WORK PLAN
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS GREAT LAKES NAVAL TRAINING CENTER GREAT LAKES, ILLINOIS

PREPARED BY
DONOHUE & ASSOCIATES, INC.

COMPREHENSIVE LONG–TERM ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

CONTRACT NO. N62472–90–D–1298
CONTRACT TASK ORDER 0019

APRIL 1992

HALLIBURTON NUS
Environmental Corporation

Donohue ENGINEERS ARCHITECTS SCIENTISTS

ENSR™

CTO19/GRLKS/WPBF/APR92

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COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

Submitted to:
Department of the Navy
Northern Division
Environmental Branch - Code 18
Naval Facilities Engineering Command
Building 77L, U.S. Naval Base
Philadelphia, Pennsylvania

Prepared by:
Donohue & Associates, Inc.
Chicago, Illinois

Submitted by:
HALLIBURTON NUS Environmental Corporation
Wayne, Pennsylvania

Contract No. N62472-90-D-1298
Contract Task Order No. 0019

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Mansour Ghiasi, P.E.
Project Manager
Donohue & Associates, Inc.

John Trepanowski, P.E.
CLEAN Program Manager
HALLIBURTON NUS Environmental Corporation

SITE INSPECTION WORK PLAN
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

Prepared by: _____ Date: _____

Mansour Ghiasi, P.E.
Project Manager
Donohue & Associates, Inc.

Reviewed by: _____ Date: _____

Lorraine Ransome, Ph.D.
Program Manager
Donohue & Associates, Inc.

Reviewed by: _____ Date: _____

Deborah Stockdale
Remedial Project Manager
Department of the Navy
Northern Division
Naval Facilities Engineering Command

Reviewed by: _____ Date: _____

John Trepanowski, P.E.
CLEAN Program Manager
HALLIBURTON NUS Environmental Corporation

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LIST OF ACRONYMS/ABBREVIATIONS

CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CTO	Contract Task Order
DOD	Department of Defense
DQO	Data Quality Objective
FSP	Field Sampling Plan
HRS	Hazard Ranking System
HSP	Health and Safety Plan
IAS	Initial Assessment Study
IEPA	Illinois Environmental Protection Agency
IR	Installation Restoration
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NACIP	Naval Assessment and Control of Installation Pollutants
NTC	Naval Training Center
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbon compounds
PCB	Polychlorinated Biphenyl
POL	Petroleum, Oil and Lubricants
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
SI	Site Inspection
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Laching Procedure
TOC	Total Organic Carbon
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VA	Veterans Administration
VOC	Volatile Organic Compound

RP/19WPBR/AA1

1.0 INTRODUCTION

Donohue & Associates, Inc. (Donohue) is submitting this Site Inspection (SI) Work Plan to the U.S. Navy Northern Division (Navy) in response to Contract Task Order (CTO) #0019 under Navy CLEAN Subcontract No. GCPP-91-001-1298 for Prime Contract No. N62472-90-D-1298. Preparation of the Work Plan and the related documents was accomplished pursuant to the CTO for the Great Lakes Naval Training Center (NTC) in Great Lakes, Illinois, dated August 2, 1991. An Implementation Plan was submitted to the Navy on September 4, 1991. The Navy issued final approval of the Implementation Plan on October 8, 1991.

This Work Plan presents Donohue's technical scope of work for the SI at Pettibone Creek, the Boat Basin, and the Harbor Areas. The objectives of the SI at Pettibone Creek, the Boat Basin, and the Harbor Areas are:

- Evaluate the types and levels of contaminants present in Pettibone Creek, the Boat Basin, and the Harbor Areas.
- Establish background levels for the contaminants of concern.
- Evaluate suspected contaminant migration pathways and patterns. Determine, if possible, whether contaminants have migrated via Pettibone Creek or Lake Michigan to the Harbor Areas.
- Collect additional samples for the Navy to evaluate dredging and disposal options for the potentially contaminated sediments in the Boat Basin and the Harbor Areas.

The Work Plan has been developed based on the existing site information as screening data. During the SI field work, surface water and sediment samples will be collected from areas of concern. Eleven locations will be sampled along Pettibone Creek including four background locations. Other surface water and sediment sampling activities will include: four locations in the Boat Basin Area; four locations in the Inner Harbor; six locations in the Outer Harbor; and six locations in Lake Michigan.

The Work Plan presents site background in Section 2.0, SI objectives and approach in Section 3.0, SI tasks in Section 4.0, data quality objectives in Section 5.0, and the project schedule in Section 6.0. Technical guidelines and procedures for conducting field work and laboratory analysis are presented in the accompanying Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HSP).

2.0 BACKGROUND

2.1 INSTALLATION RESTORATION PROGRAM

In 1980, the Department of Defense (DOD) initiated the Installation Restoration (IR) Program for investigating and remediating hazardous waste disposal sites at military installations and instructed the services to comply with program guidelines. This SI is part of the Navy's IR Program (formerly known as the Navy Assessment and Control of Installation Pollutants (NACIP) Program) designed to identify contamination of Navy and Marine Corps lands/facilities resulting from past operations and to institute corrective measures as needed. The IR Program consists of four phases as follows (Naval Facilities Engineering Command, 1991):

I. Preliminary Assessment (PA) - formerly known as an Initial Assessment Study (IAS) under the NACIP Program, determines the seriousness of hazardous substance(s) release or threat of release. The purpose of the PA is to evaluate the release or potential release of hazardous substances and to recommend additional response action at the site. As a result, no action may be taken if available data indicate that there is no threat or potential threat to public health or the environment. Alternatively, the best response action may be an immediate removal of the threat or potential threat. The PA therefore, establishes a priority for scheduling a SI by characterizing a site.

II. Site Inspection (SI) - augments the information collected in the PA and:

- Eliminates from further consideration those releases that pose no threat or potential threat to public health or the environment.
- Collects or develops additional data, as appropriate, to evaluate the release pursuant to the Hazard Ranking System (HRS).
- Collects data, as appropriate, beyond that required to score and list the release pursuant to the HRS, in order to better characterize the release for more effective and rapid initiation of a Remedial Investigation/Feasibility Study (RI/FS).

III. Remedial Investigation/Feasibility Study (RI/FS) - performs extensive on-site investigations including physical and analytical monitoring to quantify the extent of the problem and to develop alternatives for possible corrective action.

IV. Remedial Action (RA) Plans - evaluates and implements corrective projects to control and mitigate confirmed contamination.

2.2 GREAT LAKES NTC LOCATION SITE 17

The Great Lakes NTC is located in Shields Township, Lake County, Illinois, on the shore of Lake Michigan. It is bounded on the west by U.S. Route 41 (Skokie Highway), on the east by Lake Michigan, on the north by the City of North Chicago, and on the south by the Veterans Administration (VA) Hospital and the Shore Acres County Club (Figure 2-1). Great Lakes NTC occupies approximately 1,640 acres of land.

