submission of the Remedial Action Work Plan (unless previously submitted and approved by EPA):

1. Final Construction Quality Assurance Plan (CQAP)

Settling Defendant shall submit a Construction Quality Assurance Plan (CQAP) which describes the site-specific components of the performance measurement methods and quality assurance program which shall ensure that the completed project meets or exceeds all performance standards and design criteria, plans, and specifications, including achievement of compliance with the SMS. The draft CQAP shall be submitted with the Draft Final (95%) Remedial Design Submittal package and the final CQAP shall be submitted with the RA Work Plan. The CQAP shall contain, at a minimum, the following elements:

a. Organizational structure, responsibilities and authorities of all organizations and key personnel involved in the design and

construction of the remedial action, including EPA and other agencies.

b. Qualifications. Establish the minimum training and experience of the Construction Quality Assurance (CQA) Official and supporting inspection personnel, and the necessary qualifications of the remedial construction contractor and any subcontractor(s), as appropriate.

c. Performance Standards and Methods. Describe all performance standards and methods necessary to ensure implementation of the remedial action construction, including mitigation, in compliance with ARARs and identified site-specific performance standards. Performance monitoring requirements shall be stated to demonstrate that best management practices have been implemented for dredging operations; storage, handling, transportation and disposal of dredged material; transportation, handling, and storage of capping material; proper cap placement techniques; and habitat mitigation projects, if necessary.

d. Meetings. Establish requirements for scheduled meetings, including the preconstruction inspection and meeting, daily progress meetings, work deficiency meetings, etc.

e. Inspection and verification activities. Establish the observations and tests that will be required to monitor the construction and/or installation of the components of the remedial action. The plan shall include the scope and frequency of each type of inspection to be conducted. Inspections shall be required to measure compliance with environmental requirements and ensure compliance with all health and safety procedures.

f. Sampling activities. Establish requirements for quality assurance sampling activities including the sampling protocols, sample size, locations, frequency of testing, acceptance and rejection data sheets, problem identification and corrective measures reports, evaluation reports, acceptance reports, and final documentation. Establish a construction contingency plan which provides criteria for corrective action and includes a description and schedule of corrective actions to be implemented in the event that such criteria are exceeded during implementation of the remedial action.

g. Documentation. Reporting requirements for CQA activities shall be described in detail in the CQA plan. This shall include procedures for updating and maintaining records such items as daily

summary reports, inspection data sheets, health and safety reports, problem identification and corrective measures reports, activity logs, laboratory reports, emergency reports, chain of custody forms, maintenance and monitoring data, design acceptance reports, and final documentation. A description of the provisions for final storage of all records consistent with the requirements of the Consent Decree shall be included.

h. Field Changes. Describe procedures for processing design changes and securing EPA review and approval of such changes to ensure changes conform to performance standards, ARARs, requirements of this SOW, are consistent with Cleanup Objectives and are protective of human health and the environment.

i. Final Reporting. Identify all final CQAP documentation to be submitted to EPA in the Remedial Action Construction Report, or other deliverables and submissions.

2. Final Water Quality Monitoring Plan (w/ specific QAPP/FSP)

Water quality monitoring must also be performed during dredging to measure contaminant release to the water and assure that the marine acute water quality criteria are not exceeded.

3. Final Quality Assurance Project Plan (QAPP)

Settling Defendant shall develop site-specific Quality Assurance Project Plans (QAPP), covering sample analysis and data handling for samples collected in all phases of future site work, based upon the Consent Decree and guidance provided by EPA. The QAPPs shall be consistent with the requirements of the EPA Contract Lab Program (CLP) for laboratories proposed outside the CLP. The QAPPs shall, at a minimum, include:

1. Project Description
   - Facility Location and History
   - Past Data Collection Activity
   - Project Scope
   - Sample Network Design
   - Sample size
   - Parameters to be Tested and Frequency
   - Project Schedule

2. Project Organization and Responsibility
   -Qualifications of the Quality Assurance Official to demonstrate that he/she possesses the training and

experience necessary to fulfill his/her identified responsibilities

3. Data Management Plan
   - Describe tracking, sorting, retrieving data
   - Identify software for data storage,
   - Minimum data requirements & data format
   - Data backup procedures
   - Submission of data in format(s) acceptable to EPA

