Coastal Hazardous Waste Site REVIEWS

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EDITORS

Nancy Beckvar[1] and Lori Harris[1]

AUTHORS

Bo Bergquist[2], David P. Dudley[2], Dena R. Hughes[2], Corinne Severn[2], Richard E. Sturim[2], Alison Craig[2], and Christina G. Whitford[2]

[1]NOAA/HAZMAT

[2]EVS Consultants

NOAA
National Oceanic and Atmospheric Administration

ORCA
Office of Ocean Resources Conservation and Assessment

HAZMAT
Hazardous Materials Response and Assessment Division
7600 Sand Point Way NE
Seattle, Washington 98115

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REVIEWERS

Michael Buchman[1], Chuck Cairncross[1], Robert N. Dexter[2], L. Jay Field[1], Ken Finkelstein[1], Waynon Johnson[1], Denise Klimas[1], Peter Knight[1], John Lindsay[1], Mary Matta[1], Don MacDonald[1], Chris Mebane[1], Sean Morrison[1], Sandra M. Salazar[2], and Diane Wehner[1]

GRAPHICS

Kimberly L. Galimanis [2] and Christina G. Whitford[2]

[1]*NOAA/HAZMAT/Coastal Resource Coordination Branch*

[2]*EVS Consultants*

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1993

Coastal Hazardous Waste Site Reviews

Introduction

This report identifies uncontrolled hazardous waste sites that could pose a threat to natural resources for which the National Oceanic and Atmospheric Administration (NOAA) acts as a trustee. NOAA carries out responsibilities as a Federal trustee for natural resources under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan. As a trustee, NOAA is responsible for identifying sites that could affect natural resources, determining the potential for injury to the resources, evaluating cleanup alternatives, and carrying out restoration actions. NOAA works with the U.S. Environmental Protection Agency (EPA) when identifying and assessing risks to coastal resources from hazardous waste sites and developing strategies to minimize those risks.

NOAA regularly conducts evaluations of hazardous waste sites proposed for addition to the National Priorities List[1] (NPL) by EPA. The waste sites evaluated in this report are drawn from the list of all sites, including Federal facilities, proposed for inclusion on the NPL. The sites covered in this report were either proposed for inclusion on the National Priorities List by EPA in Updates 12 or 13 (Naval Air Station Adak is the only site included from Update 13), or listed in earlier NPL updates but not covered in previous NOAA reports.

The sites of concern to NOAA are located in counties bordering the Atlantic Ocean, Pacific Ocean, and Gulf of Mexico, or are near inland water bodies that support anadromous fish populations. Not all sites in coastal states will affect NOAA trust resources. To select sites on the National Priorities List for initial investigation, only sites in coastal counties or sites bordering important anadromous fish habitat are considered to have potential to affect trust resources. This initial selection criteria works better in some states than in others. It is dependent on topography, hydrography, and the nature of political subdivisions.

The information in the hazardous waste site reports provides an overall guide to the potential for injury to NOAA trust resources resulting from a site. This information is used by NOAA to establish priorities for investigating sites. Sites that appear to pose ongoing problems will be followed by a NOAA Coastal Resource Coordinator (CRC) in the appropriate region. The CRC communicates concerns about ecological impact to EPA, reviews sampling and monitoring plans for the site, and participates in planning and setting objectives for remedial actions to clean up the site. NOAA works with other trustees to plan a coordinated approach for remedial action that protects all natural resources. Other Federal and state trustees can use the hazardous waste site reports to help determine the risk of injury to their trust resources. EPA uses the site reports to help identify the types of information that may be necessary to complete an environmental assessment of the site.

Coastal site reports are often NOAA's first examination of a site. Sites with potential to impact NOAA resources may be followed by a more in-depth Preliminary Natural Resource Survey.

Eighteen coastal sites were identified in 1993 using this selection method and coastal hazardous waste site reports completed for them. A total of 262 coastal hazardous waste sites have been reviewed by NOAA since 1984 (published in April 1984[2], June 1985[3], April 1986[4], June 1987[5], March 1989[6], June 1990[7], September 1992[8], and this report). A total of 117 PNRSs have been conducted since 1988 (see table below). The current reporting brings the total number of sites considered by NOAA to 586.

Year	NPL Reports	PNRS
1984	73	
1985	20	
1986	15	
1987	33	
1988		17
1989	71	33
1990	24	32
1991		16
1992	8	11
1993	18	8

The 1993 coastal hazardous waste site reviews contain three major sections. The "Site Exposure Potential" section describes activities at the site that resulted in the release of contaminants, local topography, and contaminant migration pathways. The "NOAA Trust Habitats and

Species" section describes the types of habitats and species potentially injured by releases from the site. The life stages of organisms using habitats near the site, and commercial and recreational fisheries, are discussed. The "Site-Related Contamination" section identifies contaminants of concern to NOAA, the partitioning of the contaminants in the environment, and the concentrations at which the contaminants are found.

Tables and Screening Values

Most of these reports contain tables of contaminants measured at the site. These tables were formulated to highlight contaminants that represent a potential problem, and to focus our concerns on only a few of the many contaminants normally present at a waste site. Data presented in tables were screened against standard comparison values, depending on the media of the sample. Screening values used are ambient water quality criteria[9], selected soil averages[10], and Effective Range-Low (ER-L) values[11]. Because releases to the environment from hazardous waste sites can span many years, we are concerned about chronic impacts. Therefore, we typically make comparisons with the lower standard value (i.e., chronic vs. acute AWQC).