2.3 DESCRIPTION OF PETTIBONE CREEK

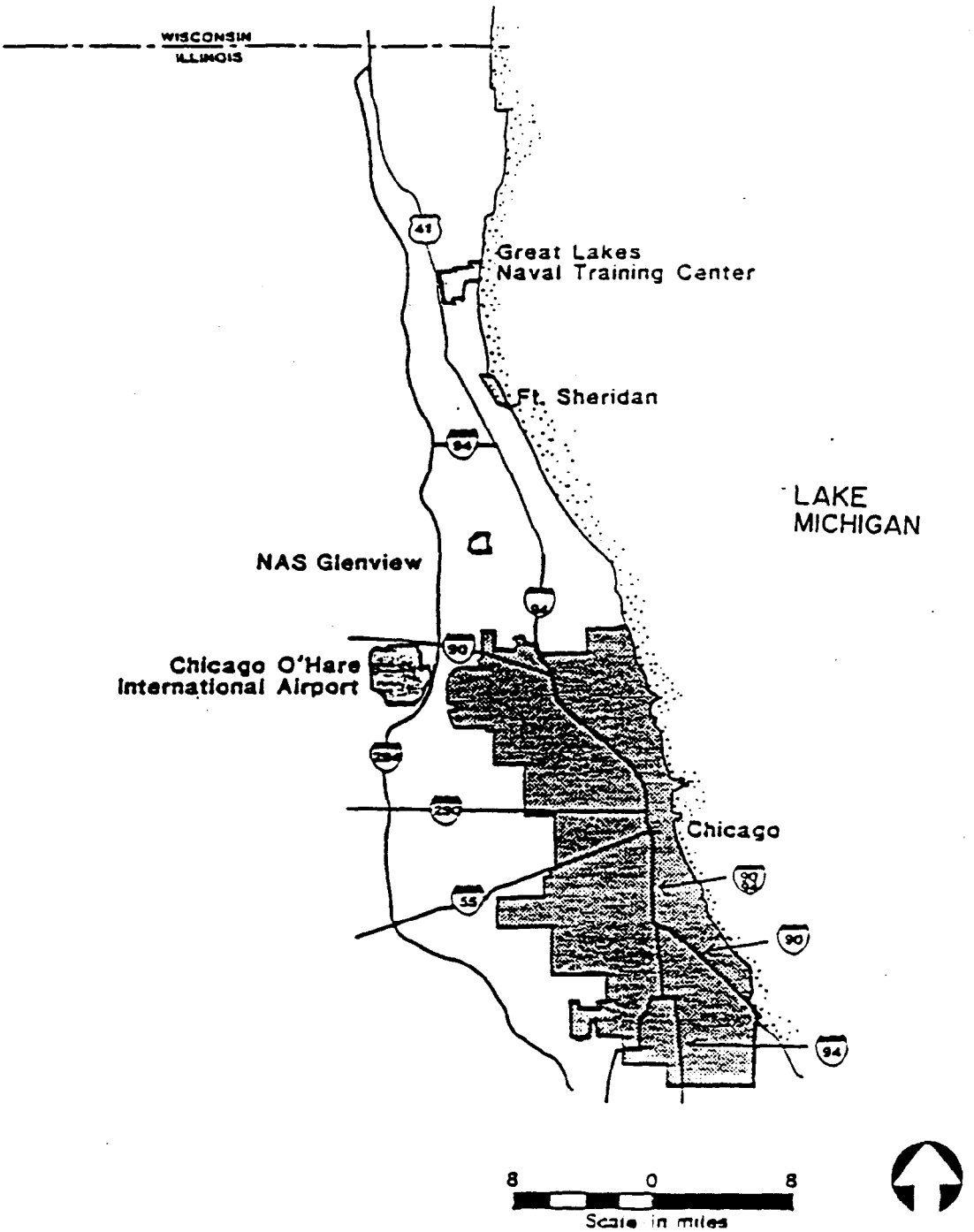
The eastern boundary of Great Lakes NTC is a sand beach on the western shore of Lake Michigan at an elevation of 580 feet above sea level. A steep bluff rises 70 feet above the beach. The majority of the base activities take place on the plateau atop this bluff. The plateau is divided by a branching ravine. Pettibone Creek and its tributaries flow in the ravine and discharge to the Boat Basin (Figure 2-2).

As can be seen in Figure 2-2, in Great Lakes NTC, Pettibone Creek has two major branches, the north branch and the south branch. The north branch originates in North Chicago near the intersection of Glen Drive and Broadway Avenue, and flows south beneath Sheridan Road where it enters Great Lakes NTC. The south branch originates in the Shore Acres Country Club and flows north entering Great Lakes NTC near the intersection of G Street and 3rd Street.

In Great Lakes NTC, Pettibone Creek ranges from between 15 and 30 feet in width, and several inches to approximately six feet in depth. Over 30 Great Lakes NTC stormwater sewer system outfalls are present along the creek banks.

2.4 DESCRIPTION OF THE BOAT BASIN AND THE HARBOR AREAS

In the past, the Boat Basin and the Harbor Areas at Great Lakes NTC have been used to moor Naval vessels ranging in size from landing craft to small destroyers. In recent years, the Harbor Area has been used for landing craft training exercises and as a small craft harbor for recreational vessels (Headland, 1990). The Harbor Area is divided into three areas: the Boat Basin, the Inner Harbor and the Outer Harbor (refer to Figure 2-3).



SOURCE:
INITIAL ASSESSMENT STUDY
ROGERS, GOLDEN, HALPERN, 1986

FIGURE 2-1

GENERAL LOCATION MAP

GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

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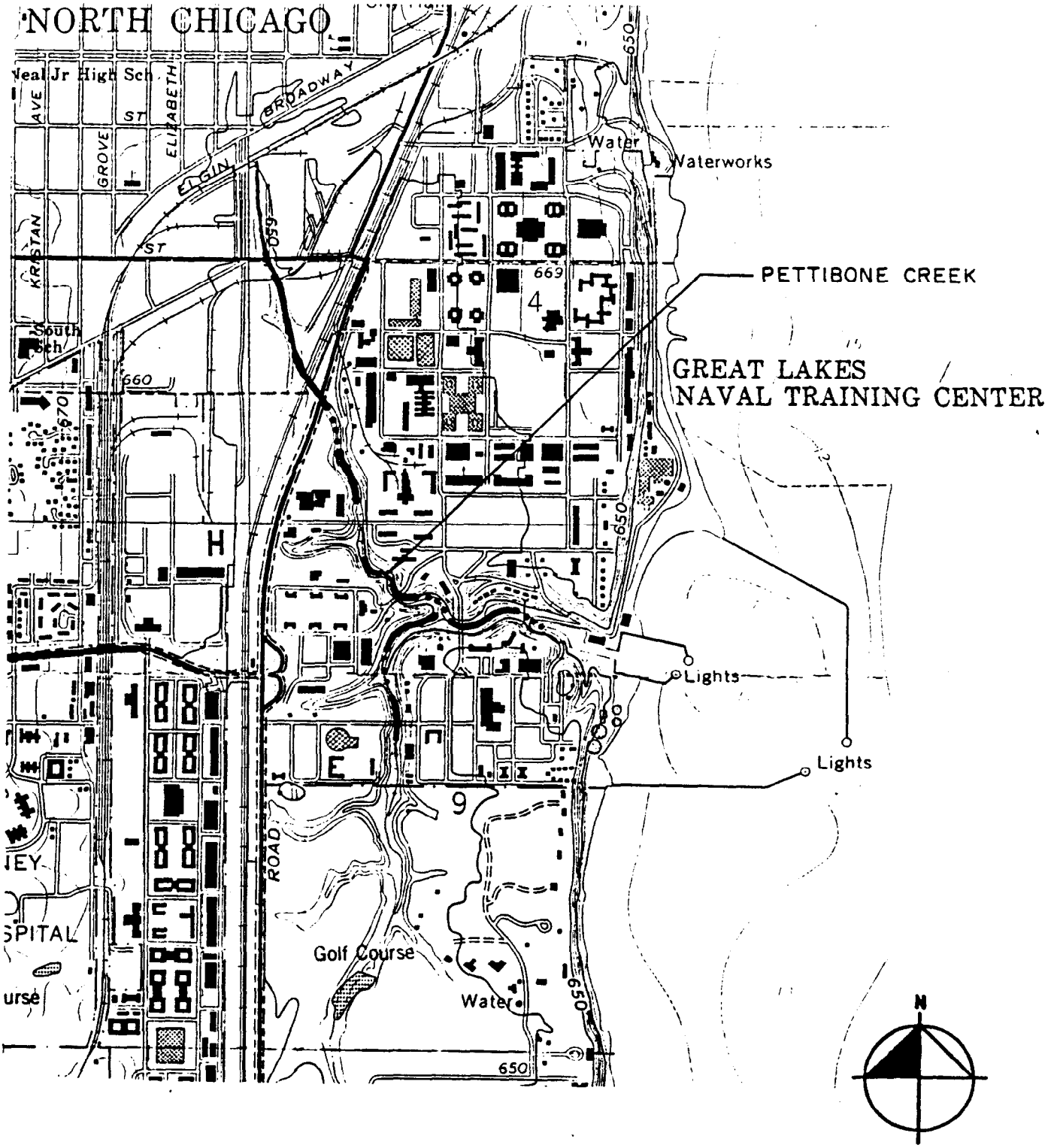

