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Ecological Evaluation of Proposed Discharge of Dredged Material From Oakland Harbor into Ocean Waters (Phase III of 38-Foot Project)

Volume 1: Background and Appendixes A through H

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Battelle/Marine Sciences Laboratory
Sequim, Washington

January 1992

Prepared for the
U.S. Army Corps of Engineers - San Francisco District
under a Related Services Agreement
with the U.S. Department of Energy
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Pacific Northwest Laboratory
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PREFACE TO VOLUME 1

This is Volume 1 of a two-volume data report that presents the data gathered during the Oakland Harbor Phase III 38-Foot Project, conducted in the Fall of 1990. This data report does not include interpretation or statistical analysis of the 38-Foot data. Volume 1 includes the project background as well as a full presentation of data and results in Appendixes A through H. Volume 2 contains the remaining data in Appendixes I through L.

ABSTRACT

At the request of the U.S. Army Corps of Engineers (USACE), environmental studies were conducted by Battelle/Marine Sciences Laboratory (MSL) to evaluate the suitability of sediments from Oakland Inner Harbor for dredging and ocean disposal. During the Phase III 38-Foot Project, sediment cores were collected from mudline to -39 ft mean lower low water at various locations in Oakland Inner Harbor channel and allocated to six composite samples. These composites were evaluated through physical/chemical analyses, acute toxicity to sensitive marine organisms, and bioaccumulation potential. Sediment samples from individual locations were tested for physical/chemical parameters only. The results of toxicological and bioaccumulation testing may be used by USACE to determine the amount of potential dredged material from Oakland Inner Harbor channel acceptable for open-water disposal as defined by the Draft Implementation Manual (EPA/USACE 1990) and consistent with the Water Resources Development Act of 1986 (Public Law 99-662).

SUMMARY

The Water Resources Development Act of 1986 (Public Law 99-662) authorized the U.S. Army Corps of Engineers (USACE), San Francisco District, to deepen and widen the navigational channels of the Oakland Inner and Outer Harbors to accommodate deeper-draft vessels. During the fall of 1990, Battelle/Marine Sciences Laboratory (MSL) conducted a study for USACE to determine whether sediments identified for dredging to a navigable depth of -38 ft mean lower low water (MLLW) in Oakland Inner Harbor were suitable for ocean disposal. The study followed the guidelines of the *Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters*, otherwise known as the Draft Implementation Manual (EPA/USACE 1990).

During the Phase III 38-Foot Project, sediment cores were collected in Oakland Inner Harbor Channel from mudline to -39 ft MLLW to ensure collection to project depth. Under the direction of USACE, the samples were allocated to six composite treatments (COMPs I to VI). Reference and control sediments were also collected at this time. The reference sediments were from six different reference areas: The Alcatraz Island Disposal Site (R-AC), Alcatraz Island Environs (R-AM), Bay Farm Borrow Area (R-BF), Point Reyes Coarse Area (R-PC), Point Reyes Fine Area (R-PF), and a deep off-shelf area (R-OS).

Composite, reference, and control sediment treatments were analyzed to determine physical/chemical characteristics, biological toxicity, and bioaccumulation potential. Physical/chemical analysis of sediment samples included measurements of Environmental Protection Agency (EPA) priority pollutant metals, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides, butyltins, conventional parameters, and sediment grain size. Physical/chemical parameters were measured in the individual samples included within the six composite treatments as well as in the composites themselves. Biological toxicity tests included solid-phase 10- and 28-day tests using *M. nasuta* and *N. caecoides*, a 10-day test using *C. stigmaeus*, and a 10-day test using *R. abronius*. These tests were conducted on the six composite treatments, the six reference treatments, and appropriate control treatments. Suspended-particulate-phase (SPP) tests were also conducted on all six composite treatments and the references R-PF, R-BF, and

R-AM using *C. stigmaeus*, *H. sculpta*, and the larvae of *C. gigas*. The tissues of *M. nasuta* and *N. caecoides* were analyzed for metals, PAHs, PCBs, pesticides, and butyltins after a 28-day exposure to composite and reference treatments.

The results of the physical/chemical analysis of the six composite samples showed that total PAH concentrations in the composite samples ranged from 1733 to 4950 µg/kg, with the highest values occurring in COMP III. Reference sediment levels were generally much lower, with the exception of R-AC, which showed a total PAH level of 2984 µg/kg. In all cases, the total PAH observed in sediment samples from Oakland Inner Harbor contained a higher percentage of high molecular weight compounds than observed in reference sites. Pesticides and most PCBs were undetected in the composites, though the PCB Aroclor 1254 was detected in most of the sediment samples and was present at the highest level (410 µg/kg) in I-C17. Metals were present in all composites at concentrations that ranged over a factor of approximately ten from lowest to highest. Tributyltin was present in elevated levels in all six composites relative to five of the six references. The sixth reference, R-AC, contained tributyltin levels that were higher than all of the composites except COMP III. Sediment from stations in the upper part of Oakland Inner Harbor near Todd Shipyard and the maneuvering area, contained the highest tributyltin concentrations.

Solid-phase toxicological testing results showed no toxicity to test organisms exposed to composite treatments in the 10- and 28-day *M. nasuta* test and the 10-day *C. stigmaeus* test. Some mortality was noted in the 10- and 28-day *N. caecoides* tests, and in the 10-day *R. abronius* test. The potential for bioaccumulation was measured by analyzing the concentrations of contaminants of concern in tissues of *M. nasuta* and *N. caecoides* after exposure to sediment treatments for 28 days. The contaminants most often present in these two species were low and high molecular weight PAHs; the metals arsenic, chromium, and lead; and tributyltin.

Examination of the results of toxicity tests and bioaccumulation data will assist USACE in determining the amount of dredged material acceptable for unconfined open-water disposal relative to a particular reference site. While physical/chemical analyses of sediment is useful in describing contaminant

trends and in the interpretation of toxicological and bioaccumulation test results, it is not used to determine acceptability of sediments for ocean disposal. According to the 1990 Draft Implementation Manual, further evaluation of the test sediments and the potential dredged material they represent may be necessary to determine whether these materials can be disposed of in the ocean. These evaluations may take the form of numerical modeling, case-specific testing, or other management action as defined by the Draft Implementation Manual and developed by the USACE District Engineer and EPA Regional Administrator.

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1.0 INTRODUCTION

Oakland Harbor is located on the eastern shoreline of central San Francisco Bay in Alameda County, between the cities of Oakland and Alameda, California. Oakland Harbor and its access channels are no longer wide or deep enough to accommodate modern deeper-draft vessels. The Water Resources Development Act of 1986 (Public Law 99-662) authorized the U.S. Army Corps of Engineers (USACE), San Francisco District, to deepen and widen the navigation channels in Oakland Harbor. Several options for disposal of the material from this dredging project are under consideration by USACE. Those options include disposal within San Francisco Bay, at open-water sites, or at uplands disposal sites.

Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), Public Law 92-532, specifies that all proposed disposal of dredged material into open water be evaluated to determine the potential environmental impacts of those activities. To comply with those requirements, the potential harmful effects of the dredged material must be evaluated by chemical characterization, toxicity testing, and bioaccumulation testing prior to dredging and disposal.

Oakland Harbor Phase III work may be placed in context by going back several years. Between March 1988 and February 1990, Battelle/Marine Sciences Laboratory (MSL),[a] operating under contract to USACE, completed three studies to evaluate the acceptability of Oakland Harbor sediments for the open-ocean disposal option: Oakland Harbor 38-Foot, 42-Foot Phase I, and 42-Foot Phase II Projects (Word et al. 1988; 1990a,b). Those studies included sediment chemistry analysis, solid- and suspended-phase sediment toxicity tests, and 10-day bioaccumulation measurements . The 1988-1990 Oakland Harbor 38-Foot, 42-Foot Phase I, and 42-Foot Phase II evaluations were conducted under the guidance of the 1977 *Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters; Implementation Manual of Section 103 of Public Law 92-532* (1977 Implementation Manual) (EPA/USACE 1977). Since the

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(a) The Marine Sciences Laboratory is part of the Pacific Northwest Laboratory, which is operated for the U.S. Department of Energy by Battelle Memorial Institute.

above evaluations were completed, the 1977 Implementation Manual was revised by EPA and USACE, and released in January 1990 as *Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters* (EPA/USACE 1990). The revised version is hereinafter referred to as the 1990 Draft Implementation Manual.

In 1990, USACE requested that MSL resample sites included in the earlier Oakland Harbor 38-Foot, Phase I, and Phase II studies, as well as some additional sites, and evaluate the sediments following the 1990 Draft Implementation Manual for ocean disposal testing. This request developed into the Oakland Harbor Phase III Program. Because of the number of sites and associated evaluations, Phase III was divided into three projects. The Oakland Harbor Phase III A Project, conducted in June, 1990, covered the deepening of Oakland Inner Harbor from -38 ft to -42 ft MLLW. The Oakland Harbor Phase III B Project, conducted in November, 1990, covered the deepening of Oakland Outer Harbor from its existing depth to -42 ft MLLW. The Oakland Harbor Phase III 38-Foot Project, conducted in September, 1990, covered the deepening of Oakland Inner Harbor from its existing depth to -38 ft MLLW. The Oakland Harbor Phase III A and Phase III B sediment evaluations are presented in separate documents.

The data in these volumes represent the Phase III 38-Foot sediment collection, bioassay testing, and sediment and tissue chemistry analyses. The study area for the Phase III 38-Foot Project included 31 sites in Oakland Inner Harbor. The project consisted of collecting sediment to represent the dredged material and subjecting the sediments to chemical, biological toxicity, and bioaccumulation analysis following the guidance in the 1990 Draft Implementation Manual. Sediments from between the mudline and -39 ft MLLW (-38 ft MLLW plus 1 ft overdepth) from individual stations were composited into six samples for biological testing. Sediment chemistry was conducted on individual samples as well as the composites. In addition to dredged material samples, reference and control sediment samples were collected and tested. The reference sediment allows the biological responses and contaminant levels of a proposed dredged sediment sample to be compared to those of a potential disposal area. The control sediments allow evaluation of the health and normal behavior of the test organisms.

Chemical analyses included measurements of EPA priority pollutant metals and organics [polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and chlorinated pesticides] as well as butyltins and conventional parameters. Biological toxicity tests included controlled laboratory exposures of sensitive marine organisms to the solid phase and suspended-particulate phase of the dredged material. Four species were exposed to the solid phase (the polychaete *Nephtys caecoides*, bentnose clam *Macoma nasuta*, amphipod *Rhepoxynius abronius*, and juvenile sanddab *Citharichthys stigmaeus*) and three species were exposed to the suspended-particulate phase (the mysid *Holmesimysis sculpta*, juvenile sanddab *Citharichthys stigmaeus*, and larvae of the pacific oyster *Crassostrea gigas*). Bioaccumulation potential was determined through a 28-day exposure of *M. nasuta* and *N. caecoides* to the solid phase of the proposed dredged material followed by chemical analysis of the tissues for the above EPA priority pollutants and butyltins. The purpose of these analyses was to provide information required to address potential ecological effects resulting from ocean disposal of the dredged material.

Volumes 1 and 2 contain all data pertinent to the Phase III 38-Foot Project. The sample collection, testing, and analysis methods are similar to those used for Phase III A and Phase III B. Phase III 38-Foot data are presented in the following volumes and appendixes:

Volume 1

Appendix A	Field Sampling Data
Appendix B	Geological Analysis Data
Appendix C	Sediment Chemistry and Quality Assurance Data
Appendix D	Bioassay Results for 10-Day Solid-Phase Flow-Through Test with *Macoma nasuta* and *Nephtys caecoides*
Appendix E	Bioassay Results for 28-Day Solid-Phase Flow-Through Test with *Macoma nasuta* and *Nephtys caecoides*
Appendix F	Bioassay Results for 10-Day Solid-Phase Static Test with *Rhepoxynius abronius*
Appendix G	Bioassay Results for 10-Day Solid-Phase Flow-Through Test with *Citharichthys stigmaeus*
Appendix H	Bioassay Results for 96-Hour Suspended-Particulate-Phase Static Test with *Citharichthys stigmaeus*

Volume 2

2.0 REFERENCES

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APPENDIX A

FIELD SAMPLING DATA

APPENDIX A

SUMMARY: FIELD SAMPLING DATA

SAMPLE TYPE	**12-IN. SEDIMENT CORES**
Sample collection device	12-in. vibratory-hammer coring device
Sampling stations	Comp I, Comp II, Comp III, Comp IV, Comp V, Comp VI; sediment was collected to a project depth of -39 ft MLLW
Dates collected	9/19/90 - 9/21/90
Sampling platform	Derrick barge *Hagar*
SAMPLE TYPE	**4-IN. SEDIMENT CORES**
Sample collection device	4-in. vibratory-hammer coring device
Sampling stations	I-C3, I-C5, I-C8 through I-C19, I-C21 through I-C35; sediment was collected to a project depth of -39 ft MLLW
Dates collected	9/19/90 - 9/21/90
Sampling platform	Derrick barge *Hagar*
SAMPLE TYPE	**REFERENCE SEDIMENTS**
Sample collection device	Pipe dredge sampler
Sampling stations	Point Reyes Coarse (R-PC), Point Reyes Fine (R-PF), Offshore Sediment (R-OS), Bay Farm (R-BF), Alcatraz Environs (R-AM), Alcatraz Disposal Site (R-AC); sediment was collected at the surface
Dates collected	9/17/90 - 9/20/90
Sampling platform	F/V *Cobra*
SAMPLE TYPE	**CONTROL SEDIMENTS**
Sample collection device	Amphipod dredge, modified van Veen grab sampler, shovel and bucket
Sampling stations	West Beach (C-WB), Sequim Bay (C-SB), Nephtys (C-NE)
Dates collected	9/29/90 (C-WB, C-SB); 10/2/90 (C-NE)
Sampling platform	Battelle Whaler

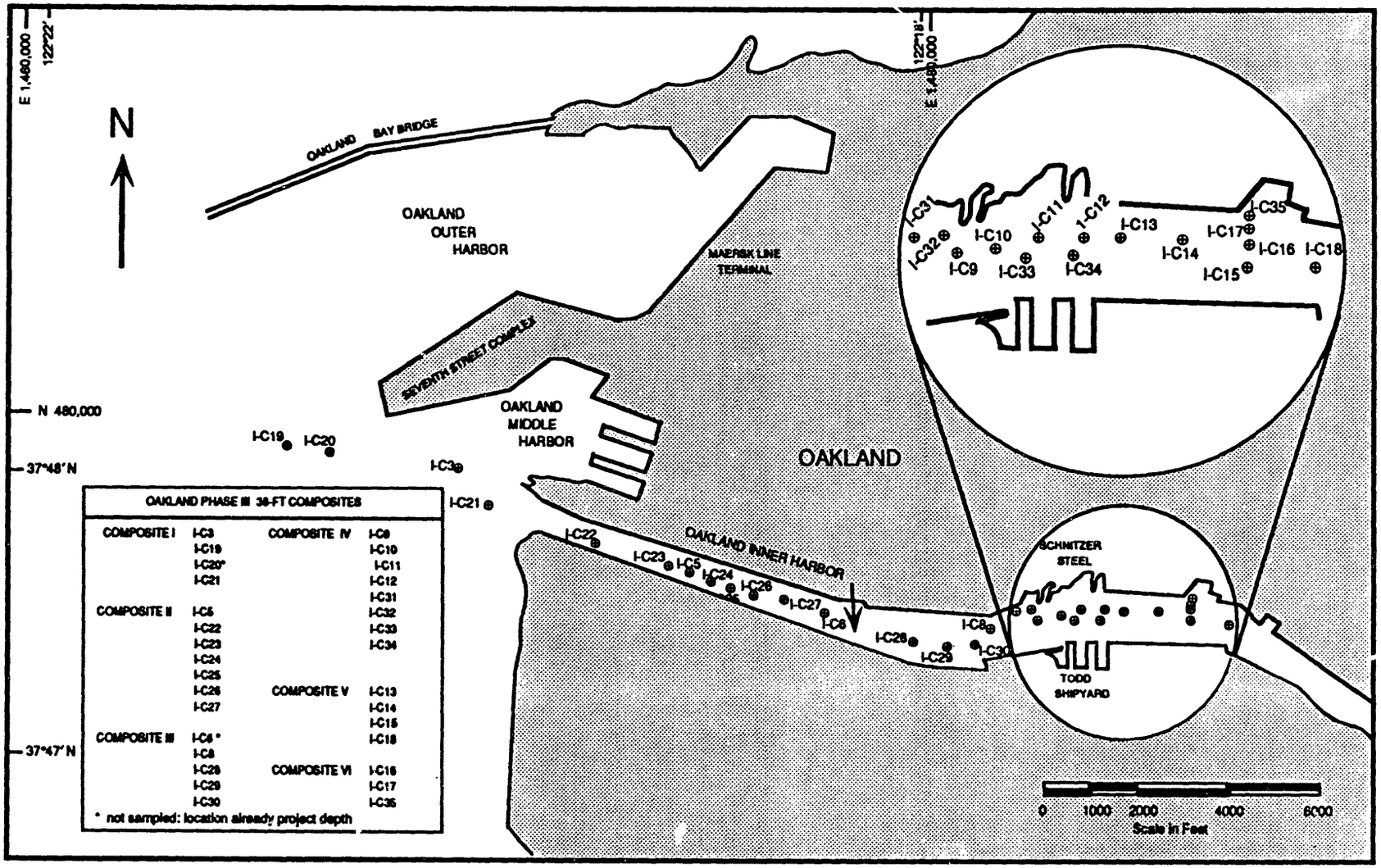


FIGURE A.1. Study Area, Sampling Sites, and Compositing Scheme for Oakland Phase III 38-Foot Project

TABLE A.1. Information for 12-in. Core Sampling and Compositing, Oakland Phase III 38′ Project

Station	Replicate	Date Collected	California State Plane Coordinates (Zone III) North (Y)	East (X)	Depth (ft MLLW)	Ft Core Required To -39 ft	Ft Core Collected	M to -39 ft Volume to 38 ft Composite[a] gal	Comp
I-C3	1	09-21-90	478,893	1,469,593	-37.2	1.8	6.8	9	to Comp I
I-C4[b]	NA[c]	09-21-90	478,100	1,469,438	-37.0	2.0	None	0	to Comp I
I-C19	1	09-21-90	479,381	1,465,766	-37.0	2.0	4.5	5	to Comp I
I-C19	2	09-21-90	479,381	1,465,766	-37.0	2.0	5.5	9	to Comp I
I-C20[d]	NA	09-21-90	479,192	1,466,712	-38.6	NA	None	0	to Comp I
I-C21	1	09-21-90	478,081	1,470,189	-34.5	4.5	7.5	9	to Comp I
I-C5	1	09-21-90	476,668	1,474,656	-36.2	2.8	8.9	7.5	to Comp II
I-C22	1	09-21-90	477,315	1,472,570	-35.9	3.1	7.3	5	to Comp II
I-C23	1	09-21-90	476,845	1,474,152	-37.0	2.0	4.0	5	to Comp II
I-C24	1	09-21-90	476,507	1,475,135	-36.7	2.3	3.2	5	to Comp II
I-C25	1	09-21-90	476,358	1,475,571	-36.8	2.2	7.4	5	to Comp II
I-C26	1	09-21-90	476,220	1,476,089	-36.8	2.2	4.5	4	to Comp II
I-C27	1	09-21-90	476,108	1,476,747	-37.0	2.0	5.5	7	to Comp II
I-C6[d]	NA	09-21-90	475,927	1,477,733	>-39.0	2.0	None	0	to Comp III
I-C8	1	09-21-90	475,480	1,481,316	-37.9	1.1	7.5	3	to Comp III
I-C28	1	09-21-90	475,139	1,479,530	-34.9	4.1	8.2	15	to Comp III
I-C29	1	09-21-90	475,091	1,480,365	-36.5	2.5	9.2	8	to Comp III
I-C30	1	09-21-90	475,170	1,480,995	-36.5	2.5	4.9	5	to Comp III
I-C 9	1	09-20-90	475,676	1,482,362	-36.3	2.7	7.9	6	to Comp IV
I-C10	1	09-20-90	475,765	1,482,876	-36.5	2.5	7.7	6	to Comp IV
I-C11	1	09-20-90	475,862	1,483,334	-34.3	4.7	5.0	5	to Comp IV
I-C12	1	09-20-90	475,890	1,483,804	-38.3	0.7	7.1	2.5	to Comp IV
I-C31	1	09-20-90	475,858	1,481,878	-34.0	5.0	5.9	7.5	to Comp IV
I-C32	1	09-20-90	475,925	1,482,226	-37.9	1.1	5.5	2.5	to Comp IV
I-C33	1	09-20-90	475,656	1,483,139	-37.5	1.5	4.7	1.5	to Comp IV
I-C34	1	09-20-90	475,696	1,483,700	-37.9	1.1	4.1	1.5	to Comp IV
I-C13	1	09-19-90	475,922	1,484,268	-36.8	2.2	4.5	6	to Comp V
I-C14	1	09-19-90	475,889	1,485,017	-36.3	2.7	8.7	9	to Comp V
I-C15	1	09-19-90	475,717	1,485,702	-34.9	4.1	7.8	15	to Comp V
I-C18	2	09-19-90	475,618	1,486,541	-37.9	1.1	6.8	1.5	to Comp V
I-C18	1	09-19-90	475,618	1,486,541	-37.9	1.1	8.4	1.5	to Comp V
I-C16	1	09-19-90	475,929	1,485,724	-35.9	3.1	7.2	9	to Comp VI
I-C17	1	09-19-90	476,063	1,485,718	-38.0	1.0	7.7	4	to Comp VI
I-C35	1	09-19-90	476,185	1,485,744	-31.0	8.0	11.7	20	to Comp VI

(a) Approximately equivalent fraction (i.e., 1/3) of mudline to -39 ft segment of each core taken for composites.
(b) Access to Station I-C4 was denied by the U.S. Navy while Alameda airstrip was in service. Station coordinates, depth, and core required pertain to the planned sampling location.
(c) Not applicable.
(d) Station was abandoned because depth was greater than -38 ft MLLW within a circular radius of 50 ft from the planned location.

TABLE A.2. Information for 4-in. Core Sampling, Oakland Phase III 38′ Project

Station	Replicate	Date Collected	California State Plane Coordinates (Zone III) North (Y)	East (X)	Depth (-ft MLLW)	Ft Core Required To -39 Ft	Ft Core Collected
I-C 3	1	09-21-90	478,893	1,469,593	37.2	1.8	2.1
I-C 4[a]	NA[b]	09-21-90	478,100	1,469,438	36.5	2.5	None
I-C 5	1	09-21-90	476,668	1,474,656	36.2	2.8	4.0
I-C 6[c]	NA	09-21-90	475,927	1,477,733	37.0	2.0	None
I-C 8	1	09-21-90	475,480	1,481,316	37.9	1.1	2.2
I-C 8	2	09-21-90	475,480	1,481,316	37.9	1.1	2.3
I-C 9	1	09-20-90	475,676	1,482,362	36.3	2.7	3.0
I-C10	1	09-20-90	475,765	1,482,876	36.5	2.5	3.8
I-C11	1	09-20-90	475,862	1,483,334	34.3	4.7	4.9
I-C12	1	09-20-90	475,890	1,483,804	38.3	0.7	3.1
I-C12	2	09-20-90	475,890	1,483,804	38.3	0.7	3.2
I-C13	1	09-19-90	475,922	1,484,268	36.8	2.2	4.4
I-C14	1	09-19-90	475,889	1,485,017	36.3	2.7	4.3
I-C15	1	09-19-90	475,717	1,485,702	34.9	4.1	4.8
I-C16	1	09-19-90	475,929	1,485,724	35.9	3.1	3.6
I-C17	1	09-19-90	476,063	1,485,718	38.0	1.0	4.0
I-C17	2	09-19-90	476,063	1,485,718	38.0	1.0	4.0
I-C18	1	09-19-90	475,618	1,486,541	37.9	1.1	1.5
I-C18	2	09-19-90	475,618	1,486,541	37.9	1.1	2.0
I-C19	1	09-21-90	479,381	1,465,766	37.0	2.0	4.5
I-C20[c]	NA	09-21-90	479,192	1,466,712	38.6	0.4	None
I-C21	1	09-21-90	478,081	1,470,189	34.5	4.5	5.0
I-C22	1	09-21-90	477,315	1,472,570	35.9	3.1	3.6
I-C23	1	09-21-90	476,845	1,474,152	37.0	2.0	4.4
I-C24	1	09-21-90	476,507	1,475,135	36.7	2.3	3.3
I-C25	1	09-21-90	476,358	1,475,571	36.8	2.2	2.7
I-C26	1	09-21-90	476,220	1,476,089	36.8	2.2	3.2
I-C27	1	09-21-90	476,108	1,476,747	37.0	2.0	3.1
I-C28	1	09-21-90	475,139	1,479,530	34.9	4.1	4.1
I-C29	1	09-21-90	475,091	1,480,365	36.5	2.5	3.2
I-C30	1	09-21-90	475,170	1,480,995	36.5	2.5	2.8
I-C31	1	09-20-90	475,858	1,481,878	34.0	5.0	5.9
I-C32	1	09-20-90	475,925	1,482,226	37.9	1.1	1.1
I-C32	2	09-20-90	475,925	1,482,226	37.9	1.1	1.8
I-C33	1	09-20-90	475,656	1,483,139	37.5	1.5	2.7
I-C33	2	09-20-90	475,656	1,483,139	37.5	1.5	2.8
I-C34	1	09-20-90	475,696	1,483,700	37.9	1.1	2.1
I-C34	2	09-20-90	475,696	1,483,700	37.9	1.1	2.5
I-C35	1	09-19-90	476,185	1,485,744	31.0	8.0	10.0

(a) Access to station I-C4 was denied by the U.S. Navy while Alameda airstrip was in service. Station coordinates, depth and core required pertain to the planned sampling location.
(b) Not applicable.
(c) Station abandoned because depth was greater than -38 ft MLLW within a circular radius of 50 ft from the planned location.

TABLE A.3. Information for Reference Sediment Sampling, Oakland Phase III 38' Project (Samples from each reference area composited into single sample representative of that area)

Station	Replicate	Date Sampled	Time	Coordinates (Lat., Long.) (N)	(W)	Depth (ft)	Comments
Alcatraz Environs							
R-AM-C	1	09-17-90	1600	37°49.75'	122°24.90'	68	gravel, med. coarse sand
R-AM-F	1	09-17-90	1650	37°49.27'	122°24.90'	78	med. sand
R-AM-I	1	09-17-90	1705	37°48.83'	122°24.90'	68 - 70	sand
R-AM-H	1	09-17-90	1730	37°48.83'	122°25.57'	63	coarse sand
R-AM-G	1	09-17-90	1750	37°48.83'	122°25.88'	58	fine sand
R-AM-D	1	09-17-90	1805	37°49.27'	122°25.88'	82	sand
R-AM-A	1	09-17-90	1825	37°49.75'	122°25.88'	68	sand
R-AM-B	1	09-17-90	1845	37°49.75'	122°25.57'	64	med. sand
Alcatraz Island Disposal Sites							
R-AC-1	1	09-17-90	1900	39°49.30'	122°25.45'	76	silt, slight H2S odor
R-AC-3	1	09-17-90	1910	39°49.30'	122°25.45'	36	silt, slight H2S odor
R-AC-7	1	09-17-90	1920	39°49.30'	122°25.45'	57	silt, slight H2S odor
Bay Farm							
R-BF-1	1	09-17-90	2005	37°44.58'	122°17.75'	21	silt, clay
R-BF-3	1	09-17-90	2020	37°44.42'	122°17.52'	27	silt
R-BF-6	1	09-17-90	2030	37°44.07'	122°16.15'	29	silt
Point Reyes Fine							
R-PF	1	09-19-90	1302	37°54.05'	122°57.15'	227	fine sand, silt
R-PF	2	09-19-90	1317	37°54.07'	122°57.00'	224	fine sand, silt
R-PF	3	09-19-90	1336	37°54.05'	122°57.08'	226	fine sand, silt, small worm tubes
R-PF	4	09-19-90	1347	37°54.06'	122°57.00'	224	fine sand, silt
R-PF	5	09-19-90	1405	37°54.03'	122°57.04'	226	fine sand, silt, few worm tubes
R-PF	6	09-19-90	1425	37°54.06'	122°57.02'	227	fine sand, silt
R-PF	7	09-19-90	1441	37°53.97'	122°57.07'	224	fine sand, silt
R-PF	8	09-19-90	1457	37°54.03'	122°57.06'	227	fine sand, silt
R-PF	9	09-19-90	1511	37°54.10'	122°56.97'	224	fine sand, silt
R-PF	10	09-19-90	1533	37°54.06'	122°56.93'	225	fine sand, silt
R-PF	11	09-19-90	1551	37°54.08'	122°57.08'	224	fine sand, silt
R-PF	12	09-19-90	1611	37°54.03'	122°57.02'	224	fine sand, silt
R-PF	13	09-19-90	1633	37°54.06'	122°57.00'	224	fine sand, silt

TABLE A.3. (Contd)

Station	Replicate	Date Sampled	Time	Coordinates (Lat., Long.) (N)	(W)	Depth (ft)	Comments
Point Reyes Coarse							
R-PC	1	09-19-90	1716	37°53.02'	123°01.95'	275	very fine material, rejected
R-PC	1	09-19-90	1748	37°51.54'	123°00.91'	276	med. sand, silt
R-PC	2	09-19-90	1820	37°48.96'	122°00.94'	250	med. sand
R-PC	3	09-19-90	1837	37°49.00'	122°00.99'	250	med. sand, some silt
Deep Off-Shelf							
R-OS	1	09-19-90	2142	37°24.05'	123°14.92'	4200	silt
R-OS	2	09-20-90	0002	37°24.06'	123°14.89'	4200	dredge empty, no sample
R-OS	1	09-18-90	1050	37°23.86'	123°15.63'	4200	silt, fine sand
R-OS	2	09-18-90	1215	37°45.17'	122°41.14'	4200	cable tangled on spool - no sample

TABLE A.4. Information for Control Sediment Sampling, Oakland Phase III 38′ Project

Station	Date Sampled	Coordinate (Lat., Long.) (N)	(W)	Depth (ft)
C-NE	09-29-90	38°13.83	122°57.67	intertidal
C-WB	09-29-90	48°50.83	122°40.00	15
C-SB	09-29-90	48°03.68	123°01.33	89

APPENDIX B

GEOLOGICAL ANALYSIS DATA

APPENDIX B

SUMMARY: GEOLOGICAL ANALYSIS DATA

Method	ASTM Procedure D2488-84, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* (ASTM 1984)
Materials	▪ Stainless steel knife ▪ Hand lens (10X) ▪ 10N Hydrochloric acid ▪ Ruler scale (in 0.1-ft increments) ▪ Blank log forms and AGI Data sheets ▪ Munsell Color Charts
General sediment characteristics noted	▪ Angularity ▪ Color ▪ Odor ▪ HCL reaction ▪ Consistency ▪ Cementation ▪ Structure ▪ Sediment classification type (i.e., lithology) ▪ Maximum particle size ▪ Dry strength ▪ Dilatancy ▪ Toughness ▪ Plasticity
Soil types	Fine-grained sediments: More than half of particles are smaller than very fine sand Coarse-grained sediments: More than half of particles are larger than very fine sand
Record of sediment description	Core Data Log

B.1 MATERIALS

The following is a checklist of items and materials useful for the examination and description of sediment cores.

- ASTM Procedure D 2488-84
- Stainless-steel knife
- Hand lens (10X magnification)
- 10 N Hydrochloric acid (HCl)
- Ruler (scaled in 0.1-foot increments)
- Blank log forms (see Figure A.1)
- Clipboard
- AGI Data Sheets
- Munsell Color Charts

In addition, the charts and/or reference materials listed in Table B.1, and included in this appendix, are useful in the description of specific sediment characteristics.

B.2 METHODS

Descriptions of the physical, chemical, and biological features preserved in sediments aid in the interpretation of the types of geologic processes active both during and after the sediment was deposited. A total of 17 sediment characteristics, outlined in ASTM (1984), are commonly used to describe inorganic soils. These are listed in Table B.2.

Moisture condition was not routinely logged because of the saturated nature of the sediments. Furthermore, since particles were rarely larger than coarse sand, neither were angularity, particle shape, range in particle size, and hardness logged. For this reason, these sediment characteristics were not included in the log form used for the description of sediments (Figure B.1). However, in the few instances where these characteristics did apply, they were described under the "COMMENTS" column.

The definition of "soil" from the engineers standpoint (ASTM, 1984), includes any unconsolidated sediment. The geologic definition of soil is slightly different and restricts soils to those sedimentary deposits that have undergone alteration near the land's surface by either physical, chemical, and/or biological processes; therefore, in a strict sense, not all sediments are soils. For the purposes of this discussion, however, "soils" and "sediments" will be used synonymously.

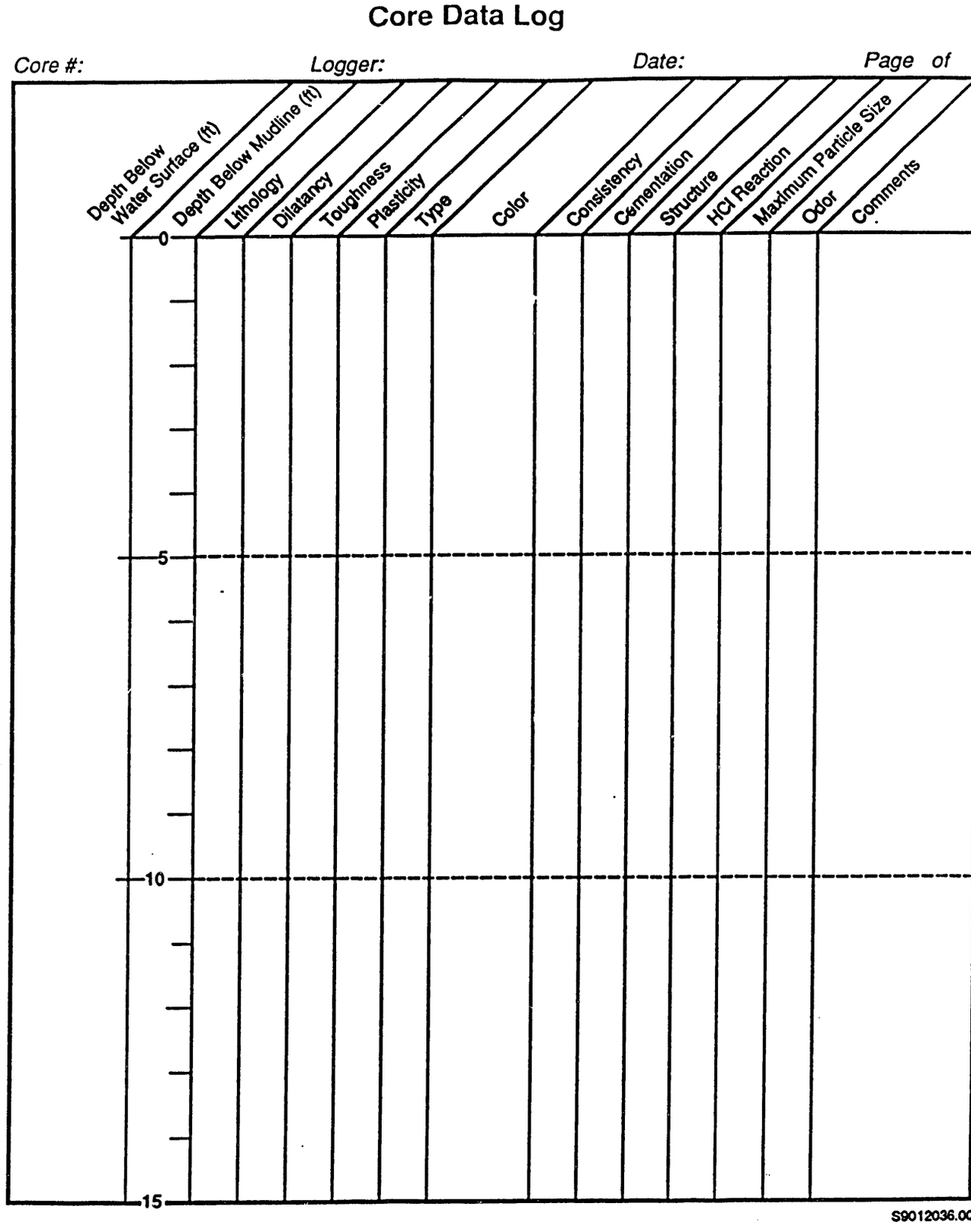


FIGURE B.1. Log Form Used to Record Sediment Descriptions

TABLE B.1. Charts and Other Reference Materials Used to Provide Standardized Descriptions of Sediment Characteristics.

CHART/REFERENCE	PURPOSE	FIGURE #
• Percentage Estimate Chart	Estimate percentage of individual particles or constituents	B.2
• Roundness Scale	Roundness of sand and coarser particles	B.3A
• Sorting Chart	Estimate of grading	B.3B
• Particle Shape	Reference to describe particle shape	B.4
• Munsell Soil Color Charts	Soil color	B.5
• Unified Soil Classification System	Method for designating sediment type	B.6, B.7
• Grain-size Scales	Range of particle sizes; maximum particle size	B.8, B.9
• Lithologic Symbols	Graphic patterns for lithologic log	B.10, B.11

TABLE B.2. Sediment characteristics identified in ASTM Procedure D2488-84.

1) angularity *
2) particle shape *
3) color
4) odor
5) moisture condition
6) HCl reaction
7) consistency (i.e., firmness)
8) cementation *
9) structure
10) sediment classification type (i.e., lithology)
11) range of particle sizes *
12) maximum particle size
13) hardness *
14) dry strength **
15) dilatancy **
16) toughness **
17) plasticity **

* Applies to coarse-grained sediment (sand and larger particles)
** Applies to fine-grained sediment of mostly silt and/or clay
Features not generally logged for this study are underlined

It is sometimes helpful to provide an estimate of the relative proportions of different constituents in sediments (e.g. light- versus dark-colored minerals). This is made easier and more accurate by using a percentage estimate chart, which provides a graphic reference with varying concentrations of a particular constituent (Figure B.2).

The criteria used to describe each of the 17 sediment characteristics identified in ASTM (1984) are discussed below.

B.2.1 Angularity

The angularity of sedimentary particles is a reflection of the sedimentary environment and the amount of time that has elapsed before deposition and burial. A chart showing how to classify the angularity of sedimentary particles is presented in Figure B.3A. A range of angularity may be stated, such as: subrounded to rounded.

B.2.2 Shape

Shapes of sedimentary particles often reflect the internal characteristics (e.g., preferential parting) of the material or sometimes the type of sedimentary environment. For example gravel clasts deposited in high-energy environments, such as beaches and river bottoms, are often worn flat.

According to Figure B.4, gravel-sized clasts may be described in one of four ways. First, if the ratio of the clast's width to thickness is >3, it is classified as flat. Second, if the ratio of the clast's length to width is >3, the clast is elongate. Third, if both criteria apply the clast is both flat and elongate. And last, if none of the criteria apply, then shape is not mentioned. Indicate the fraction of the clasts that have the shape, such as: one-third of gravel clasts are flat. Particle shape did not apply to most of the sediments logged during this project and the few pebbles that were observed were neither flat nor elongate.

B.2.3 Color

Color may be useful in identifying materials of similar geologic origin. For example, color was often a useful criteria for differentiating Younger Bay Mud from Older Bay Mud. Sediment color was determined by comparing the wet

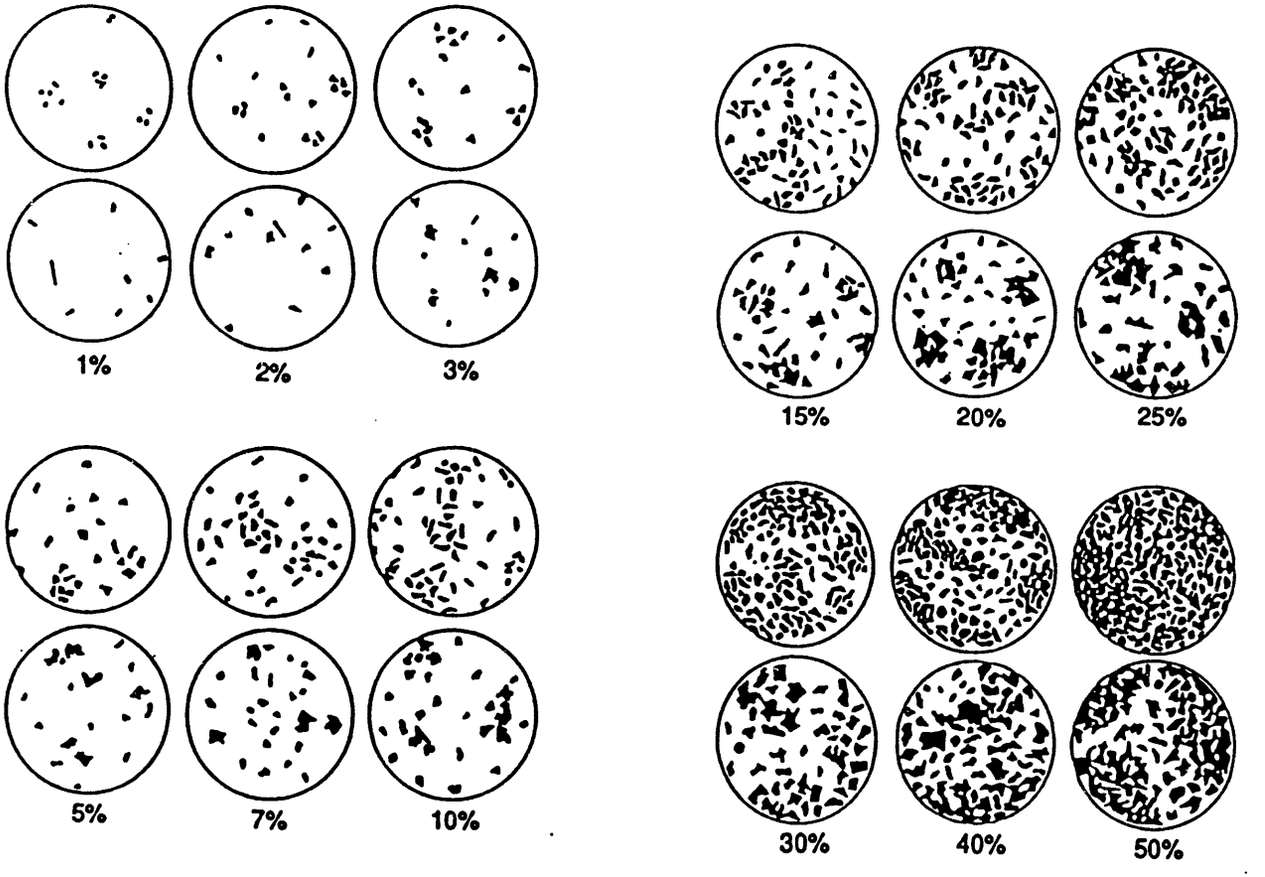


FIGURE B.2. Comparison Chart Used to Estimate the Percentages of Constituents (from AGI 1982)

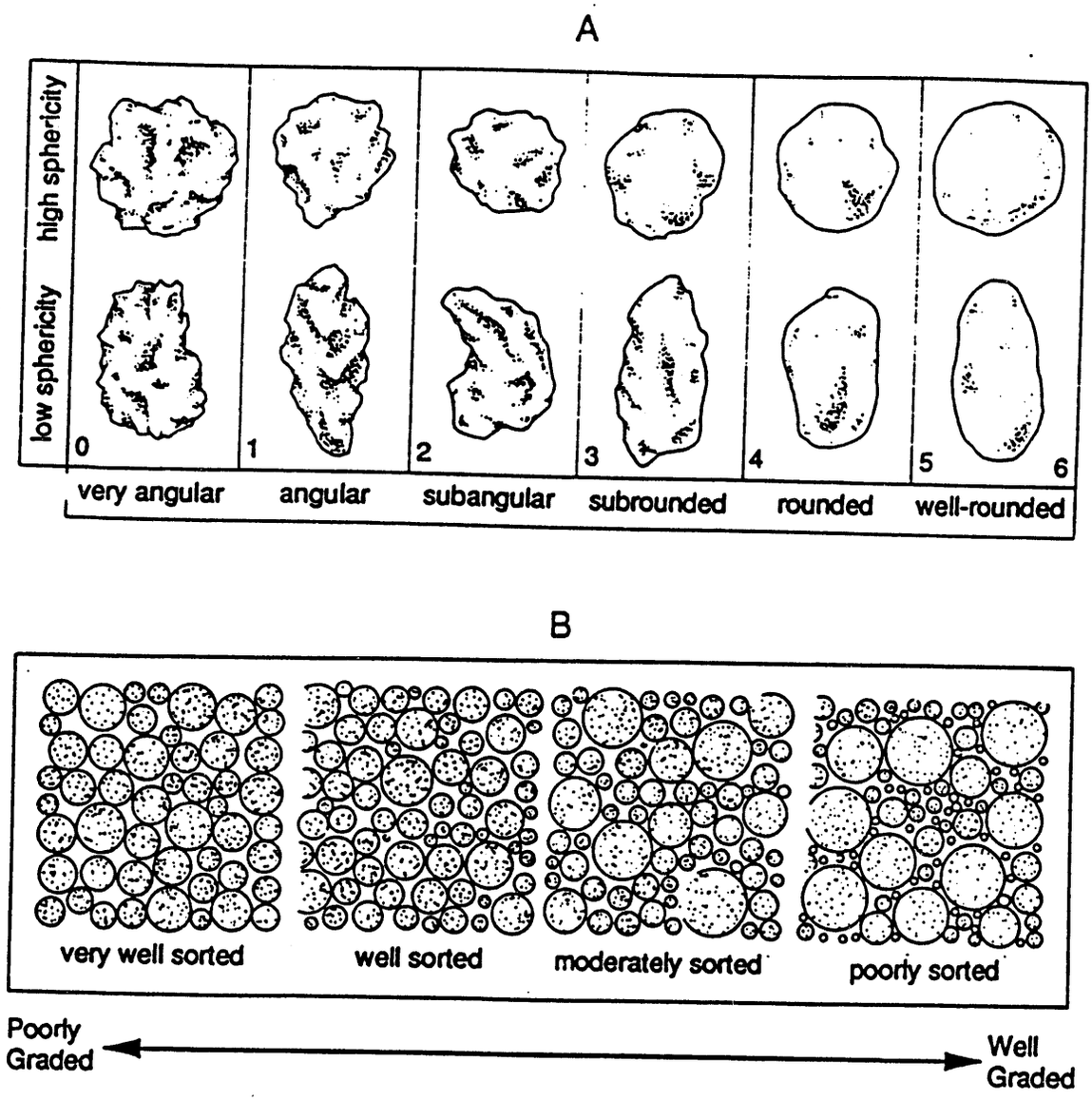
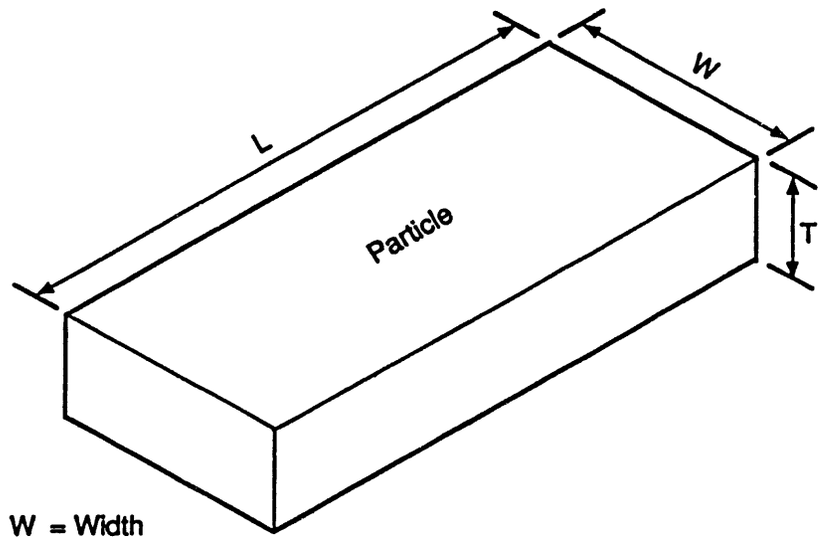


FIGURE B.3. Charts Used to Visually Estimate (A) Roundness/Sphericity and (B) Sorting/Grading



W = Width
T = Thickness
L = Length

Flat: W/T>3
Elongated: L/W>3
Flat and Elongated: meets both criteria

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FIGURE B.4. Criteria Used to Describe Particle Shape of Pebbles and Large Gravels (From ASTM 1984)

sediment with standard sediment colors given in Munsell (1975). The advantage to using the Munsell soil color system is that it provides a consistent, standardized method for describing color and subjectivity is minimized.