4. Quality Assurance Objective for Measurement Data
   - Level of Quality Control Effort
   - Accuracy, Precision, and Sensitivity of Analysis
   - Completeness, Representativeness, and

5. Comparability

6. Sampling Procedures

7. Sample Custody
   - Field Specific Custody Procedures
   - Laboratory Chain-of-Custody Procedures

8. Calibration Procedures and Frequency
   - Field Instruments/Equipment
   - Laboratory Instruments

9. Analytical Procedures
   - Non-Contract Laboratory Program Analytical Methods
   - Field Screening and Analytical Protocol
   - Laboratory Procedures

10. Internal Quality Control Checks
    - Field Measurements
    - Laboratory Analysis

11. Data Reduction, Validation, and Reporting
    - Data Reduction
    - Data Validation
    - Data Reporting

12. Performance and System Audits
    - Internal Audits of Field Activity
    - Internal Laboratory Audit

- External Field Audit
- External Laboratory Audit

13. Preventive Maintenance
    - Routine Preventive Maintenance Procedures and Schedules
    - Field Instruments/Equipment
    - Laboratory Instruments

14. Specific Routine Procedures to Assess Data Precision, Accuracy, and Completeness
    - Field Measurement Data
    - Laboratory Data

15. Corrective Action
    - Sample Collection/Field Measurement
    - Laboratory Analysis

16. Quality Assurance Reports to Management
    -Acceptance and rejection data sheets
    -Problem identification and corrective measure reports
    -Evaluation reports
    -Acceptance reports
    -Final documentation

The initial QAPP shall be designed to encompass all phases of the project from the beginning of the remedial action/construction phase to confirmatory sampling, if possible. Also, the initial QAPP shall specify all subsequent QAPP addenda anticipated for future project phases. The QAPPs should, at a minimum, address the following project elements: design sampling, upland disposal site sampling if necessary, construction monitoring sampling, water quality monitoring sampling, long-term monitoring sampling, and mitigation sampling and other sampling requirement as needed. Settling Defendant may update the pre-remedial design sampling plans (e.g., QAPP, FSP, HSP) previously prepared for the pre-remedial design effort completed to date and resubmit them for EPA's approval under this SOW.

4. Final Field Sampling Plan

Settling Defendant shall develop a field sampling plan (as described in "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA", October 1988). The Field Sampling Plan should supplement the QAPP and address all sample collection activities. Settling

Defendant shall prepare a field sampling plan for all sampling to be conducted during RA.

5. Final Health and Safety Plan

Settling Defendant shall develop a health and safety plan which is designed to protect on-site personnel and area residents and workers from physical, chemical, and all other hazards posed by this remedial action. The safety plan shall establish the performance levels and criteria necessary to address the following areas:

- Facility Description
- Personnel
- Levels of protection
- Safe work practices and safe guards
- Medical surveillance
- Personal and environmental air monitoring
- Personal protective equipment
- Personal hygiene
- Decontamination--personal and equipment
- Site work zones
- Contaminant control
- Contingency and emergency planning, including SPCC
- Logs, reports, and record keeping

The safety plan shall follow EPA guidance and all OSHA requirements as outlined in 29 C.F.R. 1910 and 1926. Settling Defendant may utilize existing Health and Safety Plan project documents (e.g., Remedial Design Investigation HASP) or other company/contractor HASP provided that Settling Defendant demonstrates the HASP has been modified, as necessary, or otherwise sufficiently addresses the activities covered by this SOW.