SOURCE:
USGS 7.5 MINUTE QUADRANGLE
WAUKEGAN, ILLINOIS, 1960
PHOTOREVISED 1972 AND 1980

PETTIBONE CREEK
LOCATION MAP

GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

FIGURE 2-2

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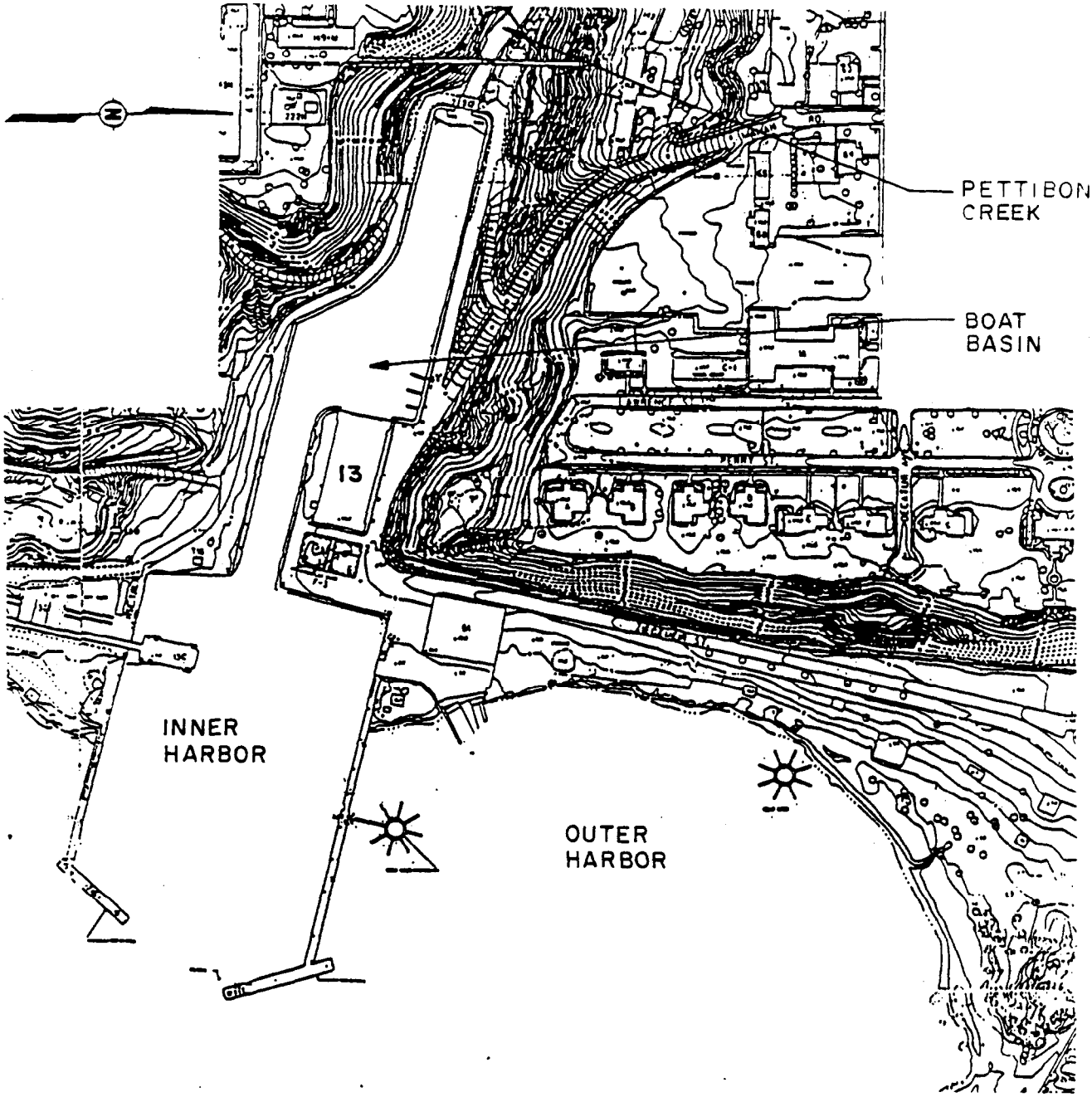

0 200 400

SCALE : FEET

SCALE IS
APPROXIMATE

FIGURE 2-3

BOAT BASIN AND HARBOR AREAS
LOCATION MAP

GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

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SCIENTISTS

2.4.1 Boat Basin

The Boat Basin is the most protected portion of the Great Lakes NTC Harbor. It has served as an area for boat slips when water was deeper in the basin. In June 1990, the water depth in the Boat Basin ranged from less than one foot to five feet (Great Lakes NTC, 1990). Access to the boat repair building (Building 13 on Figure 2-3) used to be through the eastern portion of the Boat Basin. Currently, most vessels cannot access the boat repair building due to accumulated sediment.

2.4.2 Inner Harbor

The Inner Harbor is occupied by floating slips during the boating season. A ship lift facility, used to service landing craft, is located on the south side of the Inner Harbor. A boat hoist, used to launch small craft, is located on the north side of the Inner Harbor (Headland, 1990).

In June 1990, water depths in the Inner Harbor ranged between 9 and 15 feet (Great Lakes NTC, 1990).

2.4.3 Outer Harbor

The Outer Harbor, which is enclosed by breakwaters, contains numerous small craft moorings during the boating season. A boat ramp, located on the north side of the Outer Harbor, is used to launch recreational small craft (Headland, 1990).

In June 1990, water depths in the Outer Harbor ranged between 1-foot and 25 feet (Great Lakes NTC, 1990).

2.5 PAST INVESTIGATIONS AT THE HARBOR AREAS AND SUMMARY OF ASSOCIATED CHEMICAL DATA

STS Consultants Ltd. (STS) conducted sediment and surface water sampling at the Boat Basin and Outer Harbor in April 1988, April 1989, and December 1989. These sampling events and associated chemical data are summarized below.