The Munsell color notation consists of three simple variables that combine to describe all colors known in the Munsell soil color system. The three variables are: hue, value, and chroma (Figure B.5). The hue notation indicates the relation of the sediment color with respect to red, yellow, green, blue and purple; the value notation indicates its lightness, and the chroma notation indicates its strength (i.e., intensity).

Color can be described either by the Munsell notation (e.g. 5YR 5/3; hue=5YR, value=5, chroma=3) or by its equivalent color name (e.g. reddish brown). Both the color name and Munsell notation were recorded on core Logs. Only rarely was there not a reasonable match between the true color of the core sediment and one of the colors on a Munsell color chart.

B.2.4 Odor

Odors may indicate the presence of contaminants or be the result of the geochemical environment. Odors most frequently noted were that of petroleum hydrocarbons and the smell of rotten eggs (an indication of the presence of hydrogen sulfide). Both of these odors were restricted to the Younger Bay Mud unit. Petroleum odors may be the result of contamination of the sediments by shipping spills or industrial waste, or perhaps is derived from the abundant decaying organic matter present in these sediments. Hydrogen sulfide is a common natural by-product in chemically reducing environments such as the Richmond Harbor estuary.

B.2.5 Moisture Condition

Moisture condition is described as either dry, moist, or wet according to the following criteria:

DRY Absence of moisture, dry to the touch

MOIST Damp but no visible water

WET Visible free water, usually soil is below water table (i.e., saturated)

All the sediments logged for this project were taken from below sea

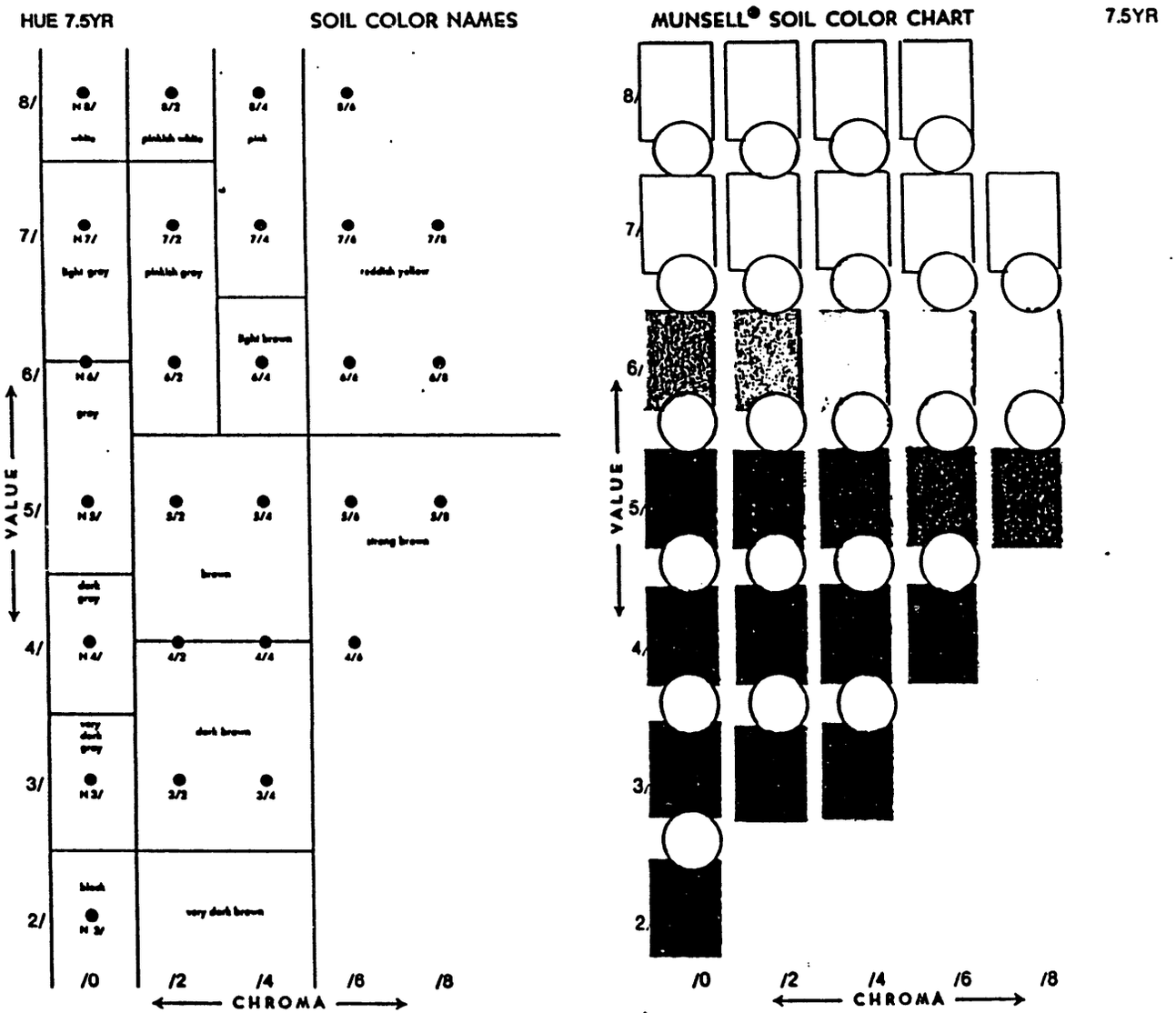

FIGURE B.5. Example of a Page from the Munsell Soil Color for Hue 7.5YR

level and did not lose any significant moisture between the time they were logged. Therefore, they are all classified as wet.

B.2.6 HCl Reaction

The reaction (i.e., effervescence) of sedimentary material, as a result of adding dilute hydrochloric acid, is an indication of the presence of calcium carbonate. Calcium carbonate in sediments may be derived from a variety of sources including: 1) physical disintegration of preexisting carbonate rocks (e.g., limestone, marble), 2) biogenic precipitation (e.g., shell, bone), and 3) soil development. In the last example, calcium carbonate concentrations, often referred to as caliche or calcrete, may accumulate over time near the land's surface in arid climates. Where calcium carbonate concentrations occur in combination with other evidence for soil development, such as root traces and oxidation, then a pedogenic (soil forming) origin is favored. Criteria for describing the reaction with 10 N HCl are as follows:

NONE	No visible reaction
WEAK	Some reaction, with bubbles forming slowly
STRONG	Violent reaction, with bubbles forming immediately

A solution of 10 N HCl is obtained by slowly adding one part of concentrated hydrochloric acid to three parts of distilled water. (To avoid a violent exothermic reaction never add water to acid).

B.2.7 Consistency

Consistency is a measure of the firmness or consolidation of sedimentary material. In general, there is a direct relationship between consistency and age of the deposit (i.e., older deposits are usually more firm because of compaction and/or cementation). Consistency is most applicable to fine-grained sediments and least applicable on sediments that contain significant amounts of gravel. The criteria used to determine consistency are as follows:

VERY SOFT	Penetrometer penetrates soil greater than 4 cm
SOFT	Penetrometer penetrates soil 2.0 to 4.0 cm
FIRM	Penetrometer penetrates soil 0.25 to 2.0 cm

HARD Penetrometer penetrates soil less than 0.25 cm

The penetrometer used for sediment core descriptions consists of a 6-in. nail spike attached to a clay brick for a total mass of 2.0 kg; the nail spike is marked in centimeter increments to quantify the amount of soil penetration.

B.2.8 Cementation

Often sedimentary particles are held together with a binding cement. Three common natural cements are calcium carbonate (lime), silica, and iron-oxide compounds. Particles cemented with calcium carbonate effervesce in the presence of hydrochloric acid (see Section B.2.6 above). Sediments cemented with iron oxide are usually some shade of red, yellow, or brown. Usually there is a relationship between consistency (Section B.2.7) and cementation, in that strongly cemented deposits are also hard to very hard. Criteria used to describe the degree of cementation are:

WEAK Crumbles or breaks with handling or light finger pressure

MODERATE Crumbles or breaks with considerable finger pressure

STRONG Will not crumble or break with finger pressure

B.2.9 Structure

Structures are features that originate within the layers of sediment or at the sediment/water interface in response to various physical, biologic and/or chemical processes. Structures may be classified into two categories: primary and secondary. Primary structures form as the sediment is being deposited (e.g., lamination, stratification). Secondary structures form after deposition, often as a result of compaction or other stresses (e.g., fissured, slickensided), biologic activity (e.g., root traces, mottling), and soil development (e.g., homogeneous, blocky, mottled). The following are some common structures observed in sedimentary deposits.

PRIMARY STRUCTURES

STRATIFIED Alternating layers of varying material or color with layers at least 6 mm thick

LAMINATED Alternating layers of varying material or color with the layers less than 6 mm thick

LENSED	Inclusion of small pockets of different sediment type, such as small lenses of sand scattered through a mass of clay. (This type of structure may also be secondary).

SECONDARY STRUCTURES

FISSURED	Breaks along definite planes of fracture with little resistance to fracturing
SLICKENSIDED	Fracture planes appear polished or glossy, sometimes striated
BLOCKY	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
MOTTLED	Variation in color of sediments as represented by localized spots or blotches of color or shades of color
HOMOGENEOUS	Same color and appearance throughout

B.2.10 Sediment Classification Type

The classification method used in this study is the Unified Soil Classification System, which consists of a two-letter designation for most soils (i.e., unconsolidated sediments). A simplified version of the Unified Soil Classification System is presented in Figure B.6, while a more-detailed breakdown is presented in Figure B.7.

According to the Unified Soil Classification System, coarse-grained sediments are classified based on grain-size distribution and grading (i.e., sorting), while fine-grained sediments are classified on the basis of grain size and liquid limit vs. plasticity.

Particle-size distribution may be determined with precision using laboratory methods (e.g., sieving of sand and coarser particles; pipette or hydrometer analysis of silt and clay). Because these methods are expensive and time-consuming, it is more desirable to estimate grain size using rapid visual-manual techniques described below. For example, sand and coarser particles are most easily identified via comparison with standard charts of grain size (Figures B.8 and B.9). Fine-grained soils, consisting of mostly silt and/or clay, on the other hand, are identified based on manual tests of their dry strength, dilatancy, toughness, and plasticity (Figure B.10).

Major Divisions			Group Symbols	Description
Coarse-Grained Sediments More than half of particles are larger than very fine sand	≥50% Gravel	Clean Gravels	GW	Well-graded (i.e., poorly sorted) gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded (i.e., well sorted) gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	≥50% Gravel	Clean Sands	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands, gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Sediments More than half of particles are smaller than very fine sand	Silts and Clays	Low Liquid Limit	ML	Silts and very fine sands, silty or clayey fine sands, or clayey silts, with slight plasticity
			CL	Clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		High Liquid Limit	MH	Silts or fine sandy silts with moderate plasticity
			CH	Clays of high plasticity, fat clays

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FIGURE B.6. Abbreviated Form of the Unified Soil Classification System (From AGI 1982)

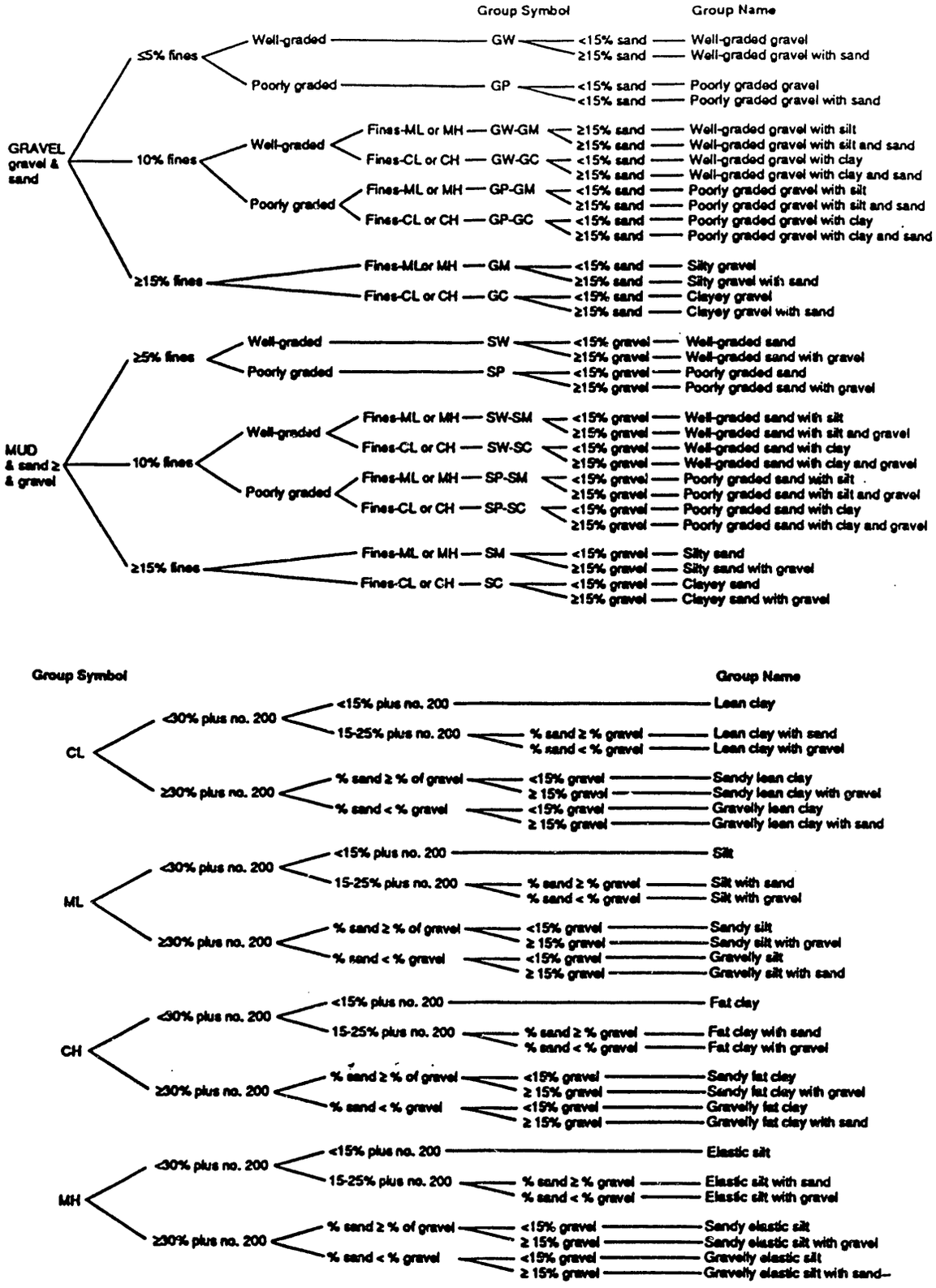

FIGURE B.7. Detailed Flow Chart For the Classification of Coarse- and Fine-Grained Soils Using the Unified Soil Classification System

Grade Limits			inches	U.S. Standard Sieve Series	Grade Name		
phi	mm	mm					
-12	4096		161.3		very large	Boulders	GRAVEL
-11	2048		80.6		large		
-10	1024		40.3		medium		
-9	512		20.2		small		
-8	256		10.1		large	Cobbles	
-7	128		5.0		small		
-6	64		2.52	63 mm	very coarse	Pebbles	
-5	32		1.26	31.5 mm	coarse		
-4	16		0.63	16 mm	medium		
-3	8		0.32	8 mm	fine		
-2	4		0.16	No. 5	very fine		
-1	2		0.08	No. 10	very coarse	Sand	SAND
0	1		0.04	No. 18	coarse		
+1	1/2	0.500		No. 35	medium		
+2	1/4	0.250		No. 60	fine		
+3	1/8	0.125		No. 120	very fine		
+4	1/16	0.062		No. 230	coarse	Silt	MUD
+5	1/32	0.031			medium		
+6	1/64	0.016			fine		
+7	1/128	0.008			very fine		
+8	1/256	0.004			coarse	Clay Size	
+9	1/512	0.002			medium		
+10	1/1024	0.001			fine		
+11	1/2048	0.0005			very fine		
+12	1/4096	0.00025					

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FIGURE B.8. Grain-size Scale Used to Determine Sedimentary Particle Size

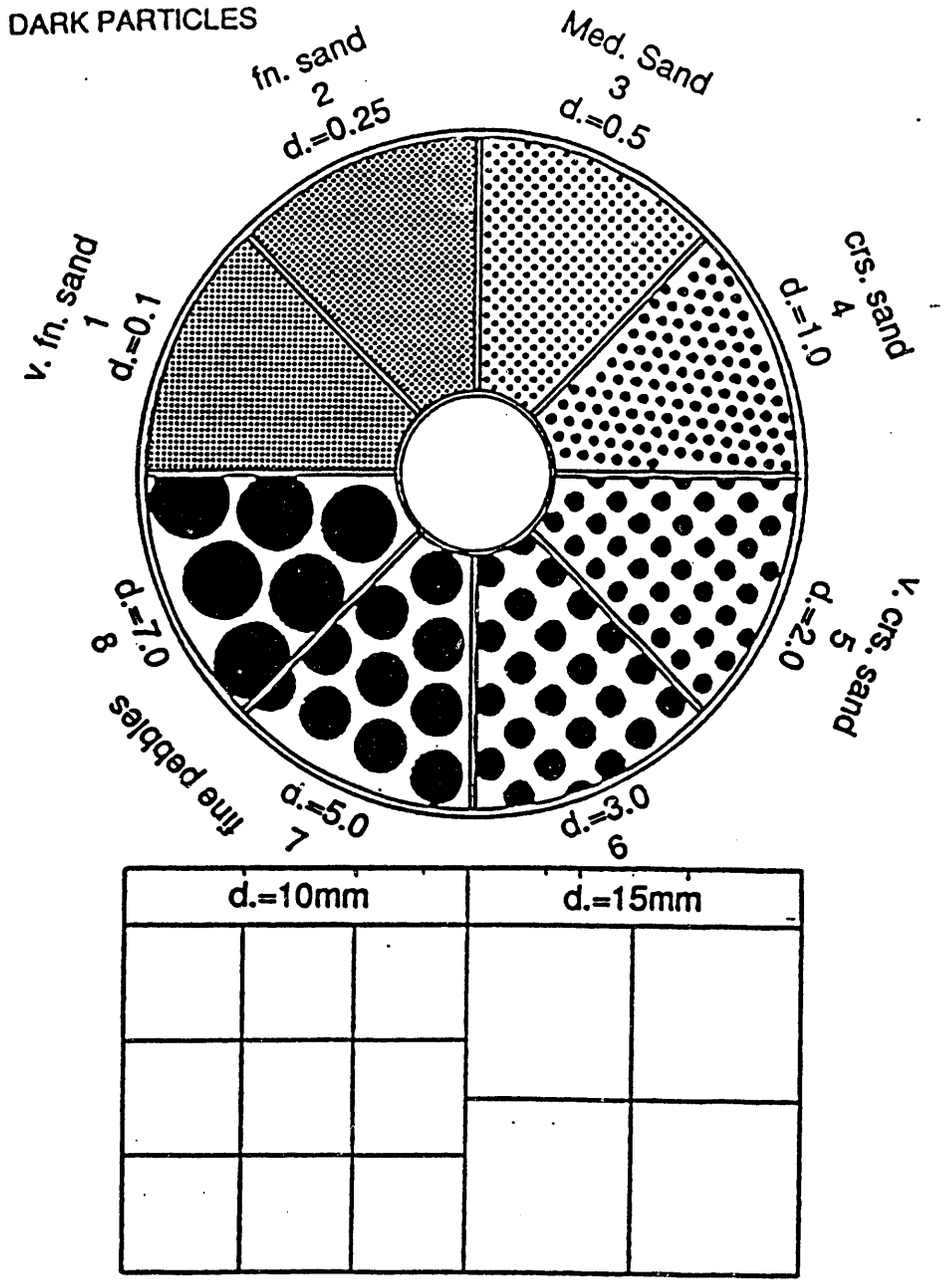


FIGURE B.9. Comparison Chart Used to Distinguish Among Sand to Pebble-size Particles (From AGI 1982). For larger particles, refer to Figure B.8; for smaller particles, refer to Sections B.2.13 and B.2.16 in this Appendix

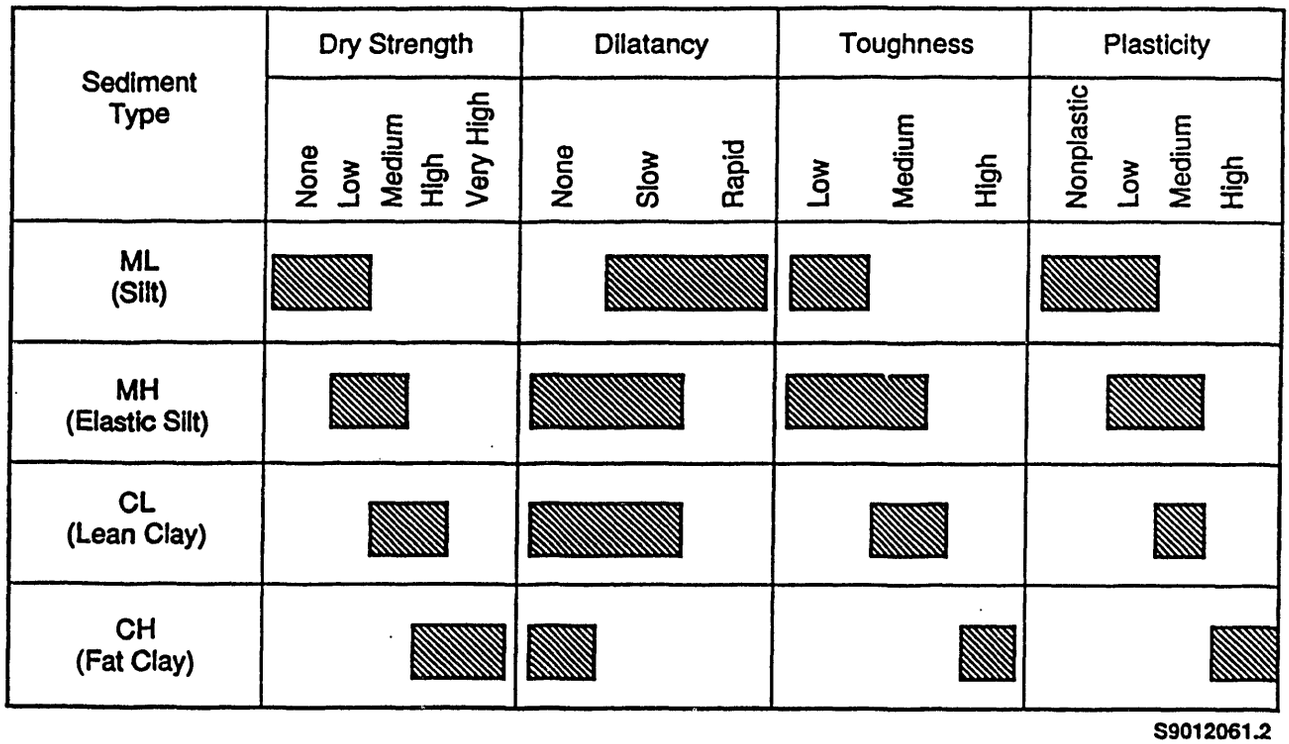


FIGURE B.10. Identification of Inorganic Fine-grained Soils From Manual Tests

In the Unified Soil Classification System, the first letter of the sediment-type symbol represents the predominant grain-size interval, be it gravel (G), sand (S), silt (M), or clay (C). For coarse-grained sediments, the first letter (i.e., G or S) may be followed by a descriptor of grading, either W (well graded) or P (poorly graded), or a secondary grain-size descriptor (M or C). The definition of grading is opposite that of sorting, a common geologic term. For example, a clean, well sorted sand, consisting of particles over a narrow range in grain size, is referred to as poorly graded in the Unified Soil Classification System and would receive the designation "SP". The relationship between grading and sorting is shown graphically in Figure B.3B. The second letter in the fine-grained soil designation consists of either L (low liquid limit) or H (high liquid limit).

The lithology column on the geologic log (Figure B.1) essentially represents a graphic display of sediment type, which can be utilized for quick easy reference and comparison between different cores and thus make interpretations easier. Examples of lithologic symbols in common use are presented in Figure B.11. Additional symbols may be used as long as they are graphically representative of the feature and are specifically defined and identified in a key that accompanies lithologic logs.

B.2.11 Range of Particle Sizes

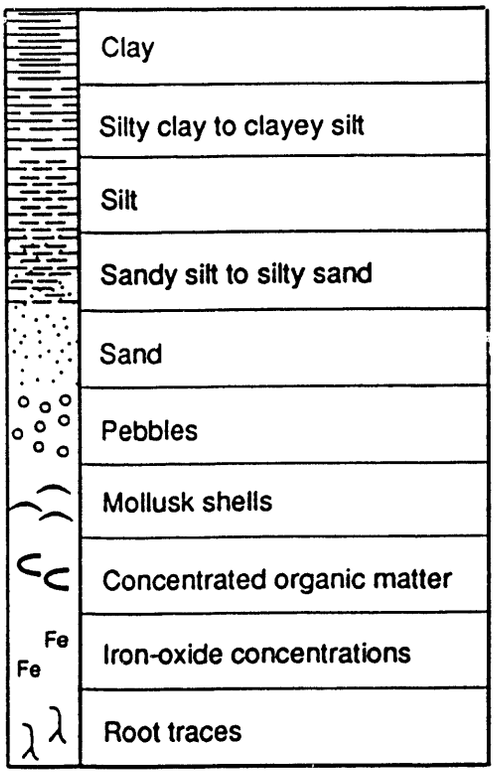
For gravel- and sand-sized particles, the range of particle sizes within each component is defined. For example, 20% fine to coarse gravel, 40% fine to coarse sand. The sizes of particles corresponding to the different size components are presented in Figures B.8 and B.9.

B.2.12 Maximum Particle Size

Maximum particle size is significant because it gives a general indication of the amount of turbulence or energy associated with deposition. If the maximum particle size is sand, it should be described as either fine, medium, or coarse sand. If the maximum particle size is in the gravel range, the largest particle is measured and its width recorded along the narrowest axis. The sizes of particles corresponding to the different size components are presented in Figures B.8 and B.9.

The maximum grain size observed for the Younger Bay Muds ranged from

Lithology:



Silt/Clay Characteristics

Dilatancy:

N = none
S = slow
R = rapid

Toughness:

L = low
M = medium
H = high

Plasticity:

N = none
L = low
M = medium
H = High

Type:

See soil group classification in ASTM D2488-84

Color (wet):

Selected from Munsell Soil Color Chart

Consistency:

H = hard = <0.25 cm
F = firm = 0.25-2.0 cm
S = soft = 2.0-4.0 cm
VS = very soft = >4.0 cm

Cementation:

N = not cemented
W = weakly cemented
M = moderately cemented
S = strongly cemented

Structure:

S = stratified
L = laminated
F = fissured
SL = slickensided
Ln = lensed
Bl = blocky
M = mottled
H = homogeneous

HCl Reaction:

N = none
W = weak
S = strong

Maximum Particle Size:

CP= coarse pebble
CS = coarse sand
MS = medium sand
FS = fine sand
VFS = very fine sand

Odor:

N = none
S = sulfide
P = petroleum
O = other
w/HCl = odor apparent after HCl application

Comments:

YBM = Younger Bay Mud unit
OBM = Older Bay Mud unit

FIGURE B.11. Lithologic Symbols Used on Core Log Forms

silt to medium sand, while the Older Bay Mud usually ranged from fine sand to coarse sand. The largest particles observed anywhere were fine pebbles in the Older Bay Mud unit.

B.2.13 Dry Strength

Dry strength, along with dilatancy, toughness, and plasticity are physical characteristics used to distinguish fine-grained inorganic soils, consisting of mostly silt and/or clay. Basically, the more clay present in a soil the greater its dry strength (Figure B.10). To perform a manual test of dry strength enough material must be selected in order to mold into a ball about 1 in. in diameter. Mold the material until it has the consistency of putty, adding water if necessary. From the molded material, make at least three test specimens each about 1/2 in. in diameter. Allow the test specimens to dry in air, sun or by artificial means, as long as the temperature does not exceed 60°C (ASTM, 1984). The criteria for determining dry strength are as follows:

NONE	The dry specimen crumbles into powder with mere pressure of handling
LOW	The dry specimen crumbles into powder with light finger pressure
MEDIUM	The dry specimen breaks into pieces or crumbles with considerable finger pressure
HIGH	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface
VERY HIGH	The dry specimen cannot be broken between the thumb and a hard surface

If dry strength was determined for cores during this project, it was noted in the comments column of the geologic log.

B.2.14 Dilatancy

Dilatancy is a measure of how easily a soil gives up water when shaken. For example, some clays have the ability to absorb and retain large amounts of water into their crystal lattice. "Fat" clays tend to retain their water even under stress whereas "lean" clays and silt tend to release water when shaken.

To test for dilatancy select enough material to mold into a ball about 1/2 in. in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky consistency. Smooth the soil ball in the palm of the hand with a blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction. Specimens with high dilatancy will quickly yield water when shaken and absorb water when squeezed. The criteria for describing dilatancy are:

NONE	No visible change in the specimen
SLOW	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
RAPID	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing

The range of dilatancy for the different fine-grained sediment types is shown in Figure B.10. From this figure it is apparent that dilatancy decreases with decreasing grain size.

B.2.15 Toughness

After completion of the dilatancy test, shape the same specimen into an elongated pat and roll by hand on a smooth surface or between the palms into a thread about 1/8 in. (3 mm) in diameter. (If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation.) Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about 1/8 in. The thread will crumble at a diameter of 1/8 in. when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles. Note the toughness of the material during kneading and classify into one of the following categories.

LOW	Only slight pressure is required to roll the thread near the plastic limit. The thread and lump are weak and soft

MEDIUM Medium pressure is required to roll the thread to near the plastic limit. The thread and lump have medium stiffness.

HIGH Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

The range of toughness for the different fine-grained sediment types is shown in Figure B.10. From this figure it is apparent that toughness increases with a decrease in particle size.

B.2.16 Plasticity

On the basis of observations made during the toughness test, describe the plasticity of the material according to the following criteria:

NONPLASTIC A 1/8 in. thread cannot be rolled at any water content

LOW The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.

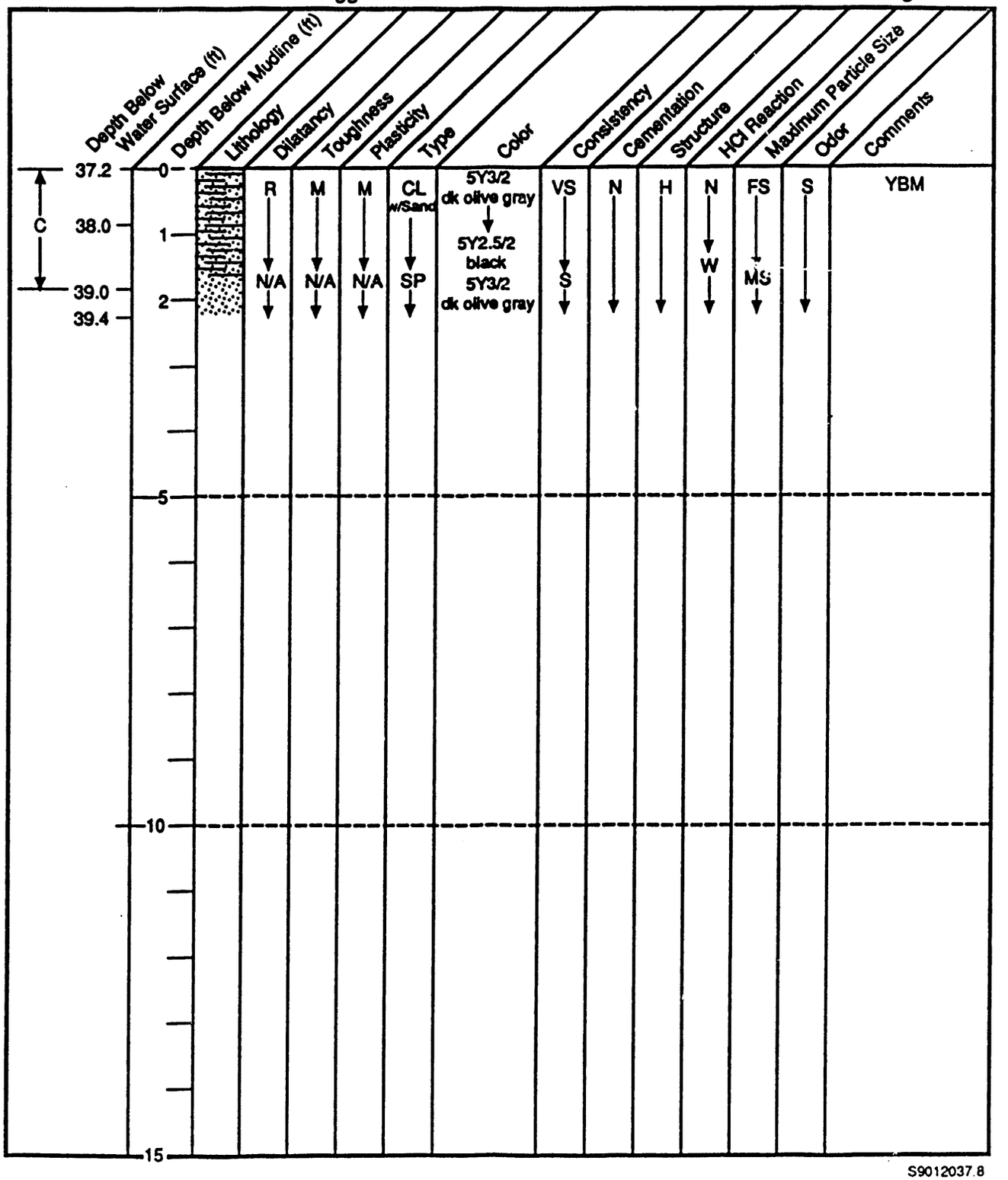
MEDIUM The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.

HIGH It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

The range of plasticity for the different fine-grained sediment types is shown in Figure B.10. From this figure it is apparent that an increase in plasticity accompanies a decrease in grain size.

Core Data Log

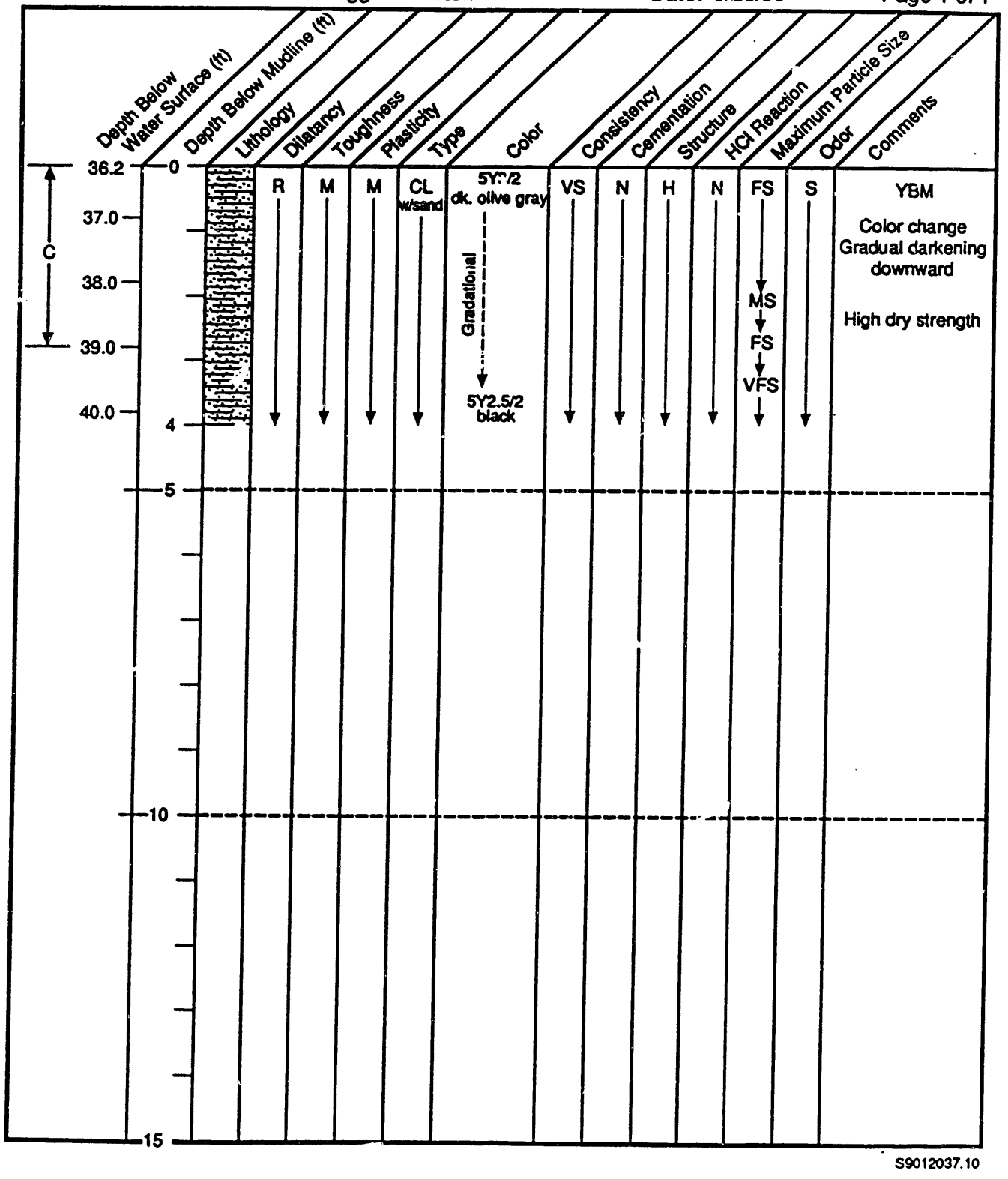
Core #: I-C-3 *Logger:* Barton *Date:* 9/28/90 *Page* 1 *of* 1



S9012037.8

Core Data Log

Core #: I-C-5 *Logger:* Barton *Date:* 9/28/90 *Page* 1 *of* 1



S9012037.10

Core Data Log

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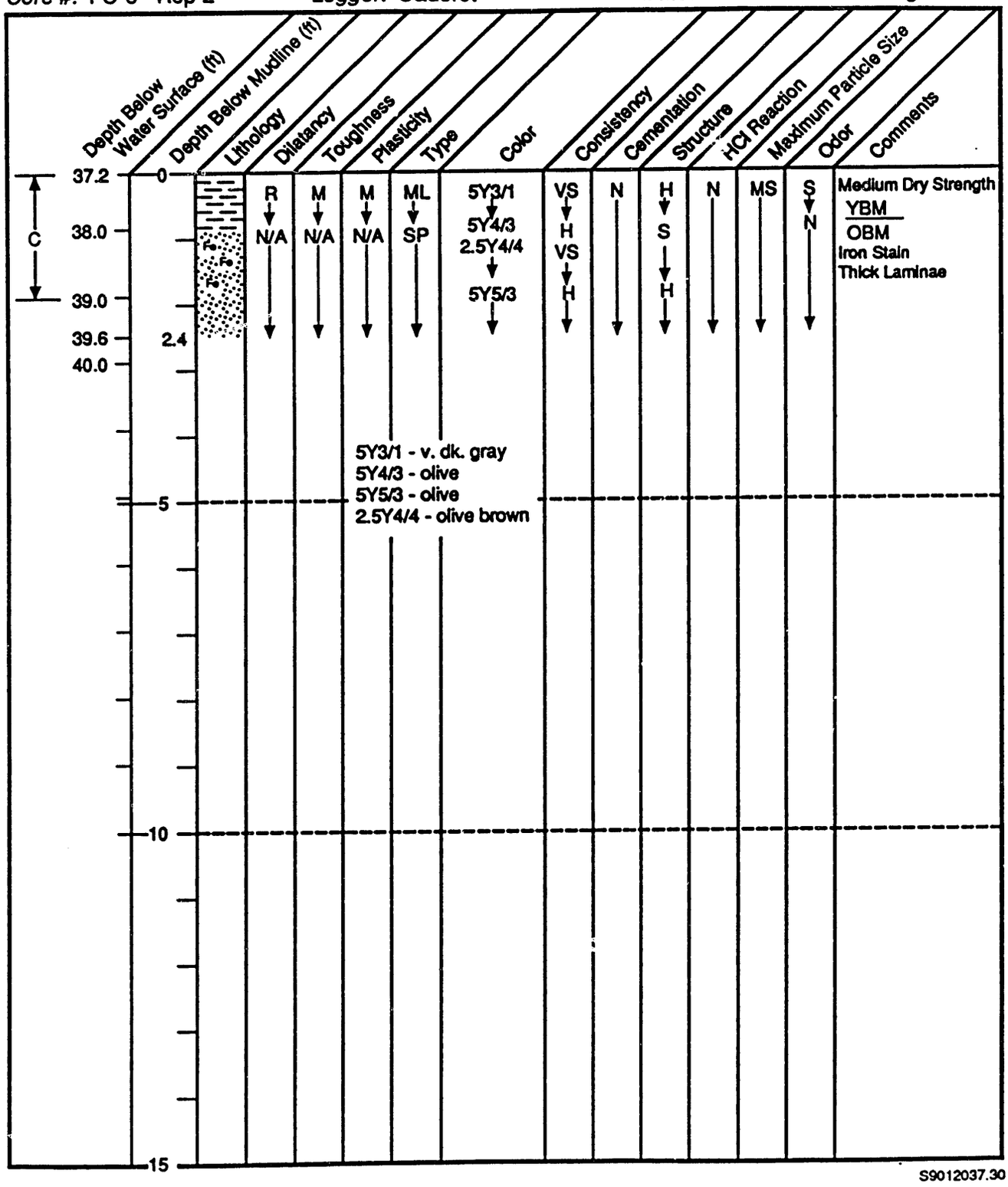
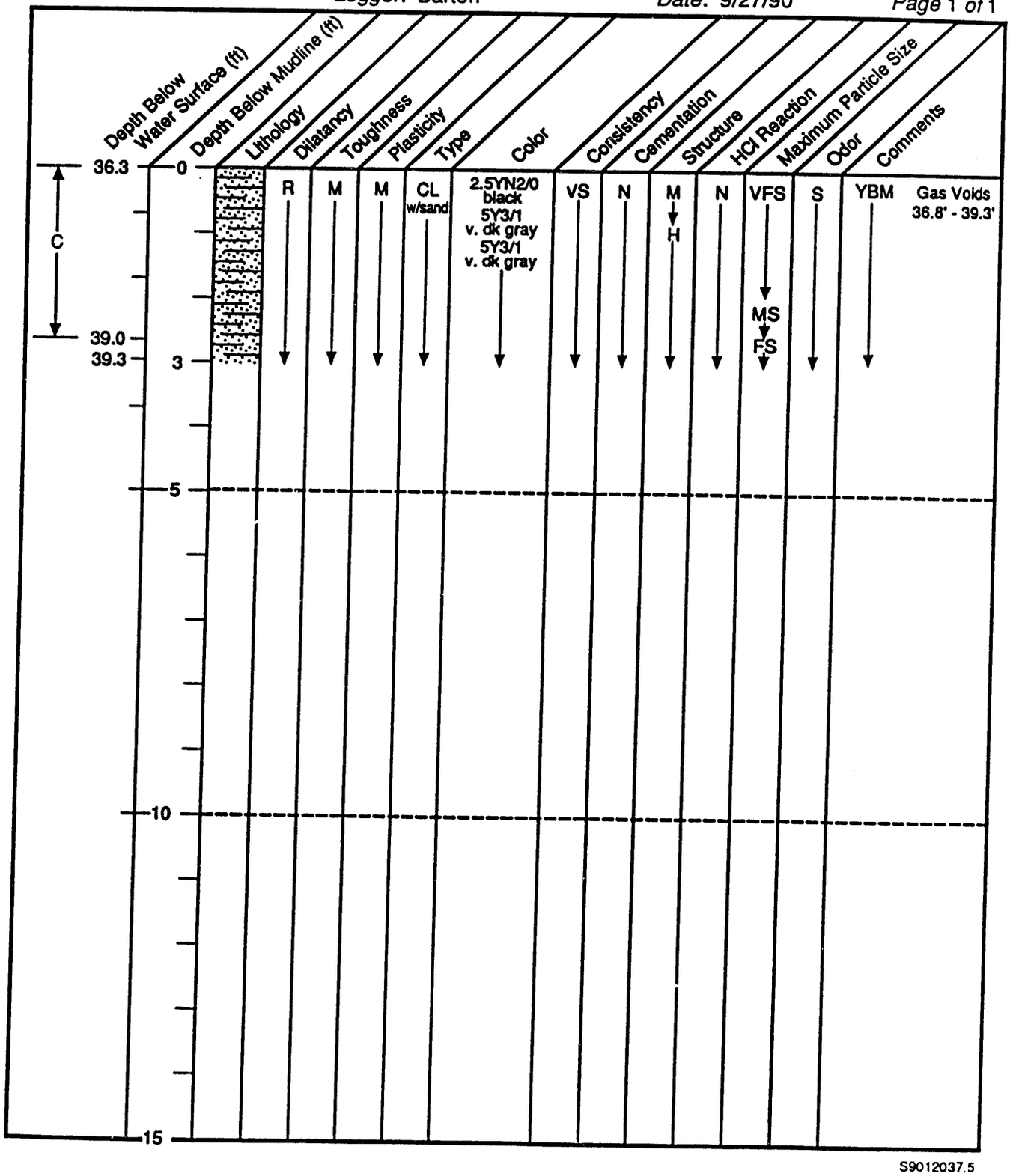


PHASE III 38'