6. Final Operation, Monitoring and Maintenance Plan (OMMP)

Settling Defendant shall submit for EPA approval a post-remedial action Operation, Maintenance, & Monitoring Plan (OMMP) and QAPP (or amendments to the remedial design QAPP). The objective of the OMMP monitoring to verify the continued long-term effectiveness of the remedy in protecting human health and the environment. This shall include:

- monitoring to ensure that recontamination of the dredged areas has not occurred;
- monitoring and evaluating the effectiveness of capping;
- monitoring and evaluating the long-term effectiveness of

source control;

- monitor effectiveness of requirements which relate to source control;
- establishing a schedule of inspections and monitoring;
- defining objective criteria for determining when maintenance is necessary; and defining objective criteria for determining whether design criteria and performance standards are being met, and establishing contingency actions to take to address thresholds or criteria that are exceeded.

Settling Defendant shall prepare an OMMP to cover long-term maintenance and monitoring of the remedial action, including the contingency areas as needed and mitigation areas. After results for each monitoring event are reported, the final OMMP will be reviewed and revised as necessary, under EPA direction and approval. The OMMP shall evaluate and include the following types of monitoring, as appropriate, to achieve the monitoring objective of each element of the remedial action:

- bathymetry
- sediment and sediment pore water chemistry
- sediment bioassays
- benthic infaunal abundance
- ground-water chemistry

Other types of monitoring may also be identified during the development of the OMMP.

The OMMP shall be composed of the following elements:

1. Description of normal operation and maintenance:
   a. Description of tasks to achieve each monitoring objective;
   b. Description of tasks for maintenance;
   c. Schedule showing frequency of each OMMP task.2.
2. Description of routine monitoring and laboratory testing:
   a. Description of monitoring tasks;
   b. Description of data quality objectives.
   c. Description of required data collection (including sample type, number, location and frequency, sampling equipment and methods), laboratory tests, and their interpretation;
   d. Description of equipment, installation of monitoring components, maintenance of site equipment, and replacement schedule for equipment and installed components:
   e. Required quality assurance and quality control, SAP, HSP, & FSP (or addenda);

f. Schedule of monitoring frequency
g. Schedule for reporting results;
h. Description of verification sampling procedures if Confirmational Numbers or performance standards are exceeded in routing monitoring; and
i. If necessary, description of the monitoring necessary during implementation of habitat mitigation and after implementation to evaluate its success, if habitat mitigation is required.

3. Corrective Action:
   a. Proposal for EPA approval of physical, chemical, or biological thresholds or criteria triggering corrective actions (based on routine monitoring results).
   b. Identify additional sampling and/or analysis to be conducted to identify, to the maximum extent possible, the source of the contamination. If based on this analysis, EPA concurs that the source is from outside the boundaries of the LSSOU or not under the control of Settling Defendant and is not attributable to the Settling Defendant then corrective action by the Settling Defendant shall not be required;
   c. Description of proposed corrective action or anticipated remedies to be implemented in the event that these thresholds or criteria are exceeded, or cleanup or performance standards are not met (e.g., if exceedances of Confirmational Numbers are detected).
   d. Schedule for implementing these corrective actions or anticipated remedies; and
   e. The corrective actions shall also address releases or threatened releases to the environment.

4. Description of procedures for a request to EPA to reduce the frequency of or discontinue monitoring.

5. Records and reporting mechanisms required:
   a. Laboratory records;
   b. Mechanisms for reporting emergencies;
   c. Personnel records;
   d. Maintenance records;
   e. Records of long-term monitoring costs;
   f. Documentation to comply with CERCLA 5-year Review Reporting Requirements; and
   g. Reports to State or Federal Agencies.

The CQAP and above supporting documents shall provide a mechanism to ensure that all performance standards for the remedial action construction are met.

B. Remedial Action Construction

Settling Defendant shall implement the remedial action as detailed in the approved Construction (Contract) Package and Final Remedial Action Work Plan. The following activities shall be completed in constructing the remedial action.

1. Pre-construction Inspection and Meeting

Settling Defendant shall participate with EPA in a preconstruction inspection and meeting to:

a. Review contract management, including methods for documenting and reporting inspection data, and compliance with specifications and plans including methods for processing design changes and securing EPA review and approval of such changes as necessary;

b. Review methods for distributing and storing documents and reports;

c. Review work area security and safety protocol;

d. Demonstrate construction management procedures are in place, and discuss any appropriate modifications of the construction quality assurance plan to ensure that site-specific considerations are addressed;

e. Address the following items:

- Construction Schedule
- Project Direction and Execution
- Remedial Action Team
- Water Quality Monitoring Plan (w/ specific QAPP/FSP)
- QAPP/H&S Plan/ FSP for remedial action construction activities
- Materials Management Plan (if necessary)
- Transportation and Disposal Plan (if necessary)
- Community Health and Safety Plan (if necessary); and

f. Conduct a site visit to verify that the design criteria, plans, and specifications are understood and to review material and equipment storage locations.