2.5.1 STS Sampling Event April 1988

On April 20, 1988, STS collected two grab samples, one from the Boat Basin and one from the Outer Harbor, for limited EP Toxicity, priority pollutant metals, and polychlorinated biphenyls (PCBs) testing. The levels for copper, cyanide, lead, nickel and zinc in both samples exceeded the 1977 U.S. Environmental Protection Agency (USEPA) guidelines for classifying Great Lakes harbor sediments as "nonpolluted" (Table 2-1) (USEPA 1977). The

TABLE 2-1

GUIDELINES FOR POLLUTIONAL CLASSIFICATION OF GREAT LAKES HARBOR SEDIMENTS (CONCENTRATIONS SHOWN ARE IN MG/KG DRY WEIGHT) SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS GREAT LAKES NAVAL TRAINING CENTER GREAT LAKES, ILLINOIS APRIL 1992

Parameter	Nonpolluted	Moderately Polluted	Heavily Polluted
Volatile solids, %	<5	5 - 8	>8
Chemical oxygen demand	<40,000	40,000 - 80,000	>80,000
Total Kjeldahl nitrogen	<1,000	1,000 - 2,000	>2,000
Ammonia	<75	75 - 200	>200
Phosphorus	<420	420 - 650	>650
Oil and grease	<1,000	1,000 - 2,000	>2,000
Arsenic	<3	3 - 8	>8
Barium	<20	20 - 60	>60
Cadmium	--	--	>6
Chromium	<25	25 - 75	>75
Copper	<25	25 - 50	>50
Cyanide	<0.10	0.10 - 0.25	>0.25
Iron	<17,000	17,000 - 25,000	>25,000
Lead	<40	40 - 60	>60
Manganese	<300	300 - 500	>500
Nickel	<20	20 - 50	>50
Zinc	<90	90 - 200	>200

Parameter	Polluted
Mercury	>1
Total PCBs	>10

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PCB concentration detected in sample B-2 also exceeded the 1977 guidelines. Results of the limited EP toxicity testing indicated that the sediment samples were not considered hazardous relevant to chromium, lead and mercury. Chemical data from the April 1988 sampling event are summarized in Table 2-2 and Table 2-3 (STS, 1988).

2.5.2 STS Sampling Event April 1989

Seven sediment composite samples (3 from the Boat Basin and 4 from the Outer Harbor), one Lake Michigan surface water sample and one background sediment sample (both from south of the south Outer Harbor breakwater) were collected on April 19 and 20, 1989, and were analyzed for metals, semivolatiles, pesticides and PCBs. Pesticides and PCBs were not analyzed in the Lake Michigan surface water sample. The background sediment sample was collected within a sediment depth of one foot; all other sediment samples were composites of samples collected from a sediment depth of zero to five feet. The levels of detectable metals in the Boat Basin sediment samples were generally higher than those collected in the Outer Harbor. Within the Boat Basin, the highest levels were generally found at B-104 location where the basin bends at about 45 degrees to join a channel leading to the Inner Harbor. Metal levels in sediment sample B-105 (next to the mouth of the Inner Harbor) were highest among all Outer Harbor sediment samples. PCBs were not detected in any of the sediment samples. Several semivolatile organic compounds were detected at low mg/kg concentrations. Chemical data from the April 1989 sampling event are summarized in Table 2-4 (STS, May 1989).

Supernatant testing and analyses of metals, total suspended solids, total volatile solids and ammonia-nitrogen were conducted for samples B-104, B-105 and B-106. These were Outer Harbor samples with fine materials (finer than a No. 230 U.S. sieve) in excess of 20 percent. Table 2-5 summarizes this data.

2.5.3 STS Sampling Event December 1989

Seven composite sediment samples (3 from the Boat Basin and 4 from the Outer Harbor) and one Lake Michigan surface water sample (from south of south breakwater) collected on December 5 and 6, 1989, were analyzed for supernatant metals, PCBs and polyaromatic hydrocarbons (PAHs). Each composite sample was a mixture of grab samples from the sediment depth between the existing lake bottom and approximately five feet below the lake bottom. Direct comparison of results from the Supernatant Test results, without the application of dilution factors, with the Illinois Environmental Protection Agency's (IEPA) maximum allowable concentrations indicates that the IEPA is not likely to permit open water disposal of the sediments (Great Lakes NTC, 1991). Chemical data from the December 1989 sampling event are summarized in Table 2-6 and Table 2-7 (STS, December 1989).

TABLE 2-2

PRIORITY POLLUTANT METALS AND PCB DATA
APRIL 1988 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Outer Harbor Sample B-1 (mg/kg)	Boat Basin Sample B-2 (mg/kg)
Arsenic	1.50	1.00
Cadmium	0.70	0.80
Chromium	13.0	11.5
Copper	37.0[M]	194[H]
Cyanide	0.13[M]	0.21[M]
Lead	55.5[M]	97.3[H]
Nickel	12.3[M]	54.2[H]
Zinc	121[M]	955[H]
Mercury	0.04	0.77
Total PCBs	<0.70	>12.1[P]

M - Moderately Polluted (refer to Table 2-1)

H - Heavily Polluted (refer to Table 2-1)

P - Polluted (refer to Table 2-1)

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TABLE 2-3

EP TOXICITY DATA
APRIL 1988 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Outer Harbor Sample B-1 (mg/L)	Boat Basin Sample B-2 (mg/L)
EP TOX - Chromium	0.021	0.013
EP TOX - Lead	0.17	0.09
EP TOX - Mercury	NR	<0.001

NR - Not Reported

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TABLE 2-4

METALS AND SEMIVOLATILE ORGANIC COMPOUND DATA (mg/kg)
APRIL 1989 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Outer Harbor B-101	Boat Basin B-102	Boat Basin B-103	Boat Basin B-104	Outer Harbor B-105	Outer Harbor B-106	Outer Harbor B-107	Background*
Thallium	<25	<25	<25	<25	<25	<25	<25	<25
Antimony	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5
Beryllium	<0.12	1.1	0.52	0.39	0.20	0.13	<0.12	<0.12
Cadmium	0.52	1.4	0.90	2.5	2.3	1.3	0.34	<0.25
Chromium	4.2	7.6	5.0	17	33	15	2.4	2.2
Hexavalent Chromium	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1
Copper	8.3	68	49	110	51	38	6.4	3.1
Lead	25	53	56	150	110	72	12	21
Nickel	4.8	22	8.5	24	15	7.2	2.6	2.3
Zinc	39	510	280	390	200	110	27	27
Silver	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Arsenic	2.2	4.0	2.6	11	20	9.0	0.98	2.1
Selenium	1.1	0.88	0.85	0.81	0.80	1.2	0.94	<0.50
Mercury	0.026	0.043	0.024	1.1	0.47	0.22	0.029	0.023
Total Cyanide	<10	<10	<10	<10	<10	<10	<10	<10
Total Organic Carbon	2,600	3,800	4,000	15,000	13,000	5,600	1,700	1,000
Acenaphthene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphtylene	<0.010	0.16	0.28	<0.010	<0.010	<0.010	<0.010	<0.010
Anthracene	<0.010	5.5	2.6	<0.010	<0.010	<0.010	<0.010	<0.010
Benzidine	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(a)anthracene	<0.010	2.1	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(a)pyrene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(g,h,i)perylene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(k)fluoranthene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Bis(2 ethylhexyl)phthalate	2.6	0.97	5.8	<0.010	<0.010	<0.010	<0.010	0.15
4 Bromophenyl phenyl ether	0.70	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Butyl benzyl phthalate	0.78	0.56	1.4	<0.010	<0.010	<0.010	<0.010	0.22

* Collected south of the south Outer Harbor breakwater beach area.