Core Data Log

Core #: I-C-9 *Logger:* Barton *Date:* 9/27/90 *Page* 1 *of* 1



S9012037.5

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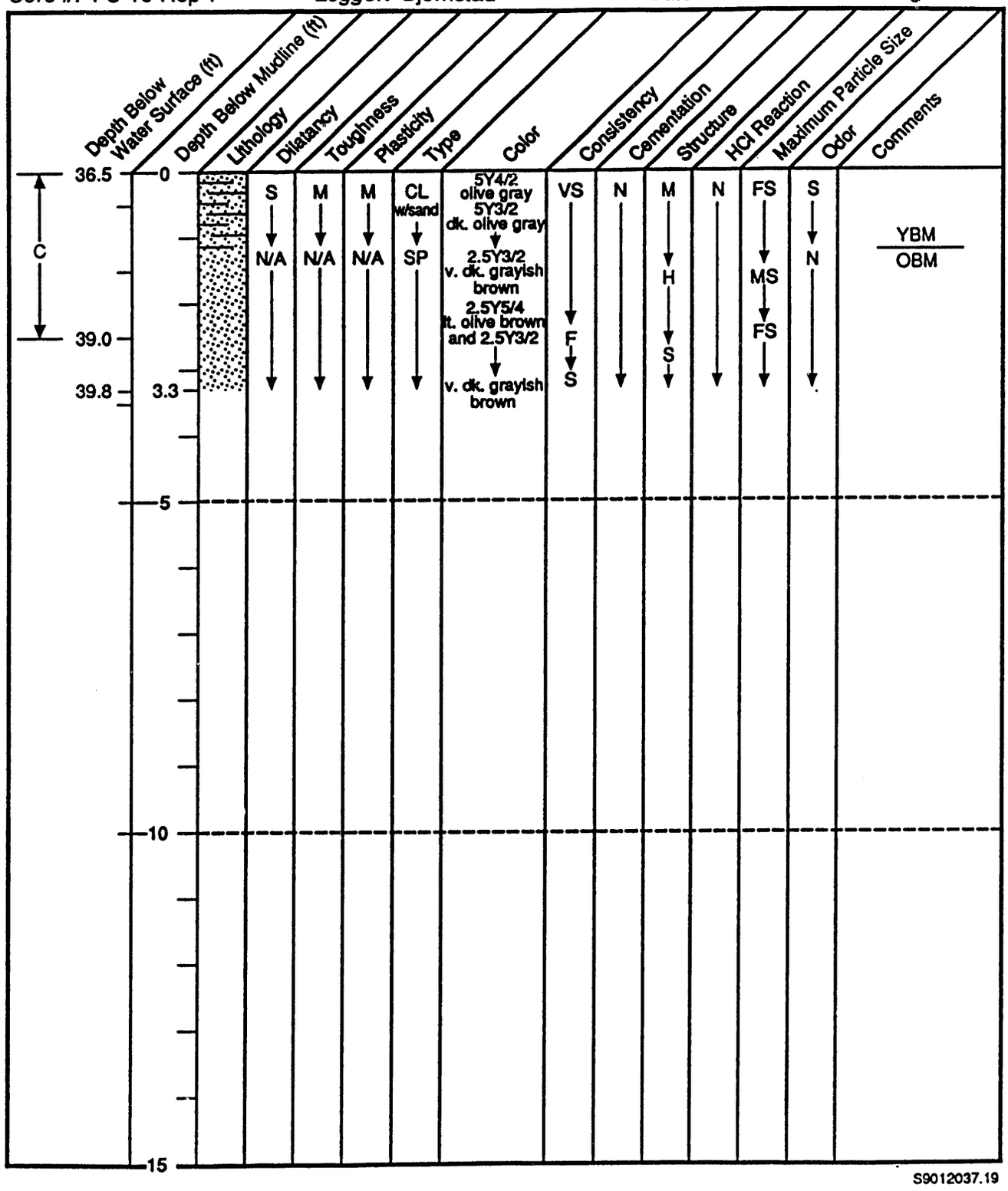

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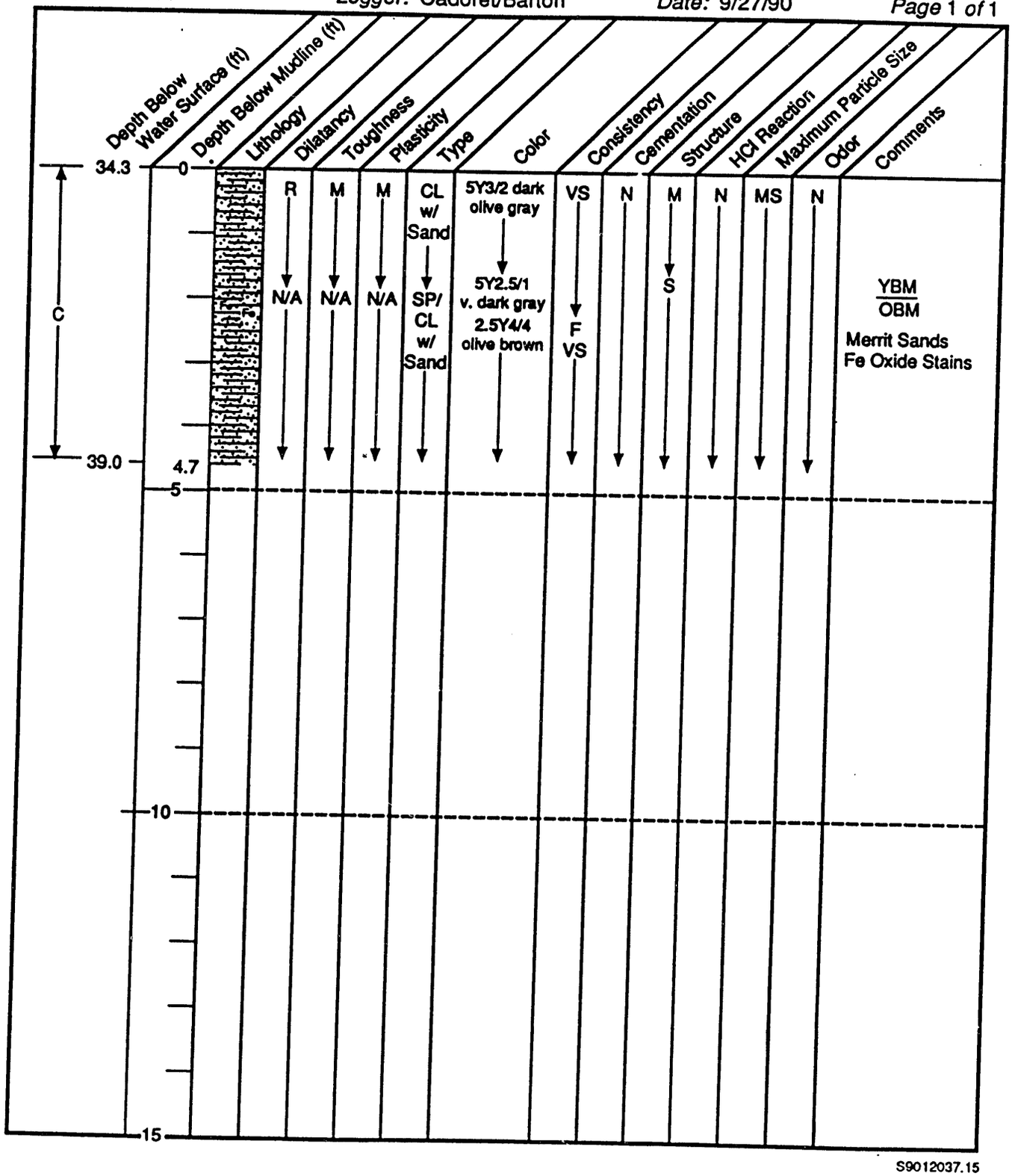

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PHASE III 38'

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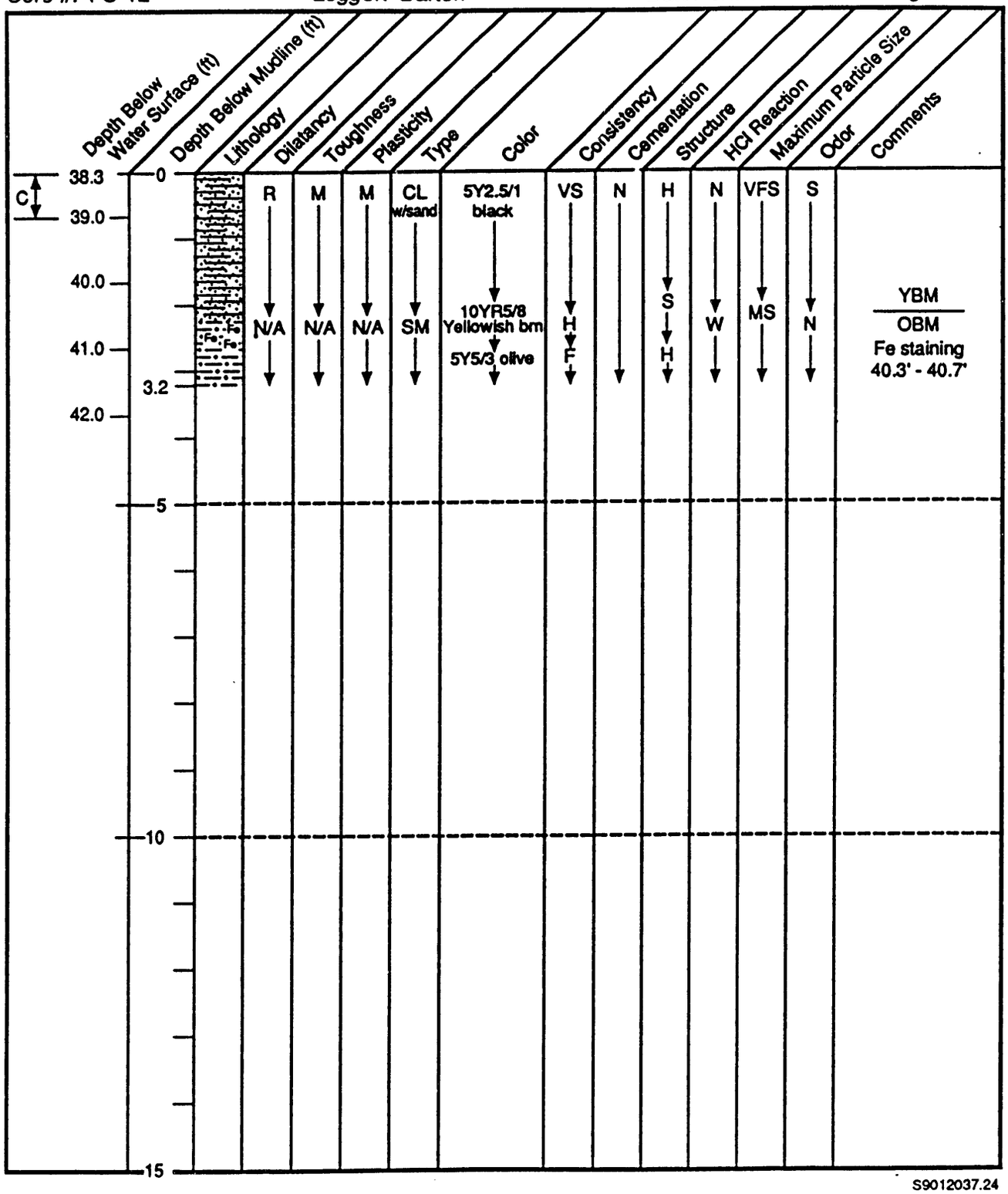

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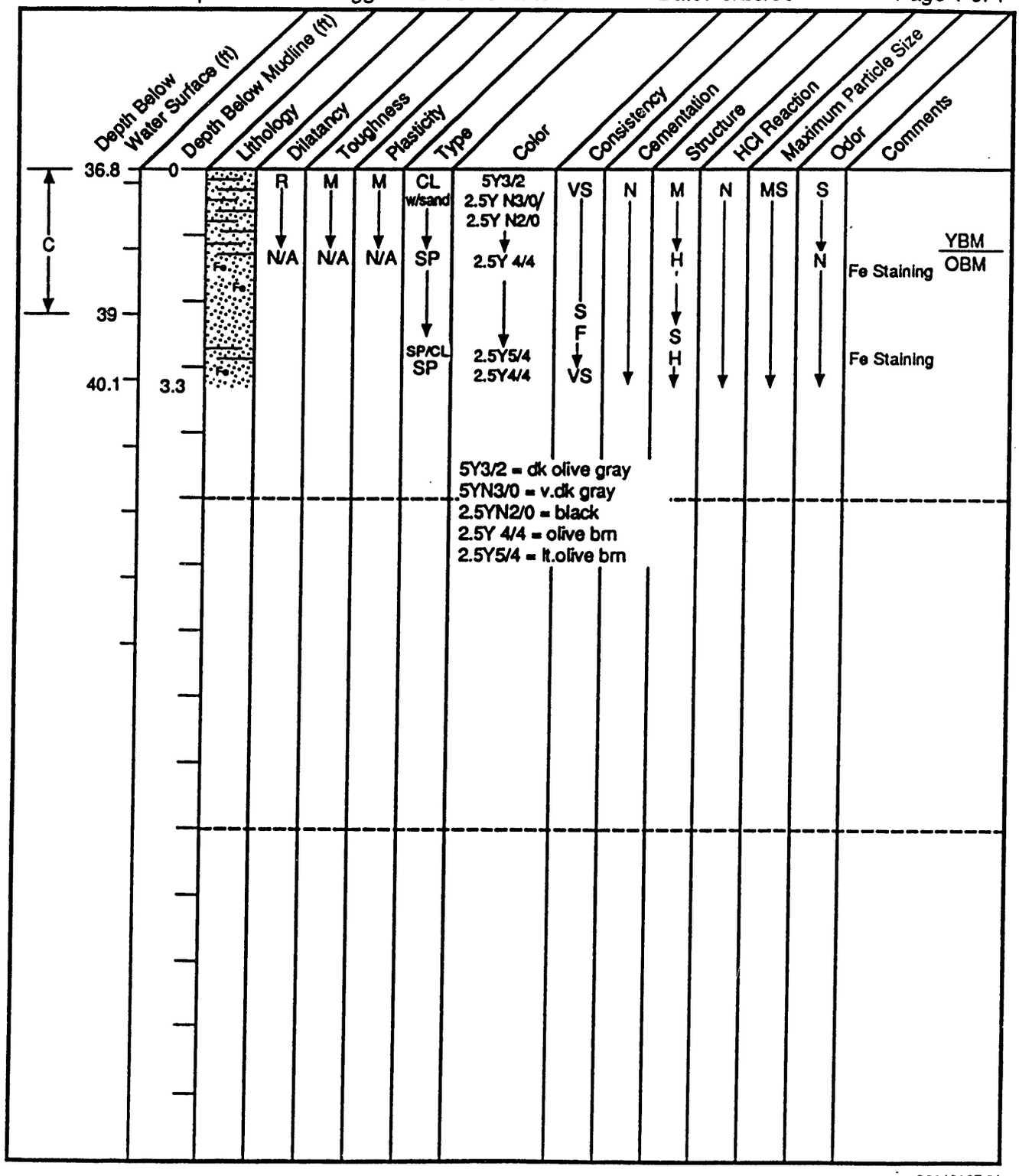

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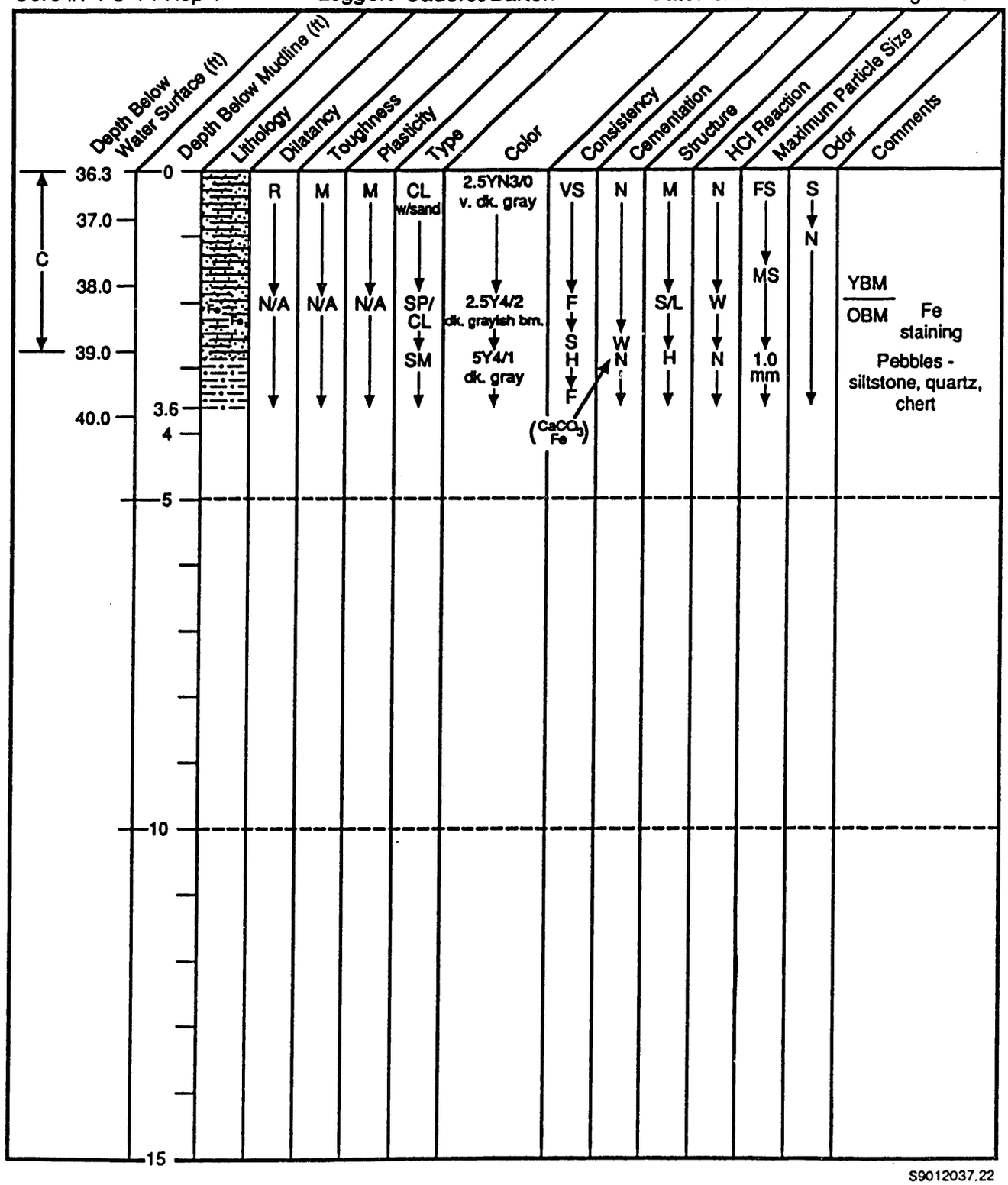

S9012037.22

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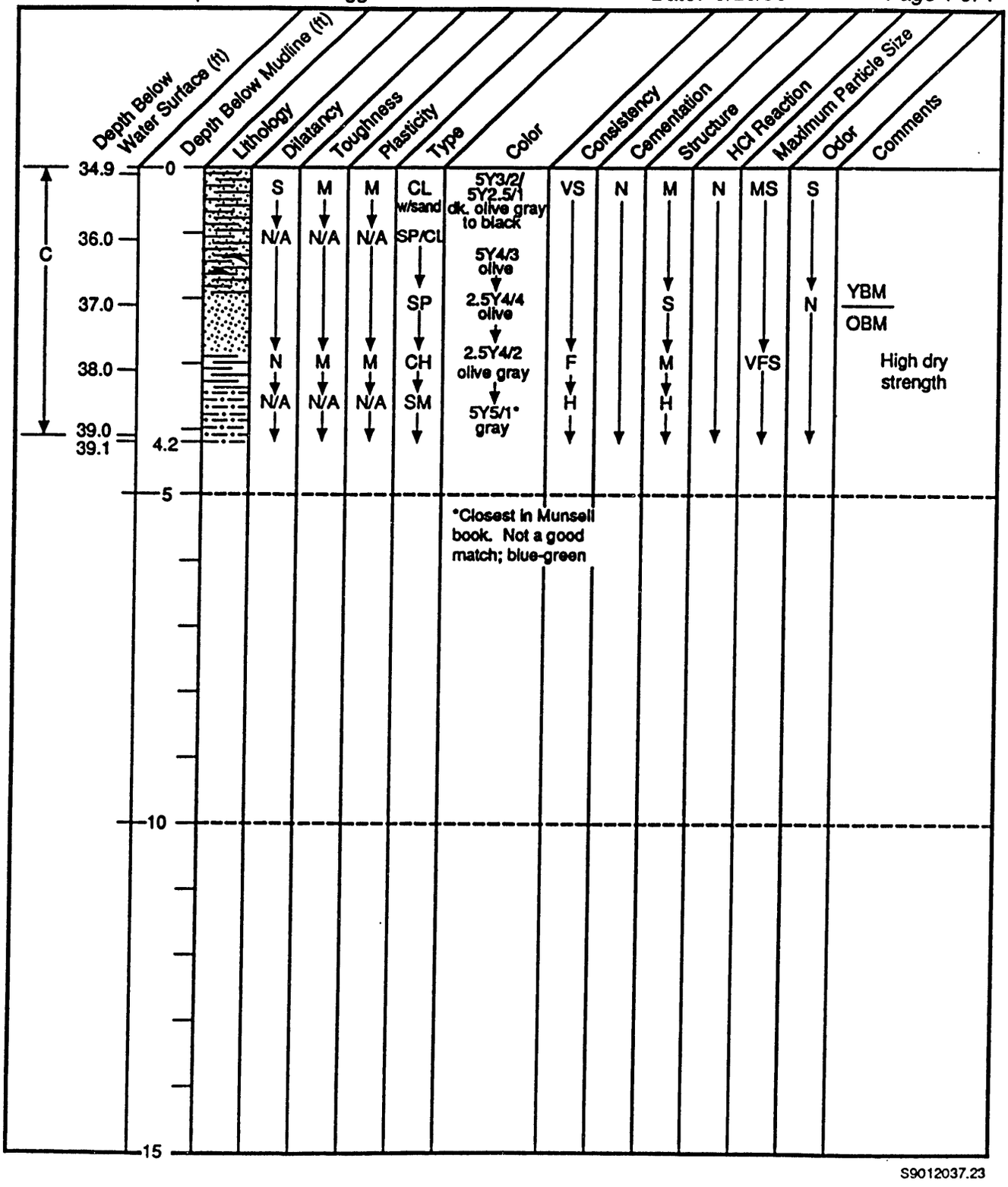

S9012037.23

PHASE III 38'

Core Data Log

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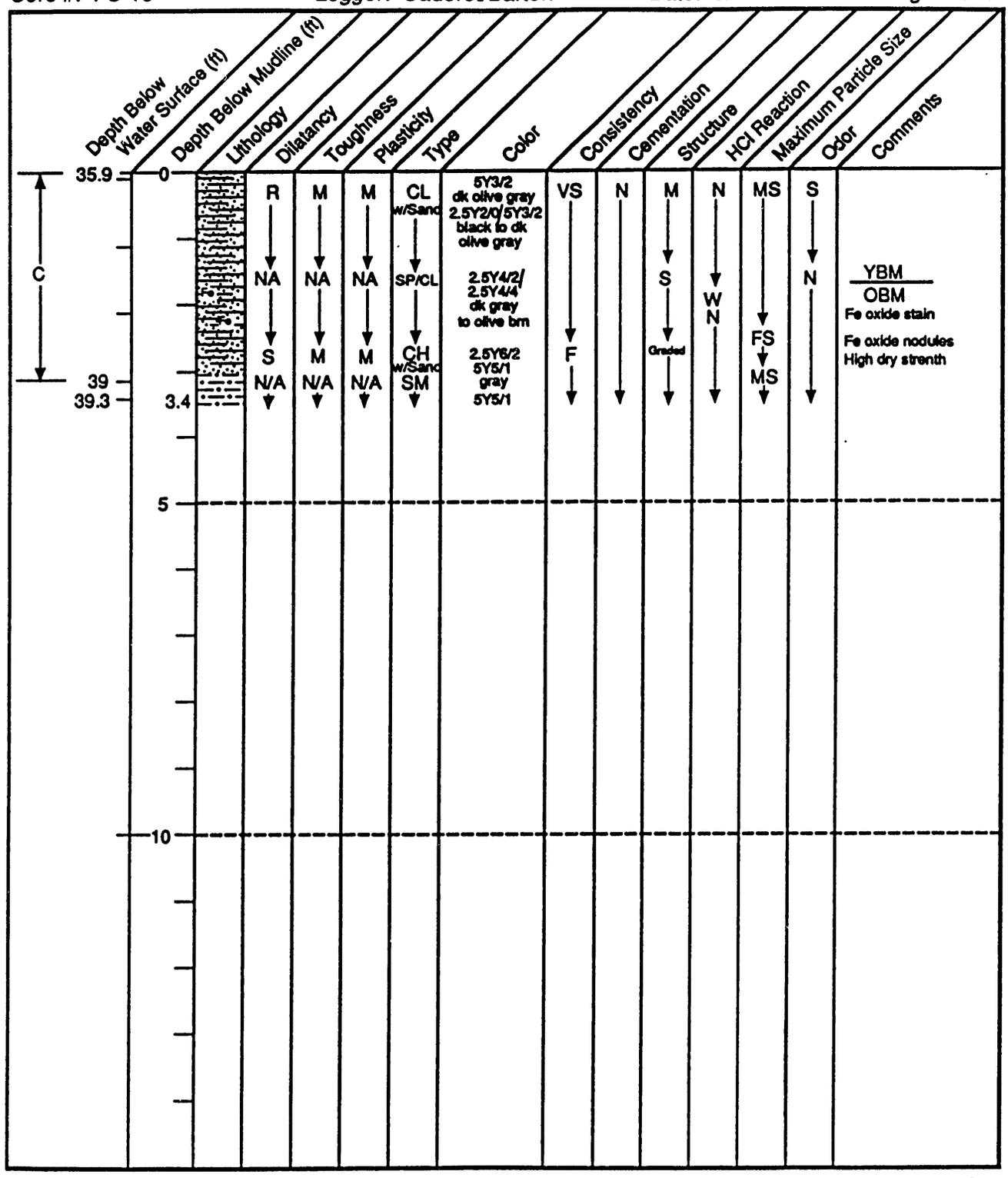

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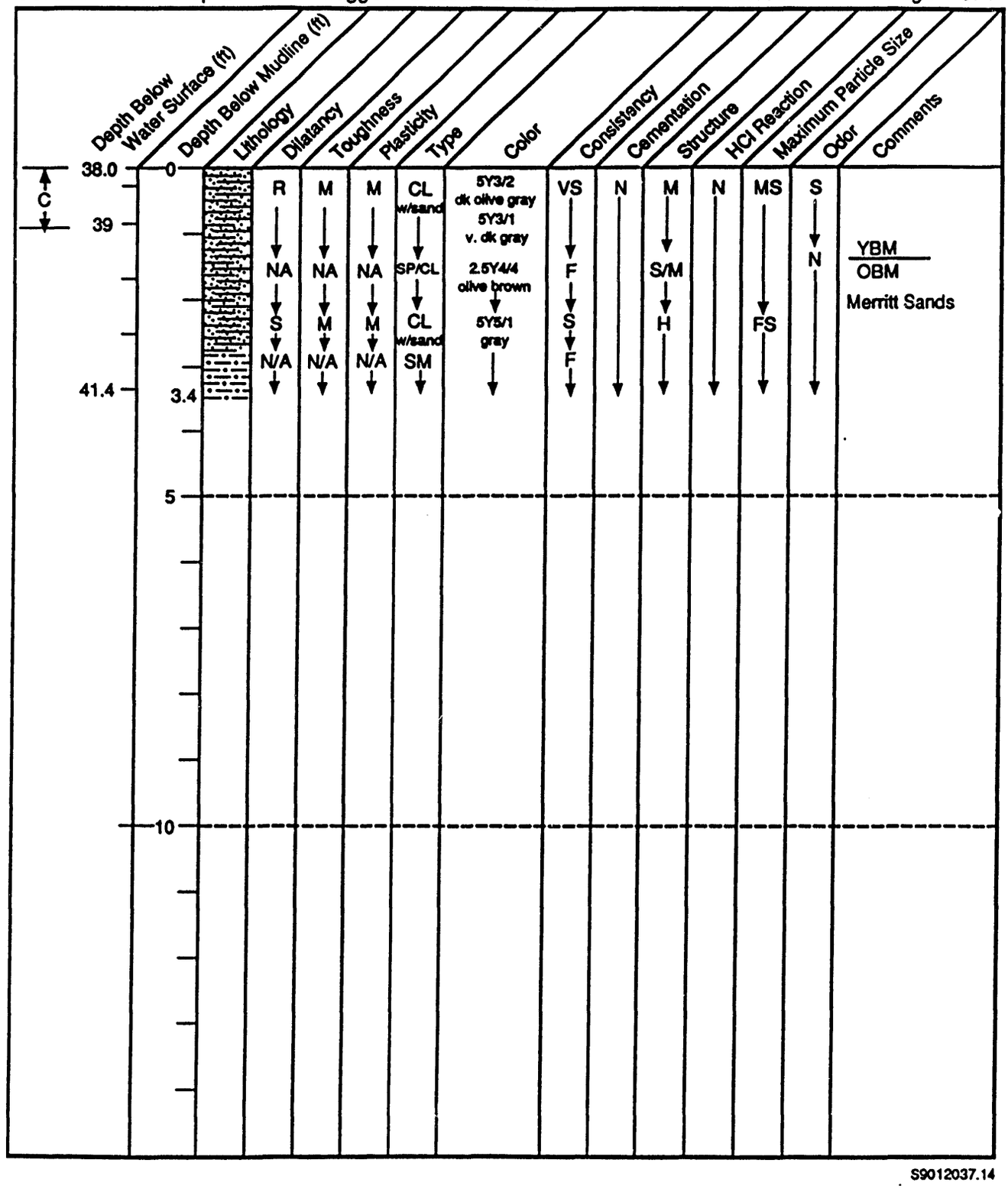

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Core Data Log

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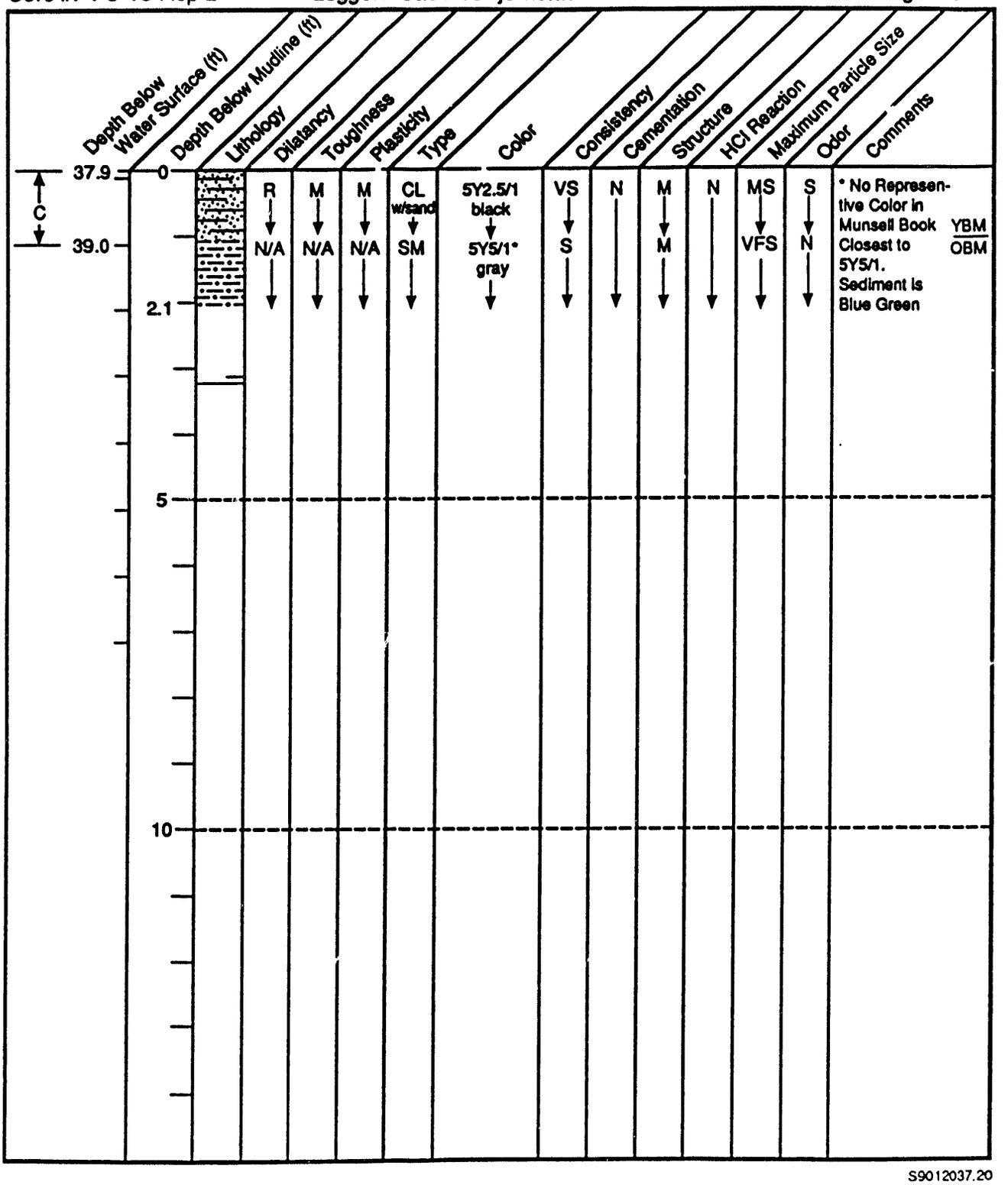

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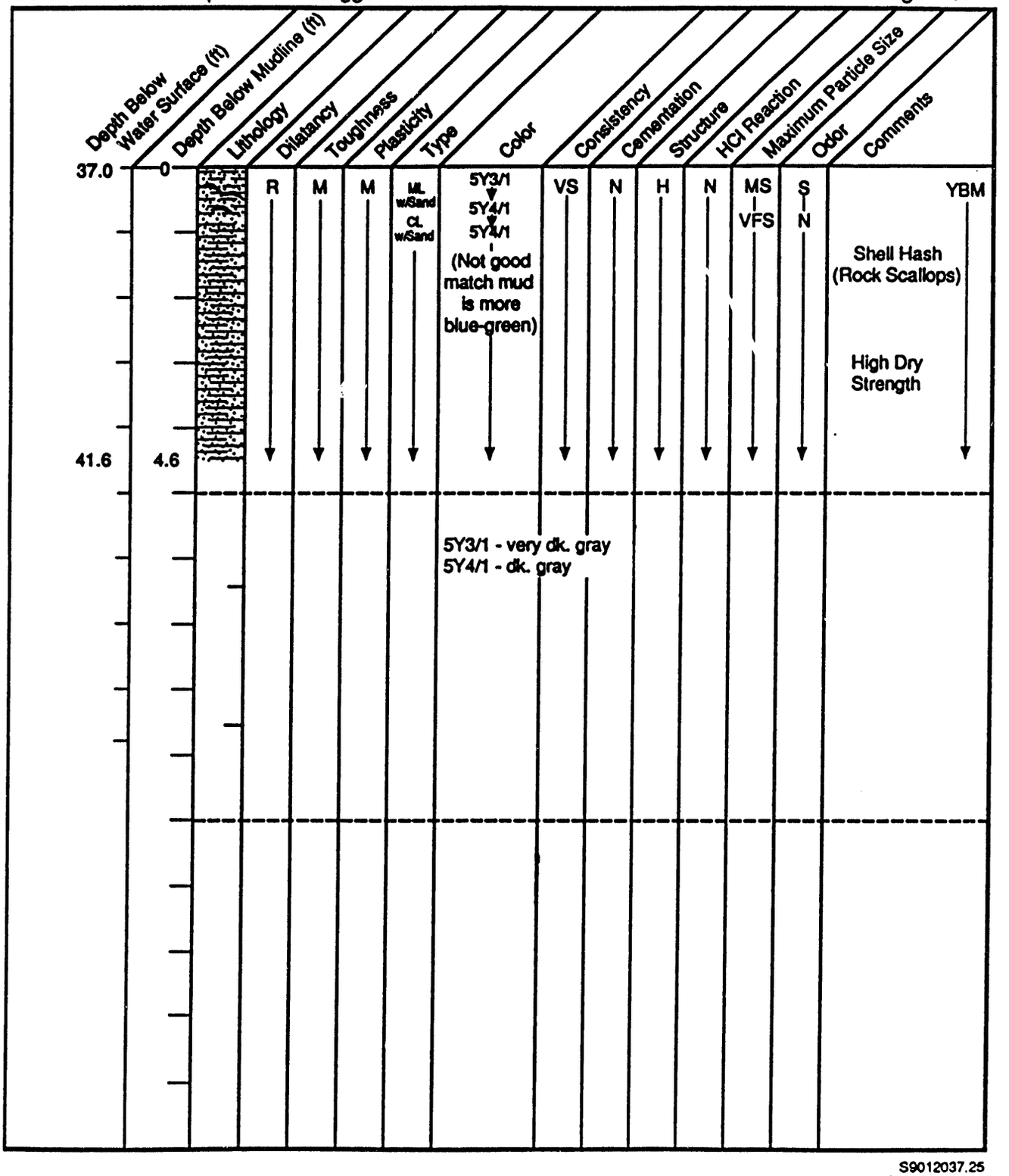

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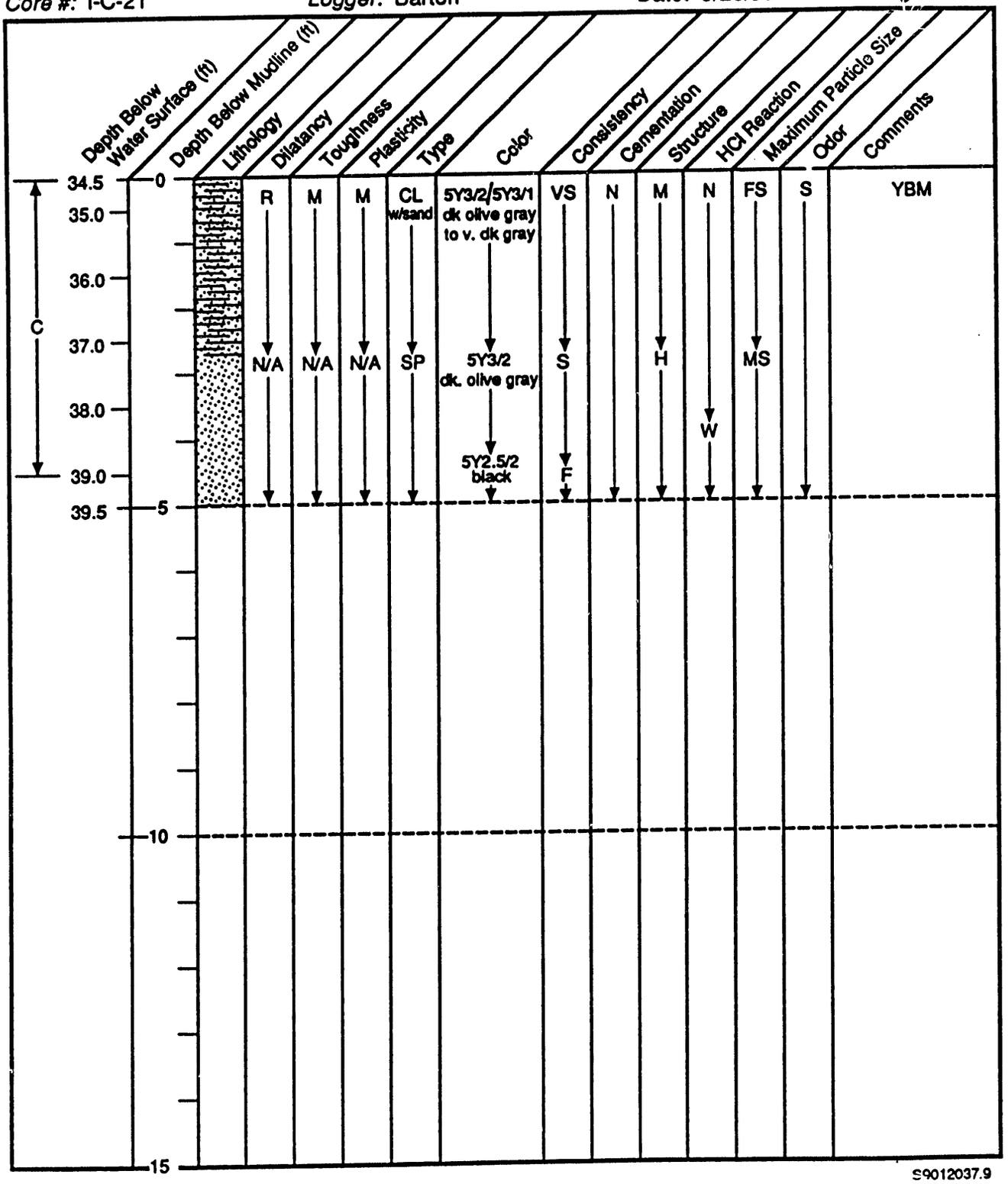

PHASE III 38'

Core Data Log

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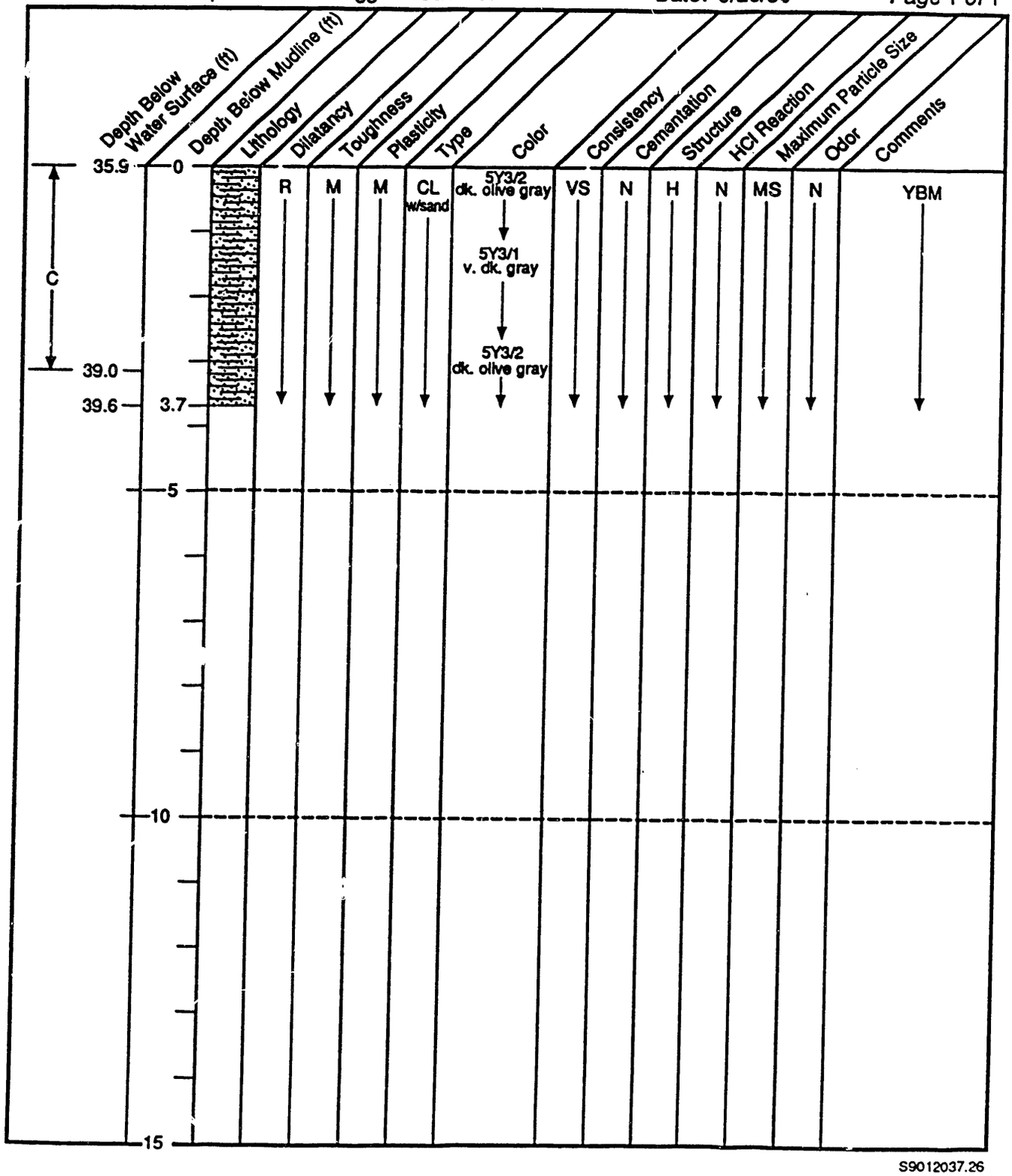

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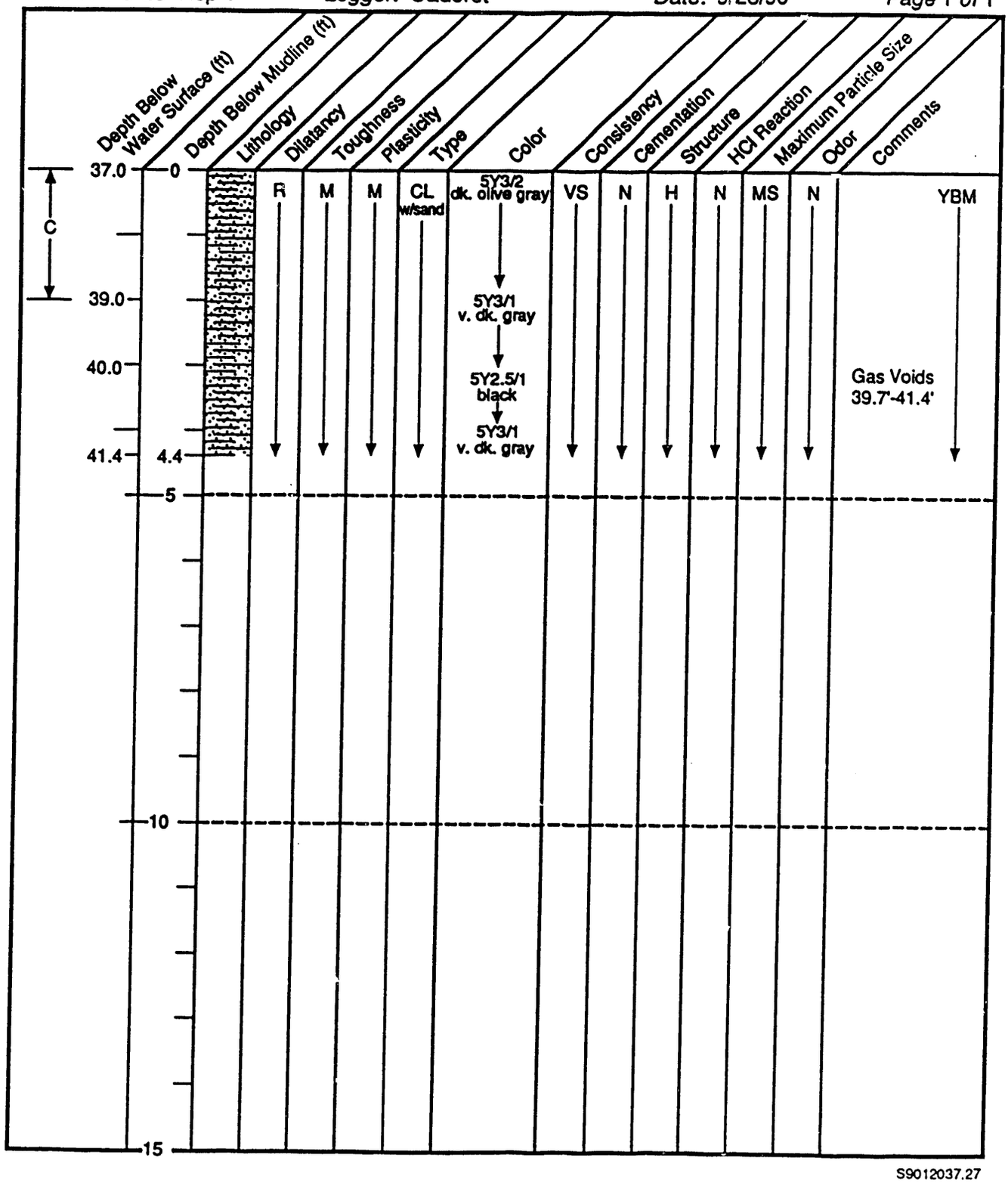