All inspections and meetings shall be documented by a Settling Defendant's designated contact and minutes (containing names of people in attendance issues discussed, clarifications made, special instructions issued, etc,) shall be transmitted to EPA within seven (7) working days of the inspection or meeting.

2. Pre-Final Construction Inspections and Report

When Settling Defendant makes preliminary determinations that construction is complete for each discrete element of the remedial action, as defined in the Final Remedial Action Work Plan, Settling Defendant shall notify EPA for the purposes of conducting a pre-final inspection. Participants shall include Settling Defendant's Project Manager, Consultants, and Construction Contractor(s); and EPA's Remedial Project Manager and Consultants; and other federal, state, and local agencies with jurisdictional interest.

The pre-final inspections shall consist of a walk-through inspection, where applicable, of each completed remedial action element with EPA, and/or a review of underwater video of the other site cleanup areas, where necessary. The inspection is to determine whether each project element is complete and consistent with the Construction (Contract) Package and the Remedial Action Work Plan, to review compliance with the CQAP, and to review field changes and change orders, and verify that Sediment Management Standards (SMS) have been achieved. Settling Defendant shall certify that each discrete element of the remedy has been constructed to meet the purpose and intent of the specifications. Retesting shall be completed where deficiencies are revealed.

The pre-final construction inspection report shall include both a summary of the major CQAP results and field changes, as well as detailed field notes from the inspection. The pre-final inspection report shall outline the incomplete or outstanding construction items, actions required to resolve items, completion date for these items, and a proposed date for final inspection.

3. RA Progress Meetings and Reports

Settling Defendant shall conduct RA progress meetings on a regular basis throughout the RA. The meetings shall be held at least monthly unless a less frequent schedule is agreed to by EPA. At a minimum, Settling

Defendant shall address the following at progress meetings:

- General progress of construction with respect to RA schedule;
- Problems encountered and associated action items;
- Pending design, personnel or schedule changes requiring EPA review and approval;
- Results of any RA verification sampling and associated decisions and action items.

4. Final Construction Inspections and Reports

After completion of any work identified in the pre-final inspection reports, Settling Defendant shall notify EPA for the purposes of conducting a final inspection of each discrete remedial action element. The final inspection shall consist of a walk-through inspection, where applicable, of each discrete element of the remedial action by EPA and Settling Defendant and/or a review of underwater video of the other portions of the LSSOU where pertinent remedial construction activity occurred. The pre-final inspection reports shall be used as a checklist (punch list) with the final inspection focusing on the outstanding construction items identified in the pre-final inspections. Confirmation shall be made that outstanding items have been resolved. Any outstanding items discovered during the inspection still requiring correction shall be identified and noted. If any items are still unresolved, the inspection shall be considered to be a pre-final construction inspection requiring another pre-final inspection report and subsequent final construction inspection.

Resolution of all outstanding items should be documented in a Final Construction Inspection Report.

5. Reports

Settling Defendant shall follow EPA guidance for preparing Remedial Action Reports described in "Close Out Procedures for National Priorities List Sites", EPA 540-R-98-016, OSWER Directive 9320.2-09A-P, PB98-963223, January 2000, in submitting the following reports.

a. Remedial Action Construction Report

This report shall be submitted when the construction is complete for all discrete remedial action elements, but before all performance standards have been attained (i.e., prior to achieving natural recovery and long-term performance standards for mitigation).