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TABLE 2-5

SUPERNATANT TESTING
APRIL 1989 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Units	Sample B-104		Sample B-105		Sample B-106		Regulatory Limit Concentration
		0 Min	15 Min	0 Min	15 Min	0 Min	15 Min	
Ammonia as N	(mg/l)	3.7	2.6	3.9	2.7	2.9	1.5	0.02
Arsenic (Total)	(ug/l)	1,270	140	6,300	1450	1,350	290	1000
Copper (Total)	(mg/l)	50	1.7	10	7	8	1.7	1.0
Mercury (Total)	(ug/l)	208	20.1	99.7	20.2	36.5	0.49	0.5
Lead (Total)	(mg/l)	53	2.1	44	10.9	11.5	2.3	0.1
Total Suspended Solids	(mg/l)	112,000	4,200	182,000	42,000	178,000	1,080	N/A
Total Volatile Solids	(mg/l)	1080	470	7,840	1,940	5,490	132	N/A
Zinc (Total)	(mg/l)	130	4.9	69	17	20	3.4	1.0

N/A - No regulatory limit

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TABLE 2-6

SUPERNATANT METALS TESTING
DECEMBER 1989 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Units	Outer Harbor B-201		Boat Basin B-202		Boat Basin B-203		Boat Basin B-204	
		0 Min	15 Min	0 Min	15 Min	0 Min	15 Min	0 Min	15 Min
Silver	mg/l	0.304	0.248	0.043	0.034	0.069	0.067	0.390	0.429
Arsenic	ug/l	1098	1074	212	216	478	448	1560	2170
Beryllium	mg/l	0.05	0.04	ND	ND	0.04	0.04	0.10	0.10
Cadmium	mg/l	0.123	0.098	0.054	0.064	0.104	0.104	0.951	1.22
Total Cyanide	ug/l	ND	ND	104	93	81	74	1450	580
Chromium	mg/l	1.35	1.48	0.449	0.501	0.735	0.695	5.19	6.10
Hex. Chromium	mg/l	ND	ND	ND	ND	ND	ND	ND	ND
Copper	mg/l	3.91	3.85	4.73	5.12	9.12	9.24	59.9	85.1
Mercury	ug/l	ND	1.4	6.9	6.4	14.6	38.4	235.0	99.0
Nickel	mg/l	2.49	2.33	1.39	1.47	2.00	2.07	14.5	23.2
Lead	mg/l	5.7	5.4	3.3	3.7	11	11	68	50
Antimony	ug/l	ND	ND	3.0	2.3	8.0	6.5	43.5	70.2
Selenium	ug/l	18.0	14.8	8.2	9.3	17.9	25.2	138	147
Thallium	mg/l	1.8	1.23	ND	ND	0.2	0.19	1.12	1.24
Zinc	mg/l	9.92	11	16.4	18.3	35.0	35.2	137	195

TABLE 2-6 (Continued)

SUPERNATANT METALS TESTING
DECEMBER 1989 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Units	Outer Harbor B-205		Boat Basin B-206		Boat Basin B-207		Lake Michigan Water
		0 Min	15 Min	0 Min	15 Min	0 Min	15 Min	
Silver	mg/l	0.441	0.062	0.362	0.098	0.108	0.017	ND
Arsenic	ug/l	2860	288	2990	786	538	118	ND
Beryllium	mg/l	0.06	0.03	0.07	0.03	0.04	ND	ND
Cadmium	mg/l	0.367	0.024	0.411	0.094	0.116	0.011	ND
Total Cyanide	ug/l	115	92	68	128	42	52	ND
Chromium	mg/l	6.72	1.57	4.72	1.49	0.910	0.218	ND
Hex. Chromium	mg/l	ND	ND	ND	ND	ND	ND	ND
Copper	mg/l	20.4	2.10	27.6	6.58	20.5	5.00	ND
Mercury	ug/l	30.2	5.2	17.8	7.4	2.1	1.8	ND
Nickel	mg/l	5.58	0.64	4.00	0.85	1.03	0.19	ND
Lead	mg/l	40	4.2	30	6.8	13	3.0	ND
Antimony	ug/l	5.2	ND	16.8	10.0	24.7	11.0	ND
Selenium	ug/l	93.0	8.4	48.0	8.2	9.9	ND	ND
Thallium	mg/l	1.46	ND	1.63	0.27	0.47	ND	ND
Zinc	mg/l	56.5	5.62	12.4	49.6	35.4	8.02	0.05

ND - Denotes concentrations below detection limits.

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TABLE 2-7

PCB AND PAH TESTING
DECEMBER 1989 SAMPLING EVENT
SITE INSPECTION FOR PETTIBONE CREEK, BOAT BASIN, AND HARBOR AREAS
GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS
APRIL 1992

Parameter	Units	Outer Harbor B-201	Boat Basin B-202	Boat Basin B-203	Boat Basin B-204	Outer Harbor B-205	Outer Harbor B-206	Outer Harbor B-207
Total Organic Carbon	mg/kg	11,900	1,190	2,530	12,300	1,570	13,300	10,700
Total Solids	%	81.4	80.9	79.6	63.0	59.5	73.9	82.0
PCB:								
PCB-1016	ug/kg	ND	ND	ND	ND	ND	ND	ND
PCB-1221	ug/kg	ND	ND	ND	ND	ND	ND	ND
PCB-1232	ug/kg	ND	ND	ND	ND	ND	ND	ND
PCB-1242	ug/kg	ND	ND	ND	ND	ND	ND	ND
PCB-1248	ug/kg	ND	ND	ND	ND	ND	ND	ND
PCB-1254	ug/kg	ND	ND	ND	2,400	ND	ND	ND
PCB-1260	ug/kg	ND	ND	ND	ND	ND	ND	ND
PAH:								
Acenaphthene	ug/kg	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ug/kg	ND	ND	ND	ND	ND	ND	ND
Anthracene	ug/kg	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ug/kg	560	270	500	1,100	180	740	550
Benzo(b)fluoranthene	ug/kg	570	260	540	740	200	260	620
Benzo(g,h,i)perylene	ug/kg	250	160	310	680	150	370	320
Benzo(a)pyrene	ug/kg	310	92	360	810	190	1,300	360
Chrysene	ug/kg	620	360	670	1,800	310	770	580
Dibenz(a,h,)anthracene	ug/kg	98	55	110	260	47	170	110
Fluoranthrene	ug/kg	170	ND	170	450	ND	ND	130
Fluorene	ug/kg	120	ND	ND	266	ND	ND	ND
Indeno(1,2,3,cd)pyrene	ug/kg	780	630	190	704	720	250	800
Phenanthrene	ug/kg	850	410	770	2,100	ND	650	600
Pyrene	ug/kg	830	450	970	2,100	340	910	630

ND - Denotes concentrations below detection limits

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3.0 SITE INSPECTION OBJECTIVES AND WORK PLAN PREPARATION

3.1 SITE INSPECTION OBJECTIVES

The objectives of the SI are:

- Evaluate the types and levels of contaminants present in Pettibone Creek, the Boat Basin, and the Harbor Areas.
- Establish background levels for the contaminants of concern.
- Evaluate suspected contaminant migration pathways and patterns. Determine, if possible, whether contaminants have migrated via Pettibone Creek or Lake Michigan to the Harbor Areas.
- Collect additional samples for the Navy to evaluate dredging and disposal options for potentially contaminated sediments in the Boat Basin and the Harbor Areas.