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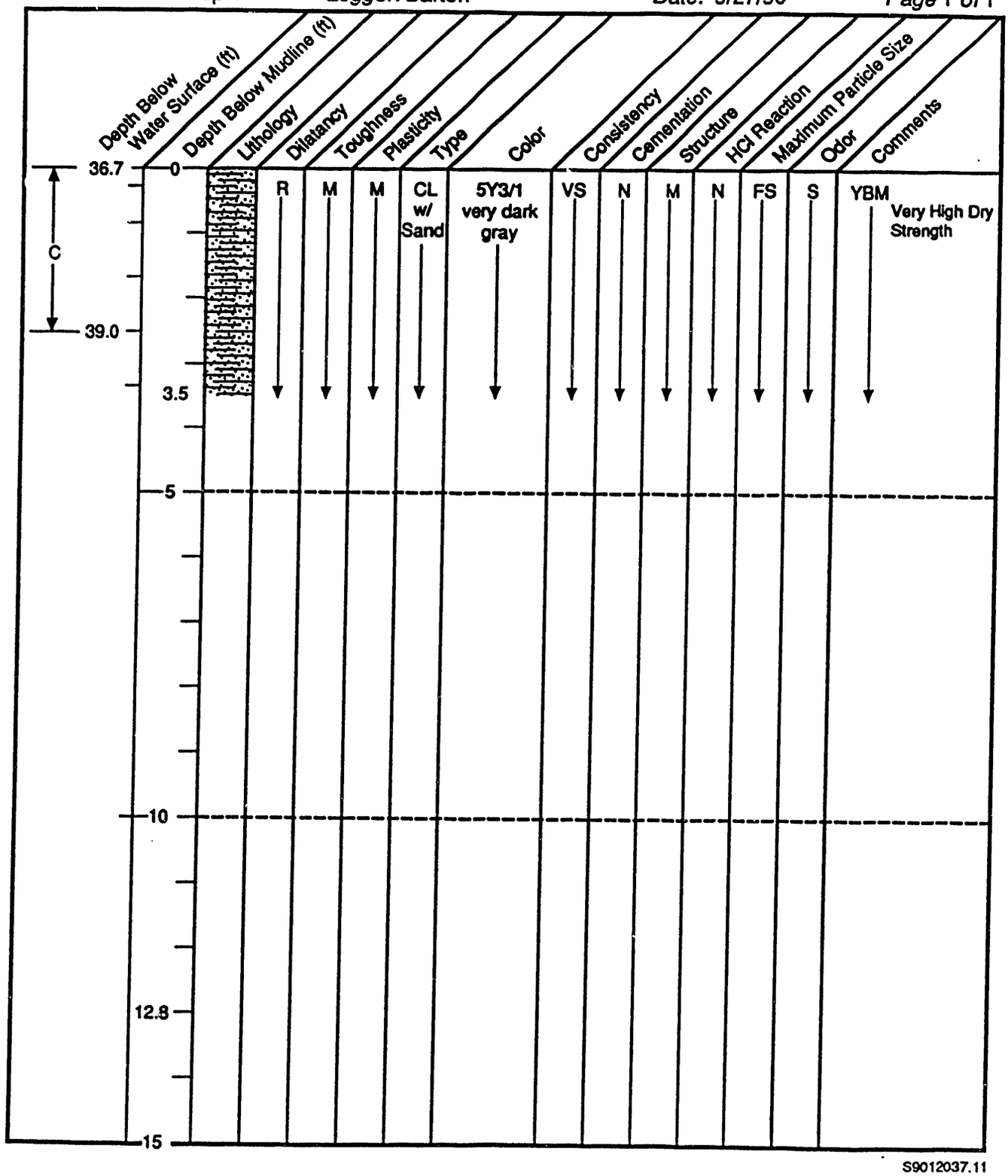

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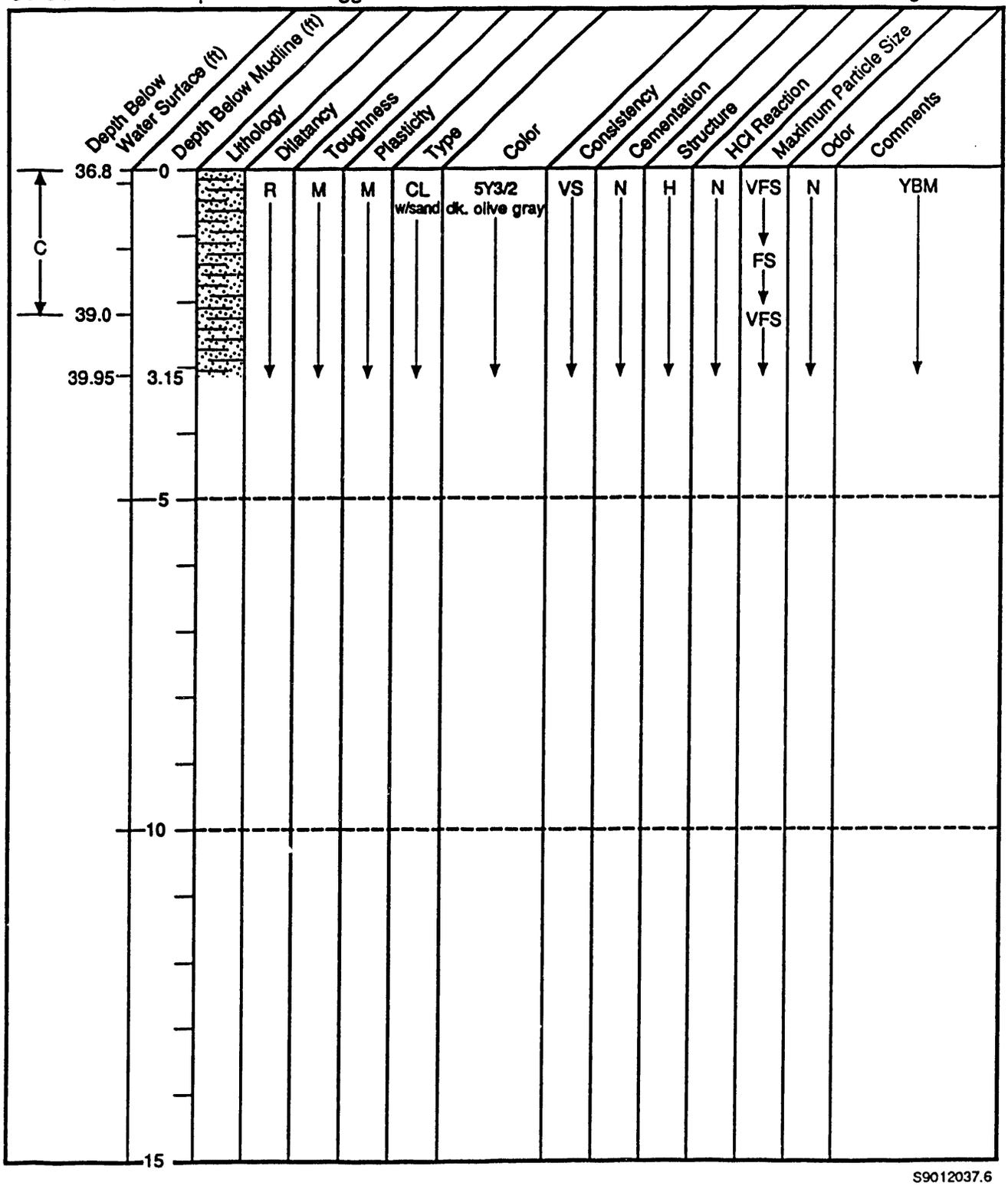

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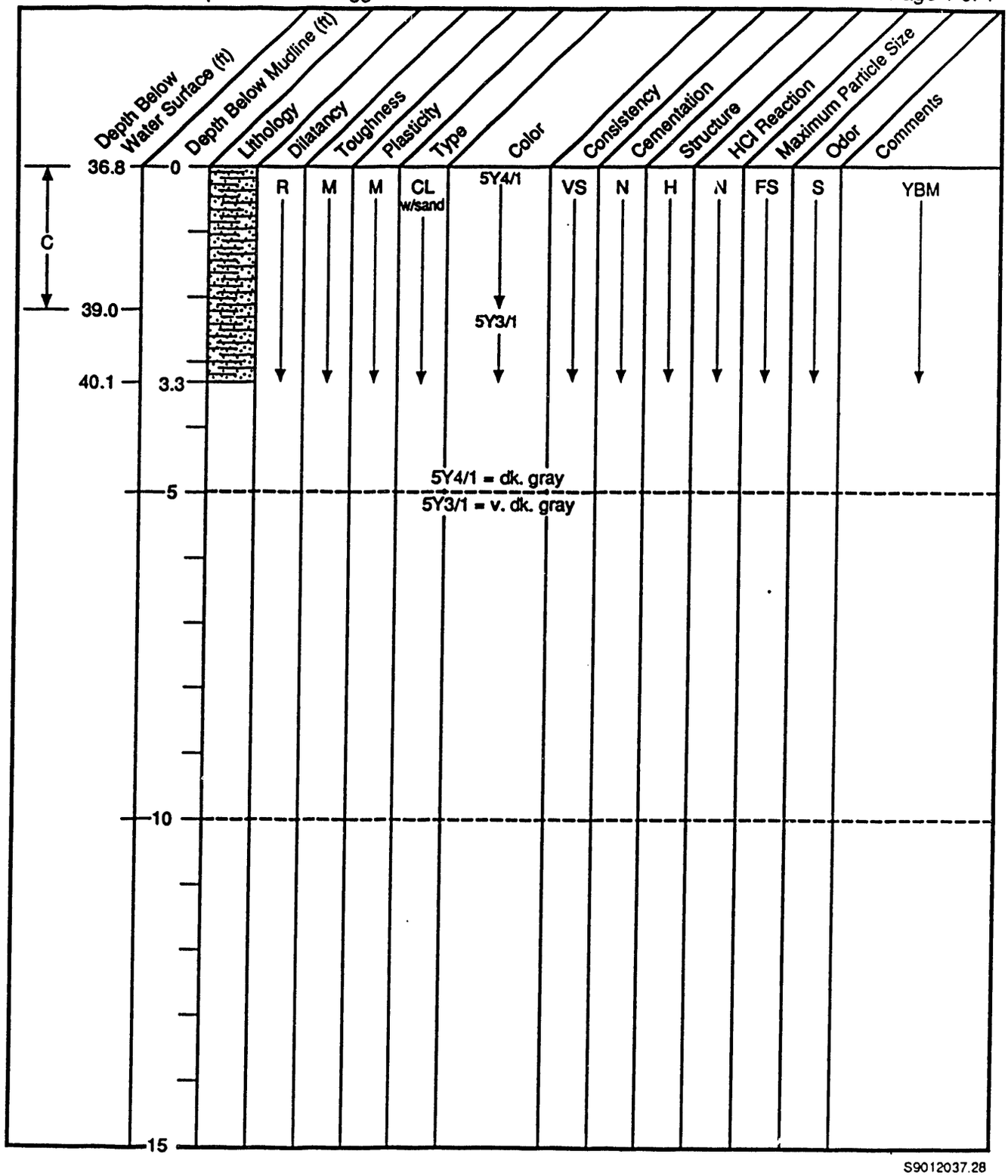

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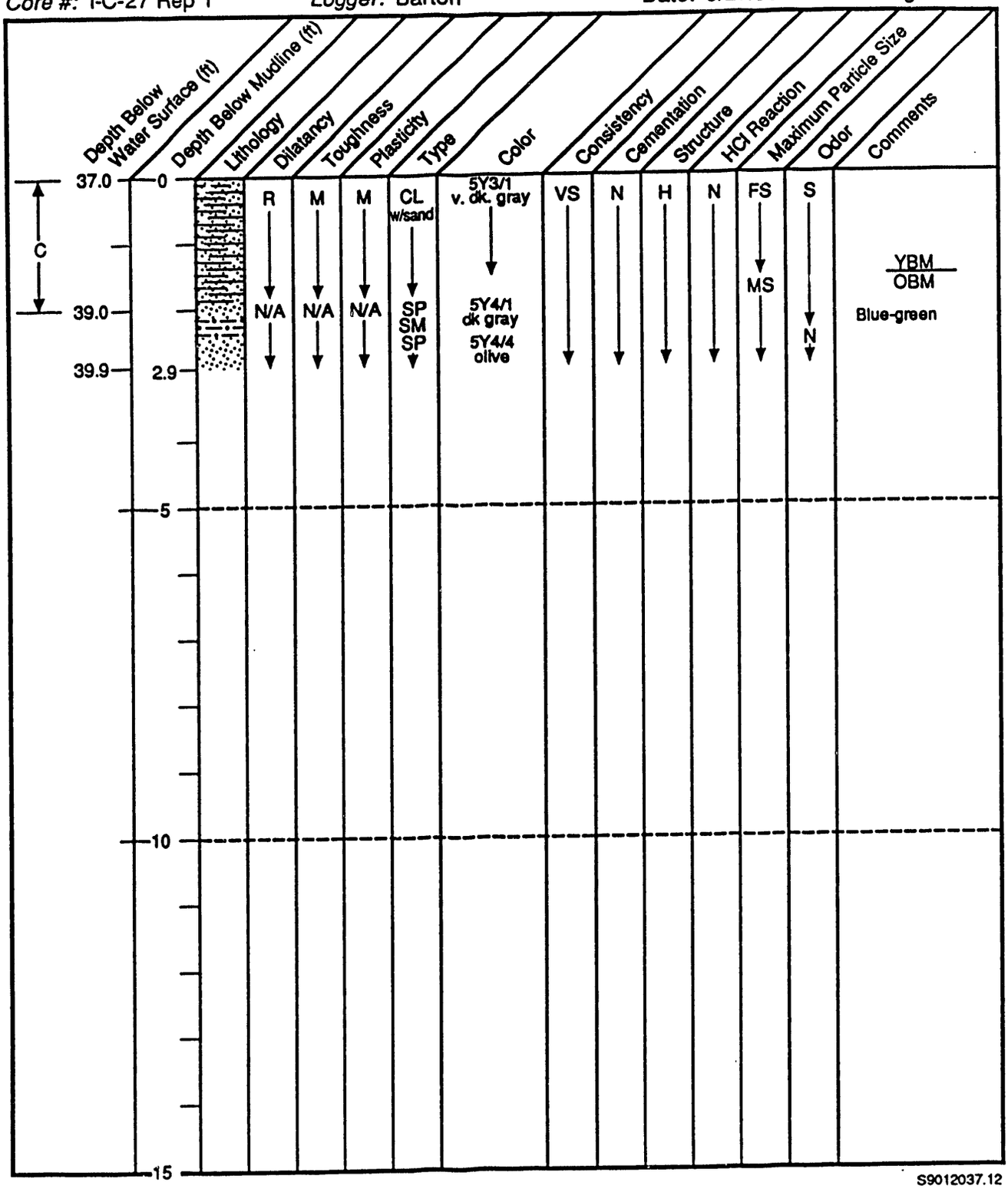

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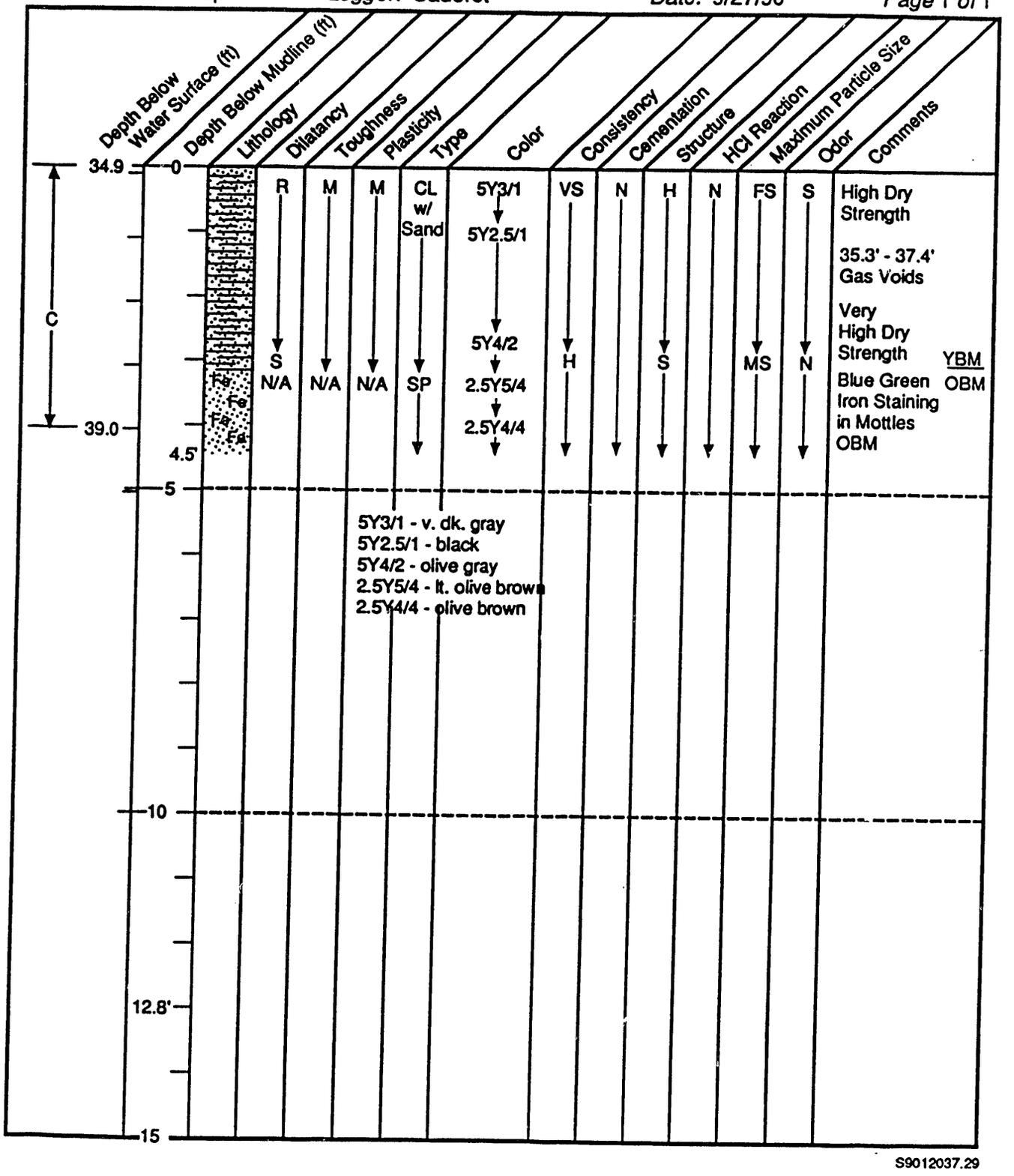

S9012037.29

Core Data Log

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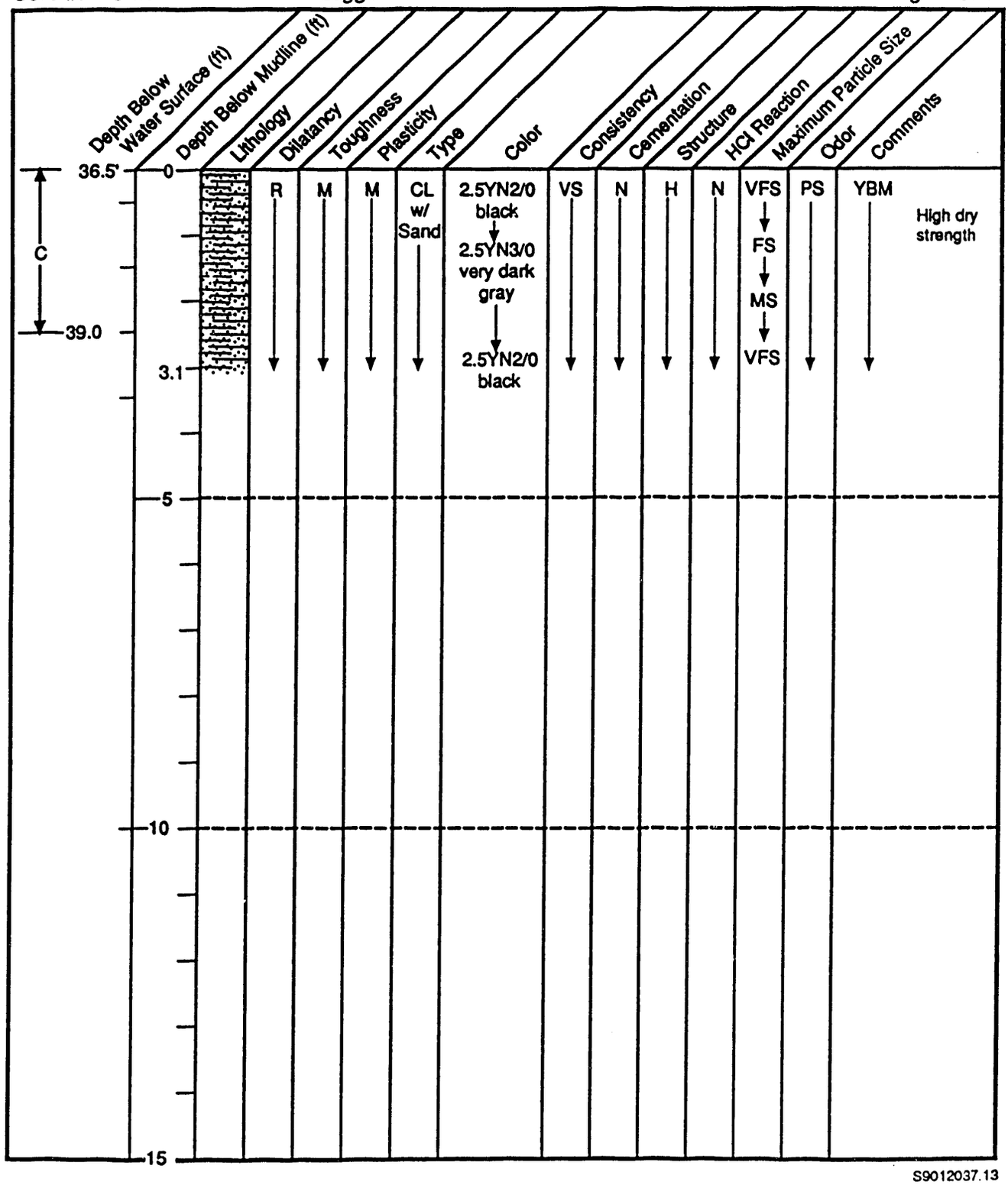

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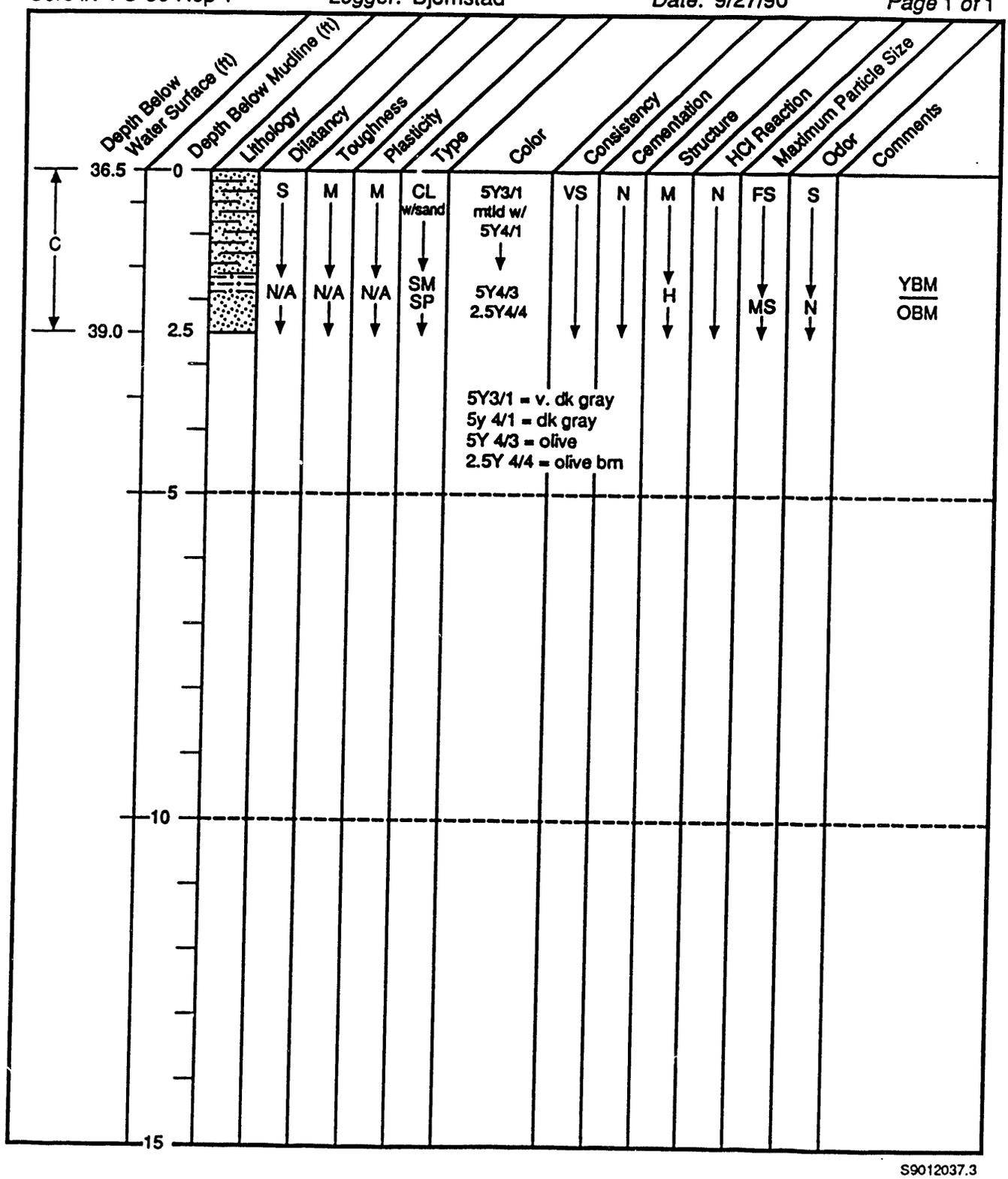

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PHASE III 38'

Core Data Log

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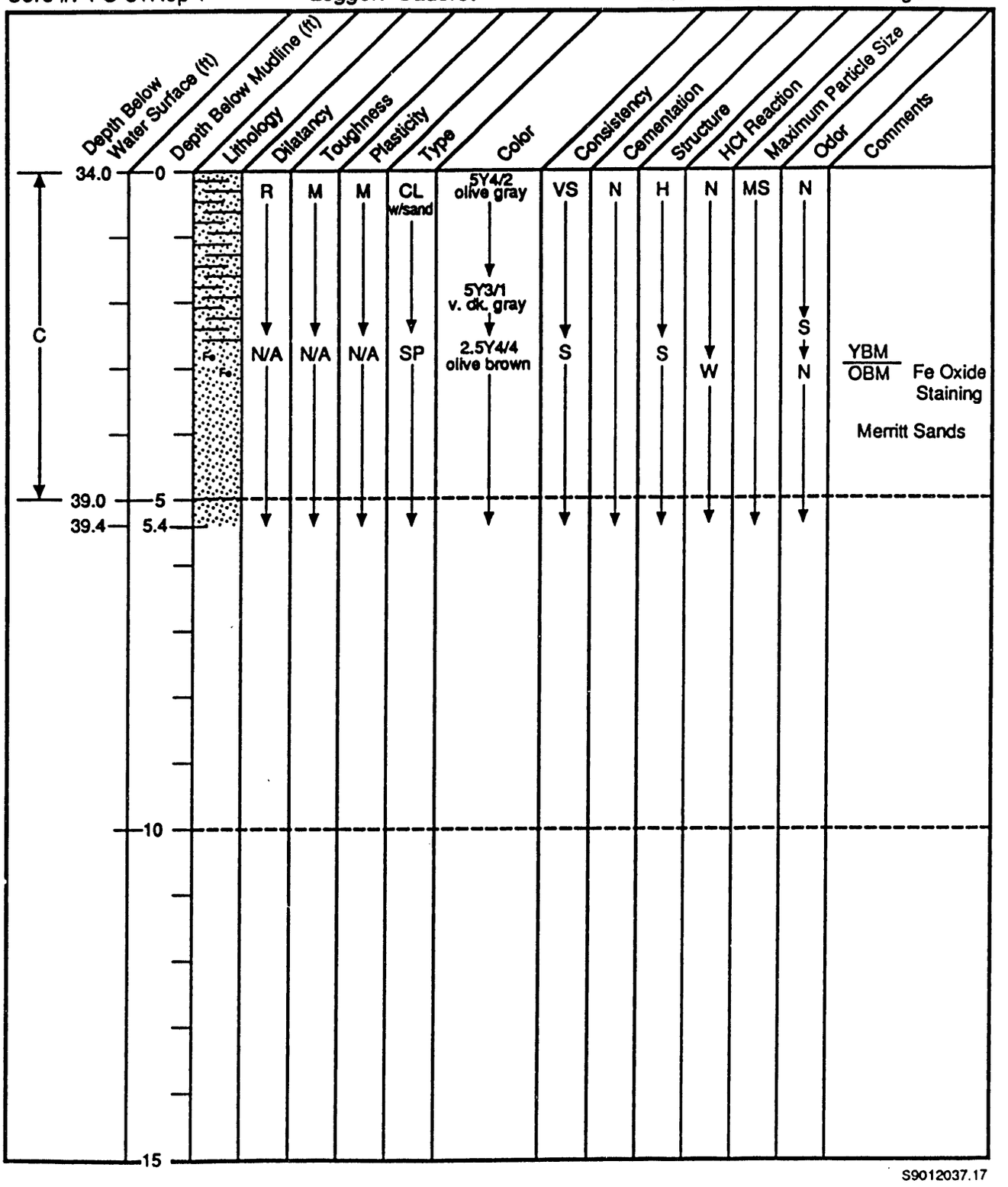

S9012037.17

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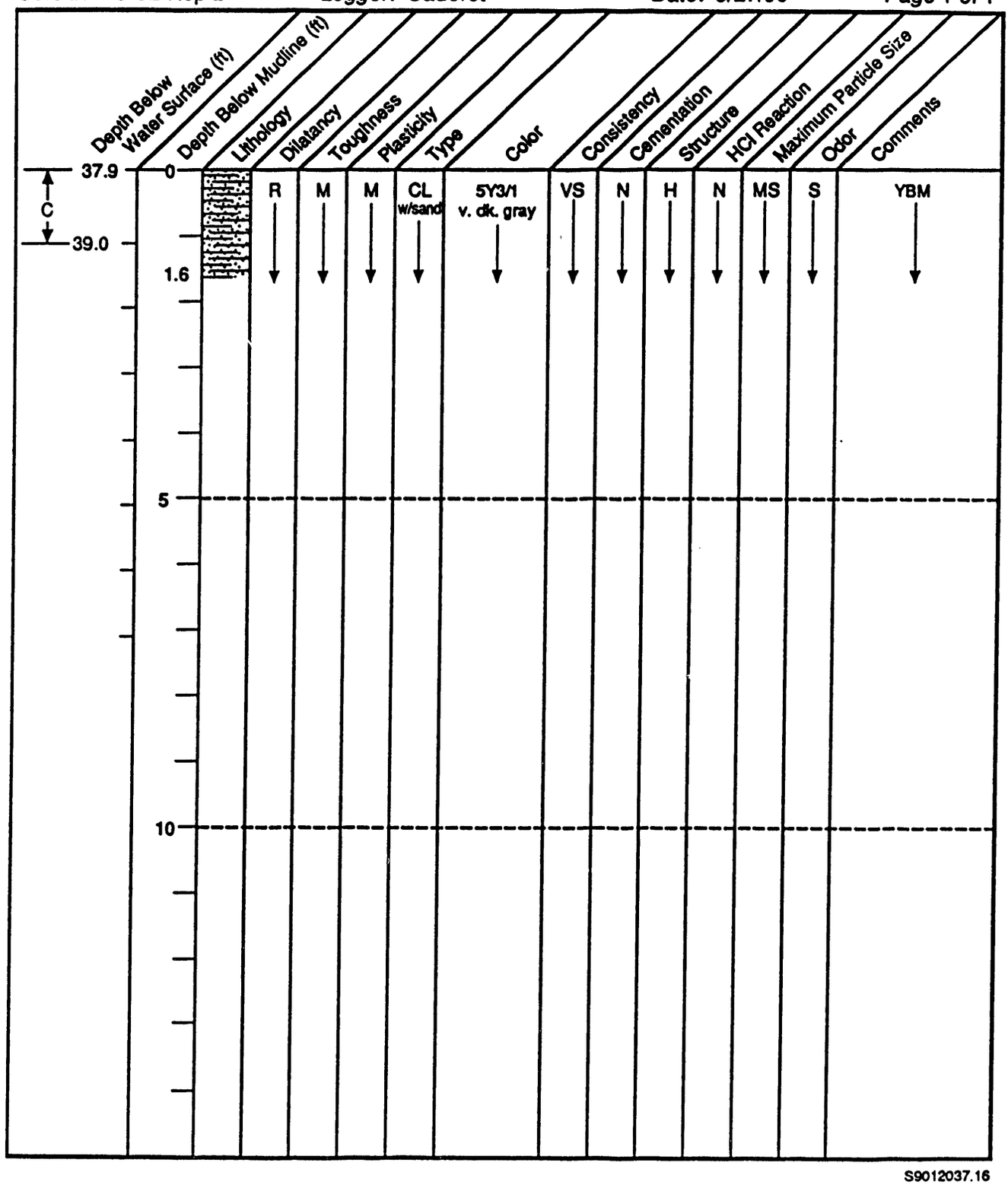

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Core Data Log

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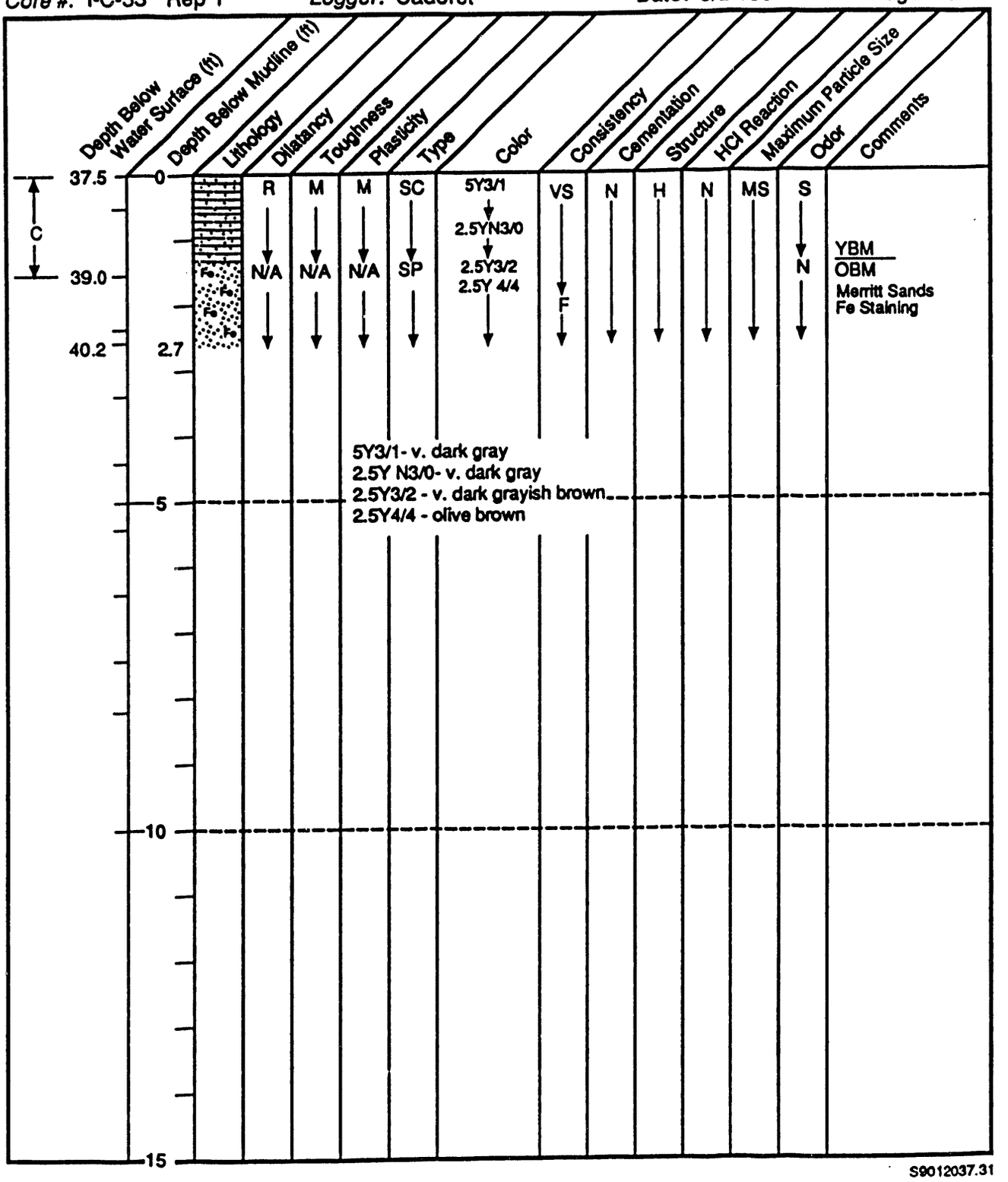

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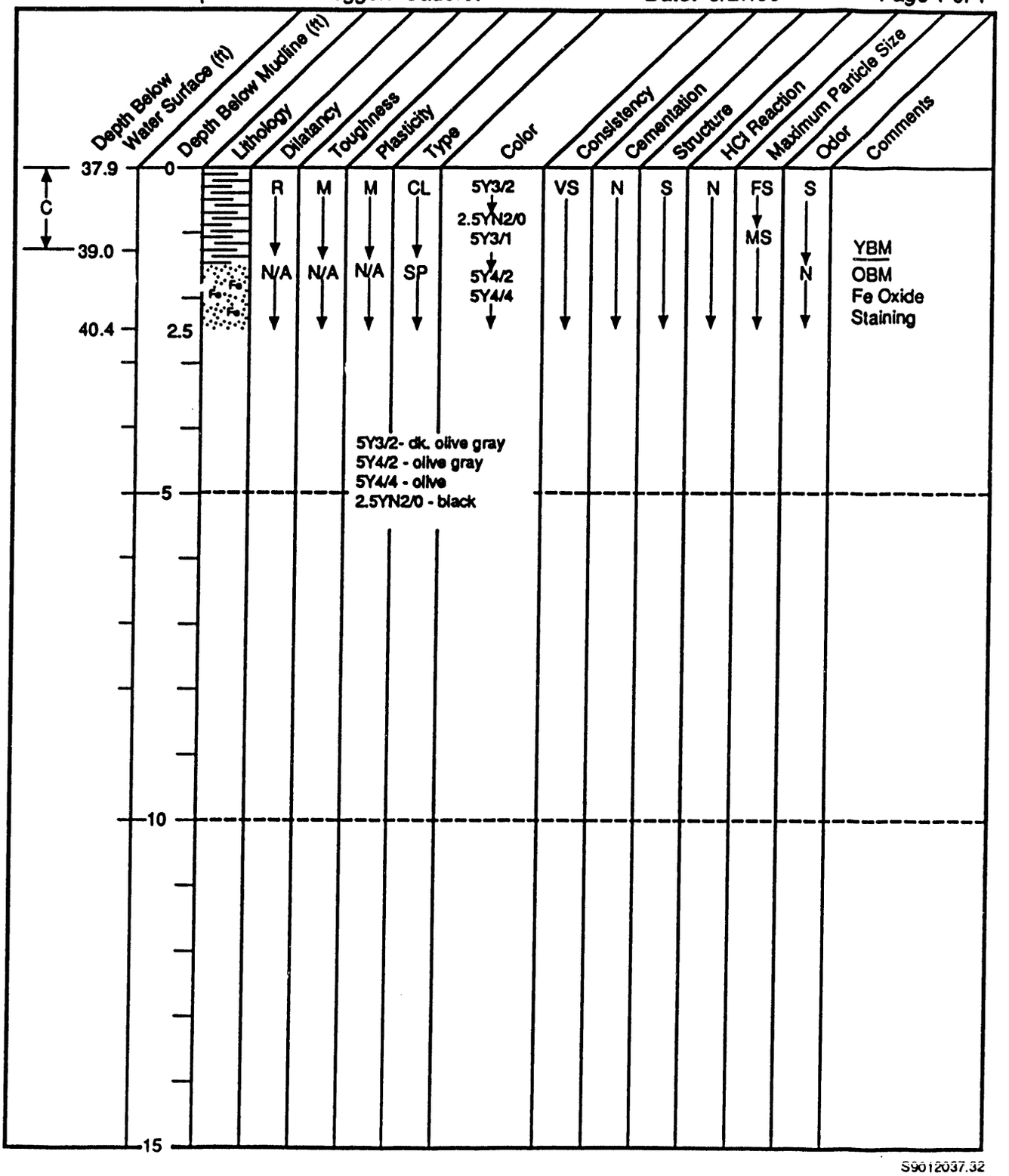

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PHASE III 38'

Core Data Log

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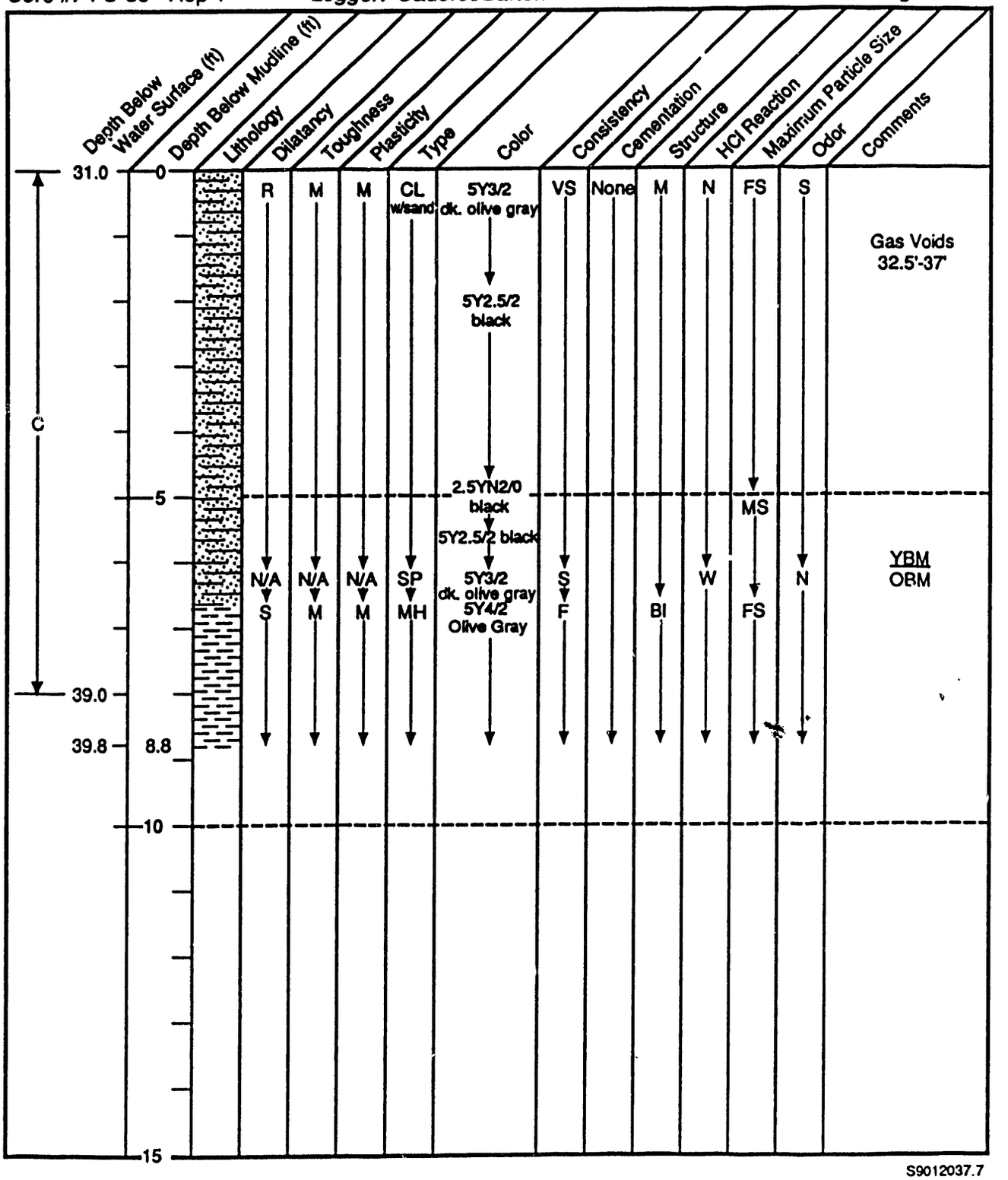

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APPENDIX C

SEDIMENT CHEMISTRY AND QUALITY ASSURANCE DATA

APPENDIX C

SUMMARY: SEDIMENT CHEMISTRY AND QUALITY ASSURANCE DATA

PARAMETER	POLYNUCLEAR AROMATIC HYDROCARBONS
Method	EPA 8270 (EPA 1986b)
Detection limit	Target: 20 μg/kg dry wt sediment Achieved: 3.92 to 76.8 μg/kg dry wt
Range of recovery	Target: DL to 199% (varies by compound; see method 8270) Achieved: Spike recoveries could not be accurately determined because the native PAH levels in the spiked sample were very high.
Relative precision	Target: 20% RPD Achieved Analytical Precision: RPD 1.6% to 63.7% (2 of 10 >20%) Achieved Compositing Efficiency: RPD 8.5% to 42.6% (11 of 20 >20%)
Analytical laboratory	Twin Cities Testing, St. Paul, MN

PARAMETER	CHLORINATED PESTICIDES
Method	EPA 8080 (EPA 1986b)
Detection limit	Target: 2 μg/kg dry wt sediment Achieved: 2.4-4.9 μg/kg dry wt (methoxychlor 13.2 to 24.4 μg/kg; toxaphene 26.3 to 48.8 μg/kg; one sample 50 μg/kg)
Range of recovery	Target: DL-202% (varies by compound; see method 8080) Achieved: 5.7% to 135% (7 of 36 out of range; low recovery of all six spiked compounds in Comp I cdup MSD; high recovery for Heptachlor in Comp I cdup MS)
Relative precision	Target: 20% RSD or RPD Achieved Analytical Precision: Could not be determined because pesticides were undetected in the two samples that were analyzed in triplicate. Achieved Compositing Efficiency: Not determined because pesticides were undetected in at least one of the compositing duplicates.