In the report, a registered professional engineer and Settling Defendant' Project Coordinator shall state that the remedial action has been constructed in accordance with the design drawings and specifications. The written report shall include as-built drawings signed and stamped by a professional engineer, and other supporting documentation to demonstrate the CQAP was followed. The report shall contain the following statement, signed by a responsible corporate official of a Settling Defendant or Settling Defendant' Project Coordinator:

> "To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

b. Remedial Action Completion Report

A Remedial Action Completion Report shall be submitted after construction is complete and all performance standards have been attained (including performance standards for natural recovery and mitigation areas), but where OMMP requirements will continue to be performed. In the report, a registered professional engineer and a responsible corporate official or Settling Defendant' Project Coordinator shall state the remedial action has been completed in full satisfaction of the requirements of the Consent Decree. The written report shall include a summary of all information (e.g., long-term monitoring data) demonstrating performance standards that had not been met at the time the Remedial Action Construction Report was submitted, have now been attained. The report shall also include documentation not previously submitted with the Remedial Action Construction Report verifying that performance standards, including the cleanup objectives described in the ROD and ESD, have been attained. The report shall contain the same written certification as written in the above section entitled Remedial Action Construction Report.

C. Performance Monitoring and Construction Quality Assurance

Performance monitoring shall be conducted to ensure that all performance standards are met, including cleanup verification methods and methods for determining compliance with performance standards and ARARs. The CQAP addresses all performance standards related to the remedial action construction, including achieving compliance with performance standards.

D. Long-term Operation, Maintenance & Monitoring

The purpose of this task is to perform the activities necessary to protect the integrity of the remedy and to evaluate system performance. Operations and maintenance (O&M) activities may include periodic inspection and maintenance of waste containment measures, long-term water monitoring, institutional controls, or any other periodic activity necessary to ensure the continued protection of public health or the environment. O&M is initiated after the remedy has achieved the remedial action objectives and the remediation goals of the ROD and ESD, and is determined to be operational and functional. This task could begin with a revision of the OMMP, if necessary based on actual remedial action implementation, and ends with the submittal of final technical memoranda summarizing project performance. Routine reports shall summarize O&M activities and submitted to EPA. Requirements and procedures for implementing O&M activities are described in the OMMP.

IV. SCHEDULE OF DELIVERABLES

The schedule for notification to EPA or submission of major deliverables to EPA is described below.

#	Submission	Due Date
1.	Draft Final (95%) Remedial Design Report, and Draft Remedial Action Work Plan, CQAP, Water Quality Monitoring Plan, and Draft Addenda to the QAPP, HSP, and FSP.	April 7, 2003 for the bulkhead construction and pier removal phase of the remedy. June 1, 2003 for dredging and capping phase of the remedy.
2.	Draft OMMP	June 1, 2003
3.	Construction (Contract) Package, Remedial Action Work Plan incl. Final CQAP, Water Quality Monitoring Plan, QAPP, HSP, and FSP.	Within 30 days after receipt of EPA's review and comment on the drafts.
4.	Notification for Remedial Action Start for bulkhead and pier demolition.	June 15, 2003

5.	Initial Award to Remedial Action Construction Contractor(s) (Later awards will be made for later stages of construction)	July 15, 2003
6.	Pre-Construction Inspection and Meeting	Fifteen (15) days before start of RA construction.
7.	Initiate Construction of Remedial Action	July 30th, 2003
8.	Completion of Bulkhead Reconstruction and Pier Demolition	February 15, 2004
9.	Completion of in-field dredging and capping remedial action	February 15, 2006
10.	Pre-final Construction Inspection(s)	No later than thirty (30) days after completion of construction for each discrete element of the remedial action.
11.	Pre-final Construction Inspection Report(s)	Within seven (7) days after the pre-final construction inspection for each discrete element of the remedial action.
12.	Final Construction Inspection(s)	As specified in each pre-final construction inspection report.
13.	Final OMMP	Within 60 days of the last Final Construction Inspection/Meeting.

14.	Final Construction Inspection Report(s)	Within thirty (30) days after each final construction inspection.
15.	Remedial Action Construction Inspection Report	Within thirty (30) days after the last successful final construction inspection.
16.	Remedial Action Completion Report	Within thirty (30) days after Remedial Action Objectives have been obtained.