3.2 WORK PLAN PREPARATION

Preparation of the Work Plan was based upon review and consideration of data, observations, and discussions associated with the following activities:

- The Navy issued CTO #0019 on August 2, 1991, authorizing Donohue to prepare an Implementation Plan for the SI Work Plan. Donohue prepared the plan and submitted it to the Navy on September 4, 1991.
- Copies of the previous investigative reports were provided to Donohue in September 1991. These included the Harbor Material Analysis report by STS Consultants, dated December 1989; and the Great Lakes Marina Sediment Investigation report, dated June 1991.
- A site visit was conducted on October 22, 1991, by Navy and Donohue representatives.
- Project files kept at the Great Lakes NTC were reviewed by Donohue personnel on October 22-23, 1991. During the file review, emphasis was placed on the files relevant to Pettibone Creek, the Boat Basin, and the Harbor Areas. The site visit/file review Technical Memorandum No. 1 was subsequently submitted to the Navy.

- A project scoping meeting with the Navy was held on November 12, 1991. The Donohue project team presented the project approach and proposed scope of the SI. The Navy Remedial Project Manager (RPM) and other representatives commented on the approach and scope of work which resulted in some modifications. A summary of this project meeting was submitted in Technical Memorandum No. 3.

The SI Work Plan has been developed using the existing site information as screening data. During the SI field work, surface water and sediment samples will be collected from areas of concern. Eleven locations will be sampled along Pettibone Creek including four background samples. Other surface water and sediment sampling activities include: four locations in the Boat Basin; four locations in the Inner Harbor; six locations in the Outer Harbor; and six locations in Lake Michigan.

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4.0 SITE INSPECTION TASKS

4.1 TASK 1 - PROJECT PLANNING

This task includes activities which must be performed in order to produce the project planning documents and project schedule necessary to execute the SI. These activities include: project scoping, a site visit, data collection and review, and preparation of the rough draft final versions of the SI Work Plan, QAPP, FSP and HSP. The required plans are defined as follows:

- The SI Work Plan includes: site background; SI objectives and approach; SI tasks, Data Quality Objectives; the project schedule, and a description of Project Management.

- The QAPP includes: a brief project description; project organization and responsibilities; quality assurance (QA) objectives; sampling procedures; sample custody; calibration procedures; analytical procedures; data reduction, validation, and reporting; internal quality control (QC) performance and systems audits; preventive maintenance; data assessment procedures; corrective actions; and QA reports.

- The FSP includes: site background; sampling objectives; sample location and frequency; sample designations; sampling equipment and procedures; and sample handling and shipping for analysis.

- The HSP includes: site-specific safety information; a hazard assessment; monitoring procedures for site operations; and other requirements in accordance with EPA protocols.

4.2 TASK 2 - DATA COLLECTION

The SI at Pettibone Creek, the Boat Basin, and the Harbor Areas will include the following activities: subcontracting, mobilization and demobilization, and the collection of a minimum of 14 surface water samples, 37 sediment samples, 8 background surface water samples, and 8 background sediment samples. This does not include Quality Control (QC) samples. The field activities are described in detail in the FSP.

Each surface water and sediment sample collected during the SI at Pettibone Creek, the Boat Basin and the Harbor Areas will be analyzed for Target Compound List (TCL) compounds and Target Analyte List (TAL) analytes, at a minimum. The TCL/TAL contains the following suites of analytes: volatile organic compounds (VOCs), base/neutral/acid extractable compounds (semi-VOCs), pesticides/PCBs,and metals/cyanide.

The full TCL and TAL scan (VOCs, semi-VOCs, pesticides/PCBs, and metals) has been chosen as the analytical parameters for the samples to be collected during the SI for two reasons. First, because it does not appear that surface water or sediment samples have ever been collected from Pettibone Creek: a chemical database for the creek does not exist. Consequently it is not prudent to eliminate individual suites of analytes from the full TCL/TAL for the creek samples. Second, past sampling by STS in the Boat Basin and Harbor Areas indicates that the sediments in these areas are impacted by semi-VOCs, and metals, and to a much lesser extent, PCBs. These contaminants represent three of the four suites of analytes included in the full TCL/TAL. Therefore, the only TCL/TAL suite which could possibly be eliminated would be VOCs. However, it is worthwhile to analyze Boat Basin and Harbor Areas samples for VOCs to confirm the STS data which indicate that the sediments are free from VOC contamination.

In addition to the TCL/TAL, Pettibone Creek surface water samples will be tested for water quality parameters. Also, in addition to the TCL/TAL, select sediment samples in the Boat Basin, Inner Harbor, and Outer Harbor will be subjected to Toxicity Characteristic Leaching Procedure (TCLP), Reactive Sulfide and Cyanide, Total Organic Carbon (TOC), Percent Solids, Particle Size, Supernatant, and Elutriate testing to allow the Navy to evaluate sediment dredging and disposal options for these three areas.

A boat-mounted pneumatic vibratory corer will be subcontracted to recover sediment core samples in the Boat Basin, Harbor Areas and Lake Michigan. Two composite sediment samples, from 0 to 3 feet and 3 to 6 feet, will be collected from the cores at each sediment sample location. Background concentrations will be established by sampling sediments in Lake Michigan where cores will be collected from 0 to 3 feet only. Surface water samples will be collected from over the side of the boat.

The following sections summarize sample collection and analysis.

4.2.1 Pettibone Creek

It appears that past sampling in Pettibone Creek has not occurred. Consequently, a chemical database for the creek does not exist. Seven surface water samples and seven sediment samples will be collected in Pettibone Creek. In addition, four background surface water samples and four background sediment samples will be collected from the creek.

The proposed sample locations in Pettibone Creek have been strategically selected to determine the overall quality of the creek sediment and surface water inside Great Lakes NTC, and to determine whether the sources of any creek surface water or sediment contamination found are located outside and/or inside Great Lakes NTC.

The surface water samples will be analyzed for TCL compounds, TAL analytes, and water quality parameters. The sediment samples will be analyzed for TCL compounds and TAL analytes.

4.2.2 Boat Basin

Past sampling events in the Boat Basin indicate the basin sediments contain PAHs and metals. One basin sediment sample contained PCBs, also.

Eight sediment samples will be collected from four locations in the Boat Basin. At each location composite sediment samples will be collected from 0 to 3 feet and 3 to 6 feet. Two surface water samples will also be collected in the Boat Basin.

The eight sediment samples will be subjected to TCL compound and TAL analyte testing. In addition, select sediment samples collected in the Boat Basin will be subjected to TCLP, Reactive Sulfide and Cyanide, TOC, percent solids, particle size, supernatant and elutriate testing. The surface water samples will be analyzed for TCL compounds and TAL analytes.

4.2.3 Inner Harbor

To Donohue' knowledge, surface water or sediment samples have never been collected from the Inner Harbor.

Eight sediment samples will be collected from four locations in the Inner Harbor. At each location composite sediment samples will be collected from 0 to 3 feet and 3 to 6 feet. Two surface water samples will also be collected in the Inner Harbor.

The eight sediment samples will be analyzed for TCL compounds and TAL analytes. In addition, select sediment samples will be subjected to TCLP, reactive sulfide and cyanide, TOC, percent solids, particle size, supernatant and elutriate testing.

The surface water samples will be analyzed for TCL compounds and TAL analytes.

4.2.4 Outer Harbor

Past sampling events indicate the Outer Harbor sediments contain PAHs and metals.

Eight sediment samples will be collected from four locations in the Outer Harbor. At each location composite sediment samples will be collected from 0 to 3 feet and 3 to 6 feet. Two surface water samples will also be collected from the Outer Harbor.

The eight sediment samples will be subjected to TCL compound and TAL analyte testing. In addition, select sediment samples from the Outer Harbor will be subjected to TOC, percent solids, particle size, supernatant and elutriate testing. The surface water samples will be analyzed for TCL compounds and TAL analytes.