PARAMETER	CHLORINATED PESTICIDES (Contd)
Analytical laboratory	Twin Cities Testing, St. Paul, MN
Comment:	Range of Surrogate (Dibutylchlorendate) Recoveries was acceptable.

PARAMETER	POLYCHLORINATED BIPHENYLS
Method	EPA 8080 (EPA 1986b)
Detection limit	Target: 20 μg/kg dry wt sediment Achieved: 20 to 50 μg/kg dry wt
Range of recovery	Target: Aroclor 1254 29% to 131%; Aroclor 1260 8% to 127% Achieved: Aroclor 1254 91% to 155%; Aroclor 1260 70% to 79%
Relative precision	Target: 20% RPD or RSD Achieved Analytical Precision: 38% RSD Achieved Compositing Efficiency: Not determined as presence of Aroclors could not be confirmed in the compositing duplicates
Analytical laboratory	Twin Cities Testing, St. Paul, MN
Comment:	Range of surrogate (dibutylchlorendate) recoveries was acceptable. Inability to detect Aroclor 1254 at the certified value in SRM HS-2 was not explained by Twin Cities Testing, however the certification sheets state that some SRMs contain sulfur, which can cause interference

PARAMETER METALS

Method (Extraction) $HNO_3/HClO_4/HF$ digestion and atomic absorption; X-ray Fluorescence (XRF)

Analytes/ Analytical method/ Detection limit target, Detection limit acheived (in mg/kg dry wt sediment)			
	As	PNL SOP 19	1.0,1.0
	Cd	EPA 200.9/Bloom & Crecelius 1984	0.1,0.01
	Cr	PNL SOP 19	1.0,1.0
	Cu	PNL SOP 19	1.0,1.0
	Pb	PNL SOP 19	1.0,1.0
	Hg	Bloom & Crecelius 1983	0.02,0.009
	Ni	PNL SOP 19	1.0,1.0
	Se	EPA 200.9/Bloom & Crecelius 1984	0.1,0.08
	Ag	EPA 200.9/Bloom & Crecelius 1984	1.0,0.01
	Zn	PNL SOP 19	1.0,1.0

PARAMETER	METALS (Contd)
Range of recovery	Target: 75% to 125% (varies slightly by metal) Achieved: 87% to 119%
Relative precision	Target: 15% RPD or RSD Achieved Analytical Precision: 0.3% to 24.1% RSD or RPD (3 of 20 >15%)
Analytical laboratory	Battelle MSL, Sequim, WA
Comment:	Analysis of Standard Reference Materials resulted in 25 measurements (29%) outside of certified ranges. Only three measurements differed from the certified value by more than 20%
PARAMETER	BUTYLTINS
Method	*GC Determination of Butyltin in Natural Water by Gas Chromatography/Flame Photoionization Spectrometry of Hexyl Derivatives with Mass Spectrometry Confirmation* (Unger et al. 1986)
Detection limit	Target: 10 µg/kg dry wt sediment Achieved: 0.3 to 1.2 µg/kg dry wt
Range of recovery	Target: 40% to 120% Achieved: TBT and DBT 58%-66%; Propyltin Surrogates 27.4 to 93.1 (8 <40%)
Relative precision	Target: 20% Achieved Analytical Precision: 1% to 39% RPD (4 of 9 >20%)
Analytical laboratory	Battelle MSL, Sequim, WA
PARAMETER	OIL AND GREASE TOTAL PETROLEUM HYDROCARBONS
Method	EPA 413.2 and EPA 418.1 (EPA 1986a)
Detection limits	Target: 20 mg/kg dry wt sediment Achieved: Oil and Grease 0.5 mg/kg dry wt; TPH 0.5 to 0.9 mg/kg dry wt
Range of recovery	Target: 50% to 150% Achieved: 53% to 288% (4 >150%; probably because of native oil and grease/TPH concentrations)

PARAMETER	OIL AND GREASE TOTAL PETROLEUM HYDROCARBONS (Contd)
Relative Precision	Target: 20% RPD or RSD Achieved Analytical Precision: 19% to 24% (1 of 2 >20%)
Analytical laboratory	Twin Cities Testing, St. Paul, MN
PARAMETER	TOTAL ORGANIC CARBON
Method	*Puget Sound Estuary Program Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound* (PSEP 1986)
Detection limits	Target: 0.1% dry wt sediment Achieved: 0.1% dry wt
Relative Precision	Target: 10% RSD or RPD Achieved: 0.95% to 9.5%
Analytical laboratory	Global Geochemistry, Canoga Park, CA
PARAMETER	TOTAL VOLATILE SOLIDS
Method	Method 160.4 (EPA 1986a)
Detection limits	Target: 0.1% dry wt sediment Achieved: 0.0% dry wt
Relative Precision	Target: 10% RSD or RPD Achieved: 0.77% to 11%
Analytical laboratory	Battelle MSL, Sequim, WA
PARAMETER	GRAIN SIZE
Methods	*Puget Sound Estuary Program Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound* (PSEP 1986) *Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants* (ASTM 1985) *Standard Method for Particle-Size Analysis of Soils* D422 (ASTM 1972)
Analytical laboratory	Soil Technologies, Bainbridge Island, WA

TABLE C.1. Total Polynuclear Aromatic Hydrocarbons (PAHs) Found in Sediment Treatments, Oakland Phase III 38' Project

Sediment Treatment	PAHs (µg/kg dry weight) Total Low Molecular Weight PAH	Total High Molecular Weight PAH	Total PAH
COMP I	185.06	1842.79	2027.85
COMP I cdup[a]	161.30	1364.66	1525.96
I-C3	93.22	831.44	924.67
I-C19	72.84	532.89	605.73
I-C21	67.07	368.49	435.56
COMP II	173.23	2104.24	2277.47
I-C5	174.21	1492.82	1667.02
I-C22	184.86	1688.86	1873.72
I-C23	171.82	1685.41	1857.24
I-C24	144.24	1316.69	1460.93
I-C25	169.67	2200.95	2370.62
I-C25 top 12", Rep 1	292.83	2011.36	2304.19
I-C25 top 12", Rep 2	311.19	2371.54	2682.73
I-C26	220.67	2100.33	2321.00
I-C27	73.34	831.27	904.61
COMP III	303.07	4646.80	4949.87
I-C8	72.25	631.26	703.52
I-C28	83.82	1233.32	1317.14
I-C28 cdup	112.41	1379.65	1492.06
I-C29	244.46	3507.68	3752.15
I-C30	221.17	2415.38	2636.54
COMP IV	165.83	2654.61	2820.44
I-C9	206.80	3509.61	3716.42
I-C10	58.57	700.45	759.02
I-C11	68.39	555.91	624.29
I-C12	368.91	6407.70	6776.61
I-C31	121.01	1440.09	1561.11
I-C32	192.91	4016.86	4209.77
I-C33	135.72	1411.43	1547.15
I-C34	284.51	4024.96	4309.47
COMP V	182.73	1551.09	1733.82
I-C13	180.49	3347.39	3527.88
I-C14	130.88	2250.48	2381.37
I-C15	90.10	3511.70	3601.80
I-C18	100.05	2166.33	2266.38

TABLE C.1. (Contd)

Sediment Treatment	PAHs (μg/kg dry weight) Total Low Molecular Weight PAH	Total High Molecular Weight PAH	Total PAH
COMP VI	170.30	2971.12	3141.42
I-C16	129.89	1867.66	1997.54
I-C17	648.45	7284.23	7932.68
I-C35 top 12"	464.09	31415.66	31879.75
I-C35	282.31	5536.81	5819.12
R-AC	979.08	2004.83	2983.90
R-AM	57.83	72.77	130.60
R-BF	49.49	540.59	590.08
R-OS	19.99	0.00	19.99
R-PC	15.05	0.00	15.05
R-PF	13.56	5.42	18.98
C-NE	11.80	0.00	11.80
C-SB	32.81	57.75	90.56
C-WB	68.95	725.97	794.92

(a) Compositing duplicate.

TABLE C.2. Concentrations of Low Molecular Weight Polynuclear Aromatic Hydrocarbons (PAHs) in Sediment, Oakland Phase III 38' Project

Sediment Treatment	PAHs (µg/kg dry weight) Naphthalene	Acenaphthylene	Acenaphthene	Flourene	Phenanthrene	Anthracene
COMP I	64.02 U[a]	9.72 U	24.31 U	19.45 U	128.94	31.81
COMP I cdup[b]	60.76 U	9.23 U	23.07 U	18.46 U	113.62	24.60
I-C3	54.84 U	8.33 U	20.83 U	16.66 U	59.24	13.16
I-C19	64.43 U	9.79 U	24.47 U	19.57 U	48.37	11.42 U
I-C21	41.38 U	6.29 U	15.72 U	12.57 U	40.92	10.43
COMP II	57.42 U	8.72 U	21.80 U	17.44 U	113.08	38.35
I-C5	63.92 U	9.71 U	24.27 U	19.42 U	112.43	37.51
I-C22	64.93 U	9.86 U	24.66 U	19.73 U	129.82	30.37
I-C23	56.44 U	8.57 U	21.43 U	17.15 U	111.32	39.07
I-C24	63.02 U	9.57 U	23.93 U	19.15 U	94.20	26.10
I-C25	63.29 U	9.61 U	24.03 U	19.23 U	105.40	40.24
I-C25 top 12", Rep 1	76.77 U	11.66 U	29.15 U	23.32 U	187.65	76.02
I-C25 top 12", Rep 2	34.36 U	9.25	17.95	23.04	177.13	83.81
I-C26	61.80 U	9.39 U	23.47 U	18.77 U	146.90	50.31
I-C27	56.23 U	8.54 U	21.35 U	17.08 U	39.78	12.20
COMP III	59.60 U	18.36	23.09	20.87	184.50	56.25
I-C8	36.00 U	5.47 U	13.67 U	10.94 U	49.99	8.59
I-C28	35.96 U	5.46 U	13.65 U	10.92 U	50.57	19.59
I-C28 cdup	39.22 U	5.96 U	14.90 U	11.92 U	71.91	25.61
I-C29	55.84 U	12.31	21.21 U	16.97 U	149.02	61.92
I-C30	52.29 U	7.94 U	21.98	15.89 U	170.05	29.14
COMP IV	40.71 U	6.29	15.79	12.37 U	109.19	34.55
I-C9	59.17 U	8.99 U	22.47 U	17.98 U	142.47	41.87
I-C10	38.33 U	5.82 U	14.55 U	11.64 U	34.81	9.20
I-C11	42.08 U	6.39 U	15.98 U	12.78 U	41.50	10.91
I-C12	70.03 U	13.91	43.41	21.27 U	253.62	57.97
I-C31	48.80 U	7.41 U	18.53 U	14.82 U	76.74	25.74
I-C32	76.32 U	11.59 U	28.98 U	23.19 U	109.60	54.33
I-C33	42.64 U	6.48 U	16.19 U	12.95 U	74.64	44.89
I-C34	58.03 U	8.81 U	22.04 U	17.63 U	169.15	93.33
COMP V	41.11 U	15.02	15.61 U	12.49 U	137.56	30.15
I-C13	47.77 U	11.91	21.26	14.51 U	120.02	27.30
I-C14	31.91 U	5.47	12.27	9.70 U	90.87	22.27
I-C15	27.67 U	9.21	10.51 U	8.41 U	51.86	18.52
I-C18	31.09 U	5.08	11.81 U	9.44 U	72.00	22.96

TABLE C.2. (Contd)

Sediment Treatment	PAHs (µg/kg dry weight) Naph-thalene	Acenaph-thylene	Acenaph-thene	Flourene	Phenan-threne	Anthra-cene
COMP VI	31 64 U	6.27	18.04	9.61 U	118.47	27.51
I-C16	42.51 U	6.46 U	16.14 U	12.91 U	94.85	18.90
I-C17	61.74 U	9.38 U	23.44 U	20.82	429.93	174.26
I-C35 top 12"	53.19	10.13	47.93	17.72	306.93	28.20
I-C35	51.20 U	10.04	26.99	15.56 U	201.09	44.20
R-AC	99.01	32.83	92.42	97.00	527.87	129.94
R-AM	32.27 U	4.90 U	12.25 U	9.80 U	31.65	13.92
R-BF	39.52 U	6.00 U	15.01 U	12.00 U	34.48	7.00 U
R-OS	52.65 U	8.00 U	19.99 U	16.00 U	21.33 U	9.33 U
R-PC	39.64 U	6.02 U	15.05 U	12.04 U	16.06 U	7.03 U
R-PF	35.70 U	5.42 U	13.56 U	10.85 U	14.46 U	6.33 U
C-NE	31.08 U	4.72 U	11.80 U	9.44 U	12.59 U	5.51 U
C-SB	86.39 U	13.12 U	32.81 U	26.25 U	35.00 U	15.31 U
C-WB	41.46 U	6.30 U	15.75 U	12.60 U	43.06	18.15

(a) Undetected above given concentration.
(b) Compositing duplicate.

TABLE C.3. Concentrations of High Molecular Weight Polynuclear Aromatic Hydrocarbons (PAHs) in Sediment, Oakland Phase III 38' Project

Sediment Treatment	PAHs (µg/kg dry weight) Flouran-thene	Pyrene	Benzo(a)-Anthracene	Chrysene	Benzo (b,k, & j)-Flouranthene	Benzo(a)-Pyrene	Indeno (1,2,3-cd) Pyrene	Dibenz(a,h)-Anthracene	Benzo(ghi)-Perylene
COMP I	220.65	318.92	98.66	172.05	365.26	277.91	137.67	8.91 U[a]	251.68
COMP I cdup[b]	201.87	273.50	100.06	125.48	236.94	183.23	90.94	8.46 U	152.65
I-C3	100.08	152.69	62.46	76.89	185.84	123.46	40.80	7.64 U	89.23
I-C19	69.27	104.69	42.87	50.73	109.09	78.93	21.91	8.97 U	55.40
I-C21	52.68	75.54	40.25	39.05	69.04	50.73	14.75	5.76 U	26.45
COMP II	226.64	330.25	115.45	201.05	442.84	302.43	172.73	7.99 U	312.85
I-C5	207.04	286.69	147.13	150.99	278.86	193.06	82.29	8.90 U	146.76
I-C22	207.15	301.95	121.43	158.38	322.98	252.37	109.27	9.04 U	215.33
I-C23	197.54	277.14	112.84	195.84	308.94	256.07	111.82	16.01	209.21
I-C24	175.59	279.38	101.84	119.75	212.66	156.93	100.71	8.78 U	169.83
I-C25	243.31	345.17	121.00	195.25	467.68	327.21	181.57	8.81 U	319.75
I-C25 top 12", Rep 1	296.25	338.95	220.64	214.60	381.16	267.17	108.30	10.69 U	184.29
I-C25 top 12", Rep 2	327.42	356.28	228.34	200.99	387.37	274.18	209.49	32.90	354.58
I-C26	293.88	427.64	158.34	181.88	343.73	243.51	168.29	8.60 U	283.07
I-C27	86.19	208.97	47.85	64.45	161.08	107.08	55.72	7.83 U	99.93
COMP III	726.92	1463.21	278.53	232.04	774.49	462.85	263.31	42.29	403.17
I-C8	87.69	148.61	22.57	92.06	120.54	42.14	44.83	5.01 U	72.82
I-C28	89.42	209.55	70.97	113.41	287.52	193.15	89.94	13.98	165.37
I-C28 cdup	136.13	286.87	81.02	129.78	258.80	177.34	122.18	5.46 U	187.53
I-C29	265.57	599.20	195.42	261.00	777.87	561.76	283.51	49.94	513.40
I-C30	303.42	627.80	101.18	281.06	546.07	7.94 U	197.85	21.91	336.09
COMP IV	248.62	547.79	120.06	210.75	529.76	408.51	226.73	28.60	333.77
I-C9	250.94	589.19	169.41	234.12	842.58	585.82	287.25	44.64	505.66
I-C10	50.25	110.99	34.35	58.85	184.31	119.96	46.50	5.34 U	95.23
I-C11	60.03	137.75	28.82	60.82	131.68	86.17	10.12 U	5.86 U	50.64
I-C12	517.29	1089.49	282.66	371.46	1443.93	1157.55	532.05	66.59	946.67
I-C31	132.97	242.18	91.91	129.79	352.50	202.26	106.46	6.79 U	182.01
I-C32	288.59	445.54	149.52	275.38	1305.70	343.98	458.86	10.63 U	749.29
I-C33	137.49	235.10	49.82	119.56	299.37	239.27	110.17	5.94 U	220.65
I-C34	600.28	831.31	203.32	538.83	842.93	311.00	288.14	8.08 U	409.15
COMP V	192.85	347.62	59.53	71.78	326.62	256.37	119.53	5.72 U	176.78
I-C13	621.05	1035.66	142.87	131.78	486.84	339.55	222.69	28.20	338.75
I-C14	217.24	493.06	117.77	141.90	456.82	357.31	182.85	15.74	267.80
I-C15	268.13	975.54	202.76	226.23	584.62	514.48	286.26	35.79	417.90
I-C18	175.86	288.10	107.49	155.88	525.99	376.85	199.58	33.58	303.01

TABLE C.3. (Contd)

Sediment Treatment	PAHs (µg/kg dry weight)								
	Flouran-thene	Pyrene	Benzo(a)-Anthracene	Chrysene	Benzo (b,k, & j)-Flouranthene	Benzo(a)-Pyrene	Indeno (1,2,3-cd) Pyrene	Dibenz(a,h)-Anthracene	Benzo(ghi)-Perylene
COMP VI	300.49	789.04	161.76	147.13	518.15	433.72	240.17	31.84	348.82
I-C16	194.10	436.62	78.17	113.30	343.35	250.18	187.08	5.92 U	264.84
I-C17	882.33	1321.79	465.14	562.58	1670.79	954.38	529.76	73.16	824.29
I-C35	477.82	1157.62	193.11	304.96	1180.36	820 26	507.01	56.76	838.92
I-C35 top 12"	652.14	1666.42	270.29	425.43	12765.59	2.23 U	7236.98	1179.94	7218.87
R-AC	355.63	455.34	188.44	209.75	256.32	210.80	123.47	5.76 U	205.08
R-AM	19.15	27.51	6.79	20.03 U	11.69	7.63	7.76 U	4.49 U	3.92 U
R-BF	78.24	116.87	26.60	56.67	94.44	75.66	31.36	5.50 U	60.77
R-OS	13.33 U	10.00 U	9.33 U	8.00 U	10.00 U	8.00 U	12.66 U	7.33 U	6.40 U
R-PC	10.04 U	7.53 U	7.03 U	6.02 U	7.53 U	6.02 U	9.53 U	5.52 U	4.82 U
R-PF	9.04 U	6.78 U	6.33 U	5.42	6.78 U	5.42 U	8.59 U	4.97 U	4.34 U
C-NE	7.87 U	5.90 U	5.51 U	4.72 U	5.90 U	4.72 U	7.48 U	4.33 U	3.78 U
C-SB	23.11	16.63	15.31 U	18.02	16.40 U	13.12 U	20.78 U	12.03 U	10.50 U
C-WB	69.42	165.55	39.03	61.33	171.12	110.02	38.82	5.77 U	70.69

(a) Undetected above given concentration.
(b) Compositing duplicate.

TABLE C.4. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbon (PAH) Analysis, Oakland Phase III 38' Project

Sample	PAHs (µg/kg dry weight) Naphthalene	Acenaphthylene	Acenaphthene	Flourene	Phenanthrene	Anthracene
Method Blanks						
Blank I	4.09	0.33 U[a]	0.82 U	0.66 U	0.98	0.38 U
Blank II	2.49	0.32 U	0.80 U	0.64 U	0.86 U	0.37 U
Blank III	2.70 U	0.41 U	1.03 U	0.82 U	1.09 U	0.48 U
Blank IV	2.54 U	0.39 U	0.96 U	0.77 U	1.03 U	0.45 U
Blank V	2.63 U	0.40 U	1.00 U	0.80 U	3.46	0.55
Matrix Spikes[b]						
COMP III	59.60 U	18.36	23.09	20.87	184.50	56.25
COMP III MS	66.39	70.33	58.44	70.43	218.55	102.94
Recovered	66.39	NS[c]	NS	49.56	NS	46.69
% Recovery	144.33%			107.75%		101.49%
Spiked: 46 µg/kg						
COMP III	59.60 U	18.36	23.09	20.87	184.50	56.25
COMP III MSD	57.62	72.20	54.65	63.51	237.56	97.71
Recovered	57.62	NS	NS	42.64	NS	41.46
% Recovery	122.61%			90.73%		88.22%
Spiked: 47 µg/kg						
I-C13	47.77 U	11.91	21.26	14.51 U	120.02	27.30
I-C13 MS	51.56	10.16	63.82	47.95	194.29	31.55
Recovered	51.56	NS	NS	47.95	NS	4.25
% Recovery	139.34%			129.59%		11.50%
Spiked: 37 µg/kg						
I-C13	47.77 U	11.91	21.26	14.51 U	120.02	27.30
I-C13 MSD	49.03	29.02	46.11	40.40	140.84	44.69
Recovered	49.03	NS	NS	40.40	NS	17.39
% Recovery	129.03%			106.32%		45.77%
Spiked: 38 µg/kg						
Standard Reference Materials						
HS-5	106.1[d]	37.5	38.7[d]	164.2[d]	3205.3[d]	100.3[d]
Certified Value	250	<150	230	400	5200	380
	±70		±100	±100	±1000	±150
Analytical Duplicates						
I-C25 top 12", Rep 1	76.77 U	11.66 U	29.15 U	23.32 U	187.65	76.02
I-C25 top 12", Rep 2	34.36 U	9.25	17.95	23.04	177.13	83.81
RPD	N/A[e]	N/A	N/A	N/A	5.77%	9.74%
I-STAT	N/A	N/A	N/A	N/A	0.03	0.05
Compositing Duplicates						
COMP I	64.02 U	9.72 U	24.31 U	19.45 U	128.94	31.81
COMP I cdup[f]	60.76 U	9.23 U	23.07 U	18.46 U	113.62	24.60
RPD	N/A	N/A	N/A	N/A	12.63%	25.55%
I-STAT	N/A	N/A	N/A	N/A	0.06	0.13

TABLE C.4 (Contd)

Sample	PAHs (µg/kg dry weight) Naphthalene	Acenaphthylene	Acenaphthene	Flourene	Phenanthrene	Anthracene
Compositing Duplicates (Contd)						
I-C28	35.96 U	5.46 U	13.65 U	10.92 U	50.57	19.59
I-C28 cdup	39.22 U	5.96 U	14.90 U	11.92 U	71.91	25.61
RPD	N/A	N/A	N/A	N/A	34.85%	26.60%
I-STAT	N/A	N/A	N/A	N/A	0.17	0.13

(a) Undetected above given concentration.
(b) Most spike recoveries could not be accurately determined because of either 1.) high detection limit, or 2.) much higher concentrations of PAHs in the spiked sample than in the spiking solution. These results do not adversely affect the quality of the analyses.
(c) Not spiked.
(d) Outside certified range.
(e) Statistical calculations not applicable due to one or more non-detect values.
(f) Compositing duplicate.

TABLE C.5. Quality Control Data for Sediment High Molecular Weight Polynuclear Armomatic Hydrocarbon (PAH) Analysis, Oakland Phase III 38' Project

	PAHs (µg/kg dry weight)								
Sample	Flouran-thene	Pyrene	Benzo(a)-Anthracene	Chrysene	Benzo (b,k, & j)-Flouranthene	Benzo(a)-Pyrene	Indeno (1,2,3-cd) Pyrene	Dibenz(a,h)-Anthracene	Benzo(ghi)-Perylene
Method Blanks									
Blank I	0.55 U[a]	0.41 U	0.38 U	0.33 U	0.41 U	0.33 U	0.52 U	0.30 U	0.26 U
Blank II	0.54 U	0.42	0.37 U	0.32 U	0.40 U	0.32 U	0.51 U	0.29 U	0.26 U
Blank III	0.68 U	0.51 U	0.48 U	0.41 U	0.51 U	0.41 U	0.65 U	0.38 U	0.33 U
Blank IV	0.64 U	0.48 U	0.45 U	0.39 U	0.48 U	0.39 U	0.61 U	0.35 U	0.31 U
Blank V	0.70	0.82	5.81	0.40 U	0.50 U	0.40 U	0.63 U	0.37 U	0.32 U
Matrix Spikes[b]									
COMP III	726.92	1463.21	278.53	232.04	774.49	462.85	263.31	42.29	403.17
COMP III MS	731.93	1303.80	468.14	288.78	878.69	613.57	543.44	150.29	661.18
Recovered	5.01	NS[c]	189.61	NS	NS	150.72	NS	NS	258.01
% Recovery	10.89%		412.19%			327.64%			560.90%
Spiked: 46 µg/kg									
COMP III	726.92	1463.21	278.53	232.04	774.49	462.85	263.31	42.29	403.17
COMP III MSD	681.56	1146.91	459.17	225.24	769.09	531.04	464.15	127.07	570.22
Recovered	-45.36	NS	180.64	NS	NS	68.19	NS	NS	167.05
% Recovery	-96.50%		384.34%			145.07%			355.42%
Spiked: 47 µg/kg									
I-C13	621.05	1035.66	142.87	131.78	486.84	339.55	222.69	28.20	338.75
I-C13 MS	589.34	806.33	224.83	166.01	816.38	228.51	597.45	137.67	739.22
Recovered	-31.71	NS	81.96	NS	NS	-111.04	NS	NS	400.47
% Recovery	-85.71%		221.51%			-300.10%			082.34%
Spiked: 37 µg/kg									
I-C13	621.05	1035.66	142.87	131.78	486.84	339.55	222.69	28.20	338.75
I-C13 MSD	494.07	722.42	204.02	134.63	519.77	270.47	326.87	85.76	410.72
Recovered	-126.98	NS	61.15	NS	NS	-69.08	NS	NS	71.97
% Recovery	-334.16%		160.91%			-181.79%			189.40%
Spiked: 38 µg/kg									
Standard Reference Materials									
HS-5	3516.5	2616.0[d]	1261.0[d]	1522.0 U[d]	2127.4	619.5[d]	800.1[d]	200.5	787.9[d]
Certified Value	8400 ±2600	5800 ±1800	2900 ±1200	2800 ±900	1060 ±1400	1700 ±800	5800 ±1800	200 ±100	1300 ±300

TABLE C.5. (Contd)

Sample	PAHs (µg/kg dry weight)								
	Flouran-thene	Pyrene	Benzo(a)-Anthracene	Chrysene	Benzo (b,k, & j)-Flouranthene	Benzo(a)-Pyrene	Indeno (1,2,3-cd) Pyrene	Dibenz(a,h)-Anthracene	Benzo(ghi)-Perylene
Analytical Duplicates									
I-C25 top 12", Rep 1	296.25	338.95	220.64	214.60	381.16	267.17	108.30	10.69 U	184.29
I-C25 top 12", Rep 2	327.42	356.28	228.34	200.99	387.37	274.18	209.49	32.90	354.58
RPD	9.99%	4.99%	3.43%	6.55%	1.62%	2.59%	63.68%	NA(f)	63.20%
I-STAT	0.05	0.02	0.02	0.03	0.01	0.01	0.32	NA	0.32
Composting Duplicates									
COMP I	220.65	318.92	98.66	172.05	365.26	277.91	137.67	8.91 U	251.68
COMP I cdup(e)	201.87	273.50	100.06	125.48	236.94	183.23	90.94	8.46 U	152.65
RPD	8.89%	15.33%	1.40%	31.31%	42.62%	41.06%	40.88%	NA	48.98%
I-STAT	0.04	0.08	0.01	0.16	0.21	0.21	0.20	NA	0.24
I-C28	89.42	209.55	70.97	113.41	287.52	193.15	89.94	13.98	165.37
I-C28 cdup	136.13	286.87	81.02	129.78	258.80	177.34	122.18	5.46 U	187.53
RPD	41.42%	31.15%	13.22%	13.46%	10.51%	8.53%	30.40%	NA	12.56%
I-STAT	0.21	0.16	0.07	0.07	0.05	0.04	0.15	NA	0.06

(a) Undetected above given concentrations.
(b) Concentrations of PAHs in samples used for matrix spikes were much higher than the concentrations of analytes in the spiking solution. Thus, spike recoveries cannot be determined accurately. These results do not adversely effect the quality of the analyses.
(c) Not Spiked.
(d) Outside certified range.
(e) Compositing duplicate.
(f) Not applicable.

TABLE C.6. Surrogate Recoveries for Sediment Polynuclear Aromatic Hydrocarbon (PAH) Analysis, Oakland Phase III 38′ Project

Sediment Treatment	Surrogate Percent Recoveries D10 Flourene	D10 Anthracene	D10 Pyrene
COMP I	40	91	73
COMP I cdup[a]	69	102	70
I-C 3	60	90	75
I-C19	56	103	79
I-C21	70	120	63
COMP II	64	99	79
I-C 5	78	126	73
I-C22	56	87	71
I-C23	73	97	89
I-C24	65	101	81
I-C25	69	91	81
I-C25 top 12", Rep 1	84	91	66
I-C25 top 12", Rep 2	72	74	72
I-C26	68	107	90
I-C27	68	114	87
COMP III	136	115	164
I-C 8	76	84	72
I-C28	82	91	78
I-C28 cdup	78	115	81
I-C29	81	103	103
I-C30	62	51	78
COMP IV	74	88	88
I-C 9	87	87	86
I-C10	73	86	75
I-C11	69	126	74
I-C12	56	76	63
I-C31	60	95	77
I-C32	78	59	84
I-C33	50	74	64
I-C34	77	69	77
COMP V	71	88	88
I-C13	123	114	181
I-C14	74	84	85
I-C15	60	89	95
I-C18	86	125	93

TABLE C.6. (Contd)

Sediment Treatment	Surrogate Percent Recoveries D10 Flourene	D10 Anthracene	D10 Pyrene
COMP VI	78	90	103
I-C16	82	119	84
I-C17	57	92	78
I-C35	3	0	12
I-C35	53	77	64
R-AC	68	96	87
R-AM	63	147	65
R-BF	51	118	78
R-OS	66	156	74
R-PC	58	0	40
R-PF	72	132	65
C-NE	53	105	52
C-SB	71	133	78
C-WB	78	127	74
QC Samples			
Blank I	111	81	99
Blank II	93	80	85
Blank III	105	105	108
Blank IV	80	80	83
Blank V	75	65	90
SRM HS-5	2	0	11
COMP III MS	107	97	134
COMP III MSD	99	92	120
I-C13 MS	102	45	132
I-C13 MSD	88	66	120

(a) Compositing Duplicate.

TABLE C.7. Sediment Chlorinated Pesticide Results (alphabetical, Aldrin - 4,4'-DDT), Oakland Phase III 38' Project

Sediment Treatment	Pesticides (µg/kg dry weight)									
	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Alpha-Chlordane	Gamma-Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
COMP I	4.1 U[a]	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1U	4.1 U
COMP I cdup[b]	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	47.0	3.9 U
I-C 3	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	6.8	3.6 U	61.0	6.6	3.6 U
I-C19	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
I-C21	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
COMP II	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U
I-C 5	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	44.2 U	4.4 U	4.4 U
I-C22	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	13.3	4.3 U	4.3 U
I-C23	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U
I-C24	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U
I-C25	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	5.8	4.5 U	4.5 U
I-C25 top 12"	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
I-C26	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	50.0	4.3 U	4.3 U
I-C27	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U
COMP III	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U
I-C 8	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
I-C28	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
I-C28 cdup	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
I-C29	3.6 U	3.6 U	5.2	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	6.5	3.6 U
I-C30	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	12.2	3.4 U	3.4 U
COMP IV	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
I-C 9	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U
I-C10	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
I-C11	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
I-C12	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	18.0	4.7 U	4.7 U
I-C31	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
I-C32	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U
I-C33	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
I-C34	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U

TABLE C.7. (Contd)

Sediment Treatment	Pesticides (µg/kg dry weight)									
	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Alpha-Chlordane	Gamma-Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
COMP V Rep 1	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
COMP V Rep 2	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
COMP V Rep 3	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
I-C13	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U
I-C14	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
I-C15	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
I-C18 Rep 1	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
I-C18 Rep 2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
I-C18 Rep 3	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
COMP VI	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
I-C16	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
I-C17	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.6	6.1	4.3 U
I-C35	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
R-AC	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
R-AM	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
R-8F	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
R-OS	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
R-PC	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
R-PF	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U
C-NE	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
C-SB	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U
C-WB	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U

(a) Undetected above given concentration.
(b) Compositing duplicate.

TABLE C.8. Sediment Chlorinated Pesticide Results (alphabetical, Dieldrin - Toxaphene), Oakland Phase III 38' Project

Sediment Treatment	Pesticides (µg/kg dry weight)									
	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Methoxychlor	Toxaphene
COMP I	4.1 U[a]	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	20.4 U	40.8 U
COMP I cdup[b]	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	19.0 U	39.0 U
I-C 3	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	17.9 U	35.7 U
I-C19	9.6 B[c]	4.0 U	4.0 U	7.4	4.0 U	4.0 U	4.0 U	4.0 U	20.0 U	40.0 U
I-C21	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	14.9 U	29.9 U
COMP II	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	21.3 U	42.6 U
I-C 5	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	22.2 U	44.4 U
I-C22	19.5 B	4.3 U	7.4	4.3 U	8.0	4.3 U	4.3 U	4.3 U	21.3 U	42.6 U
I-C23	3.8 B	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	18.9 U	37.7 U
I-C24	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	20.8 U	41.7 U
I-C25	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	22.7 U	45.5 U
I-C25 top 12"	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	250.0 U	500.0 U
I-C26	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	21.7 U	43.5 U
I-C27	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	19.0 U	37.0 U
COMP III	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	19.2 U	38.5 U
I-C 8	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	13.0 U	25.0 U
I-C28	7.6	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	16.7 U	33.3 U
I-C28 cdup	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.0 U	29.0 U
I-C29	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	17.9 U	35.7 U
I-C30	4.6	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	16.9 U	33.9 U
COMP IV	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	16.9 U	33.9 U
I-C 9	4.3	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	20.0 U	41.0 U
I-C10	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	13.2 U	26.3 U
I-C11	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.0 U	29.0 U
I-C12	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	23.3 U	46.5 U
I-C31	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	16.1 U	32.3 U
I-C32	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	24.4 U	48.8 U
I-C33	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	13.7 U	27.4 U
I-C34	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	19.0 U	39.0 U

TABLE C.8. (Contd)

Sediment Treatment	Pesticides (µg/kg dry weight)									
	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Methoxychlor	Toxaphene
COMP V Rep 1	2.8	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	13.5 U	27.0 U
COMP V Rep 2	3.5	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	13.5 U	27.0 U
COMP V Rep 3	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	14.0 U	27.0 U
I-C13	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	15.0 U	31.0 U
I-C14	6.3	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	15.2 U	30.3 U
I-C15	3.5	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	13.0 U	26.0 U
I-C18 Rep 1	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.7 U	29.4 U
I-C18 Rep 2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
I-C18 Rep 3	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.7 U	29.4 U
COMP VI	2.9 U	2.9 U	3.6	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.3 U	28.6 U
I-C16	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.0 U	29.0 U
I-C17	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	21.7 U	43.5 U
I-C35	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	16.9 U	33.9 U
R-AC	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	18.0 U	35.0 U
R-AM	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	12.0 U	24.0 U
R-BF	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	12.5 U	25.0 U
R-OS	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	17.2 U	34.5 U
R-PC	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	13.5 U	27.0 U
R-PF	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	14.1 U	28.2 U
C-NE	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	12.8 U	25.6 U
C-SB	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	5.4 U	27.0 U	54.1 U
C-WB	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	17.2 U	34.5 U

(a) Undetected above given concentration.
(b) Compositing duplicate.
(c) Analyte detected in associated blank, at less than twice the method detection limit; sample concentration not blank corrected.

TABLE C.9. Quality Control Data for Pesticide Analysis (Alphabetical Aldrin-4,4 DDT), Oakland Phase III 38' Project

Sediment Treatment	Pesticide Concentration (µg/kg dry weight)									
	Aldrin	Alpha-BHC	Beta-BHC	(Lindane) Delta-BHC	Alpha-Gamma-BHC	Gamma-Chlordane	Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
Method Blanks										
Blank I	2.0 U[a]	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Blank II	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Blank III	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Blank IV	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	4.2
Blank V	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Blank I A	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Blank II A	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Blank III	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Matrix Spikes - Reported Separately in Table C.11										
Analytical Triplicates										
COMP V Rep 1	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
COMP V Rep 2	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
COMP V Rep 3	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
RSD	NA[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-C18 Rep 1	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
I-C18 Rep 2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
I-C18 Rep 3	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
RSD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Compositing Duplicates										
COMP I	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U
COMP I cdup[c]	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	47.0	3.9 U
RPD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE C.9. (Contd)

Sediment Treatment	Pesticide Concentration (µg/kg dry weight)									
	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Alpha-Chlordane	Gamma-Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
Compositing Duplicates (Contd)										
I-C28	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
I-C28 cdup	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U
RPD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) Undetected above given concentration.
(b) Not applicable due to one or more undetected values.
(c) Compositing duplicate.

TABLE C.10. Quality Control Data for Pesticide Analysis (Alphabetical Dieldrin-Toxaphene), Oakland Phase III 38' Project

Sediment Treatment	Pesticide Concentration (µg/kg dry weight)									
	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Methoxychlor	Toxaphene
Method Blank										
Blank I	2.0 U[a]	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank II	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank III	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank IV	3.2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank V	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank I A	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank II A	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Blank III	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
Matrix Spikes - Reported Separately in Table C.11										
Analytical Triplicates										
COMP V Rep 1	2.8	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	13.5 U	27.0 U
COMP V Rep 2	3.5	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	13.5 U	27.0 U
COMP V Rep 3	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	14.0 U	27.0 U
RSD	NA[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-C18 Rep 1	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.7 U	29.4 U
I-C18 Rep 2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 U	20.0 U
I-C18 Rep 3	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.7 U	29.4 U
RSD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Compositing Duplicates										
COMP I	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	20.4 U	40.8 U
COMP I cdup[c]	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	19.0 U	39.0 U
RPD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-C28	7.6	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	16.7 U	33.3 U
I-C28 cdup	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	14.0 U	29.0 U
RPD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) Undetected above given concentration.
(b) Not applicable due to one or more undetected value.
(c) Compositing Duplicate.

TABLE C.11. Matrix Spike Data for Pesticide Analysis, Oakland Phase III 38' Project

Station Name	Pesticide Concentrations (µg/kg dry weight)					
	Aldrin	(Lindane) Gamma-BHC	4,4'-DDT	Dieldrin	Endrin	Heptachlor
Matrix Spikes						
COMP V MS	19.3	18.5	25.8	23.4	33.0	20.6
% Rec.	78.8%	75.5%	105.3%	95.5%	134.7%	84.1%
(Spiked with 24.5 µg/kg)						
COMP V MSD	19.7	18.4	27.8	21.7	26.6	21.0
% Rec.	82.1%	76.7%	115.8%	90.4%	110.8%	87.5%
(Spiked with 24.0 µg/kg)						
RPD	4%	2%	10%	5%	19%	4%
I-STAT	0.02	0.01	0.05	0.03	0.10	0.02
IC-18 MS	17.4	15.9	21.9	19.6	24.4	18.7
% Rec.	79.5%	72.6%	100.0%	89.5%	111.4%	85.4%
(Spiked with 21.9 µg/kg)						
IC-18 MSD	20.2	18.0	26.8	22.4	29.9	21.6
% Rec.	82.8%	73.8%	109.8%	91.8%	122.5%	88.5%
(Spiked with 24.4 µg/kg)						
RPD	4%	2%	9%	3%	10%	4%
I-STAT	0.02	0.01	0.05	0.01	0.05	0.02
COMP I cdup MS	39.0	52.0	50.0	31.0	38.0	58.0
% Rec.	81.6%	108.8%	104.6%	64.9%	79.5%	121.3%
(Spiked with 47.8 µg/kg)						
COMP I cdup MSD	16.0	4.7	2.9	3.1	4.1	4.9
% Rec.	31.4%	9.2%	5.7%	6.1%	8.1%	9.6%
(Spiked with 50.9 µg/kg)						
RPD	89%	169%	179%	166%	163%	171%
I-STAT	0.44	0.84	0.90	0.83	0.82	0.85

TABLE C.12. Sediment Polychlorinated Biphenyls (PCBs) Results, Oakland Phase III 38′ Project

Sediment Treatment	PCB Concentration (µg/kg dry weight) Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
COMP I	40.8 U[a]	40.8 U	40.8 U	40.8 U	40.8 U	70	40.8 U
COMP I cdup[b]	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U
I-C 3	35.7 U	35.7 U	35.7 U	35.7 U	35.7 U	360	35.7 U
I-C19	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U
I-C21	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U
COMP II	42.6 U	42.6 U	42.6 U	42.6 U	42.6 U	87	42.6 U
I-C 5	44.4 U	44.4 U	44.4 U	44.4 U	44.4 U	96 UE[c]	44.4 U
I-C22	42.6 U	42.6 U	42.6 U	42.6 U	42.6 U	42.6 U	42.6 U
I-C23	37.7 U	37.7 U	37.7 U	37.7 U	37.7 U	130	83
I-C24	41.7 U	41.7 U	41.7 U	41.7 U	41.7 U	41.7 U	41.7 U
I-C25	45.5 U	45.5 U	45.5 U	45.5 U	45.5 U	77	45.5 U
I-C25 top 12"	44.0 U	44.0 U	44.0 U	44.0 U	44.0 U	120	44.0 U
I-C26	43.5 U	43.5 U	43.5 U	43.5 U	43.5 U	100	43.5 U
I-C27	37.0 U	37.0 U	37.0 U	37.0 U	37.0 U	74	37.0 U
COMP III	38.5 U	38.5 U	38.5 U	38.5 U	38.5 U	220 UE	38.5 U
I-C 8	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
I-C28	33.3 U	33.3 U	33.3 U	33.3 U	33.3 U	140	57 UE
I-C28 cdup	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U	41 UE	79 UE
I-C29	35.7 U	35.7 U	35.7 U	35.7 U	35.7 U	310	77
I-C30	33.9 U	33.9 U	33.9 U	33.9 U	33.9 U	33.9 U	33.9 U
COMP IV	33.9 U	33.9 U	33.9 U	33.9 U	33.9 U	64	33.9 U
I-C 9	41.0 U	41.0 U	41.0 U	41.0 U	41.0 U	250	96
I-C10	26.3 U	26.3 U	26.3 U	26.3 U	26.3 U	64	26.3 U
I-C11	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U
I-C12	46.5 U	46.5 U	46.5 U	46.5 U	46.5 U	46.5 U	46.5 U
I-C31	32.3 U	32.3 U	32.3 U	32.3 U	32.3 U	68 UE	32.3 U
I-C32	48.8 U	48.8 U	48.8 U	48.8 U	48.8 U	120	48.8 U
I-C33	27.4 U	27.4 U	27.4 U	27.4 U	27.4 U	78	27.4 U
I-C34	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U
COMP V Rep 1	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U
COMP V Rep 2	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	110	27.0 U
I-C13	31.0 U	31.0 U	31.0 U	31.0 U	31.0 U	31.0 U	31.0 U
I-C14	30.3 U	30.3 U	30.3 U	30.3 U	30.3 U	160	140
I-C15	26.0 U	26.0 U	26.0 U	26.0 U	26.0 U	49 UE	26.0 U
I-C18 Rep 1	29.4 U	29.4 U	29.4 U	29.4 U	29.4 U	130	59 UE
I-C18 Rep 2	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	270	200 UE
I-C18 Rep 3	29.4 U	29.4 U	29.4 U	29.4 U	29.4 U	170	120 UE
COMP VI	28.6 U	28.6 U	28.6 U	28.6 U	28.6 U	46 UE	28.6 U
I-C16	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U
I-C17	43.5 U	43.5 U	43.5 U	43.5 U	43.5 U	410	120
I-C35	33.9 U	33.9 U	33.9 U	33.9 U	33.9 U	150	33.9 U
R-AC	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
R-AM	24.0 U	24.0 U	24.0 U	24.0 U	24.0 U	24.0 U	24.0 U
R-BF	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	51	25.0 U
R-OS	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	260	34.5 U
R-PC	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	73	27.0 U
R-PF	28.2 U	28.2 U	28.2 U	28.2 U	28.2 U	52	28.2 U

TABLE C.12. (Contd)

Sediment Treatment	PCB Concentration (μg/kg dry weight)						
	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
C-NE	25.6 U	25.6 U	25.6 U	25.6 U	25.6 U	120 UE	49 UE
C-SB	54.1 U	54.1 U	54.1 U	54.1 U	54.1 U	150	54.1 U
C-WB	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	110	45

(a) Undetected above given concentration.
(b) Compositing duplicate.
(c) Elevated detection limit due to chromatographic interference and significant difference in quantitation between first and second columns.

TABLE C.13. Quality Control Data for Polychlorinated Biphenyl (PCB) Analysis, Oakland Phase III 38′ Project

Sediment Treatment	PCB Concentration (µg/kg dry weight) Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
Method Blanks							
Blank II	20.0 U[a]	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Blank III	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Blank IV	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Blank V	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Blank I A	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Blank II A	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Matrix Spikes							
COMP V, Rep 1	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U
COMP V MS	NS[b]	NS	NS	NS	NS	NS	1060
Recovered							1060
% Recovery							79%
Spiked with 1340 ug/kg							
COMP V, Rep 1	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U
COMP V MSD	NS	NS	NS	NS	NS	NS	910
Recovered							910
% Recovery							70%
Spiked with 1300 ug/kg							
RPD	NA[c]	NA	NA	NA	NA	NA	14%
I-STAT	NA	NA	NA	NA	NA	NA	0.07
I-C21	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U
I-C21 MS	NS	NS	NS	NS	NS	1131	NS
Recovered						1131	
% Recovery						155%	
Spiked with 728 ug/kg							
I-C21	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U	29.9 U
I-C21 MSD	NS	NS	NS	NS	NS	1016	NS
Recovered						1016	
% Recovery						154%	
Spiked with 660 ug/kg							
RPD	NA	NA	NA	NA	NA	1%	NA
I-STAT	NA	NA	NA	NA	NA	0.00	NA
C-WB	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	110	45
C-WB MS	NS	NS	NS	NS	NS	790	NS
Recovered						680	
% Recovery						91%	
Spiked with 750 µg/kg							
C-WB	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	110	45
C-WB MSD	NS	NS	NS	NS	NS	786	NS
Recovered						676	
% Recovery						92%	
Spiked with 734 µg/kg							
RPD	NA	NA	NA	NA	NA	1.6%	NA
I-Stat	NA	NA	NA	NA	NA	0.01	NA
Analytical Duplicates							
COMP V Rep 1	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U
COMP V Rep 2	27.0 U	27.0 U	27.0 U	27.0 U	27.0 U	110	27.0 U
RPD	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA

TABLE C.13. (Contd)

Sediment Treatment	PCB Concentration (µg/kg dry weight) Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
Analytical Triplicates							
I-C18 Rep 1	29.4 U	29.4 U	29.4 U	29.4 U	29.4 U	130	59 UE[d]
I-C18 Rep 2	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	270	200 UE
I-C18 Rep 3	29.4 U	29.4 U	29.4 U	29.4 U	29.4 U	170	120 UE
RSD	NA	NA	NA	NA	NA	38%	NA
Compositing Duplicates							
COMP I	40.8 U	40.8 U	40.8 U	40.8 U	40.8 U	70	40.8 U
COMP I cdup[e]	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U	39.0 U
RPD	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA
I-C28	33.3 U	33.3 U	33.3 U	33.3 U	33.3 U	140	57 UE
I-C28 cdup	29.0 U	29.0 U	29.0 U	29.0 U	29.0 U	41	79 UE
RPD	NA	NA	NA	NA	NA	NA	NA
I-STAT	NA	NA	NA	NA	NA	NA	NA
Standard Reference Materials							
HS-2	20 U	20 U	20 U	20 U	20 U	71[g]	36 UE
Certified	NC[f]	NC	NC	NC	NC	111.8 ±2.5	NC

(a) Undetected above given concentration.
(b) Not spiked.
(c) Not applicable.
(d) Elevated detection limit due to chromatographic interference and significant difference in quantitation between first and second columns.
(e) Compositing duplicate.
(f) Not certified.
(g) Data point out of certified range.