APPENDIX C

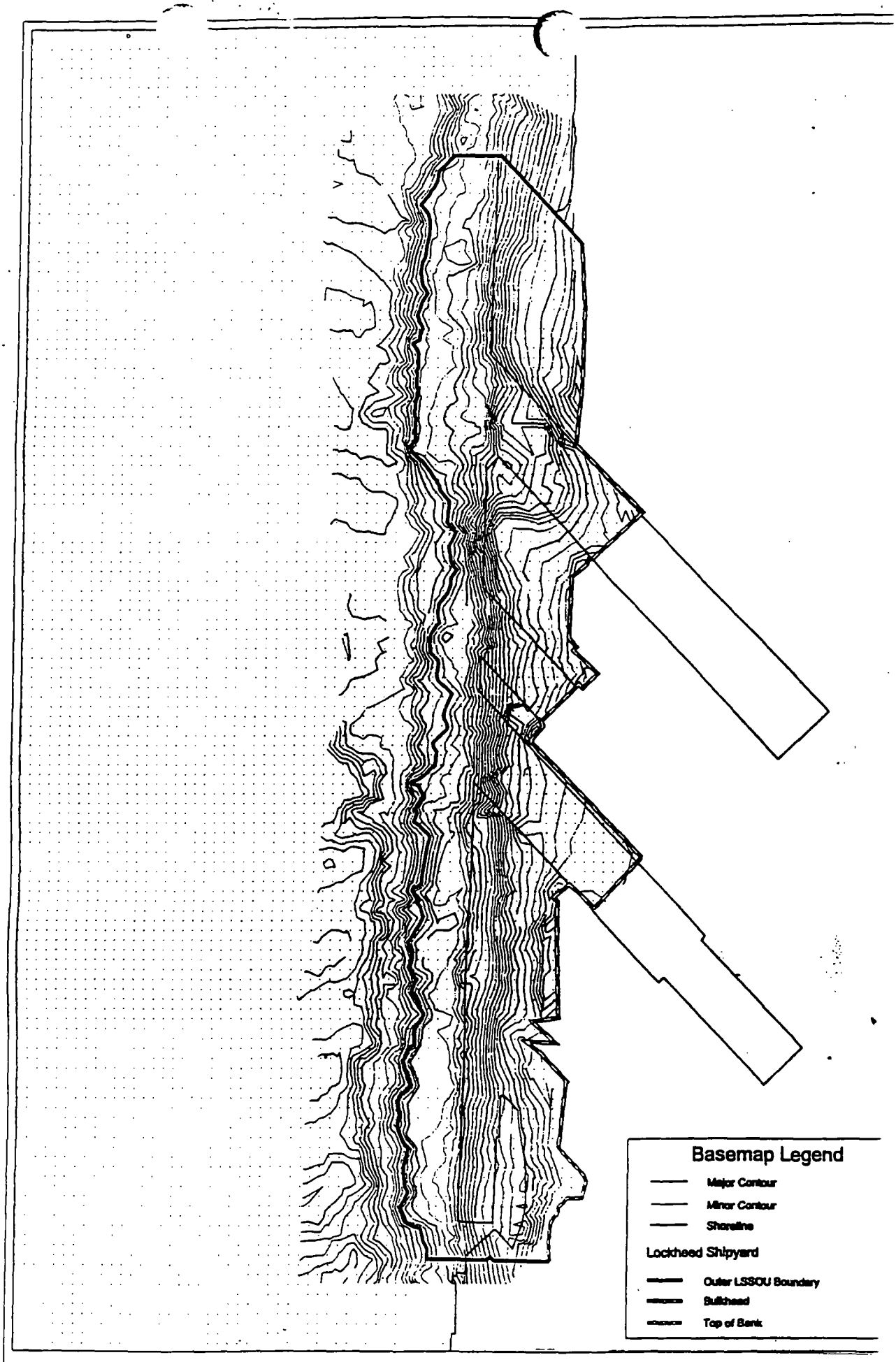

Figure 1 - Lockheed Shipyard Sediment Operable Unit

300 0 300 Feet

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