4.2.5 Lake Michigan (Background)

Four background sediment samples and four background surface water samples will be collected north of the Outer Harbor. Also, two background sediment samples and one surface water sample will be collected south of the Outer Harbor. Sediment samples will be composited from the 0- to 3-foot intervals. The chemical results of the background samples will be statistically compared with the samples collected in the Boat Basin and Inner and Outer Harbors to determine the degree of contamination in these areas. Also, the background surface water and sediment samples collected north of the Outer Harbor will be used to aid in determining if contaminants have been transported from upgradient sources towards Great Lakes NTC by Lake Michigan littoral currents.

The background sediment samples will be analyzed for TCL compounds and TAL analytes. The background surface water samples will be analyzed for TCL compounds and TAL analytes.

4.3 TASK 3 - SAMPLE ANALYSIS

This task includes chemical and physical analysis of samples collected during the SI at Pettibone Creek, the Boat Basin, and the Harbor Areas. As indicated in the FSP and QAPP, samples collected during the SI will be analyzed by a contract laboratory approved by the Navy. Information from this task will be included in the SI report appendices.

The QAPP is consistent with the QA/QC guidelines, "Sampling and Chemical Analysis Chemical Assurance Requirements for the Navy Installation Restoration Program," (NEESA, 1988).

4.4 TASK 4 - DATA VALIDATION AND EVALUATION

4.4.1 Data Validation

Data validation will be performed by a Donohue chemist in accordance with the CLEAN data validation procedures established by HALLIBURTON NUS and the Navy. The data validation procedures are discussed in detail in the QAPP.

4.4.2 Data Evaluation

Data evaluation will be initiated upon receipt of validated field data from the SI, and after sample analysis and data validation are performed. The results of this task will be incorporated into the SI report. The analytical data will be reviewed to evaluate contaminant distributions and the completeness of the database. The results will be reviewed with the Navy and IEPA to determine whether the database is sufficient or whether additional sampling is required. The specific subtasks of data evaluation are discussed in the following subsections.

4.4.2.1 Data Reduction/Tabulation

Tables will be developed to exhibit and summarize the analytical chemical data. Contaminant levels may be plotted on site maps to depict contaminant distributions.

4.4.2.2 Comparison of On-Site Chemical Data to Background Data and Other Criteria

Pettibone Creek, Boat Basin, Harbor Areas, and Lake Michigan sediment data will be compared to "Guidelines for Pollution Classification of Great Lakes Harbor Sediments" (USEPA, 1977), and will be statistically compared to background data.

Pettibone Creek, Boat Basin, Harbor Areas, and Lake Michigan surface water data will be compared to Ambient Water Quality Criteria and to IEPA Title 35, Subpart C - Water Pollution Criteria. On-site surface water data will also be statistically compared to background data.

The statistical comparison of on-site sediment and surface water data to background data will consist of the following methodology.

1. Four background sediment samples and four background surface water samples will be collected from both Pettibone Creek and Lake Michigan.

2. A statistical analysis will be done on the results of the four background samples for each matrix to determine the mean and standard deviation for each analyte of the four background locations. The data set will be checked for outliers; any outliers will be discarded from the data set. An upper limit background concentration for each analyte will then be calculated by adding three standard deviations to the sample mean. This upper limit background concentration will then be compared to the on-site data. Any on-site data points which exceed the upper limit background concentration will be considered contaminated.

4.5 TASK 5 - SITE INSPECTION REPORT

A Draft SI Report will be prepared to summarize the office and field activities performed, data collected, and conclusions and recommendations regarding the presence or absence of contamination at each site. Comments received from the Navy will be addressed to complete the Final SI Report.

The following items will be included in the SI report:

- A brief restatement of past investigations conducted at the Boat Basin and Harbor Areas.
- Figures showing sample locations.
- A narrative describing the rationale used in the selection of analytical parameters and sampling objectives.
- A detailed description of the SI field work and analytical findings with associated QA/QC documentation. The tabulation of criteria, data, calculations, etc., which are performed but not included in the report will be assembled as appendices.
- Sediment core logs and associated documentation.
- Safety inspection logs and associated documentation.
- A site-specific assessment of actual/potential migration of contaminants.
- An explanation of the methodology and results of statistical comparison of on-site surface water and sediment data to background data.

- A summary of the results of the comparison of on-site data to federal and state standards.

- Site-specific detailed recommendations with supporting documentation for the termination or continuation of the IR study.

4.6 TASK 6 - PROJECT MANAGEMENT

The Donohue Project Manager, Mansour Ghiasi, P.E., will be responsible for implementing the SI and coordinating and monitoring daily project activities. Responsibilities include:

- Serve as the principal contact with the Navy RPM.

- Ensure the project is appropriately staffed.

- Monitor budget and schedule, identify variances, and take appropriate corrective action.

- Provide overall project direction and resolve problem areas.

- Ensure project objectives and requirements are achieved.

Figure 4-1 presents the organizational chart for the Great Lakes NTC project.

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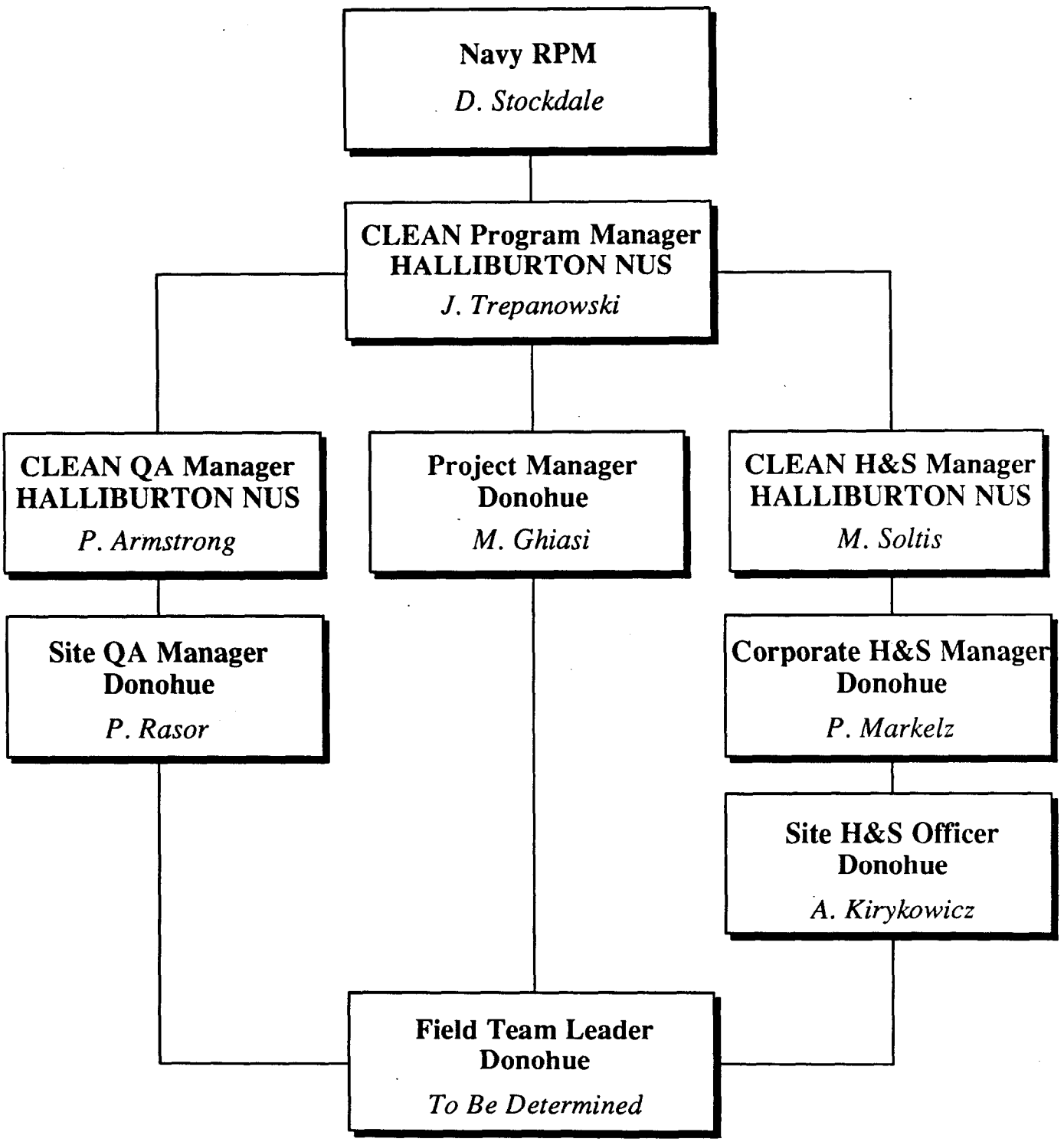
Figure 4–1