TABLE C.14. Pesticide and PCB Surrogate (Dibutylchlorendate, DBC) Recovery, Oakland Phase III 38' Project

Sediment Treatment	Surrogate (DBC) Recovery (%)	Sediment Treatment	Surrogate (DBC) Recovery (%)
COMP I	120	I-C30	105.0
COMP I cdup[a]	116.0	I-C31	0.0[b]
COMP II	89.0	I-C32	87.0
COMP III	102.0	I-C33	78.0
COMP IV	84.0	I-C34	101.0
COMP V Rep 1	79.0	I-C35	50.0
COMP V Rep 2	155[c]	R-AC	61.0
COMP VI	72.0	R-AM	81.0
C-NE	71.0	R-BF	111.0
C-SB	88.0	R-OS	90.0
C-WB	121.0	R-PC	101.0
I-C 3	94.4	R-PF	120.0
I-C 5	83.6		
I-C 8	116.0	QC Samples	
I-C 9	82.8		
I-C10	90.6	COMP V MS	141
I-C11	115.0	COMP V MSD	101
I-C12	91.1	I-C21 MS	121
I-C13	85.0	I-C21 MSD	130
I-C14	84.0	C-WB MS	73
I-C15	95.0	C-WB MSD	0.0[c]
I-C16	70.0	HS-2	75
I-C17	61.0		
I-C18 Rep 1	89.0		
I-C18 Rep 2	135.0		
I-C18 Rep 3	129.0		
I-C19	93.0		
I-C21	122.0		
I-C22	81.0		
I-C23	102.0		
I-C24	81.1		
I-C25	96.0		
I-C25 top 12"	113.0		
I-C26	120.0		
I-C27	80.0		
I-C28	76.0		
I-C28 cdup	92.0		
I-C29	94.0		

(a) Compositing duplicate.
(b) Inadvertantly not spiked with surrogate compound.
(c) Most of blank I inadvertantly transfered into sample; additional DBC from blank is reason for high recovery in COMP V Rep 2.

TABLE C.15. Sediment Metals Results, Oakland Phase III 38' Project

Sediment Treatment	Metals (mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target Detection Limit	1.0	1.0	0.1	1.0	1.0	0.02	1.0	1.0	0.1	1.0
COMP I	0.26	9.30	0.25	235	44.4	0.275	87.8	26.5	0.18	111.6
COMP I cdup[a]	0.30	9.40	0.24	335	174.3	0.314	86.0	24.9	0.18	135.5
I-C 3	0.22	8.37	0.15	363	37.2	0.227	75.2	22.1	0.13	98.1
I-C19	0.19	8.60	0.23	186	49.5	0.116	96.5	14.5	0.26	95.8
I-C21	0.13	6.12	0.10	375	26.0	0.248	57.3	14.5	0.08	59.8
COMP II	0.36	9.50	0.28	251	54.9	0.358	100.5	57.1	0.27	146.9
I-C 5	0.40	11.00	0.23	201	55.5	0.374	105.9	36.9	0.21	146.5
I-C22	0.39	12.00	0.20	215	57.4	0.370	104.5	32.5	0.30	133.8
I-C23	0.40	10.70	0.24	224	54.8	0.298	103.6	32.9	0.29	139.0
I-C24 Rep 1	0.38	11.90	0.28	209	54.1	0.337	97.6	32.2	0.23	139.5
I-C24 Rep 2	0.40	10.70	0.25	198	56.9	0.337	104.9	34.4	0.27	139.9
I-C24 Rep 3	0.36	NT[b]	0.22	NT	NT	0.364	NT	NT	0.26	NT
I-C25	0.44	9.70	0.27	219	62.2	0.424	108.6	38.9	0.18	152.6
I-C25 top 12"	0.42	9.70	0.21	207	60.6	0.374	105.3	34.6	0.34	143.9
I-C26	0.42	12.10	0.23	188	59.1	0.390	99.4	34.9	0.29	147.9
I-C27	0.30	10.10	0.25	240	46.5	0.281	94.9	28.5	0.09	119.4
COMP III	0.55	11.60	0.59	284	60.3	0.521	90.4	41.9	0.18	144.2
I-C 8	0.10	4.96	0.11	263	23.1	0.085	58.8	12.0	0.08U[c]	59.6
I-C28	0.41	8.80	0.42	351	47.2	0.372	85.6	32.9	0.09	112.4
I-C28 cdup	0.43	7.00	0.43	431	44.2	0.345	88.0	33.1	0.08U	115.6
I-C29	0.87	11.40	0.99	282	82.9	1.280	103.0	63.5	0.18	216.0
I-C30	0.28	7.94	0.25	285	46.3	0.264	80.4	25.7	0.08U	107.1
COMP IV	0.28	8.50	0.32	414	44.2	0.272	87.0	28.6	0.09	113.2
I-C 9	0.50	10.60	0.59	301	68.9	0.502	108.4	52.9	0.18	166.4
I-C10	0.14	3.35	0.16	441	24.3	0.107	72.0	16.5	0.08U	67.4
I-C11	0.12	4.30	0.15	955	24.8	0.101	74.9	13.3	0.08U	79.6
I-C12	0.50	11.50	0.52	240	74.4	0.518	113.8	51.9	0.22	176.4
I-C31	0.15	6.99	0.59	345	32.5	0.177	77.6	20.4	0.22	91.6
I-C32	0.50	11.10	0.42	198	75.1	0.500	110.4	50.7	0.18	192.0
I-C33	0.20	5.23	0.21	525	39.8	0.207	78.9	21.9	0.08U	96.7
I-C34	0.42	9.50	0.38	275	69.2	0.426	101.6	45.3	0.18	159.1
COMP V Rep 1	0.14	5.41	0.19	498	25.1	0.147	69.6	17.0	0.09	66.5
COMP V Rep 2	0.09	4.57	0.18	606	25.2	0.151	68.4	17.7	0.09	65.9
COMP V Rep 3	0.10	NT	0.16	NT	NT	0.147	NT	NT	0.09	NT
I-C13	0.15	6.15	0.21	643	30.4	0.184	82.0	20.6	0.08U	86.2
I-C14	0.24	8.90	0.26	405	38.1	0.236	84.3	26.7	0.08U	104.3
I-C15	0.09	6.65	0.15	454	20.6	0.120	66.5	12.2	0.08U	58.8
I-C18	0.33	4.10	0.52	327	43.6	0.685	73.5	43.3	0.09	117.9
COMP VI	0.19	9.10	0.30	303	35.7	0.210	79.8	20.2	0.09	88.4
I-C16	0.17	5.24	0.24	640	29.1	0.178	75.8	23.5	0.08U	91.9
I-C17	0.68	10.10	0.84	258	82.2	0.798	110.1	79.3	0.23	200.0
I-C35	0.35	8.20	0.19	297	59.7	0.582	93.8	49.5	0.18	143.4
R-AC	0.32	10.70	0.23	229	56.1	0.306	104.0	24.4	0.21	115.3
R-AM	0.02	13.20	0.35	121	11.4	0.048	38.8	11.0	0.08U	35.4
R-BF	0.12	6.75	0.13	479	31.2	0.191	65.5	19.0	0.13	80.7
R-OS	0.28	4.25	0.38	240	27.0	0.112	75.1	6.9	1.11	88.7
R-PC	0.03	6.35	1.11	271	11.5	0.054	36.6	5.5	0.07U	42.9
R-PF	0.06	3.56	1.63	359	12.4	0.066	42.3	8.8	0.13	49.9

TABLE C.15. (Contd)

Sediment Treatment	Metals (mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
C-SB	0.22	9.44	0.77	109	37.7	0.097	45.0	12.7	0.76	84.9
C-WB	0.03	2.94	0.06	179	11.1	0.009	42.8	6.3	0.07U	43.6
C-NE	0.04	5.27	0.03	81	8.0	0.054	22.7	3.5	0.07U	22.0

(a) Compositing duplicate.
(b) No triplicate analyzed by XRF.
(c) Undetected above given concentration.

TABLE C.16. Quality Control Data for Sediment Metals Analyses, Oakland Phase III 38' Project

Sample	Metal Concentration (mg/kg dry weight) Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Method Blanks										
Blank I	0.013	NA[a]	0.008 U[b]	NA	NA	0.009	NA	NA	0.08 U	NA
Blank II	NA	NA	0.008 U	NA	NA	0.004	NA	NA	0.08 U	NA
Blank III	0.01	NA	0.01 U	NA	NA	0.005	NA	NA	0.07 U	NA
Blank IV	0.01	NA	0.01 U	NA	NA	0.007	NA	NA	0.07 U	NA
Blank V	0.01	NA	0.01 U	NA	NA	NA	NA	NA	0.07 U	NA
Matrix Spikes and Recovery										
COMP V mean	0.11	3.33	0.18	368.00	16.77	0.148	46.00	11.57	0.09	44.13
COMP V Spike	2.49	NS[c]	21.20	NS	NS	1.110	NS	NS	4.45	NS
Recovered	2.38		21.02			0.962			4.36	
Spiked with	2.00		20.00			1.000			5.00	
% Recovery	119%		105%			96%			87%	
I-C24, mean	0.38	7.53	0.25	135.67	37.00	0.346	67.50	22.20	0.25	93.13
I-C24, Spike	2.64	NS	22.50	NS	NS	1.335	NS	NS	4.70	NS
Recovered	2.26		22.25			0.989			4.45	
Spiked with	2.00		20.00			1.000			5.00	
% Recovery	113%		111%			99%			89%	
Standard Reference Materials										
BEST-1 Rep 1	NA	NA	NA	NA	NA	0.092	NA	NA	NA	NA
BEST-1 Rep 2	NA	NA	NA	NA	NA	0.092	NA	NA	NA	NA
Certified	NC[d]	NC	NC	NC	NC	0.092	NC	NC	NC	NC
BCSS Rep 1	0.093	NA	0.27	NA	NA	0.136	NA	NA	NA	NA
BCSS Rep 2	NA	NA	NA	NA	NA	0.135	NA	NA	NA	NA
Certified	NC	NA	0.25 ±0.04	NA	NA	0.129 ±0.012	NA	NA	NA	NA
MESS-1 Rep 1	0.106	9.9	0.71[e]	65	27.0[e]	0.180	32.2	35.1	0.32	183.0
MESS-1 Rep 2	0.11	11.0	0.55[e]	64	29.0[e]	0.184	30.6	31.8	0.30	175.7
MESS-1 Rep 3	NT[f]	11.9	NT	67	29.1[e]	NT	29.9	30.6	0.34	175.0
Certified	NC	10.6 ±1.2	0.59 ±0.01	71 ±11	25.1 ±3.8	NC	29.5 ±2.7	34.0 ±6.1	0.34 ±0.06	191.0 ±17.0
PACS-1 Rep 1	2.05	167.7[e]	2.38	116	399[e]	4.72	46.0	394	1.00	800.0[e]
PACS-1 Rep 2	1.68	164.5[e]	2.19[e]	121	397[e]	4.40	43.7	380[e]	0.98	775.0[e]
PACS-1 Rep 3	NT	168.5[e]	NT	122[e]	402[e]	NT	43.1	380[e]	NT	789.0[e]
Certified	NC	211.0 ±11.0	2.38 ±0.02	113 ±8	452 ±16	4.57 ±0.16	44.1 ±2.0	404 ±20	1.09 ±0.11	824.0 ±22.0
SRM 1646 Rep 1	0.095	13.4[e]	0.37	70[e]	19.9	0.070	30.4	23.4[e]	0.49	132.0
SRM 1646 Rep 2	0.09	8.6[e]	0.32	79	20.4	0.073	34.0	30.6[e]	0.49	125.1[e]
SRM 1646 Rep 3	0.10	12.4	0.31	79	21.1[e]	NT	33.8	25.4[e]	0.47	127.8[e]
Certified	NC	11.6 ±1.3	0.36 ±0.07	76 ±3	18.0 ±3	0.063 ±0.012	32.0 ±3.0	28.2 ±1.8	NC	138.0 ±6.0

TABLE C.16. (Contd)

Sample	Metal Concentration (mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target Detection Limit	1.0	1.0	0.1	1.0	1.0	0.02	1.0	1.0	0.1	1.0
Analytical Duplicates/Triplicates										
COMP V Rep 1	0.14	5.41	0.19	498	25.1	0.147	69.6	17.0	0.09	66.5
COMP V Rep 2	0.09	4.57	0.18	606	25.2	0.151	68.4	17.7	0.09	65.9
COMP V Rep 3	0.10	NT	0.16	NT	NT	0.147	NT	NT	0.09	NT
RSD	24.05%	NA	8.65%	NA	NA	1.56%	NA	NA	0.00%	NA
RPD	NA	16.83%	NA	19.57%	0.40%	NA	1.74%	4.03%	NA	0.91%
I-STAT	NA	0.08	NA	0.10	0.00	NA	0.01	0.02	NA	0.00
I-C24 Rep 1	0.38	11.90	0.28	209	54.1	0.337	97.6	32.2	0.23	139.5
I-C24 Rep 2	0.40	10.70	0.25	198	56.9	0.337	104.9	34.4	0.27	139.9
I-C24 Rep 3	0.36	NT	0.22	NT	NT	0.364	NT	NT	0.26	NT
RSD	5.26%	NA	12.00%	NA	NA	4.51%	NA	NA	8.22%	NA
RPD	NA	10.62%	NA	5.41%	5.05%	NA	7.21%	6.61%	NA	0.29%
I-STAT	NA	0.05	NA	0.03	0.03	NA	0.04	0.03	NA	0.00
Compositing Duplicates										
COMP I	0.26	9.30	0.25	235	44.4	0.275	87.8	26.5	0.18	111.6
COMP I cdup(g)	0.30	9.40	0.24	335	174.3	0.314	86.0	24.9	0.18	135.5
RPD	14.29%	1.07%	4.08%	35.09%	118.79%	13.24%	2.07%	6.23%	0.00%	19.34%
I-STAT	0.07	0.01	0.02	0.18	0.59	0.07	0.01	0.03	0.00	0.10
I-C28	0.41	8.80	0.42	351	47.2	0.372	85.6	32.9	0.09	112.4
I-C28 cdup	0.43	7.00	0.43	431	44.2	0.345	88.0	33.1	0.08 U	115.6
RPD	4.76%	22.78%	2.35%	20.46%	6.56%	7.53%	2.76%	0.61%	NA	2.81%
I-STAT	0.02	0.11	0.01	0.10	0.03	0.04	0.01	0.00	NA	0.01

(a) Not applicable to analyte or method.
(b) Undetected above given concentration.
(c) Not spiked; matrix spikes do not apply to metals analyzed by XRF.
(d) Not certified.
(e) Outside of certified range.
(f) No triplicate analyzed.
(g) Compositing duplicate.

TABLE C.17. Sediment Butyltin Results, Oakland Phase III 38' Project

Sediment Treatment	Propyltin Surrogate Recovery %	Butyltin Species (µg/kg dry weight) Tetra-butyl	Tri-butyl	Di-butyl	Mono-butyl
COMP I	50.1	0.8 U[a]	8.2	2.7	1.0
COMP I cdup[b]	44.0	0.6 U	3.8	1.8	0.7
I-C3	61.6	0.6 U	3.5	2.0	0.6
I-C19	47.0	0.7 U	2.4	1.2	0.6 U
I-C21	47.4	0.7 U	9.6	3.3	0.6 U
COMP II	55.8	0.9 U	9.1	4.6	1.1
I-C5	54.3	1.8	11.1	4.5	1.3
I-C22	54.3	0.7 U	6.7	3.6	1.3
I-C23	47.6	0.5 U	10.6	3.3	0.5
I-C24	53.6	10.8	11.6	5.3	1.3
I-C25	68.2	0.8 U	11.8	6.3	1.4
I-C25 top 12"	39.6	1.1 U	16.3	10.4	1.7
I-C26	53.0	1.2 U	13.1	4.9	1.3
I-C27	27.4	1.0 U	9.9	11.0	1.1
COMP III	40.9	0.7 U	30.7	21.9	3.0
I-C8	32.5	0.5 U	12.7	5.0	0.5
I-C28	59.9	0.5 U	15.3	9.0	1.7
I-C28 cdup	30.7	0.4 U	9.5	7.0	2.2
I-C29	53.8	0.5 U	35.0	18.9	5.8
I-C30	85.6	0.5 U	33.4	17.2	2.6
COMP IV	88.1	0.7 U	16.8	12.5	2.5
I-C9	70.1	0.7 U	33.6	21.9	3.8
I-C10	60.2	0.3 U	6.4	3.4	0.6
I-C11	46.3	0.5 U	5.0	3.0	0.4 U
I-C12	49.0	0.9 U	26.6	24.1	3.7
I-C31	51.0	0.6 U	8.0	5.2	0.7
I-C32	62.7	1.1 U	34.9	15.6	3.3
I-C33	57.4	0.5 U	19.9	14.8	2.4
I-C34	37.6	0.6 U	32.8	18.6	1.8
COMP V	89.0	0.5 U	17.2	7.8	1.5
I-C13	53.8	0.9 U	7.0	6.3	1.7
I-C14	75.0	0.5 U	9.2	9.1	1.4
I-C15	67.8	0.4 U	3.7	2.6	0.5
IC-18	68.5	0.5 U	14.4	14.7	2.8
COMP VI	80.2	0.6 U	7.9	6.5	1.5
I-C16	44.7	0.5 U	6.5	5.4	0.5
I-C17	70.7	0.9 U	44.5	40.1	3.4
I-C35	93.1	0.6 U	38.8	17.4	3.2

TABLE C.17. (Contd)

Sediment Treatment	Propyltin Surrogate Recovery %	Butyltin Species (μg/kg dry weight) Tetra-butyl	Tri-butyl	Di-butyl	Mono-butyl
R-AC	66.5	0.5 U	19.4	4.2	1.0
R-AM	40.7	0.4 U	1.0	0.6	0.4 U
R-BF	70.7	1.0 U	4.2	1.8	0.9 U
R-OS	49.7	0.9 U	1.9	1.0	0.8 U
R-PC	48.3	0.4 U	0.8	0.3 U	0.3 U
R-PF	31.2	0.6 U	0.9	0.9	0.6 U
C-SB	59.7	1.1 U	3.8	2.7	1.0 U
C-WB	35.3	0.5 U	0.7	0.6	0.4 U
C-NE	33.5	0.7 U	0.8	0.6 U	0.6 U

(a) Undetected above given concentration.
(b) Compositing duplicate.

TABLE C.18. Quality Control Data for Sediment Butyltin Analysis, Oakland Phase III 38' Project

Sediment Treatment	Propyltin Surrogate Recovery %	Butyltin Species (µg/kg dry weight) Tetra-butyl	Tri-butyl	Di-butyl	Mono-butyl
Method Blanks					
Blank R	10.9	1.0 U[a]	1.1 U	0.9 U	0.8 U
Blank-1	32.0	0.6 U	0.8	0.6 U	0.6 U
Blank-2	42.7	0.6 U	2.1	0.5 U	0.5 U
Blank-3	25.9	0.3 U	0.7	0.3 U	0.3 U
Blank-4	70.5	0.5 U	0.9	0.5 U	0.5 U
Matrix Spikes					
COMP I A	70.4	0.8 U	5.5	2.8	1.0
COMP I spike	70.2	1.4	149.5	145.4	48.2
Recovery		NS[b]	144.0	142.7	47.1
% Recovery			64%	63%	21%
Spike Concentration: 225 ng/g					
I-C12 A	48.8	0.9 U	19.9	21.3	2.8
I-C12 spike	70.6	2.6	171.4	177.3	66.6
Recovery		NS	151.5	156.1	63.8
% Recovery			61%	63%	26%
Spike Concentration: 247 ng/g					
C-WB A	54.4	0.4 U	0.8	0.5	0.4 U
C-WB spike	54.1	1.4	87.4	98.7	17.1
Recovery		NS	86.6	98.2	16.7
% Recovery			58%	66%	11%
Spike Concentration: 149 ng/g					
Standard Reference Materials					
PACS-1	64.3	5.8 U	649.9	567.9	80.7
corrected for surrogate			1011[c]	883[c]	126
PACS-2	78.9	5.5 U	545.8	569.5	93.7
corrected for surrogate			691[c]	722[c]	119
PACS-3 A	28.0	9.4 U	403.3	371.7	54.8
corrected for surrogate			1440	1328	196
PACS Certified Value		NC[d]	1270 ±220	1160 ±180	280 ±170

TABLE C.18. (Contd)

Sediment Treatment	Propyltin Surrogate Recovery %	Butyltin Species (µg/kg dry weight) Tetra-butyl	Tri-butyl	Di-butyl	Mono-butyl
Analytical duplicates					
COMP I	50.1	0.8 U	8.2	2.7	1.0
COMP I A	70.4	0.8 U	5.5	2.8	1.0
RPD	NA[e]	NA	39%	4%	1%
I-STAT	NA	NA	0.19	0.02	0.01
IC-12	49.0	0.9 U	26.6	24.1	3.7
IC-12 A	48.8	0.9 U	19.9	21.3	2.8
RPD	NA	NA	29%	13%	26%
I-STAT	NA	NA	0.15	0.06	0.13
C-WB	35.3	0.5 U	0.7	0.6	0.4
C-WB A	54.4	0.4 U	0.8	0.5	0.4
RPD	NA	NA	3%	28%	18%
I-STAT	NA	NA	0.02	0.14	0.09
Compositing Duplicates					
COMP I	50.1	0.8 U	8.2	2.7	1.0
COMP I cdup[f]	44.0	0.6 U	3.8	1.8	0.7
RPD	NA	NA	73%	40%	34%
I-STAT	NA	NA	0.37	0.20	0.17
I-C28	59.9	0.5 U	15.3	9.0	1.7
I-C28 cdup	30.7	0.4 U	9.5	7.0	2.2
RPD	NA	NA	47%	25%	27%
I-STAT	NA	NA	0.23	0.12	0.14

(a) Undetected above given concentration.
(b) Not spiked.
(c) Outside of certified range.
(d) Not certified.
(e) Not applicable.
(f) Compositing duplicate.

TABLE C.19. Sediment Oil and Grease and Total Petroleum Hydrocarbons (TPH) Results, Oakland Phase III 38' Project

Sediment Treatment	Concentrations (mg/kg dry weight) Oil & Grease	Total Petroleum Hydrocarbons	Petroleum Fraction %
COMP I	105	87	83.19
COMP I cdup[a]	89	75	84.34
I-C3	48	37	78.11
I-C19	18	17	97.36
I-C21	47	18	38.37
COMP II	69	59	85.45
I-C5	111	68	61.76
I-C22	78	58	74.30
I-C23	79	43	55.21
I-C24	77	40	52.19
I-C25	146	121	82.52
I-C25 top 25"	128	81	63.14
I-C26	16	62	390.52
I-C27	57	29	50.54
COMP III	202	167	82.87
I-C8	33	12	36.15
I-C28	97	85	87.30
I-C28 cdup	152	108	71.02
I-C29	245	181	74.02
I-C30	14	0.8 U[b]	5.72
COMP IV Rep 1	79	59	74.58
COMP IV Rep 2	58	36	62.03
COMP IV Rep 3	84	52	61.91
I-C9	175	142	81.18
I-C10	21	18	88.51
I-C11	49	36	73.16
I-C12	100	93	92.68
I-C31	53	47	88.43
I-C32	158	124	78.52
I-C33	57	42	73.76
I-C34	90	48	53.41
COMP V	58	36	61.68
I-C13	66	59	88.91
I-C14	82	65	79.24
I-C15	29	20	69.37
I-C18	135	102	75.63

TABLE C.19. (Contd)

Sediment Treatment	Concentrations (mg/kg dry weight) Oil & Grease	Total Petroleum Hydrocarbons	Petroleum Fraction %
COMP VI	58	51	88.64
I-C16	56	46	81.89
I-C17	188	145	77.22
I-C35	142	112	78.50
R-AC	92	78	84.81
R-AM	13	0.6 U	4.72
R-BF	34	10	29.55
R-OS	72	0.9 U	1.25
R-PC	25	0.7 U	2.78
R-PF	27	8	29.79
C-SB	76	67	88.25
C-WB	21	9	40.34
C-NE	15	2	13.72

(a) Compositing duplicate.
(b) Undetected above given concentration.

TABLE C.20. Quality Control Data for Sediment Oil and Grease and Total Petroleum Hydrocarbon (TPH) Analyses, Oakland Phase III 38′ Project

Sample	Concentrations (mg/kg dry weight) Oil & Grease	Total Petroleum Hydrocarbons
Method Blanks		
Blank 1	0.4	0.5 U[a]
Blank 2	0.5 U	0.5 U
Blank 3	3.0	0.5 U
Blank 4	1.0	0.5 U
Matrix Spikes		
COMP IV	74	49
COMP IV, MS	192	139
Recovery	118	90
% Recovery	288%	220%
Spiked with 69 mg/kg		
COMP IV	74	49
COMP IV, MSD	171	116
Recovery	97	67
% Recovery	226%	156%
Spiked with 70 mg/kg		
RPD	24%	34%
I-STAT	0.12	0.17
I-C15	23	16
I-C15 MS	43	43
Recovery	20	27
% Recovery	57%	77%
Spiked with 35 mg/kg		
I-C15	23	16
I-C15, MSD	61	37
Recovery	38	21
% Recovery	95%	53%
Spiked with 40 mg/kg		
RPD	50%	38%
I-STAT	0.25	0.19

TABLE C.20. (Contd)

Sample	Concentrations (mg/kg dry weight) Oil & Grease	Total Petroleum Hydrocarbons
Analytical Duplicates/Triplicates		
COMP IV	79	59
COMP IV	58	36
COMP IV	84	52
RSD	19%	24%
Compositing Duplicates		
COMP I	105	87
COMP I cdup[(b)]	89	75
RPD	16%	15%
I-STAT	0.08	0.07
I-C28	97	85
I-C28 cdup	152	108
RPD	44%	24%
I-STAT	0.22	0.12

(a) Undetected above given concentration.
(b) Compositing duplicate.

TABLE C.21. Sediment Total Organic Carbon (TOC) and Total Volatile Solids (TVS) Results, Oakland Phase III 38′ Project

Sediment Treatment	Batch	Total Organic Carbon (percent dry weight)	Total Volatile Solids (percent dry weight)
COMP I	2	0.88	7.01
COMP I cdup[a]	2	0.36	7.94
I-C 3	3	0.61	5.60
I-C19	3	0.61	8.75
I-C21	3	0.32	3.52
COMP II	2	1.14	8.77
I-C 5	3	1.13	9.48
I-C22	3	1.05	9.30
I-C23	3	1.12	8.96
I-C24 Rep 1	3	1.05	9.09
I-C24 Rep 2	3	NA[b]	9.02
I-C24 Rep 3	3	NA	8.95
I-C25	2	1.19	8.90
I-C25 top 12 in.	4	1.35	10.60
I-C26	3	1.13	9.06
I-C27	2	0.81	5.69
COMP III	1	0.90	5.95
I-C 8	2	0.21	2.63
I-C28	2	0.58	4.59
I-C28 cdup	3	0.54	5.28
I-C29	2	1.01	6.25
I-C30	2	0.60	4.67
COMP IV	1	0.61	5.06
I-C 9	2	1.03	7.50
I-C10	2	0.22	2.63
I-C11	2	0.24	2.76
I-C12	2	1.15	8.67
I-C31	2	0.45	4.38
I-C32	2	1.31	10.01
I-C33	2	0.43	3.74
I-C34	2	0.99	9.42
COMP V Rep 1	1	0.22	2.82
COMP V Rep 2	1	NA	2.78
COMP V Rep 3	1	NA	3.38
I-C13	2	0.34	3.49
I-C14	2	0,51	4.40
I-C15	2	0.20	2.84
I-C18	1	0.44	3.75

TABLE C.21. (Contd)

Sediment Treatment	Batch	Total Organic Carbon (percent dry weight)	Total Volatile Solids (percent dry weight)
COMP VI	1	0.36	3.96
I-C16	2	0.31	3.24
I-C17	2	1.25	8.46
I-C35	2	0.76	5.96
R-AC	4	0.94	8.61
R-AM	2	0.07	2.13
R-BF	3	0.48	5.14
R-OS	3	1.00	6.99
R-PC	3	0.26	2.61
R-PF	3	0.42	3.24
C-NE	5	0.07	1.43
C-SB	3	2.03	10.71
C-WB	3	0.11	1.19

(a) Compositing duplicate.
(b) Not applicable - sample not replicated for analyte.

TABLE C.22. Quality Control Data for Sediment Total Organic Carbon Data (TOC) and Total Volatile Solids (TVS) Analyses, Oakland Phase III 38' Project

Sediment Treatment	Batch	Total Organic Carbons (percent dry weight)	Total Volatile Solids (percent dry weight)
Method Blanks			
Blank 1	NA[a]	NA	0.00%
Blank 2	NA	NA	0.00%
Blank 3	NA	NA	0.00%
Blank 4	NA	NA	0.00%
Blank 5	NA	NA	0.00%
Standard Reference Materials[b]			
MESS-1 Rep 1	NA	2.36	NA
MESS-1 Rep 2	NA	2.34	NA
MESS-1 Rep 3	NA	2.31	NA
RSD		1.08%	
Compositing Duplicates			
COMP I	2	0.88	7.01
COMP I cdup[c]	2	0.36	7.94
RPD		83.87%	12.44%
I-STAT		0.42	0.06
I-C28	2	0.58	4.59
I-C28 cdup	3	0.54	5.28
RPD		7.14%	13.98%
I-STAT		0.04	0.07
Analytical Duplicates			
COMP V	NA	0.22	NA
COMP V Duplicate	NA	0.20	NA
RPD		9.52%	
I-STAT		0.05	
I-C24	NA	1.05	NA
I-C24 Duplicate	NA	1.06	NA
RPD		0.95%	
I-STAT		0.00	

TABLE C.22. (Contd)

Sediment Treatment	Batch	Total Organic Carbons (percent dry weight)	Total Volatile Solids (percent dry weight)
Analytical Triplicates			
IC-24 Rep 1	3	NA	9.09
IC-24 Rep 2	3	NA	9.02
IC-24 Rep 3	3	NA	8.95
RSD			0.77
COMP V Rep 1	1	NA	2.82
COMP V Rep 2	1	NA	2.78
COMP V Rep 3	1	NA	3.38
RSD			11

(a) Not applicable.
(b) MESS-1 is not certified for TOC, but frequent analyses at Battelle indicate a TOC value of approximately 2.3%.
(c) Compositing duplicate.

TABLE C.23. Summary of Sediment Grain Size, Oakland Phase III 38′ Project

Sediment Treatment	percent of dry weight Gravel >2000 μm	Sand 62.5-2000 μm	Silt 3.9-62.5 μm	Clay <3.9 μm
COMP I	0	32	32	36
COMP I cdup[a]	0	31	32	37
I-C3	0	49	22	29
I-C19	21	13	29	37
I-C21	0	68	15	17
COMP II	0	8	44	48
I-C5	0	7	43	50
I-C22	0	11	43	46
I-C23	0	9	46	45
I-C24	0	8	45	47
I-C25	0	6	43	51
I-C25 top 12 in.	0	10	53	37
I-C26	0	8	45	47
I-C27	0	32	33	35
COMP III	0	38	29	33
I-C8	0	70	15	15
I-C28	0	51	24	25
I-C28 cdup	0	51	22	27
I-C29	0	29	31	40
I-C30	0	55	19	26
COMP IV	0	53	19	28
I-C9	0	26	31	43
I-C10	0	79	8	13
I-C11	0	76	10	14
I-C12	0	14	34	52
I-C31	0	63	14	23
I-C32	0	5	38	57
I-C33	0	65	14	21
I-C34	0	26	28	46
COMP V	0	65	18	17
I-C13	0	71	11	18
I-C14	0	56	17	27
I-C15	1	62	20	17
I-C18	1	52	24	23
COMP VI	0	41	32	27
I-C16	0	72	11	17
I-C17	0	17	32	51
I-C35	0	30	32	38

TABLE C.23. (Contd)

Sediment Treatment	Gravel >2000 um	Sand 62.5-2000 um	Silt 3.9-62.5 um	Clay <3.9 um
	percent of dry weight			
R-AC	0	15	40	45
R-AM	4	94	1	1
R-BF	0	51	24	25
R-OS	0	32	46	22
R-PC	0	82	13	5
R-PF	0	61	28	11
C-NE	0	95	1	4
C-SB	0	20	50	30
C-WB	0	98	1	1

(a) Compositing duplicate.

TABLE C.24. Sediment Grain Size Results, Oakland Phase III 38' Project

Sediment Treatment	phi / μm	Percent in Size Fraction (dry weight)																
		>3350	3350-2000	2000-1000	1000-500	500-250	250-125	4 125-62.5	4.5 62.5-48.0	5 48.0-31.2	5.5 31.2-23.0	6 23.0-15.6	7 15.6-7.8	8 7.8-3.9	9 3.9-1.9	10 1.9-0.9	11 0.9-0.4	12 0.4-0.2	<12 <0.2
COMP I		0	0	0	1	8	14	9	1	5	8	4	8	6	7	8	5	15	1
COMP I cdup[a]		0	0	0	1	7	15	8	2	6	5	5	8	6	8	7	6	15	1
I-C3		0	0	0	1	13	28	7	2	3	4	2	6	5	6	6	5	12	0
I-C19		18	3	3	2	3	2	3	2	4	4	5	5	9	7	6	6	17	1
I-C21		0	0	0	1	20	38	9	2	3	2	1	5	2	3	3	3	8	0
COMP II		0	0	0	0	2	2	4	3	6	8	8	10	9	11	9	8	18	2
I-C5		0	0	0	0	1	3	3	3	9	6	7	10	8	10	10	8	21	1
I-C22		0	0	0	0	3	5	3	4	8	6	7	9	9	9	9	8	20	0
I-C23		0	0	0	0	1	4	4	5	9	10	3	10	9	10	10	7	18	0
I-C24		0	0	0	0	1	3	4	5	8	9	4	10	9	9	9	8	20	1
I-C25		0	0	0	0	1	2	3	0	7	7	6	12	11	13	13	8	17	0
I-C25 Top 12"		0	0	0	1	2	2	5	8	5	9	9	12	10	10	8	5	13	1
I-C26		0	0	0	0	1	4	3	4	8	7	6	10	10	10	10	8	19	0
I-C27		0	0	0	0	12	16	4	3	6	5	6	7	6	7	7	6	15	0
COMP III		0	0	0	1	9	22	6	4	5	2	5	5	8	8	6	6	13	0
I-C8		0	0	0	0	17	42	11	4	3	2	1	3	2	2	2	2	8	1
I-C28		0	0	0	1	17	28	5	4	4	3	3	5	5	5	5	4	11	0
I-C28 cdup		0	0	0	1	16	28	6	2	3	4	2	6	5	4	6	3	14	0
I-C29		0	0	0	0	5	17	7	4	5	4	4	7	7	8	7	6	19	0
I-C30		0	0	0	0	15	34	6	1	4	2	2	5	5	5	5	5	11	0
COMP IV		0	0	0	1	15	31	6	2	2	3	2	5	5	6	6	5	11	0
I-C9		0	0	0	0	4	16	6	3	3	5	4	7	9	8	9	8	18	0
I-C10		0	0	0	0	20	52	7	1	3	0	0	2	2	2	3	2	6	0
I-C11		0	0	0	0	20	46	10	1	2	1	1	2	3	2	4	2	6	0
I-C12		0	0	0	1	3	8	2	1	3	4	6	8	12	12	11	9	20	0
I-C31		0	0	0	0	22	37	4	1	2	2	1	4	4	4	5	3	10	1
I-C32		0	0	0	1	1	2	1	2	3	5	4	12	12	14	14	10	19	0
I-C33		0	0	0	0	18	40	7	0	3	2	1	4	4	4	4	3	10	0
I-C34		0	0	0	0	7	15	4	0	3	4	4	8	9	11	8	8	18	1
COMP V		0	0	1	0	16	38	10	4	4	2	2	3	3	2	3	3	8	1
I-C13		0	0	0	0	21	45	5	1	1	1	1	4	3	4	3	3	8	0
I-C14		0	0	1	1	15	32	7	1	2	3	2	5	4	5	5	4	11	2
I-C15		0	1	0	1	16	34	11	5	4	3	2	3	3	3	2	3	9	0
I-C18		1	0	0	1	10	29	12	6	5	2	3	3	5	4	4	4	11	0

TABLE C.24. (Contd)

Sediment Treatment	phi / μm	Percent in Size Fraction (dry weight)																	
		>3350	3350-2000	2000-1000	1000-500	500-250	250-125	4 125-62.5	4.5 62.5-48.0	5 48.0-31.2	5.5 31.2-23.0	6 23.0-15.6	7 15.6-7.8	8 7.8-3.9	9 3.9-1.9	10 1.9-0.9	11 0.9-0.4	12 0.4-0.2	<12 <0.2
COMP VI		0	0	0	1	8	21	11	7	6	3	4	7	5	6	5	4	12	0
I-C16		0	0	0	0	16	49	7	1	1	2	2	2	3	3	3	3	7	1
I-C17		0	0	0	0	4	10	3	1	2	5	4	9	11	11	11	8	21	0
I-C35		0	0	0	0	6	18	6	1	5	5	5	8	8	8	8	5	15	2
R-AC		0	0	1	0	4	5	5	1	8	6	6	10	9	8	10	7	18	2
R-AM		2	2	5	23	49	17	0	0	0	0	0	0	1	0	0	0	1	0
R-BF		0	0	0	2	21	23	5	4	5	3	2	5	5	6	10	3	6	0
R-OS		0	0	0	0	3	3	26	18	7	6	3	7	5	4	4	4	9	1
R-PC		0	0	0	0	3	25	54	8	3	1	0	1	0	1	0	0	3	1
R-PF		0	0	0	0	0	5	56	20	4	2	1	0	1	0	1	1	3	5
C-NE		0	0	0	0	26	64	5	0	0	0	0	0	1	0	0	0	1	3
C-SB		0	0	0	0	1	9	10	0	3	7	10	17	13	8	5	3	11	3
C-WB		0	0	0	0	22	71	5	0	1	0	0	0	0	0	0	0	1	0

(a) Compositing duplicate.

TABLE C.25. Quality Control Data for Sediment Grain Size

Sediment Treatment	phi / μm	Percent in Size Fraction (dry weight)																	
		>3350	3350-2000	2000-1000	1000-500	500-250	250-125	4 125-62.5	4.5 62.5-48.0	5 48.0-31.2	5.5 31.2-23.0	6 23.0-15.6	7 15.6-7.8	8 7.8-3.9	9 3.9-1.9	10 1.9-0.9	11 0.9-0.4	12 0.4-0.2	<12 <0.2
Compositing Duplicates																			
COMP I		0	0	0	1	8	14	9	2	5	8	4	8	6	7	8	5	15	0
COMP I cdup[a]		0	0	0	1	7	15	8	2	6	5	5	8	6	8	7	6	15	1
RPD		0%	0%	0%	0%	13%	7%	12%	0%	18%	46%	22%	0%	0%	13%	13%	18%	0%	200%
I-STAT		0.00	0.00	0.00	0.00	0.07	0.03	0.06	0.00	0.09	0.23	0.11	0.00	0.00	0.07	0.07	0.09	0.00	1.00
I-C28		0	0	0	1	17	28	5	4	4	3	3	5	5	5	5	4	11	0
I-C28 cdup		0	0	0	1	16	28	6	2	3	4	2	6	5	4	6	3	14	0
RPD		0%	0%	0%	0%	6%	0%	18%	67%	29%	29%	40%	18 %	0%	22%	18%	29%	24%	0%
I-STAT		0.00	0.00	0.00	0.00	0.03	0.00	0.09	0.33	0.14	0.14	0.20	0.09	0.00	0.11	0.09	0.14	0.12	0.00
Analytical Duplicates																			
Comp II		0	0	0	0	2	2	4	3	6	8	8	10	9	11	9	8	18	2
Comp II Replicate 1		0	0	0	0	2	5	4	1	9	7	6	11	9	11	9	8	18	0
RPD		0%	0%	0%	0%	0%	86%	0%	100%	40%	13%	29%	10%	0%	0%	0%	0%	0%	200%
I-STAT		0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.50	0.20	0.07	0.14	0.05	0.00	0.00	0.00	0.00	0.00	1.00
Comp IV		0	0	0	1	8	21	11	7	6	3	4	7	5	6	5	4	12	0
Comp IV Replicate 1		0	0	0	1	8	20	11	5	6	2	5	6	6	6	5	4	14	1
RPD		0%	0%	0%	0%	0%	5%	0%	33%	0%	40%	22%	15%	18%	0%	0%	0%	15%	200%
I-STAT		0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.17	0.00	0.20	0.11	0.08	0.09	0.00	0.00	0.00	0.08	1.00
I-C11		0	0	0	0	20	46	10	1	2	1	1	2	3	2	4	2	6	0
I-C11 Replicate 1		0	0	0	0	20	47	9	2	1	1	1	2	3	2	3	3	6	0
RPD		0%	0%	0%	0%	0%	2%	11%	67%	67%	0%	0%	0%	0%	0%	29%	40%	0%	0%
I-STAT		0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.14	0.20	0.00	0.00
I-C30		0	0	0	0	15	34	6	1	4	2	2	5	5	5	5	5	11	0
I-C30 Replicate 1		0	0	0	0	15	34	6	1	2	3	2	6	4	6	5	4	12	0
RPD		0%	0%	0%	0%	0%	0%	0%	0%	67%	40%	0%	18%	22%	18%	0%	22%	9%	0%
I-STAT		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.20	0.00	0.09	0.11	0.09	0.00	0.11	0.04	0.00
R-PF		0	0	0	0	0	5	56	20	4	2	1	0	1	0	1	1	3	6
R-PF Replicate 1		0	0	0	0	0	4	56	22	6	2	1	1	1	0	1	1	3	2
RPD		0%	0%	0%	0%	0%	22%	0%	10%	40%	0%	0%	200%	0%	0%	0%	0%	0%	100%
I-STAT		0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.05	0.20	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.50

(a) Compositing duplicate.

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APPENDIX D

BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE FLOW-THROUGH TEST WITH MACOMA NASUTA AND NEPHTYS CAECOIDES

APPENDIX D

SUMMARY: **BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE FLOW-THROUGH TEST WITH *MACOMA nasuta* AND *NEPHTYS caecoides***

Test type and method	10-d acute flow-through toxicity test: 5 replicates per treatment, 20 *M. nasuta* and 20 *N. caecoides* per replicate. Refer to *Draft Ecological Evaluation of Dredged Material into Ocean Waters* (EPA/USACE 1990)
Test species	Bent-nose clam *Macoma nasuta* Marine worm *Nephtys caecoides*
Test materials	Oakland Harbor sediment samples: Comp I, Comp II, Comp III, Comp IV, Comp V, Comp VI
Reference materials	Point Reyes Coarse (R-PC), Point Reyes Fine (R-PF), Offshore Sediment (R-OS), Bay Farm (R-BF), Alcatraz Environs (R-AM), Alcatraz Disposal Site (R-AC)
Control materials	Sequim Bay (C-SB), *N. caecoides* native sediment (C-NE and C-NE-A)
Dilution water	Filtered seawater from Sequim Bay, WA
Test dates	10/3/90 - 10/15/90
Source of organisms	*M. nasuta* - Discovery Bay, WA (Gunstone Clams) *N. caecoides* - Tomales Bay, CA (Brezina & Associates)
Test water quality parameter ranges	D.O. ≥4.0 mg/L pH 7.40 - 8.40 Salinity 30.0 - 34.0 o/oo Temperature 13 - 17°C Flow Rate 125 ± 10 mL/min
Test results	Refer to Tables D.1 and D.4

TABLE D.1. Rank Order Based Upon Mean Proportion Surviving 10-Day *M. nasuta* Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Mean Proportion Surviving
R-AC	0.97
COMP V	0.98
COMP VI	0.98
C-NE	0.98
C-NE-A	0.99
R-PC	0.99
R-OS	0.99
R-PF	0.99
C-SB	1.00
COMP IV	1.00
COMP I	1.00
R-BF	1.00
R-AM	1.00
COMP III	1.00
COMP II	1.00

TABLE D.2. Test Results for All Replicates in 10-Day *M. nasuta* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*M. nasuta* Live	*M. nasuta* Dead or Missing	Mean Proportion Surviving
COMP I	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
COMP II	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
COMP III	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
COMP IV	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
COMP V	1	20	0	
	2	18	2	
	3	20	0	
	4	20	0	
	5	20	0	0.98
COMP VI	1	20	0	
	2	19	1	
	3	19	1	
	4	20	0	
	5	20	0	0.98
R-AC	1	20	0	
	2	20	0	
	3	20	0	
	4	17	3	
	5	20	0	0.97

TABLE D.2. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Live	*M. nasuta* Dead or Missing	Mean Proportion Surviving
R-AM	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
R-BF	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
R-OS	1	20	0	
	2	19	1	
	3	20	0	
	4	20	0	
	5	20	0	0.99
R-PC	1	20	0	
	2	20	0	
	3	20	0	
	4	19	1	
	5	20	0	0.99
R-PF	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	19	1	0.99
C-SB	1	20	0	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	1.00
C-NE	1	20	0	
	2	20	0	
	3	19	1	
	4	20	0	
	5	19	1	0.98

TABLE D.2. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Live	*M. nasuta* Dead or Missing	Mean Proportion Surviving
C-NE-A[(a)]	1	19	1	
	2	20	0	
	3	20	0	
	4	20	0	
	5	20	0	0.99

(a) C-NE-A was initiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as intitial C-NE exposure.

TABLE D.3. Rank Order Based Upon Mean Proportion Surviving 10-Day *N. caecoides* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Mean Proportion Surviving
COMP VI	0.62
COMP III	0.69
COMP IV	0.70
R-AC	0.71
COMP V	0.72
COMP I	0.74
COMP II	0.77
R-OS	0.78
R-PF	0.80
R-BF	0.80
C-SB	0.84
R-PC	0.92
R-AM	0.92
C-NE-A	0.98

TABLE D.4. Test Results for all Replicates in 10-Day *N. caecoides* Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*N. caecoides* Live	*N. caecoides* Dead or Missing	Mean Proportion Surviving
COMP I	1	10	10	
	2	15	5	
	3	18	2	
	4	14	6	
	5	17	3	0.74
COMP II	1	17	3	
	2	17	3	
	3	10	10	
	4	14	6	
	5	19	1	0.77
COMP III	1	14	6	
	2	14	6	
	3	17	3	
	4	7	13	
	5	17	3	0.69
COMP IV	1	20	0	
	2	18	2	
	3	13	7	
	4	10	10	
	5	9	11	0.70
COMP V	1	16	4	
	2	14	6	
	3	17	3	
	4	12	8	
	5	13	7	0.72
COMP VI	1	11	9	
	2	9	11	
	3	15	5	
	4	15	5	
	5	12	8	0.62
R-AC	1	14	6	
	2	15	5	
	3	12	8	
	4	15	5	
	5	15	5	0.71

TABLE D.4. (Contd)

Sediment Treatment	Replicate	*N. caecoides* Live	*N. caecoides* Dead or Missing	Mean Proportion Surviving
R-AM	1	19	1	
	2	16	4	
	3	19	1	
	4	19	1	
	5	19	1	0.92
R-BF	1	20	0	
	2	17	3	
	3	15	5	
	4	12	8	
	5	16	4	0.80
R-OS	1	13	7	
	2	16	4	
	3	15	5	
	4	14	6	
	5	28	2	0.78
R-PC	1	28	2	
	2	17	3	
	3	20	0	
	4	19	1	
	5	17	3	0.92
R-PF	1	16	4	
	2	15	5	
	3	17	3	
	4	14	6	
	5	18	2	0.80
C-SB	1	18	2	
	2	16	4	
	3	17	3	
	4	15	5	
	5	18	2	0.84

TABLE D.4. (Contd)

Sediment Treatment	Replicate	*N. caecoides* Live	*N. caecoides* Dead or Missing	Mean Proportion Surviving
C-NE	1	16	4	
	2	18	2	
	3	18	2	
	4	18	2	
	5	15	5	0.85
C-NE-A(a)	1	20	0	
	2	19	1	
	3	20	0	
	4	19	1	
	5	20	0	0.98

(a) C-NE-A was intitiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as intitial C-NE exposure.

TABLE D.5. Water Quality Summary for 10-Day *M. nasuta/N. caecoides* Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Flow Rate (ml/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.40	8.40	4.0	---	30.0	34.0	115	135
COMP I	14.2	15.0	7.72	7.92	7.0	8.0	31.5	32.0	104[a]	132
COMP II	14.1	15.0	7.71	7.90	6.9	8.6	31.5	32.0	116	132
COMP III	14.2	14.9	7.70	7.93	6.2	8.2	31.5	32.5	108[a]	132
COMP IV	14.2	15.0	7.70	7.94	6.8	8.5	31.5	32.0	112[a]	132
COMP V	14.3	14.8	7.57	7.93	7.0	7.9	31.5	32.0	116	135
COMP VI	14.2	15.0	7.61	7.97	6.9	8.2	31.5	32.0	116	134
R-AC	14.2	14.9	7.45	7.96	6.9	8.3	31.0	32.0	116	132
R-AM	14.1	14.9	7.62	7.96	6.3	8.2	31.5	32.0	116	132
R-BF	14.2	14.9	7.64	7.97	6.8	8.5	31.5	32.0	112[a]	134
R-OS	14.1	15.0	7.61	7.96	6.6	8.2	31.5	32.0	116	134
R-PC	14.2	15.0	7.72	7.96	6.7	8.6	31.0	32.0	112[a]	132
R-PF	14.2	15.0	7.69	7.96	6.2	8.2	31.5	32.0	116	134
C-SB	14.1	14.8	7.71	7.99	6.9	8.4	31.5	32.0	116	132
C-NE	14.2	15.0	7.73	7.84	6.1	8.3	31.0	32.0	116	132
C-NE-A	14.2	15.2	7.10[a]	7.92	7.1	7.9	32.0	32.0	116	134

(a) Data point out of target quality control range. Low pH in C-NE-A was not sustained and did not affect the test results. Though some flow rates fell below the target range, the rates are more than sufficient to replace 90% of the water volume every 4 h as required by the 1990 Implementation Manual.

TABLE D.6. Daily Observation of *M. nasuta* on Sediment Surface During 10-Day Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*M. nasuta* on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	1	1	0	0	0	0	0	0	0	0
COMP I	2	1	1	0	0	0	0	0	0	0	1
COMP I	3	3	2	1	1	1	1	1	1	1	1
COMP I	4	2	2	1	1	1	1	0	0	1	1
COMP I	5	2	2	2	2	2	2	2	2	2	1
COMP II	1	3	3	3	3	3	3	2	2	1	1
COMP II	2	6	2	1	1	1	1	1	1	1	2
COMP II	3	5	3	3	3	1	1	0	0	0	0
COMP II	4	4	0	0	0	0	0	0	0	0	0
COMP II	5	5	2	1	0	0	0	1	0	0	0
COMP III	1	6	5	4	4	3	4	2	2	1	1
COMP III	2	2	1	0	0	0	0	0	0	0	0
COMP III	3	3	1	1	1	1	0	1	1	0	0
COMP III	4	1	1	0	0	0	0	0	0	0	0
COMP III	5	10	8	7	4	5	5	4	4	4	2
COMP IV	1	3	2	2	2	3	3	1	1	1	0
COMP IV	2	1	0	0	0	0	0	0	0	0	0
COMP IV	3	2	2	2	2	2	3	3	2	2	2
COMP IV	4	4	2	1	1	1	1	1	0	0	0
COMP IV	5	7	6	3	2	2	2	1	1	0	0
COMP V	1	4	2	1	2	2	2	1	1	1	1
COMP V	2	4	4	5	4	4	4	4	3	2	2
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	1	1	1	0	0	0	0	0	0	0
COMP V	5	1	1	1	1	1	1	1	1	1	1
COMP VI	1	1	0	0	0	0	0	0	1	1	1
COMP VI	2	3	4	3	2	2	2	2	3	3	3
COMP VI	3	2	2	0	1	1	1	0	0	1	1
COMP VI	4	0	0	0	0	0	0	0	0	0	0
COMP VI	5	5	1	0	0	0	0	0	0	0	0
R-AC	1	0	0	0	0	1	0	0	0	0	0
R-AC	2	3	2	1	0	0	0	1	0	1	1
R-AC	3	3	0	0	1	0	1	1	1	1	1
R-AC	4	0	1	1	0	0	0	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	0	0

TABLE D.6. (Contd)

Sediment Treatment	Replicate	*M. nasuta* on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	10	10	10	10	9	10	9	10	10	9
R-AM	2	3	2	1	1	3	1	0	1	0	0
R-AM	3	2	2	2	1	2	4	4	3	1	1
R-AM	4	5	4	5	3	3	4	5	4	6	7
R-AM	5	6	2	2	3	2	5	1	3	5	3
R-BF	1	0	0	0	0	1	1	1	1	1	0
R-BF	2	0	0	0	0	1	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	1	3	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	0	1
R-OS	1	0	0	0	0	1	0	1	0	0	2
R-OS	2	1	1	2	1	2	0	2	1	1	0
R-OS	3	1	0	0	0	1	1	1	1	1	1
R-OS	4	4	0	0	0	2	1	2	2	1	1
R-OS	5	0	0	0	2	0	0	0	0	0	0
R-PC	1	0	0	0	0	0	0	0	0	0	0
R-PC	2	1	0	0	0	0	1	0	0	0	1
R-PC	3	0	0	1	0	0	0	2	1	1	0
R-PC	4	0	1	0	1	1	1	0	0	1	1
R-PC	5	0	0	0	0	0	0	0	0	0	0
R-PF	1	0	0	0	1	2	3	2	0	1	2
R-PF	2	1	0	0	0	0	0	0	1	0	2
R-PF	3	0	0	1	0	2	1	0	0	0	1
R-PF	4	4	2	0	3	2	1	1	3	2	4
R-PF	5	1	2	1	3	2	3	2	4	3	2
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	T[a]	0	0
C-NE	1	2	2	2	3	3	3	3	4	1	2
C-NE	2	2	2	2	2	2	1	2	1	1[b]	2
C-NE	3	2	2	0	2	2	4	2	1		NA[c]
C-NE	4	1	1	2	3	1	1	1	1	1	2
C-NE	5	6	5	4	2	2	2	3	3	2	2

TABLE D.6. (Contd)

Sediment Treatment	Replicate	*M. nasuta* on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
C-NE-A[(d)]	1	4	4	4	3	3	5	5	2	5	5
C-NE-A[(d)]	2	2	1	1	2	1	1	3	3	3	1
C-NE-A[(d)]	3	5	0	0	0	0	2	1	2	0	1
C-NE-A[(d)]	4	2	2	2	3	4	3	5	3	3	4
C-NE-A[(d)]	5	3	1	1	1	1	1	1	1	2	2

(a) Too turbid to see.
(b) Inadvertantly terminated on Day 8.
(c) Not applicable.
(d) C-NE-A was initiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as initial C-NE exposure.

TABLE D.7. Daily Observation of *M. nasuta* Siphons Exposed During 10-Day Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*M. nasuta* Siphons Exposed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	4	3	2	2	0	0	2	0	2	1
COMP I	2	2	6	4	4	3	1	1	1	1	0
COMP I	3	2	1	4	2	1	1	1	2	3	0
COMP I	4	8	6	4	7	7	4	4	2	3	4
COMP I	5	3	6	8	2	4	8	7	4	2	3
COMP II	1	6	5	3	3	3	4	5	5	2	4
COMP II	2	12	4	4	4	2	3	2	1	1	1
COMP II	3	5	4	2	4	4	1	0	0	0	0
COMP II	4	7	6	3	2	1	0	0	1	0	0
COMP II	5	3	3	2	0	2	3	4	2	1	2
COMP III	1	16	8	8	4	4	4	5	1	1	2
COMP III	2	5	3	7	3	0	2	2	3	2	1
COMP III	3	3	6	6	5	2	2	2	2	0	0
COMP III	4	4	3	7	4	3	2	4	2	2	0
COMP III	5	26	16	15	12	16	10	13	9	11	9
COMP IV	1	5	7	6	4	7	3	3	5	3	2
COMP IV	2	2	1	1	2	1	2	3	1	1	2
COMP IV	3	11	5	4	4	3	0	2	2	3	3
COMP IV	4	6	4	4	2	3	2	1	1	1	1
COMP IV	5	13	12	6	3	4	3	3	1	1	0
COMP V	1	10	9	6	13	9	6	4	9	3	1
COMP V	2	5	11	9	6	6	6	9	5	5	5
COMP V	3	1	3	2	1	0	0	1	3	2	1
COMP V	4	2	3	3	1	0	5	1	3	0	2
COMP V	5	2	6	7	3	5	3	4	8	3	2
COMP VI	1	2	4	1	1	0	0	2	1	1	2
COMP VI	2	9	10	11	9	4	6	7	5	5	3
COMP VI	3	0	5	4	4	4	1	3	2	1	1
COMP VI	4	3	1	1	0	0	0	0	1	0	0
COMP VI	5	11	12	7	4	2	1	2	0	1	1
R-AC	1	4	6	10	2	5	0	0	0	2	0
R-AC	2	11	7	9	8	7	4	5	5	2	2
R-AC	3	12	8	8	4	6	7	6	5	5	5
R-AC	4	0	4	3	5	4	4	4	6	3	1
R-AC	5	5	4	3	3	3	8	3	2	0	0

TABLE D.7. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Siphons Exposed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	10	12	15	12	11	12	16	18	11	11
R-AM	2	4	4	3	1	5	2	0	0	1	1
R-AM	3	0	1	2	3	3	5	6	3	2	2
R-AM	4	7	5	9	7	7	7	9	8	9	13
R-AM	5	7	1	0	2	3	6	3	6	4	4
R-BF	1	1	0	2	0	1	1	4	2	2	0
R-BF	2	2	1	0	2	3	1	2	2	3	4
R-BF	3	0	1	0	1	0	0	0	1	0	1
R-BF	4	0	1	1	0	0	0	1	0	0	0
R-BF	5	1	4	2	2	2	2	2	1	1	2
R-OS	1	7	5	3	3	3	6	5	2	3	2
R-OS	2	3	7	1	2	5	2	4	1	6	4
R-OS	3	9	6	2	1	1	4	5	3	4	3
R-OS	4	3	4	2	3	4	0	1	4	0	0
R-OS	5	2	2	2	2	5	3	7	0	2	4
R-PC	1	0	1	1	2	0	0	0	0	0	2
R-PC	2	5	0	1	1	0	0	0	1	0	0
R-PC	3	3	1	2	0	0	0	0	4	2	2
R-PC	4	1	4	2	4	3	3	1	1	1	1
R-PC	5	2	1	0	0	0	0	0	1	0	1
R-PF	1	0	0	0	1	6	7	2	0	3	0
R-PF	2	5	3	0	2	2	2	0	3	1	0
R-PF	3	0	3	2	1	2	0	1	0	0	1
R-PF	4	11	2	3	9	3	2	1	2	2	5
R-PF	5	1	3	2	1	2	3	1	4	0	1
C-SB	1	0	1	5	0	1	1	1	0	3	0
C-SB	2	?	0	5	0	0	0	0	0	0	0
C-SB	3	3	1	4	1	0	0	1	0	0	0
C-SB	4	3	1	0	0	1	1	0	1	2	0
C-SB	5	2	0	0	2	0	0	0	T[a]	1	0
C-NE	1	9	6	4	6	6	5	5	2	5	6
C-NE	2	2	4	3	5	4	3	3	4	4	11
C-NE	3	0	3	2	2	1	6	4	8	[b]	NA[c]
C-NE	4	4	2	2	7	2	2	3	0	2	2
C-NE	5	8	13	9	5	5	3	4	5	4	4

TABLE D.7. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Siphons Exposed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
C-NE-A[(d)]	1	10	9	7	7	8	5	7	7	9	9
C-NE-A[(d)]	2	3	4	1	3	2	2	4	5	2	2
C-NE-A[(d)]	3	9	2	0	1	1	4	3	6	4	2
C-NE-A[(d)]	4	6	4	4	4	6	5	7	7	5	5
C-NE-A[(d)]	5	5	5	2	2	3	2	3	4	2	3

(a) Too turbid to see.
(b) Inadvertantly terminated on Day 8.
(c) Not applicable.
(d) C-NE-A was initiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as intitial C-NE exposure.

TABLE D.8. Daily Observation of *M. nasuta* Number Removed During 10-Day Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*M. nasuta* Removed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	0	0	0	0	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	0	0	0	0
COMP I	3	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	0	0	0	0	0	0	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	0	0	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	0	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	0	0	0	0	0	0	0
COMP III	2	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	0	0	0	0	0	0	0	0	0
COMP III	5	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	0	0	0	0	0	0	0	0	0
COMP IV	4	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0
COMP V	1	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	1	0	0	1	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	0	0	0	0	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	0	0	0	0	0	0	0
COMP VI	5	0	0	0	0	0	0	0	0	0	0
R-AC	1	0	0	0	0	1	0	0	0	0	0
R-AC	2	0	0	0	0	0	0	0	0	0	0
R-AC	3	0	0	0	0	0	0	0	0	0	0
R-AC	4	0	0	0	0	0	0	0	0	1	0
R-AC	5	0	0	0	0	0	0	0	0	0	0

TABLE D.8. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Removed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	0	0
R-OS	1	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	1	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0
R-PC	1	0	0	0	0	0	0	0	0	0	0
R-PC	2	0	0	0	0	0	0	0	0	0	0
R-PC	3	0	0	0	0	0	0	0	0	0	0
R-PC	4	0	0	0	0	1	0	0	0	0	0
R-PC	5	0	0	0	0	0	0	0	0	0	0
R-PF	1	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	1	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	T[a]	0	0
C-NE	1	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	0	0	0	1	0	0	[b]	NA[c]
C-NE	4	0	0	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0

TABLE D.8. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Removed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
C-NE-A[(d)]	1	0	0	0	0	0	0	1	0	0	0
C-NE-A[(d)]	2	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	3	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	4	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	5	0	0	0	0	0	0	0	0	0	0

(a) Too turbid to see.
(b) Inadvertantly terminated on Day 8.
(c) Not applicable.
(d) C-NE-A was initiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as intial C-NE exposure.

TABLE D.9. Daily Observation of *N. caecoides* on Sediment Surface During 10-Day Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*N. caecoides* on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	2	1	0	0	0	0	0	0	0	0
COMP I	2	0	1	0	1	0	0	0	0	0	0
COMP I	3	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	3	1	1	1	0	0	0	0	0
COMP I	5	0	0	0	1	0	0	0	0	0	0
COMP II	1	0	1	0	0	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	1	0	1	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	1	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	1	1	1	0	0	0	0	0	0
COMP III	2	2	2	0	0	0	0	0	0	0	0
COMP III	3	0	0	0	1	0	0	0	0	0	0
COMP III	4	2	3	3	3	0	0	0	0	0	0
COMP III	5	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	1	1	0	0	0	0	0
COMP IV	3	0	0	1	1	0	0	0	0	0	0
COMP IV	4	0	0	0	2	0	0	0	0	0	0
COMP IV	5	1	3	1	0	0	0	0	0	0	0
COMP V	1	0	1	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	3	2	3	0	0	0	0	0	0
COMP V	5	0	2	0	1	0	0	1	1	1	0
COMP VI	1	1	1	1	0	1	1	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	1	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	1	0	0	0	0	0	0
COMP VI	5	1	4	1	2	1	0	0	0	0	0
R-AC	1	0	1	2	2	0	0	0	0	0	0
R-AC	2	0	0	0	1	0	0	0	0	0	0
R-AC	3	0	0	0	2	0	0	0	0	0	0
R-AC	4	0	1	1	0	0	1	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	0	0

TABLE D.9. (Contd)

Sediment Treatment	Replicate	*N. caecoides* on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	0	0	1	0	0	0	0	0	0	0
R-AM	2	0	0	2	3	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	1	1	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	1	1	1	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	1	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	1	0	0	0	0	0	0
R-OS	1	0	0	0	1	0	0	0	0	0	0
R-OS	2	0	1	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	1	0	1	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0
R-PC	1	0	0	0	1	0	0	0	0	0	0
R-PC	2	2	2	0	1	0	0	0	0	0	0
R-PC	3	0	0	0	0	1	0	0	0	0	0
R-PC	4	0	0	0	1	0	0	0	0	0	0
R-PC	5	0	0	0	1	1	0	0	0	0	0
R-PF	1	0	1	0	0	0	0	0	0	0	0
R-PF	2	1	1	1	2	0	0	0	0	0	0
R-PF	3	0	0	2	1	1	0	0	0	0	0
R-PF	4	3	0	1	0	1	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	1	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	1	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	T[a]	0	0
C-NE	1	1	2	1	0	0	0	0	1	0	0
C-NE	2	0	0	0	0	1	0	0	0	0	0
C-NE	3	1	2	2	0	0	0	0	0	[b]	NA[c]
C-NE	4	1	2	0	0	0	0	0	0	0	0
C-NE	5	1	1	0	1	4	3	1	0	0	0

TABLE D.9. (Contd)

Sediment Treatment	Replicate	*N. caecoides* on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
C-NE-A[(d)]	1	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	2	0	0	1	2	0	0	0	0	0	0
C-NE-A[(d)]	3	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	4	0	0	0	1	0	0	0	0	0	0
C-NE-A[(d)]	5	0	0	0	0	0	0	0	0	0	0

(a) Too turbid to see.
(b) Inadvertantly terminated on Day 8.
(c) Not applicable.
(d) C-NE-A was initiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as intial C-NE exposure.

TABLE D.10. Daily Observation of *N. caecoides* Number Removed Surface During 10-Day Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*N. caecoides* Removed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	0	0	0	0	0	0	0	0	0
COMP I	2	0	0	0	1	0	0	0	0	0	0
COMP I	3	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	1	1	0	0	0	0	0
COMP I	5	0	0	0	1	0	0	0	0	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	0	1	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	1	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	1	0	0	0	0	0	0
COMP III	2	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	0	0	3	0	0	0	0	0	0
COMP III	5	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	1	0	0	0	0	0
COMP IV	3	0	0	0	0	0	0	0	0	0	0
COMP IV	4	0	0	0	2	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0
COMP V	1	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	3	0	0	0	0	0	0
COMP V	5	0	0	0	1	0	0	0	0	1	0
COMP VI	1	0	0	0	0	1	1	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	0	0	0	0	0	0	0
COMP VI	5	0	0	0	1	1	0	0	0	0	0
R-AC	1	0	0	0	2	0	0	0	0	0	0
R-AC	2	0	0	0	0	0	0	0	0	0	0
R-AC	3	0	0	0	2	0	0	0	0	0	0
R-AC	4	0	0	0	0	0	1	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	0	0

TABLE D.10. (Contd)

Sediment Treatment	Replicate	*N. caecoides* Removed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	3	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	1	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	1	1	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	1	0	0	0	0	0	0
R-OS	1	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	1	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0
R-PC	1	0	0	0	1	0	0	0	0	0	0
R-PC	2	0	0	0	1	0	0	0	0	0	0
R-PC	3	0	0	0	0	0	0	0	0	0	0
R-PC	4	0	0	0	1	0	0	0	0	0	0
R-PC	5	0	0	0	1	1	0	0	0	0	0
R-PF	1	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	2	0	0	0	0	0	0
R-PF	3	0	0	0	0	1	0	0	0	0	0
R-PF	4	0	0	0	0	1	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	1	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	1	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	T[a]	0	0
C-NE	1	0	2	1	0	0	0	0	1	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	2	0	0	0	0	0	[b]	NA[c]
C-NE	4	0	2	0	0	0	0	0	0	0	0
C-NE	5	0	1	0	1	0	2	1	0	0	0

TABLE D.10. (Contd)

Sediment Treatment	Replicate	*N. caecoides* Removed for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
C-NE-A[(d)]	1	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	2	0	0	0	2	0	0	0	0	0	0
C-NE-A[(d)]	3	0	0	0	0	0	0	0	0	0	0
C-NE-A[(d)]	4	0	0	0	1	0	0	0	0	0	0
C-NE-A[(d)]	5	0	0	0	0	0	0	0	0	0	0

(a) Too turbid to see.
(b) Inadvertantly terminated on Day 8.
(c) Not applicable.
(d) C-NE-A was initiated on 10/10 and terminated on 10/19, as it became apparent that *N. caecoides* survival would fall below 90% in C-NE. Organisms were from same shipments as intial C-NE exposure.

REFERENCES

U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1990. Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. EPA-503-8-90-002, U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

APPENDIX E

BIOASSAY RESULTS FOR 28-DAY SOLID-PHASE FLOW-THROUGH TEST WITH MACOMA NASUTA AND NEPHTYS CAECOIDES

APPENDIX E

SUMMARY: **BIOASSAY RESULTS FOR 28-DAY SOLID-PHASE FLOW-THROUGH TEST WITH *MACOMA nasuta* AND *NEPHTYS caecoides***

Test type and method	28-d acute flow-through toxicity test: 5 replicates per treatment, 25 *M. nasuta* and 30 *N. caecoides* per replicate. Refer to *Draft Ecological Evaluation of Dredged Material into Ocean Waters* (EPA/USACE 1990)
Test species	Bent-nose clam *Macoma nasuta* Marine worm *Nephtys caecoides*
Test materials	Oakland Harbor sediment samples: Comp I, Comp II, Comp III, Comp IV, Comp V, Comp VI
Reference materials	Point Reyes Coarse (R-PC), Point Reyes Fine (R-PF), Offshore Sediment (R-OS), Bay Farm (R-BF), Alcatraz Environs (R-AM), Alcatraz Disposal Site (R-AC)
Control materials	Sequim Bay (C-SB), Nepthys (C-NE and C-NE-A)
Dilution water	Filtered seawater from Sequim Bay, WA
Test dates	10/3/90 - 11/2/90
Source of organisms	*M. nasuta* - Discovery Bay, WA (Gunstone Clams) *N. caecoides* - Tomales Bay, CA (Brezina & Associates)
Test water quality parameter ranges	D.O. ≥4.0 mg/L pH 7.40 - 8.40 Salinity 30.0 - 34.0 °/oo Temperature 13 - 17°C Flow Rate 125 ± 10 mL/min
Test results	Refer to Tables E.1 and E.4

TABLE E.1. Rank Order Based Upon Mean Proportion Surviving the 28-Day *M. nasuta* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Mean Proportion Surviving
C-SB	0.94
R-AC	0.94
R-PC	0.94
COMP III	0.95
COMP IV	0.95
COMP V	0.95
R-BF	0.96
R-OS	0.96
COMP I	0.97
COMP II	0.97
C-NE	0.97
C-NE-A	0.98
R-PF	0.98
COMP VI	0.99
R-AM	0.99

TABLE E.2. Test Results for all Replicates 28-Day *M. nasuta* Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*M. nasuta* Live	*M. nasuta* Dead or Missing	Mean Proportion Surviving
COMP I	1	25	0	
	2	23	2	
	3	24	1	
	4	25	0	
	5	24	1	0.97
COMP II	1	25	0	
	2	23	2	
	3	24	1	
	4	24	1	
	5	25	0	0.97
COMP III	1	25	0	
	2	22	3	
	3	25	0	
	4	22	3	
	5	25	0	0.95
COMP IV	1	22	3	
	2	23	2	
	3	25	0	
	4	24	1	
	5	25	0	0.95
COMP V	1	24	1	
	2	23	2	
	3	25	0	
	4	24	1	
	5	23	2	0.95
COMP VI	1	24	1	
	2	25	0	
	3	25	0	
	4	25	0	
	5	25	0	0.99
R-AC	1	24	1	
	2	22	3	
	3	23	2	
	4	24	1	
	5	25	0	0.94

TABLE E.2. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Live	*M. nasuta* Dead or Missing	Mean Proportion Surviving
R-AM	1	24	1	
	2	25	0	
	3	25	0	
	4	25	0	
	5	25	0	0.99
R-BF	1	25	0	
	2	24	1	
	3	23	2	
	4	25	0	
	5	23	2	0.96
R-OS	1	23	2	
	2	24	1	
	3	23	2	
	4	25	0	
	5	25	0	0.96
R-PC	1	24	1	
	2	24	1	
	3	23	2	
	4	24	1	
	5	23	2	0.94
R-PF	1	24	1	
	2	25	0	
	3	25	0	
	4	25	0	
	5	23	2	0.98
C-SB	1	23	2	
	2	24	1	
	3	24	1	
	4	22	3	
	5	25	0	0.94
C-NE	1	25	0	
	2	23	2	
	3	24	1	
	4	24	1	
	5	25	0	0.97

TABLE E.2. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Live	*M. nasuta* Dead or Missing	Mean Proportion Surviving
C-NE-A[a]	1	24	1	
	2	25	0	
	3	25	0	
	4	23	2	
	5	25	0	0.98

(a) C-NE-A was intitiated on 10/10 as it became apparent that *N. caecoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the initial C-NE exposure.

TABLE E.3. Rank Order Based Upon Mean Proportion Surviving 28-Day *N. caecoides* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Mean Proportion Surviving
COMP VI	0.74
COMP II	0.78
COMP V	0.79
C-NE	0.81
COMP III	0.84
COMP IV	0.85
R-BF	0.85
COMP I	0.88
R-AC	0.90
R-PC	0.92
R-OS	0.93
C-SB	0.94
C-NE-A	0.96
R-AM	0.96
R-PF	0.96

TABLE E.4. Test Results for all Replicates in 28-Day *N. caecoides* Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
COMP I	1	28	2	
	2	28	2	
	3	23	7	
	4	26	4	
	5	27	3	0.88
COMP II	1	23	7	
	2	23	7	
	3	22	8	
	4	24	6	
	5	25	5	0.78
COMP III	1	29	1	
	2	23	7	
	3	27	3	
	4	26	4	
	5	21	9	0.84
COMP IV	1	26	4	
	2	26	4	
	3	24	6	
	4	28	2	
	5	23	7	0.85
COMP V	1	23	7	
	2	26	4	
	3	25	5	
	4	24	6	
	5	20	10	0.79
COMP VI	1	23	7	
	2	21	9	
	3	24	6	
	4	22	8	
	5	21	9	0.74
R-AC	1	28	2	
	2	24	6	
	3	28	2	
	4	26	4	
	5	29	1	0.90

TABLE E.4. (Contd)

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
R-AM	1	29	1	
	2	29	1	
	3	26	4	
	4	30	0	
	5	30	0	0.96
R-BF	1	25	5	
	2	29	1	
	3	27	3	
	4	23	7	
	5	24	6	0.85
R-OS	1	30	0	
	2	30	0	
	3	27	3	
	4	25	5	
	5	27	3	0.93
R-PC	1	26	4	
	2	29	1	
	3	26	4	
	4	28	2	
	5	29	1	0.92
R-PF	1	29	1	
	2	29	1	
	3	30	0	
	4	27	3	
	5	29	1	0.96
C-SB	1	27	3	
	2	29	1	
	3	30	0	
	4	28	2	
	5	27	3	0.94
C-NE	1	24	6	
	2	25	5	
	3	26	4	
	4	27	3	
	5	20	10	0.81

TABLE E.4. (Contd)

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
C-NE-A[(a)]	1	28	2	
	2	29	1	
	3	27	3	
	4	30	0	
	5	30	0	0.96

(a) C-NE-A was intitiated on 10/10 as it became apparent that *N. caecoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the initial C-NE exposure.

TABLE E.5. Water Quality Summary 28-Day *M. nasuta/N. caecoides* Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Temperature (°C) Min	Temperature (°C) Max	pH Min	pH Max	Dissolved Oxygen (mg/L) Min	Dissolved Oxygen (mg/L) Max	Salinity (o/oo) Min	Salinity (o/oo) Max	Flow Rates (mL/min) Min	Flow Rates (mL/min) Max
Acceptable Range	13.0	17.0	7.40	8.40	4.0	---	30.0	34.0	115	135
COMP I	13.9	15.1	7.66	7.93	6.3	8.6	31.5	32.0	112(a)	132
COMP II	14.0	15.1	7.58	8.19	5.8	8.2	31.0	33.5	114(a)	132
COMP III	14.0	15.1	6.87(a)	7.95	6.5	8.3	31.5	32.5	114(a)	134
COMP IV	13.9	15.1	7.72	7.93	6.0	8.3	31.5	32.5	112(a)	132
COMP V	13.7	15.2	7.72	7.93	6.5	7.9	31.5	32.0	112(a)	132
COMP VI	14.1	15.1	7.58	8.07	6.3	8.4	31.5	32.5	112(a)	132
R-AC	14.1	15.0	7.46	8.05	6.0	8.4	31.5	33.0	116	134
R-AM	14.0	15.9	7.75	8.09	6.7	8.4	31.5	32.5	114(a)	132
R-BF	14.0	15.1	7.36(a)	7.96	6.1	8.3	31.0	33.0	112(a)	132
R-OS	13.9	15.1	7.17(a)	8.20	6.3	8.2	31.5	33.5	112(a)	132
R-PC	14.0	15.0	7.68	7.97	6.4	8.2	31.5	32.0	114(a)	134
R-PF	14.0	15.1	7.48	8.15	6.0	8.3	31.5	32.0	112(a)	132
C-SB	14.0	15.1	6.93(a)	8.29	6.0	8.0	31.5	33.0	108(a)	132
C-NE	13.7	15.1	7.58	8.10	6.1	8.4	31.5	32.0	116	132
C-NE-A	13.6	16.6	6.90(a)	8.10	7.3	7.9	30.5	32.5	116	134

(a) Data point out of target quality control range. Flow rates and pHs out of target range were not sustained and did not appear to affect the outcome of the test. Though out of target range, the flow rates were sufficient to replace 90% of the water volume every 4 h as required by the 1990 Implementation Manual.

TABLE E.6. Daily Observation of *M. nasuta* on Sediment Surface During 28-Day Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*M. nasuta* on Surface for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
COMP I	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	2	1	1	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
COMP I	3	2	2	1	2	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	5	5	3	3	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	2	7	2	1	1	1	1	1	0	1	2	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
COMP II	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	4	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0
COMP II	5	3	2	2	2	0	1	1	1	2	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0
COMP III	1	2	2	0	3	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	0
COMP III	2	3	3	3	3	2	2	2	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
COMP III	3	5	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
COMP III	4	1	2	2	1	1	1	1	1	1	2	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
COMP III	5	3	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0
COMP IV	1	5	4	3	3	2	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	2	4	2	2	2	2	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	4	7	3	3	1	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
COMP V	1	1	1	1	2	2	1	3	2	3	1	2	1	1	1	2	3	2	3	2	2	2	2	1	1	2	1	2	2
COMP V	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	4	2	1	1	1	1	0	2	2	1	2	2	1	1	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1
COMP V	5	8	7	6	5	5	5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	1	3	2	1	1	1	1	0	1	0	1	1	3	0	0	1	0	0	1	0	0	T	0	0	0	0	1	0	0
COMP VI	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	3	4	4	4	3	?	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
COMP VI	4	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	5	3	1	1	0	0	1	2	2	0	1	0	2	1	1	0	1	0	0	1	0	1	1	0	0	0	0	0	0
R-AC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	1	1	0	0	1	0	T[a]
R-AC	2	0	2	1	0	0	1	1	1	1	2	1	2	1	2	2	2	2	1	2	3	3	2	2	1	0	1	0	1
R-AC	3	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
R-AC	4	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	5	0	2	1	0	0	0	0	0	2	2	2	2	0	1	1	1	1	1	1	2	1	1	0	1	0	0	0	1

TABLE E.6. (Contd)

Sediment Treatment	Replicate	*M. nasuta* on Surface for Test Days 1 through 28																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
R-AM	1	5	4	3	6	7	10	8	5	7	7	6	8	9	11	8	8	10	8	10	9	7	7	6	9	9	11	8	10
R-AM	2	12	10	11	11	11	11	11	10	10	11	10	9	9	11	11	10	9	11	6	7	8	7	7	10	7	8	6	9
R-AM	3	6	4	5	5	6	4	6	8	7	5	5	6	7	10	9	9	8	10	9	10	9	6	6	5	5	5	6	5
R-AM	4	9	5	8	6	6	10	8	10	9	9	8	10	9	6	9	8	8	10	9	10	11	10	8	9	9	9	10	9
R-AM	5	16	12	13	13	10	12	12	13	13	14	14	14	12	11	12	10	11	12	11	12	11	11	12	9	10	10	11	11
R-BF	1	0	0	0	0	1	1	0	0	2	1	0	0	2	1	2	1	0	2	1	2	2	1	0	0	3	1	0	1
R-BF	2	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0
R-BF	3	0	0	0	1	2	0	0	0	1	1	1	1	1	1	0	0	0	0	2	0	1	0	0	0	0	1	1	1
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	2	1	3	0	0	2	1	0
R-BF	5	0	0	0	0	0	1	0	0	T	0	0	0	1	0	0	0	0	0	0	0	3	2	0	0	1	0	0	1
R-OS	1	0	0	0	0	1	1	0	2	1	2	0	2	0	0	1	0	1	1	1	1	2	1	2	0	1	1	1	2
R-OS	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2	1	3	2	2	2	1	1	1
R-OS	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
R-OS	5	1	0	0	1	0	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	1	2	2	1	0	3	1
R-PC	1	1	1	0	0	0	3	2	0	0	1	2	2	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
R-PC	2	1	0	2	0	0	0	0	1	3	0	3	2	1	1	0	0	0	1	0	0	1	1	1	0	1	0	1	0
R-PC	3	1	0	0	1	0	1	2	0	3	1	1	2	1	3	0	1	2	1	2	2	4	3	2	1	1	2	2	2
R-PC	4	1	0	1	1	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	5	0	0	0	1	0	1	0	0	0	0	1	0	1	0	2	1	1	1	1	1	1	1	0	0	1	1	0	0
R-PF	1	0	3	1	0	1	2	4	5	3	1	2	0	2	3	5	4	3	4	3	2	2	2	3	3	3	2	2	6
R-PF	2	0	2	1	0	0	2	0	0	1	1	1	0	1	0	2	2	0	1	0	2	0	0	1	1	0	1	0	0
R-PF	3	2	2	2	2	1	4	2	2	1	2	0	2	1	4	2	4	3	1	2	2	2	1	1	0	0	4	5	1
R-PF	4	0	0	3	2	3	2	2	2	6	1	2	3	2	2	4	3	4	1	4	5	4	0	2	1	1	3	5	1
R-PF	5	2	1	0	4	1	2	3	1	2	1	5	3	1	3	2	2	2	1	1	1	4	2	0	3	2	5	4	4
C-SB	1	3	2	2	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	1	3	2	1	2	3	2	3	3	2	1	1	2	3	3	3	3	2	2	3	2	2	2	2	2	3	3	3	2
C-NE	2	1	0	1	4	3	3	5	2	2	2	2	4	5	5	3	3	7	4	7	7	4	4	3	4	2	3	5	4
C-NE	3	2	1	1	1	2	3	3	2	2	2	3	3	3	5	3	3	2	2	2	3	3	2	5	6	4	5	5	5
C-NE	4	0	0	0	1	1	1	0	0	1	1	0	3	2	1	0	1	2	2	3	3	3	2	4	3	3	2	2	2
C-NE	5	5	4	4	3	2	3	3	4	4	3	3	4	2	4	4	3	4	2	2	2	4	2	3	4	5	3	4	3

TABLE E.6. (Contd)

Sediment Treatment	Replicate	*M. nasuta* on Surface for Test Days 1 through 28																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
C-NE-A[(b)]	1	3	4	0	7	4	4	2	2	3	2	3	2	3	2	1	2	0	2	1	3	2	2	3	2	1	1	2	1
C-NE-A	2	2	2	4	3	1	2	2	5	4	9	7	5	4	5	2	4	3	4	5	2	7	5	7	7	5	6	10	7
C-NE-A	3	2	0	1	0	1	1	2	1	1	1	0	5	2	1	3	4	2	3	3	2	2	2	3	5	3	3	3	1
C-NE-A	4	1	2	3	3	2	5	5	5	6	5	6	5	3	5	4	2	3	3	4	3	3	4	3	3	6	3	2	4
C-NE-A	5	0	0	4	1	2	0	0	1	1	2	3	3	2	4	2	2	2	3	3	4	2	2	3	3	3	2	2	5

(a) Too turbid to see.
(b) C-NE-A was intitiated on 10/10 as it became apparent that *N. caecoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the intial C-NE exposure.

TABLE E.7. Daily Observation of *M. nasuta* Siphons Exposed During 28-Day Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*M. nasuta* Siphons Exposed for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
COMP I	1	3	2	2	1	0	0	2	1	0	3	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
COMP I	2	11	6	4	5	0	0	0	0	0	0	1	1	1	2	2	2	3	1	2	3	2	1	0	0	0	2	0	0
COMP I	3	8	9	6	6	5	3	3	3	4	5	2	1	2	2	1	1	1	2	1	1	2	1	1	3	1	2	2	2
COMP I	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	1	0	0
COMP I	5	13	8	6	2	2	5	3	5	3	0	0	0	1	1	0		1	0	0	1	0	2	1	0	2	0	0	2
COMP II	1	6	0	1	0	0	3	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	2
COMP II	2	9	8	3	1	1	0	0	2	3	3	0	1	4	3	0	0	2	0	0	1	3	1	0	1	1	0	3	3
COMP II	3	8	8	5	6	6	4	1	1	4	3	1	3	3	2	2	1	1	1	0	1	3	1	0	0	2	1	0	0
COMP II	4	0	2	1	1	0	0	0	1	0	1	2	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	2	0
COMP II	5	6	2	3	2	3	1	2	2	2	1	2	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	1	1
COMP III	1	8	5	4	4	1	0	3	1	0	0	0	2	0	3	0	0	0	0	2	1	1	0	0	1	0	0	1	0
COMP III	2	5	3	3	2	2	3	5	3	2	2	4	1	1	3	2	1	2	1	0	3	1	2	3	2	3	1	1	4
COMP III	3	24	12	11	4	6	5	4	2	4	2	0	2	0	1	0	0	1	0	3	2	5	4	2	3	3	3	0	1
COMP III	4	11	6	4	4	2	2	4	4	4	2	0	2	0	1	1	0	0	0	0	1	0	0	0	0	1	1	1	1
COMP III	5	12	4	3	2	1	0	1	0	0	1	0	1	1	3	0	0	0	1	0	1	0	1	0	0	0	0	3	0
COMP IV	1	6	8	5	6	5	2	2	2	2	0	1	1	0	1	1	1	1	0	0	2	1	1	1	1	1	1	1	4
COMP IV	2	7	4	3	3	3	3	4	4	2	2	2	2	1	3	1	2	0	0	0	0	0	2	0	0	0	0	0	0
COMP IV	3	3	8	4	2	2	3	4	3	5	3	2	2	1	2	2	2	1	0	2	2	1	2	2	1	2	0	0	0
COMP IV	4	13	8	4	5	5	3	5	3	3	5	4	5	7	4	3	3	1	4	3	2	3	3	4	5	2	3	5	3
COMP IV	5	2	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1
COMP V	1	10	5	6	7	8	2	6	5	6	5	6	8	1	9	2	3	1	1	2	3	3	4	2	5	4	6	4	3
COMP V	2	10	5	0	6	1	0	4	2	1	1	0	1	0	1	0	2	2	0	0	0	1	0	1	0	3	3	0	3
COMP V	3	5	5	1	4	3	3	1	5	5	7	1	2	1	2	3	3	3	2	4	3	2	6	5	1	1	2	2	3
COMP V	4	6	5	2	4	0	1	1	2	1	1	0	1	4	4	4	2	3	1	0	1	1	2	0	0	1	3	1	1
COMP V	5	17	13	9	10	9	5	10	10	12	6	4	6	3	3	2	2	1	3	3	4	6	6	0	3	0	0	1	1
COMP VI	1	12	11	6	5	8	3	10	5	0	2	4	6	2	9	1	1	1	1	2	0	T	4	0	0	1	3	0	3
COMP VI	2	8	5	7	4	0	0	0	0	1	3	2	3	3	3	0	0	1	0	0	0	0	1	2	0	0	1	1	1
COMP VI	3	5	5	4	4	1	2	4	6	0	1	0	2	1	2	1	1	3	5	2	3	0	4	3	1	2	2	1	2
COMP VI	4	12	9	5	4	3	4	9	4	2	2	4	4	5	0	0	0	0	0	0	0	3	1	0	0	0	0	1	1
COMP VI	5	8	6	1	0	2	5	4	4	0	6	1	2	6	2	2	1	7	NA	3	0	0	1	0	0	2	.1	0	1
R-AC	1	7	7	3	1	0	0	1	1	3	2	2	2	1	5	3	2	3	2	4	6	4	4	0	0	0	0	0	T[a]
R-AC	2	6	9	5	15	6	2	2	5	14	5	1	4	4	7	10	3	5	3	5	4	7	4	8	4	5	2	7	5
R-AC	3	6	5	3	1	0	3	1	2	4	2	0	1	0	2	2	3	3	0	2	1	3	1	2	1	1	2	3	3
R-AC	4	8	4	7	4	2	2	3	3	0	1	0	0	2	2	2	0	0	3	0	1	2	1	3	4	2	3	2	2
R-AC	5	4	2	1	0	3	0	1	0	1	0	0	1	0	0	0	0	0	0	1	1	3	3	5	2	0	0	1	4

TABLE E.7. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Siphons Exposed for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
R-AM	1	6	8	4	7	6	11	13	10	7	12	11	9	10	14	13	12	12	12	14	15	10	13	10	11	17	21	15	15
R-AM	2	12	11	15	13	14	13	17	17	12	15	13	18	17	15	10	13	12	11	9	3	14	9	10	11	16	14	16	17
R-AM	3	11	7	3	8	10	8	12	14	13	6	7	6	9	15	10	15	11	9	8	16	15	11	11	6	9	10	6	6
R-AM	4	10	6	5	13	2	11	16	21	12	7	12	14	11	11	8	8	8	14	6	15	17	15	11	13	10	12	9	11
R-AM	5	21	12	15	20	15	15	18	22	18	18	17	23	25	18	21	18	19	15	16	20	22	25	22	16	22	18	23	20
R-BF	1	1	1	1	4	4	0	0	1	1	3	2	4	2	7	4	4	1	8	5	3	4	3	2	3	5	8	4	6
R-BF	2	2	4	1	2	2	1	2	0	2	0	0	2	0	2	1	1	1	3	0	0	1	0	0	1	1	2	1	1
R-BF	3	0	0	0	0	0	2	4	2	1	1	1	1	2	5	0	0	2	1	3	3	3	4	0	1	0	2	4	6
R-BF	4	3	0	2	0	0	0	3	0	0	1	8	3	1	1	1	1	3	0	0	1	6	2	7	4	2	7	1	2
R-BF	5	1	0	0	1	2	2	2	0	T	1	0	0	1	6	3	3	3	1	1	2	3	4	0	1	1	4	2	2
R-OS	1	8	5	2	4	2	3	3	4	5	1	1	1	1	4	2	2	4	0	1	4	5	5	2	4	3	4	4	6
R-OS	2	1	6	3	11	6	3	5	3	13	5	1	4	2	3	11	7	3	4	1	1	6	4	6	10	10	10	7	6
R-OS	3	8	2	6	1	0	0	1	0	1	1	2	4	4	2	5	4	4	2	3	3	6	6	1	3	0	3	0	6
R-OS	4	1	5	3	1	0	0	0	0	2	0	0	0	2	2	2	2	1	0	0	0	1	2	0	1	2	1	1	1
R-OS	5	3	10	3	4	3	1	3	4	7	0	0	2	4	4	2	0	3	0	3	7	5	6	8	5	7	8	8	3
R-PC	1	6	2	2	2	3	6	6	3	3	6	4	4	3	5	2	3	1	2	1	0	4	2	2	4	1	1	3	2
R-PC	2	2	2	4	7	0	1	4	3	2	5	4	2	0	4	6	1	2	2	0	6	5	6	3	2	5	5	1	3
R-PC	3	1	2	2	0	0	2	4	3	2	1	3	6	3	5	1	2	3	3	3	8	6	9	2	10	5	8	6	9
R-PC	4	3	0	0	0	0	2	1	3	1	0	0	1	0	5	3	2	3	1	1	1	1	0	2	3	2	3	4	3
R-PC	5	5	4	3	0	0	2	5	6	16	5	3	2	2	3	9	8	2	3	3	8	7	7	9	9	8	15	2	3
R-PF	1	0	9	1	3	6	2	6	6	8	5	4	4	4	8	7	9	5	6	8	5	6	7	5	4	8	7	6	7
R-PF	2	3	0	0	0	4	0	4	2	3	2	0	0	0	3	3	2	3	0	0	2	0	0	0	0	0	0	2	3
R-PF	3	5	2	0	4	2	7	0	2	1	1	0	5	6	5	3	7	4	0	5	10	9	6	8	5	2	5	5	8
R-PF	4	0	4	3	1	4	3	1	1	5	4	2	6	4	3	2	2	6	1	7	6	6	5	4	6	5	4	1	3
R-PF	5	10	2	3	8	4	3	3	7	7	6	5	5	4	7	6	2	5	2	2	4	3	2	2	7	5	3	4	11
C-SB	1	5	1	2	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	2	1	5	1	1	1	0	3	1
C-SB	2	3	3	2	1	0	0	1	2	0	0	0	1	0	0	2	0	0	0	0	0	3	1	0	0	0	4	1	1
C-SB	3	1	0	0	1	0	0	1	0	2	0	0	0	1	1	0	1	0	0	0	0	1	2	1	0	0	0	0	0
C-SB	4	2	1	1	1	0	0	1	0	0	0	0	1	0	1	1	0	2	0	1	1	1	2	2	5	3	3	0	3
C-SB	5	2	0	0	0	0	0	1	3	0	2	1	0	0	1	0	2	1	2	1	1	1	0	1	0	0	1	0	1
C-NE	1	8	3	2	1	1	2	4	4	4	3	3	1	3	4	3	4	4	2	7	4	6	1	3	6	3	3	9	5
C-NE	2	4	4	3	6	6	7	5	3	2	3	2	8	7	8	4	2	10	6	12	9	6	4	6	6	2	5	11	11
C-NE	3	7	6	2	2	2	3	5	4	8	2	1	16	1	3	3	6	4	3	5	5	2	0	2	2	2	9	8	7
C-NE	4	0	1	0	3	4	3	1	0	0	2	0	4	2	5	2	0	1	2	4	6	1	0	11	4	5	3	8	5
C-NE	5	11	10	7	10	6	8	5	8	5	7	4	19	5	7	7	6	7	8	6	5	5	5	5	8	8	8	8	8

TABLE E.7. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Siphons Exposed for Test Days 1 through 28																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
C-NE-A[b]	1	3	8	1	9	7	8	3	5	1	2	2	4	3	3	1	4	3	3	3	4	2	15	2	5	4	2	3	4
C-NE-A	2	2	6	4	3	1	4	2	6	6	1	7	6	5	9	12	6	8	13	11	7	9	9	12	10	10	11	12	5
C-NE-A	3	2	6	3	1	2	5	4	1	2	1	0	5	2	2	2	6	3	5	6	4	2	5	1	5	4	3	2	2
C-NE-A	4	7	6	4	5	4	5	4	6	6	7	4	4	3	4	7	3	10	6	7	5	5	7	8	10	8	8	4	6
C-NE-A	5	1	2	8	2	5	1	1	1	5	5	4	2	2	5	3	1	3	4	5	3	3	5	5	5	6	4	4	6

(a) Too turbid to see.
(b) C-NE-A was intitiated on 10/10 as it became apparent that *N. caecoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the intitial C-NE exposure.