Organizational Chart
Great Lakes Naval Training Center
Great Lakes, Illinois



5.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are based on the concept that different data uses may require different levels of data quality. Data quality is defined as the degree of certainty of a data set with respect to precision, accuracy, reproducibility, comparability, and completeness. DQOs are qualitative and quantitative statements specifying the required quality of data required to support SI activities. They also support engineering alternative evaluation and selection decisions.

The five levels of data quality are (EPA, 1987):

1. Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data included those generated on-site through the use of HNu, pH, conductivity, and other real-time monitoring equipment.

2. Field Analyses (DQO Level 2): This provides rapid results and better quality than in Level 1. Analyses include mobile lab generated data.

3. Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile laboratory generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full quality control (QC) documentation).

4. Confirmational (DQO Level 4): This provides the highest level of data quality and is used for purposes of risk assessment, engineering design, and cost analyses. These analyses require full CLP analytical and data validation procedures in accordance with EPA recognized protocols.

5. Non-Standard (DQO Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaption. The level of QC is usually similar to DQO Level 4 data.

Donohue will generate DQO Level 1 and 4 analytical data during the SI at the Great Lakes NTC. The DQO Level 1 data to be generated are field measurements of pH, temperature, specific conductivity and turbidity during surface water sampling.

Water quality analysis of Pettibone Creek surface water samples will be performed by DQO Level 3.

Laboratory analytical testing of environmental samples will be performed by a contract laboratory to obtain Level 4 data. Detection limits for the individual components and QA/QC parameters to meet the data requirements are specified in the QAPP. Level 4 data will be generated according to NEESA Level D (NEESA, 1988).

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6.0 PROJECT SCHEDULE

A tentative schedule for the completion of CTO19 is presented on the next page.

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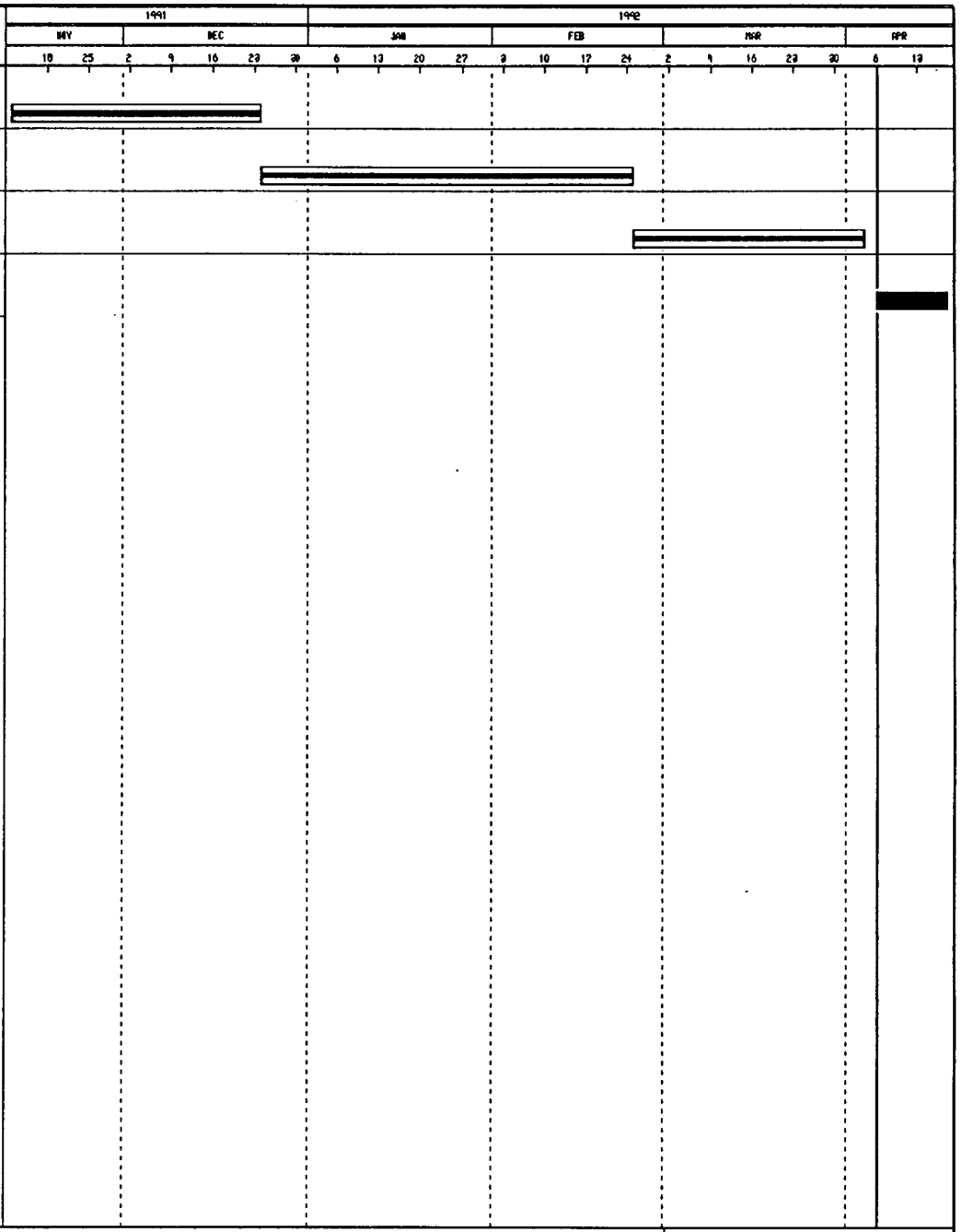
LINE	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
10	Prepare/Submit Draft Documents	30	12NOV91A	23DEC91A
20	Navy Review/Comments	25	24DEC91A	24FEB92A
30	Response to Comments	9	25FEB92A	3APR92A
40	Prepare/Submit Final Documents	10	6APR92A	17APR92



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc.

DONOHUE - PROJECT SCHEDULE
FINAL SITE INSPECT. WORK PLAN
PETTIBONE CREEK, BOAT BASIN & HARBOR AREAS

Project Start : 12NOV91

Data Date: 6APR92

Sheet 1 of 1

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Date	Revision	Checked	Approved

7.0 REFERENCES

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