TABLE E.8. Daily Observation of *M. nasuta* Number Removed During 28-Day Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*M. nasuta* Number Removed for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
COMP I	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	2	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
COMP III	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	T	0	0	0	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0
R-AC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T
R-AC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
R-AC	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E.8. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Number Removed for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
R-AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	T[a]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
R-OS	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
R-PF	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
C-NE	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E.8. (Contd)

Sediment Treatment	Replicate	*M. nasuta* Number Removed for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
C-NE-A[b]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) Too turbid to see.
(b) C-NE-A was intitiated on 10/10 as it became apparent that *N. caecoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the intitial C-NE exposure.

TABLE E.9. Daily Observation of *N. caecoides* on Sediment Surface During 10-Day Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*N. caecoides* on Surface Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
COMP I	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	3	0	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	2	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	3	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	4	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	5	1	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
COMP IV	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	5	1	2	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T[a]	0	0	0	0	0	0	0
COMP VI	2	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	4	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	5	2	0	3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0
R-AC	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T
R-AC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
R-AC	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	4	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E.9. (Contd)

Sediment Treatment	Replicate	*N. caecoides* on Surface Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
R-AM	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	4	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	3	1	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	4	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	1	1	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	2	3	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	3	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	5	2	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E.9. (Contd)

Sediment Treatment	Replicate	*N. caecoides* on Surface Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
C-NE-A[b]	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	3	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) Too turbid to see.
(b) C-NE-A was intitiated on 10/10 as it became apparent that *N. cacoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the initial C-NE exposure.

TABLE E.10. Daily Observation of *N. caecoides* Number Removed During 28-Day Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*N. caecoides* Number Removed for Test Days 1 through 28																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
COMP I	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	3	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	5	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	0	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T[a]	0	0	0	0	0	0	0
COMP VI	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0
R-AC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T
R-AC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
R-AC	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E.10. (Contd)

Sediment Treatment	Replicate	*N. caecoides* Number Removed for Test Days 1 through 28																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
R-AM	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	3	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
R-PC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PC	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	1	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	5	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE E.10. (Contd)

Sediment Treatment	Replicate	*N. caecoides* Number Removed for Test Days 1 through 28																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
C-NE-A[b]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE-A	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) Too turbid to see.
(b) C-NE-A was initiated on 10/10 as it became apparent that *N. caecoides* control survival would fall below 90% in C-NE. Test organisms were from the same shipments as in the initial C-NE exposure.

REFERENCES

U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1990. Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. EPA-503-8-90/002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

APPENDIX F

BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE STATIC TEST WITH RHEPOXYNIUS ABRONIUS

APPENDIX F

SUMMARY: BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE STATIC TEST WITH *RHEPOXYNIUS abronius*

Test type and method	10-d static acute toxicity test: 5 replicates per treatment, 20 organisms per replicate. Refer to *Draft Ecological Evaluation of Dredged Material into Ocean Waters* (EPA/USACE 1990); *Phoxocephalid Amphipod Bioassay for Marine Sediment Toxicity* (Swartz, R.C., W.A. DeBen, J.K.P. Jones, J.O. Lamberson, and F.A. Cole 1985).
Test species	Amphipod *Rhepoxinius abronius*
Test materials	Oakland Harbor sediment samples: Comp I, Comp II, Comp III, Comp IV, Comp V, Comp VI
Reference materials	Point Reyes Coarse (R-PC), Point Reyes Fine (R-PF), Offshore Sediment (R-OS), Bay Farm (R-BF), Alcatraz Environs (R-AM), Alcatraz Disposal Site (R-AC); also Cadmium Reference
Control materials	West Beach (C-WB), Sequim Bay (C-SB)
Dilution water	Filtered seawater from Sequim Bay, WA
Test dates	10/2/90 - 10/13/90 West Beach Control Retest 10/12/90 - 10/22/90
Source of organisms	*R. abronius* - West Beach, Whidbey Island, WA (Battelle)
Test water quality parameter ranges	D.O. ≥4.0 mg/L pH 7.40 - 8.40 Salinity 30.0 - 34.0 °/oo Temperature 13 - 17°C
Test results	Refer to Table F.1

TABLE F.1. Rank Order Based Upon Mean Proportion Surviving 10-Day *R. abronius* Solid-Phase Static Test, Oakland Phase III 38' Project

Sediment Treatment	Mean Proportion Surviving
COMP V	0.58
R-OS	0.59
R-AC	0.71
R-BF	0.71
COMP VI	0.72
COMP I	0.77
COMP IV	0.82
COMP III	0.83
COMP II	0.83
R-AM	0.86
R-PF	0.88
C-SB	0.88
R-PC	0.91
C-WB	0.98

TABLE F.2. Test Results for all Replicates in 10-Day *R. abronius* Solid-Phase Static Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
COMP I	1	17	3	
	2	15	5	
	3	16	4	
	4	12	8	
	5	17	3	0.77
COMP II	1	15	5	
	2	17	3	
	3	16	4	
	4	19	1	
	5	16	4	0.83
COMP III	1	14	6	
	2	19	1	
	3	18	2	
	4	16	4	
	5	16	4	0.83
COMP IV	1	20	0	
	2	17	3	
	3	18	2	
	4	14	6	
	5	13	7	0.82
COMP V	1	13	7	
	2	12	8	
	3	14	6	
	4	8	12	
	5	11	9	0.58
COMP VI	1	15	5	
	2	17	3	
	3	13	7	
	4	17	3	
	5	10	10	0.72
R-AC	1	15	5	
	2	14	6	
	3	14	6	
	4	16	4	
	5	12	8	0.71

TABLE F.2. (Contd)

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
R-AM	1	18	2	
	2	15	5	
	3	17	3	
	4	16	4	
	5	20	0	0.86
R-BF	1	14	6	
	2	16	4	
	3	13	7	
	4	11	9	
	5	17	3	0.71
R-OS	1	13	7	
	2	7	13	
	3	17	3	
	4	12	8	
	5	10	10	0.59
R-PC	1	18	2	
	2	18	2	
	3	18	2	
	4	18	2	
	5	19	1	0.91
R-PF	1	17	3	
	2	16	4	
	3	19	1	
	4	18	2	
	5[(a)]	0	0	0.88
C-SB	1	17	3	
	2	17	3	
	3	18	2	
	4	18	2	
	5	18	2	0.88
C-WB	1	20	0	
	2	20	0	
	3	20	0	
	4	19	1	
	5	19	1	0.98

(a) Not Initiated; replicate not used in analysis.

TABLE F.3. Water Quality Summary for 10-Day *R. abronius* Solid-Phase Static Test, Oakland Phase III 38' Project

Sediment Treatment	Temperature (°C) Min	Temperature (°C) Max	pH Min	pH Max	Dissolved Oxygen (mg/L) Min	Dissolved Oxygen (mg/L) Max	Salinity (o/oo) Min	Salinity (o/oo) Max
Acceptable Range	13.0	17.0	7.40	8.40	4.0	---	30.0	34.0
COMP I	14.7	15.7	7.89	8.35	7.1	7.8	30.5	32.5
COMP II	14.7	15.7	7.79	8.38	6.6	7.8	31.0	33.0
COMP III	14.8	15.7	8.03	8.43[a]	6.9	7.8	31.0	33.0
COMP IV	14.8	15.7	7.87	8.28	6.7	7.8	31.0	32.5
COMP V	14.7	15.6	7.83	8.26	3.8[a]	7.8	30.5	32.4
COMP VI	14.7	15.7	7.99	8.30	6.9	7.8	31.0	32.5
R-AC	14.9	15.7	7.78	8.34	4.1	7.8	31.5	33.0
R-AM	14.7	15.6	7.90	8.25	7.1	7.9	21.0	33.0
R-BF	14.8	15.7	7.87	8.23	7.2	7.7	32.0	33.0
R-OS	14.8	16.0	8.03	8.26	7.0	7.9	32.0	33.0
R-PC	14.8	15.6	7.94	8.23	6.8	7.8	32.0	33.0
R-PF	14.8	15.6	7.55	8.26	7.0	7.8	31.0	33.0
C-SB	14.8	15.6	7.88	8.38	7.2	7.8	32.0	33.5
C-WB	14.8	15.7	7.77	8.61[a]	6.4	7.8	32.0	33.0

(a) Data point out of target quality control range. Values were out of range on day 0 (prior to intiation) only, so did not affect outcome of test.

TABLE F.4. Water Quality Summary for 10-Day *R. abronius* Solid-Phase Static Reference Toxicant Test, Oakland Phase III 38' Project

Cadmium Concentration mg/L		Temperature (°C) Min	Temperature (°C) Max	pH Min	pH Max	D.O. mg/L) Min	D.O. mg/L) Max	Salinity (oo/o) Min	Salinity (oo/o) Max
Acceptable Range	-----	13.0	17.0	7.40	8.40	4.0	-----	30.0	34.0
0.0		14.4	15.3	7.40	8.12	7.2	9.1	32.0	32.0
0.5		14.2	15.2	7.60	8.12	7.4	9.0	32.0	32.5
1.0		14.4	15.3	7.50	8.10	7.0	9.0	32.0	32.0
2.0		14.4	15.1	7.40	8.06	7.4	9.1	32.0	32.0
4.0		14.4	15.4	7.40	7.98	7.4	9.0	32.0	32.0

TABLE F.5. Daily Observations of *R. abronius* on Sediment During 10-Day Solid-Phase Static Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*R. abronius* on Sediment for Test Days 1-10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	0	0	0	0	0	0	0	0	1
COMP I	2	1	0	1	1	1	0	1	0	0	0
COMP I	3	0	0	1	1	1	0	1	0	0	0
COMP I	4	0	0	1	1	1	1	1	2	2	0
COMP I	5	1	1	0	0	0	0	1	1	1	0
COMP II	1	2	0	0	0	0	0	0	0	0	0
COMP II	2	0	1	0	0	0	0	0	0	0	0
COMP II	3	1	1	1	0	0	0	0	0	0	0
COMP II	4	0	0	1	0	1	T[a]	0	0	0	1
COMP II	5	0	0	0	0	0	0	1	0	0	2
COMP III	1	1	1	1	1	0	2	0	1	0	0
COMP III	2	0	0	0	1	0	0	0	0	0	0
COMP III	3	1	0	0	1	1	1	0	1	0	0
COMP III	4	2	1	0	0	0	1	0	1	1	2
COMP III	5	0	0	0	0	1	1	1	1	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	1	1	1	1	1	0	0	1
COMP IV	3	0	0	0	0	0	T	0	0	0	0
COMP IV	4	1	0	0	0	1	0	0	1	0	0
COMP IV	5	0	0	1	2	0	1	1	0	0	1
COMP V	1	0	0	1	1	0	0	0	0	0	1
COMP V	2	0	1	1	1	1	1	0	0	3	2
COMP V	3	0	0	2	0	0	0	0	0	2	3
COMP V	4	1	0	1	1	0	0	0	1	2	2
COMP V	5	0	1	2	1	1	0	0	0	2	1
COMP VI	1	0	0	1	0	0	1	T	0	0	0
COMP VI	2	1	0	0	0	0	0	1	0	0	1
COMP VI	3	1	1	3	2	2	0	0	1	0	1
COMP VI	4	1	1	1	1	0	1	0	T	0	0
COMP VI	5	0	0	0	0	0	1	0	0	0	1
R-AC	1	T	0	1	0	0	0	0	0	0	2
R-AC	2	0	0	1	T	0	0	0	0	0	0
R-AC	3	T	0	T	0	0	T	0	0	1	1
R-AC	4	0	0	0	0	0	0	0	0	0	1
R-AC	5	1	3	2	0	0	0	0	0	0	0

TABLE F.5. (Contd)

Sediment Treatment	Replicate	*R. abronius* on Sediment for Test Days 1-10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	0	0	0	1	2	2	2	2	1	2
R-AM	2	0	0	0	0	1	1	1	1	1	1
R-AM	3	3	2	2	0	0	1	0	0	0	0
R-AM	4	0	2	2	2	2	2	2	3	2	2
R-AM	5	1	0	0	0	0	3	0	0	2	2
R-BF	1	0	0	1	2	2	1	1	0	0	0
R-BF	2	0	0	1	0	0	1	0	0	0	1
R-BF	3	0	0	0	1	1	1	1	1	1	0
R-BF	4	1	3	6	4	3	3	1	1	0	0
R-BF	5	0	0	0	0	0	0	0	T	0	T
R-OS	1	1	1	1	2	0	0	0	0	0	1
R-OS	2	0	0	0	0	0	1	1	1	2	1
R-OS	3	0	0	0	1	0	1	0	0	1	1
R-OS	4	1	2	2	0	0	0	0	0	0	0
R-OS	5	0	0	1	1	0	1	1	1	1	0
R-PC	1	0	0	1	1	1	1	0	0	0	0
R-PC	2	0	0	1	1	1	1	1	1	1	1
R-PC	3	0	0	0	1	1	1	1	1	1	1
R-PC	4	0	0	2	2	2	2	2	2	2	2
R-PC	5	0	0	1	1	1	1	1	1	1	1
R-PF	1	0	0	0	0	1	1	0	0	3	2
R-PF	2	0	2	0	2	3	3	3	3	3	3
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	1	2	1	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	2	0	0	0	0	0
C-SB	2	1	2	2	2	2	2	0	0	1	2
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	T	0	0	1	1	1	2	0	0	0
C-SB	5	0	0	1	1	1	0	0	0	0	0
C-WB	1	0	0	0	0	0	0	0	0	0	1
C-WB	2	0	1	1	1	2	2	1	3	2	3
C-WB	3	0	0	0	0	0	0	1	1	0	1
C-WB	4	0	0	9	15	10	10	11	9	10	6
C-WB	5	0	0	0	0	0	0	1	1	1	3

(a) Too turbid to see.

TABLE F.6. Daily Observations of *R. abronius* on Sediment During 10-Day Solid-Phase Static Test, C-WB Retest, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*R. abronius* on Sediment for Test Days 1-10									
		1	2	3	4	5	6	7	8	9	10
C-WB	1	ND[a]	ND	0	0	0	0	0	0	0	0
C-WB	2	ND	ND	0	0	0	0	0	0	0	0
C-WB	3	ND	ND	0	0	0	0	0	0	0	0
C-WB	4	ND	ND	1	1	1	1	1	1	1	1
C-WB	5	ND	ND	1	1	1	1	1	1	1	1

(a) No data available.

TABLE F.7. Daily Observations of *R. abronius* Floating on Surface During 10-Day Solid-Phase Static Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	*R. abronius* Floating for Test Days 1-10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	2	0	2	0	1	0	3	2	2
COMP I	2	1	1	1	0	2	0	0	1	0	0
COMP I	3	0	1	2	2	0	3	3	2	1	3
COMP I	4	1	3	1	2	2	1	2	2	2	3
COMP I	5	0	0	0	0	0	1	0	0	0	0
COMP II	1	1	0	3	2	2	3	2	1	1	2
COMP II	2	0	1	1	2	1	1	2	1	2	0
COMP II	3	0	0	0	2	3	0	1	1	2	1
COMP II	4	0	1	0	1	0	T[a]	2	2	2	3
COMP II	5	0	2	0	2	1	1	1	2	1	0
COMP III	1	0	1	3	0	1	0	2	0	3	2
COMP III	2	0	0	0	1	0	3	2	2	2	0
COMP III	3	1	0	2	0	0	0	2	1	1	1
COMP III	4	0	2	2	3	3	2	2	0	2	1
COMP III	5	1	4	4	7	3	3	3	3	6	1
COMP IV	1	0	0	0	0	0	0	0	2	3	1
COMP IV	2	1	1	1	0	0	0	0	0	0	0
COMP IV	3	0	0	0	1	1	T	2	0	1	2
COMP IV	4	0	2	0	0	0	0	1	0	1	1
COMP IV	5	0	0	1	1	1	1	0	0	1	2
COMP V	1	0	0	0	0	1	2	1	0	1	2
COMP V	2	0	0	1	0	0	0	1	2	1	0
COMP V	3	0	1	0	0	0	0	3	2	2	1
COMP V	4	0	0	1	0	0	2	2	1	1	1
COMP V	5	0	1	0	0	0	2	2	1	0	0
COMP VI	1	0	1	4	0	0	1	T	2	0	1
COMP VI	2	0	0	0	1	0	1	1	0	0	1
COMP VI	3	2	1	1	1	1	2	4	3	3	1
COMP VI	4	0	1	1	0	1	0	1	T	1	0
COMP VI	5	2	0	0	2	2	1	2	1	0	0
R-AC	1	T	0	0	0	0	1	1	0	0	0
R-AC	2	0	0	0	T	0	0	1	0	0	0
R-AC	3	T	0	T	0	1	T	0	0	0	1
R-AC	4	0	0	0	0	0	0	0	0	0	0
R-AC	5	0	0	0	0	1	0	0	0	0	0

TABLE F.7. (Contd)

Sediment Treatment	Replicate	*R. abronius* Floating for Test Days 1-10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	0	0	0	0	0	2	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	1	0	1	0	0	0	1	0
R-BF	2	0	0	0	0	1	0	0	0	1	1
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	1	0	1	1
R-BF	5	0	0	1	0	0	0	0	T	0	T
R-OS	1	0	0	0	0	0	0	0	1	1	0
R-OS	2	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	1	0	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	1	0	0	0
R-PC	1	0	0	0	0	0	0	0	0	0	0
R-PC	2	0	0	0	0	0	0	0	0	0	0
R-PC	3	0	1	0	1	0	0	0	0	0	0
R-PC	4	0	0	0	0	0	0	0	1	1	0
R-PC	5	0	0	0	0	1	0	0	0	0	0
R-PF	1	0	0	0	0	1	0	0	0	0	0
R-PF	2	1	0	2	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	0	0
R-PF	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	1	0	1	0	0	0	0
C-SB	2	0	0	0	2	2	1	3	1	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	T	2	0	2	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	1	0	0
C-WB	1	0	0	0	0	0	0	0	0	0	0
C-WB	2	0	0	0	1	1	0	0	0	0	0
C-WB	3	0	0	1	1	0	1	1	1	0	0
C-WB	4	1	0	2	0	0	0	0	0	0	0
C-WB	5	0	0	1	0	0	0	0	1	0	0

(a) Too turbid to see.

TABLE F.8. Daily Observations of *R. abronius* Floating on Surface During 10-Day Solid-Phase Static Test, C-WB Retest, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*R. abronius* Floating for Test Days 1-10									
		1	2	3	4	5	6	7	8	9	10
C-WB	1	ND[a]	ND	0	0	0	0	0	0	0	0
C-WB	2	ND	ND	0	0	0	0	0	0	0	0
C-WB	3	ND	ND	0	0	0	0	0	0	0	0
C-WB	4	ND	ND	0	0	0	0	0	0	0	0
C-WB	5	ND	ND	0	0	0	0	0	0	0	0

(a) No data available.

REFERENCES

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U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1990. Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. EPA-503-8-90/002, U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

APPENDIX G

BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE FLOW-THROUGH TEST WITH CITHARICHTHYS STIGMAEUS

APPENDIX G

SUMMARY: BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE FLOW-THROUGH TEST WITH *CITHARICHTHYS stigmaeus*

Test type and method	10-d acute flow-through toxicity test: 5 replicates per treatment, 10 individuals per replicate. Refer to *Draft Ecological Evaluation of Dredged Material into Ocean Waters* (EPA/USACE 1990)
Test species	Sanddab *Citharichthys stigmaeus*
Test materials	Oakland Harbor sediment samples: Comp I, Comp II, Comp III, Comp IV, Comp V, Comp VI
Reference materials	Point Reyes Coarse (R-PC), Point Reyes Fine (R-PF), Offshore Sediment (R-OS), Bay Farm (R-BF), Alcatraz Environs (R-AM), Alcatraz Disposal Site (R-AC)
Control materials	Sequim Bay (C-SB), *C. stigmaeus* (C-NE, Tomales Bay Sediment)
Dilution water	Filtered seawater from Sequim Bay, WA
Test dates	10/3/90 - 10/15/90
Source of organisms	*C. stigmaeus* - Tomales Bay, CA (Brezina & Assoc.)
Test water quality parameter ranges	D.O. ≥ 4.0 mg/L pH 7.40 - 8.40 Salinity 30.0 - 34.0 °/oo Temperature 13 - 17°C Flow Rate 125 ± 10 mL/min
Test results	Refer to Tables G.1 and G.2

TABLE G.1. Rank Order Based Upon Mean Proportion Surviving 10-Day *C. stigmaeus* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Mean Proportion Surviving
R-PC	0.89
R-AC	0.90
R-BF	0.90
R-PF	0.90
COMP II	0.90
COMP IV	0.92
COMP I	0.92
COMP VI	0.92
C-NE	0.92
COMP V	0.94
R-OS	0.94
R-AM	0.96
COMP III	0.96
C-SB	0.98

TABLE G.2. Test Results for all Replicates in 10-Day *C. stigmaeus* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
COMP I	1	10	0	
	2	9	1	
	3	8	2	
	4	10	0	
	5	9	1	0.92
COMP II	1	9	1	
	2	10	0	
	3	7	3	
	4	9	1	
	5	10	0	0.90
COMP III	1	9	1	
	2	10	0	
	3	10	0	
	4	10	0	
	5	9	1	0.96
COMP IV	1	7	3	
	2	10	0	
	3	10	0	
	4	9	1	
	5	10	0	0.92
COMP V	1	8	2	
	2	10	0	
	3	10	0	
	4	9	1	
	5	10	0	0.94
COMP VI	1	10	0	
	2	11	0	
	3	8	2	
	4	9	1	
	5	9	1	0.92
R-AC	1	9	1	
	2	6	4	
	3	10	0	
	4	10	0	
	5	10	0	0.90

TABLE G.2. (Contd)

Sediment Treatment	Replicate	Live	Dead or Missing	Mean Proportion Surviving
R-AM	1	9	1	
	2	10	0	
	3	9	1	
	4	10	0	
	5	10	0	0.96
R-BF	1	8	2	
	2	9	1	
	3	9	1	
	4	9	1	
	5	10	0	0.90
R-OS	1	9	1	
	2	9	1	
	3	10	0	
	4	10	0	
	5	9	1	0.94
R-PC	1	8	2	
	2	12	0	
	3	10	0	
	4	8	2	
	5	8	2	0.89
R-PF	1	9	1	
	2	7	3	
	3	10	0	
	4	9	1	
	5	11	0	0.90
C-SB	1	10	0	
	2	9	1	
	3	10	0	
	4	10	0	
	5	11	0	0.98
C-NE	1	12	0	
	2	10	0	
	3	9	1	
	4	8	2	
	5	9	1	0.92

TABLE G.3. Water Quality Summary for 10-Day *C. stigmaeus* Solid-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Temperature (°C)		Dissolved Oxygen (mg/L)		pH		Salinity (o/oo)		Flow Rates (mL/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	4.0	---	7.40	8.40	30.0	34.0	115	135
COMP I	14.1	15.1	6.5	8.2	7.69	7.95	31.5	33.0	116	134
COMP II	14.1	15.7	6.6	8.3	7.71	7.95	31.5	32.5	116	132
COMP III	14.1	15.7	6.6	8.5	7.70	7.94	31.5	33.0	112[a]	132
COMP IV	14.1	15.7	6.6	8.7	7.72	7.93	31.5	33.0	116	132
COMP V	14.1	15.7	6.9	8.3	7.73	7.97	31.5	33.0	116	134
COMP VI	14.1	15.7	6.2	8.5	7.69	7.99	31.5	32.5	116	132
R-AC	14.1	15.7	6.6	8.3	7.70	7.99	31.5	32.5	104[a]	132
R-AM	14.1	15.7	6.6	8.1	7.73	7.96	31.0	32.0	104[a]	112
R-BF	14.1	15.7	6.6	8.4	7.72	7.96	31.5	33.0	112[a]	132
R-OS	14.1	15.7	6.9	7.9	7.57	7.99	31.5	33.0	104[a]	132
R-PC	14.1	15.7	6.6	8.7	7.60	7.99	31.5	33.0	104[a]	132
R-PF	14.1	15.7	6.3	8.4	7.71	7.97	31.5	33.5	116	132
C-SB	14.1	15.7	6.8	8.0	7.75	7.88	31.5	32.5	104[a]	136[a]
C-NE	14.1	15.7	6.8	8.4	7.71	7.89	32.0	33.0	116	134

(a) Data point out of target quality control range. Flow rates are still sufficient to replace 90% of water volume every 4 h as required by the 1990 Implementation Manual.

TABLE G.4. Daily Observations of *C. stigmaeus* Live During 10-Day Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*C. stigmaeus* Live for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	4	8	5	7	8	7	8	T[a]	T	10
COMP I	2	3	4	3	4	5	6	T	8	8	9
COMP I	3	1	3	4	5	T	3	T	T	T	8
COMP I	4	3	6	4	2	5	2	T	8	T	10
COMP I	5	2	6	4	4	5	2	T	T	T	9
COMP II	1	6	7	9	7	7	9	8	8	T	9
COMP II	2	2	7	6	3	6	T	T	7	8	10
COMP II	3	3	6	4	6	3	8	7	T	T	7
COMP II	4	3	4	5	4	2	6	T	T	T	9
COMP II	5	T	1	4	7	5	T	T	T	T	10
COMP III	1	4	5	4	6	6	6	T	T	T	9
COMP III	2	4	4	8	7	10	9	9	8	T	10
COMP III	3	2	6	5	4	7	7	6	7	T	10
COMP III	4	2	4	3	3	3	6	7	8	T	10
COMP III	5	4	4	7	9	8	8	10	T	T	9
COMP IV	1	2	2	4	4	6	6	T	T	T	7
COMP IV	2	2	4	3	4	7	6	T	T	T	10
COMP IV	3	2	4	5	5	4	9	T	8	T	10
COMP IV	4	1	2	7	5	6	6	10	T	T	9
COMP IV	5	4	3	5	3	T	6	7	T	T	10
COMP V	1	2	6	5	9	10	10	10	10	9	8
COMP V	2	5	4	8	7	5	7	T	7	9	10
COMP V	3	3	5	6	9	8	9	9	10	8	10
COMP V	4	2	3	3	5	2	4	T	T	9	9
COMP V	5	T	3	7	9	5	9	9	10	10	10
COMP VI	1	4	5	3	4	T	3	T	T	T	10
COMP VI	2	5	5	4	10	8	10	8	9	T	11
COMP VI	3	6	6	7	7	6	5	T	T	T	8
COMP VI	4	1	3	7	6	6	7	8	T	7	9
COMP VI	5	2	2	3	2	T	6	10	10	10	9
R-AC	1	5	4	8	4	3	6	5	8	T	9
R-AC	2	4	3	3	5	7	3	T	T	T	6
R-AC	3	2	6	6	4	6	4	T	9	T	10
R-AC	4	2	1	4	4	2	6	T	T	T	10
R-AC	5	2	7	3	5	T	6	T	T	T	10

TABLE G.4. (Contd)

Sediment Treatment	Replicate	*C. stigmaeus* Live for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	5	8	9	10	9	9	10	9	10	9
R-AM	2	4	9	9	9	10	10	9	9	9	10
R-AM	3	3	9	8	8	8	9	9	T	9	9
R-AM	4	2	6	10	10	10	10	10	10	9	10
R-AM	5	2	4	8	10	9	10	10	9	10	10
R-BF	1	1	2	7	6	3	T	T	T	T	8
R-BF	2	T	2	2	3	3	4	T	T	T	9
R-BF	3	1	4	2	6	2	4	8	8	T	9
R-BF	4	1	3	2	5	2	T	T	T	T	9
R-BF	5	T	4	3	5	T	6	T	T	T	10
R-OS	1	3	1	5	4	T	5	9	T	T	9
R-OS	2	2	1	3	6	5	7	T	10	T	9
R-OS	3	2	4	3	8	6	9	10	8	8	10
R-OS	4	1	5	7	4	6	7	T	T	T	10
R-OS	5	4	5	6	6	6	T	3	T	T	9
R-PC	1	3	4	4	7	6	6	8	8	8	8
R-PC	2	3	5	7	9	10	10	10	9	11	12
R-PC	3	7	5	7	10	10	9	9	9	10	10
R-PC	4	ND[(b)]	9	8	8	8	9	8	8	8	8
R-PC	5	5	3	3	8	9	7	10	T	9	8
R-PF	1	2	4	5	7	7	9	9	9	8	9
R-PF	2	4	6	6	6	7	7	8	7	7	7
R-PF	3	4	8	8	9	8	10	9	10	10	10
R-PF	4	5	5	5	8	8	10	9	10	8	9
R-PF	5	3	3	6	9	10	10	10	10	10	11
C-SB	1	2	3	T	2	T	T	T	4	5	10
C-SB	2	2	6	1	8	T	T	T	4	7	9
C-SB	3	4	3	T	2	T	T	T	6	7	10
C-SB	4	4	5	2	6	T	T	T	4	5	10
C-SB	5	4	2	3	4	T	T	T	6	10	10
C-NE	1	4	8	10	9	10	10	10	12	12	12
C-NE	2	2	5	10	10	9	10	8	10	10	10
C-NE	3	2	10	8	9	9	8	9	9	9	9
C-NE	4	3	8	10	10	10	7	9	8	8	8
C-NE	5	8	10	10	10	10	10	10	9	9	9

(a) Too turbid to see.
(b) No data available.

TABLE G.5. Daily Observations of *C. stigmaeus* Dead During 10-Day Solid-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Replicate	*C. stigmaeus* Dead for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	0	0	0	0	0	0	T[a]	T	0
COMP I	2	0	0	0	0	0	0	T	0	0	0
COMP I	3	0	0	0	0	T	0	T	T	T	0
COMP I	4	0	0	0	0	0	0	T	0	T	0
COMP I	5	0	0	0	0	0	0	T	T	T	0
COMP II	1	0	0	0	0	0	0	0	0	T	0
COMP II	2	0	0	0	0	0	0	T	T	0	0
COMP II	3	0	0	0	0	0	0	0	T	T	0
COMP II	4	0	0	0	0	0	0	T	T	T	0
COMP II	5	0	0	0	0	0	T	T	T	T	0
COMP III	1	0	0	0	0	0	0	T	T	T	0
COMP III	2	0	0	0	0	0	0	0	0	T	0
COMP III	3	0	0	0	0	0	0	0	0	T	0
COMP III	4	0	0	0	0	0	0	0	0	T	0
COMP III	5	0	0	0	0	0	0	0	T	T	0
COMP IV	1	0	0	0	0	0	0	T	T	T	0
COMP IV	2	0	0	0	0	0	0	T	T	T	0
COMP IV	3	0	0	0	0	0	0	T	0	T	0
COMP IV	4	0	0	0	0	0	0	0	T	T	0
COMP IV	5	0	0	0	0	T	0	0	T	T	0
COMP V	1	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	T	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	0	0	0	T	T	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	0	0	T	0	T	T	T	0
COMP VI	2	0	0	0	0	0	0	0	0	T	0
COMP VI	3	0	0	0	0	0	0	T	T	T	0
COMP VI	4	0	0	0	0	0	0	0	T	1	1
COMP VI	5	0	0	0	0	T	0	0	0	0	0
R-AC	1	0	0	0	0	0	0	0	0	T	1
R-AC	2	0	0	0	0	0	0	T	T	T	3
R-AC	3	0	0	0	0	0	0	T	0	T	0
R-AC	4	0	0	0	0	0	0	T	T	T	0
R-AC	5	0	0	0	0	T	0	T	T	T	0

TABLE G.5. (Contd)

Sediment Treatment	Replicate	*C. stigmaeus* Dead for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AM	1	0	0	0	0	1	0	0	0	0	1
R-AM	2	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	T	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	1	0	0	0	0	0
R-BF	1	0	0	0	0	0	T	T	T	T	0
R-BF	2	0	0	0	0	0	0	T	T	T	0
R-BF	3	0	0	0	0	0	0	0	0	T	0
R-BF	4	0	0	0	0	0	T	T	T	T	0
R-BF	5	0	0	0	0	T	0	T	T	T	0
R-OS	1	0	0	0	0	T	0	0	T	T	1
R-OS	2	0	0	0	0	0	0	T	0	T	1
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	0	0	0	T	T	T	0
R-OS	5	0	0	0	0	0	T	0	T	T	1
R-PC	1	0	0	0	0	0	0	0	0	0	2
R-PC	2	0	0	0	0	0	0	0	0	0	0
R-PC	3	0	0	0	0	0	0	0	0	0	0
R-PC	4	0	0	0	0	1	0	0	0	0	1
R-PC	5	0	0	0	0	1	0	0	T	0	0
R-PF	1	0	0	0	0	0	0	0	1	0	1
R-PF	2	0	0	0	0	0	0	2	1	0	
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	1	0
R-PF	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	ND[b]	0	T	T	0	0	0
C-SB	2	0	0	0	0	0	T	T	0	0	1
C-SB	3	0	0	0	ND	0	T	T	0	0	0
C-SB	4	0	0	0	0	0	T	T	0	0	0
C-SB	5	0	0	0	0	0	T	T	0	0	0
C-NE	1	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	0	0	0	0	1	0	0	1
C-NE	4	0	0	0	0	0	0	0	0	0	2
C-NE	5	0	0	0	0	0	0	0	0	0	1

(a) Too turbid to see.
(b) No data available.

REFERENCES

U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1990. Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. EPA-503-8-90/002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

APPENDIX H

BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE-PHASE STATIC TEST WITH CITHARICHTHYS STIGMAEUS

APPENDIX H

SUMMARY: BIOASSAY RESULTS FOR 96-HOUR SUSPENDED PARTICULATE-PHASE STATIC TEST WITH *CITHARICHTHYS stigmaeus*

Test type and method	96-h static acute toxicity test: 4 SPP concentrations per treatment, 3 replicates per concentration, 10 individuals per replicate. Refer to *Draft Ecological Evaluation of Dredged Material into Ocean Waters* (EPA/USACE 1990)
Test species	Sanddab *Citharichthys stigmaeus*
Test materials	Oakland Harbor sediment samples: Comp I, Comp II, Comp III, Comp IV, Comp V, Comp VI
Reference materials	Point Reyes Fine (R-PF), Bay Farm (R-BF), Alcatraz Environs (R-AM)
Control materials	Filtered Sequim Bay seawater (0% SPP)
Dilution water	Filtered seawater from Sequim Bay, WA
Test dates	9/27/90 - 10/1/90
Source of organisms	*C. stigmaeus* - Tomales Bay, CA (Brezina & Assoc.)
Test water quality parameter ranges	D.O. ≥ 4.0 mg/L pH 7.40 - 8.40 Salinity 30.0 - 34.0 °/oo Temperature 13 - 17°C
Test results	Refer to Tables H.1 and H.2

TABLE H.1. Summary of Results for 96-Hour C. stigmaeus Suspended-Particulate-Phase Test, Oakland Phase III 38′ Project

Sediment Treatment	Concentration	Mean Proportion Surviving
COMP I	0%	1.00
COMP I	10%	0.90
COMP I	50%	1.00
COMP I	100%	1.00
COMP II	0%	1.00
COMP II	10%	1.00
COMP II	50%	1.00
COMP II	100%	1.00
COMP III	0%	1.00
COMP III	10%	1.00
COMP III	50%	1.00
COMP III	100%	1.00
COMP 1V	0%	1.00
COMP 1V	10%	1.00
COMP IV	50%	0.97
COMP IV	100%	1.00
COMP V	0%	1.00
COMP V	10%	0.93
COMP V	50%	0.97
COMP V	100%	1.00
COMP VI	0%	1.00
COMP VI	10%	1.00
COMP VI	50%	1.00
COMP VI	100%	1.00
R-AM	0%	0.97
R-AM	10%	0.97
R-AM	50%	1.00
R-AM	100%	1.00
R-BF	0%	1.00
R-BF	10%	1.00
R-BF	50%	1.00
R-BF	100%	1.00
R-PF	0%	1.00
R-PF	10%	0.93
R-PF	100%	0.97

TABLE H.2. Survival Data for all Replicates in 96-Hour *C. Stigmaeus* Suspended-Particulate-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Concentration	Replicate	*C. stigmaeus* Live	*C. stigmaeus* Dead or Missing	Mean Proportion Surviving
COMP I	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
COMP I	10%	1	10	0	
	10%	2	9	1	
	10%	3	8	2	0.90
COMP I	50%	1	10	0	
	50%	2	10	0	
	50%	3	10	0	1.00
COMP I	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
COMP II	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
COMP II	10%	1	10	0	
	10%	2	10	0	
	10%	3	10	0	1.00
COMP II	50%	1	10	0	
	50%	2	10	0	
	50%	3	10	0	1.00
COMP II	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
COMP III	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
COMP III	10%	1	10	0	
	10%	2	10	0	
	10%	3	10	0	1.00
COMP III	50%	1	10	0	
	50%	2	10	0	
	50%	3	10	0	1.00

TABLE H.2. (Contd)

Sediment Treatment	Concentration	Replicate	*C. stigmaeus* Live	*C. stigmaeus* Dead or Missing	Mean Proportion Surviving
COMP III	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
COMP IV	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
COMP IV	10%	1	10	0	
	10%	2	10	0	
	10%	3	10	0	1.00
COMP IV	50%	1	10	0	
	50%	2	9	1	
	50%	3	10	0	0.97
COMP IV	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
COMP V	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
COMP V	10%	1	10	0	
	10%	2	8	2	
	10%	3	10	0	0.93
COMP V	50%	1	10	0	
	50%	2	10	0	
	50%	3	9	1	0.97
COMP V	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
COMP VI	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
COMP VI	10%	1	10	0	
	10%	2	10	0	
	10%	3	10	0	1.00

TABLE H.2. (Contd)

Sediment Treatment	Concentration	Replicate	*C. stigmaeus* Live	*C. stigmaeus* Dead or Missing	Mean Proportion Surviving
COMP VI	50%	1	10	0	
	50%	2	10	0	
	50%	3	10	0	1.00
COMP VI	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
R-AM	0%	1	10	0	
	0%	2	9	1	
	0%	3	10	0	0.97
R-AM	10%	1	9	1	
	10%	2	10	0	
	10%	3	10	0	0.97
R-AM	50%	1	10	0	
	50%	2	10	0	
	50%	3	10	0	1.00
R-AM	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
R-BF	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00
R-BF	10%	1	10	0	
	10%	2	10	0	
	10%	3	10	0	1.00
R-BF	50%	1	10	0	
	50%	2	10	0	
	50%	3	10	0	1.00
R-BF	100%	1	10	0	
	100%	2	10	0	
	100%	3	10	0	1.00
R-PF	0%	1	10	0	
	0%	2	10	0	
	0%	3	10	0	1.00

TABLE H.2. (Contd)

Sediment Treatment	Concentration	Replicate	*C. stigmaeus* Live	*C. stigmaeus* Dead or Missing	Mean Proportion Surviving
R-PF	10%	1	9	1	
	10%	2	10	0	
	10%	3	9	1	0.93
R-PF	100%	1	10	0	
	100%	2	9	1	
	100%	3	10	0	0.97

TABLE H.3. Water Quality Summary for 96-Hour *C. Stigmeus* Suspended-Particulate-Phase Test, Oakland Phase III 38' Project

Sediment Treatment	Concentration	Temperature (°C) Min	Temperature (°C) Max	Dissolved Oxygen (mg/L) Min	Dissolved Oxygen (mg/L) Max	pH Min	pH Max	Salinity (o/oo) Min	Salinity (o/oo) Max
Acceptable Range		13.0	17.0	4.0	---	7.40	8.40	30.0	34.0
COMP I	0%	14.1	15.4	6.9	8.0	7.80	7.94	32.0	32.0
COMP I	10%	14.0	15.4	6.9	8.2	7.82	7.93	32.0	32.5
COMP I	50%	14.2	15.2	6.9	7.9	7.82	8.04	32.0	32.0
COMP I	100%	13.3	15.3	7.0	7.8	7.80	8.15	32.0	32.0
COMP II	0%	14.1	15.4	6.8	7.5	7.77	7.90	32.0	32.0
COMP II	10%	13.9	15.3	7.1	7.4	7.77	7.95	32.0	32.0
COMP II	50%	13.7	15.3	7.0	7.6	7.71	8.10	32.0	32.0
COMP II	100%	13.1	15.4	6.6	7.7	7.63	8.13	32.0	32.0
COMP III	0%	14.3	15.5	6.7	7.7	7.80	7.97	32.0	33.0
COMP III	10%	14.3	15.5	6.8	7.8	7.77	8.02	32.0	32.0
COMP III	50%	13.8	15.6	6.9	7.6	7.93	8.12	32.0	32.5
COMP III	100%	14.2	15.6	7.1	7.7	7.96	8.19	32.0	32.5
COMP IV	0%	14.1	15.5	7.0	7.6	7.83	7.94	32.0	32.0
COMP IV	10%	14.2	15.5	7.0	7.7	7.86	7.96	32.0	32.0
COMP IV	50%	14.0	15.5	7.0	7.7	7.82	8.01	32.0	32.5
COMP IV	100%	13.9	15.6	7.0	7.8	7.89	8.08	32.0	32.5
COMP V	0%	14.3	15.7	6.9	8.0	7.78	7.94	32.0	32.0
COMP V	10%	13.5	14.9	6.7	7.7	7.72	7.93	32.0	32.0
COMP V	50%	13.1	14.9	7.0	7.6	7.85	7.99	32.0	32.5
COMP V	100%	13.4	14.9	5.9	7.5	7.87	7.99	32.0	32.5
COMP VI	0%	13.7	15.0	6.7	7.6	7.78	7.96	32.0	32.5
COMP VI	10%	14.1	15.0	7.0	7.7	7.81	7.94	32.0	32.0
COMP VI	50%	14.0	15.1	7.0	7.6	7.84	8.04	32.0	32.0
COMP VI	100%	13.7	15.0	7.0	7.7	7.81	8.06	32.0	32.5
R-AM	0%	14.1	15.4	6.7	7.5	7.70	7.92	32.0	32.0
R-AM	10%	14.0	15.5	6.9	7.4	7.82	7.91	32.0	32.0
R-AM	50%	14.1	15.5	6.9	7.5	7.80	7.89	32.0	32.0
R-AM	100%	13.0	15.5	6.7	7.8	7.72	7.91	32.0	32.0
R-BF	0%	15.0	15.4	6.6	9.4	7.68	7.99	32.0	32.5
R-BF	10%	15.2	15.5	7.1	9.3	7.85	8.00	32.0	33.0
R-BF	50%	14.3	14.9	6.9	9.6	7.79	8.02	32.0	32.5
R-BF	100%	15.0	15.4	7.2	9.4	7.91	8.08	32.0	32.0
R-PF	0%	14.3	15.4	6.9	7.4	7.80	7.91	32.0	32.0
R-PF	10%	14.1	15.5	6.7	7.4	7.74	7.93	32.0	32.0
R-PF	50%	NI(a)	NI	NI	NI	NI	NI	NI	NI
R-PF	100%	14.7	15.3	6.8	7.5	7.80	7.97	32.0	32.0

(a) Not initiated because not enough sediment to prepare SPP.

TABLE H.4. Observations of *C. stigmeus* During 96-Hour Suspended-Particulate-Phase Test, Oakland Phase III 38' Project

SPP Treatment	Concentration	Replicate	*C. stigmeus* Live						*C. stigmeus* Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP I	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10%	2	10	10	10	10	10	9	0	0	0	0	0	1
COMP I	10%	3	10	10	10	10	10	8	0	0	0	0	0	2
COMP I	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10%	3	10	10	10	10	10	10	0	0	0	0	0	0

TABLE H.4. (Contd)

SPP Treatment	Concentration	Replicate	*C. stigmeus* Live						*C. stigmeus* Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP IV	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	50%	2	10	10	10	10	10	9	0	0	0	0	0	1
COMP IV	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	10%	2	10	10	10	10	10	8	0	0	0	0	0	2
COMP V	10%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50%	3	10	10	9	9	9	9	0	0	1	0	0	0
COMP V	100%	1	10	T[a]	10	10	10	10	0	T	0	0	0	0
COMP V	100%	2	10	T	10	10	10	10	0	T	0	0	0	0
COMP V	100%	3	10	T	10	10	10	10	0	T	0	0	0	0
COMP VI	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	0%	2	10	10	10	10	10	9	0	0	0	0	0	1
R-AM	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	10%	1	10	10	10	10	10	9	0	0	0	0	0	1
R-AM	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	10%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-AM	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	0%	3	10	10	10	10	10	10	0	0	0	0	0	0

TABLE H.4. (Contd)

SPP Treatment	Concentration	Replicate	*C. stigmeus* Live 0h	4h	24h	48h	72h	96h	*C. stigmeus* Dead 0h	4h	24h	48h	72h	96h
R-BF	10%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	10%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	50%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	50%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	50%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	100%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-BF	100%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-PF	0%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-PF	0%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-PF	0%	3	10	10	10	10	10	10	0	0	0	0	0	0
R-PF	10%	1	10	10	10	10	10	9	0	0	0	0	0	1
R-PF	10%	2	10	10	10	10	10	10	0	0	0	0	0	0
R-PF	10%	3	10	10	10	10	9	9	0	0	0	0	1	0
R-PF	50%	1												
R-PF	50%	2	50% Test Not Done-Insufficient R-PF Sediment to Prepare SPP											
R-PF	50%	3												
R-PF	100%	1	10	10	10	10	10	10	0	0	0	0	0	0
R-PF	100%	2	10	10	10	10	9	9	0	0	0	0	1	1
R-PF	100%	3	10	10	10	10	10	10	0	0	0	0	0	0

(a) Too turbid to make observation.

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U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1990. Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. EPA-503-8-90/002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection. Washington, D.C.

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