Very little information exists regarding the toxicity of contaminated soil or sediment. No criteria similar to the AWQC are available.

Sediment concentrations were screened by comparison with the ER-L reported by Long and Morgan[11]. The ER-L value is the concentration equivalent to that reported at the lower 10 percentile of the screened sediment toxicity data. As such, it represents the low end of the range of concentrations at which effects were observed in the studies compiled by those authors. Although freshwater studies were included, predominantly marine and estuarine toxicity studies were used for generating ER-L values.

Soil samples were compared to selected average levels from Lindsay (1979) as reported by EPA in 1983 in Hazardous Waste Land Treatment. These values were averaged from a data set (selected by Lindsay) from soil throughout the entire U.S. Ideally, reference values for soil would be calculated on a regional basis, from a data set large enough to give a value representative of the area. In the absence of such data, the values from Lindsay were used as a reference for comparison purposes only.

All of the hazardous waste sites considered by NOAA in this review are contained in the Table of Contents, including the name and location of the site and the beginning page number of the site report. Table 1 lists all the sites at which NOAA has been involved that have the potential to affect trust resources (586), as of June 1993. Table 2 lists acronyms, abbreviations, and terms commonly used in these waste site reports.

[1]National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300.

[2]Ocean Assessments Division. 1984. *Coastal Hazardous Waste Site Review April 13, 1984.* NOAA/OAD, Seattle, Washington.

[3]Pavia, R., et al. 1985. *Coastal Hazardous Waste Site Review June 1985.* NOAA/OAD, Seattle, Washington.

[4]Pavia, R., et al. 1986. *Coastal Hazardous Waste Site Review April 1986.* NOAA/OAD, Seattle, Washington.

[5]Pavia, R., et al. 1987. *Coastal Hazardous Waste Site Review June 1987.* NOAA/OAD, Seattle, Washington.

[6]Pavia, R., et al. 1989. *Coastal Hazardous Waste Site Review March 1989.* NOAA/OAD, Seattle, Washington.

[7]Hoff, R., et al. 1990. *Coastal Hazardous Waste Site Review June 1990.* NOAA/OAD, Seattle, Washington.

[8]Beckvar, N., et al. 1992. *Coastal Hazardous Waste Site Review September 1992.* NOAA/ORCA, Seattle, Washington.

[9]U.S. Environmental Protection Agency. 1986. *Quality criteria for water.* Washington, D.C.

[10]U.S. Environmental Protection Agency. 1991. *Quality criteria for water*, May 1, 1991 poster. Washington, D.C.

[11]Lindsay, W.L. 1979. *Chemical Equilibria in Soils.* New York: John Wiley & Sons.

[12]Long, E.R. and L.G. Morgan. 1990. *The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program.* NOAA Technical Memorandum NOS OMA-52. Seattle: Coastal and Estuarine Assessment Branch, National Oceanic and Atmospheric Administration.

Table 1. Sites which NOAA has reviewed (586) as of June 1993, including those sites for which a Coastal Hazardous Waste Site Review (262) or Preliminary Natural Resource Survey (PNRS) (117) have been completed. (An asterisked site indicates that NOAA was not involved in the remedial process for that site.)

State	Cerclis	Site Name	Report Date Review	Report Date PNRS
Federal Region I				
CT	CTD980732333	Barkhamsted-New Hartford Landfill	1989	
CT	CTD072122062	Beacon Heights, Inc.	1984	
CT	CTD108960972	Gallup's Quarry	1989	
CT	CTD980670814	Kellogg-Deering Well Field	1987	
CT	CTD980521165	Laural Park, Inc.		1988
CT	CTD001153923	Linemaster Switch		
CT	CTD982747933	New London Submarine Base		
CT	CTD980669261	Nutmeg Valley Road		
CT	CTD980667992	O'Sullivans Island	1984	
CT	CTD980670806	Old Southington Landfill		
CT	CTD004532610	Revere Textile Prints Corps		
CT	CTD001449784	Sikorsky Aircraft Div UTC		
CT	CTD009717604	Solvents Recovery Service		
CT	CTD980906515	US Naval Submarine Base, New London	1990	
CT	CTD009774969	Yaworski Waste Lagoon	1985	1989
MA	MAD001026319	Atlas Tack Corp	1989	
MA	MAD001041987	Baird & McGuire, Inc.		
MA	MAD982191363	Blackburn & Union Privileges	1993	
MA	MAD079510780	CE Bridgewater		1988
MA	MAD980525232	CE Plymouth	1984	1990
MA	MAD003809266	Charles George Land Reclamation	1987	1988
MA	MAD980520670	Fort Devens - Sudbury Training Annex		
MA	MA7210025154	Fort Devens		
MA	MAD980732317	Groveland Wells 1&2	1987	1988
MA	MAD980523336	Haverhill Municipal Landfill	1985	
MA	MAD980732341	Hocomonco Pond		
MA	MAD076580950	Industriplex	1987	1988
MA	MAD051787323	Iron Horse Park		
MA	MAD980731335	New Bedford	1984	
MA	MAD980670566	Norwood PCB's		
MA	MAD990685422	Nyanza Chemical	1987	1993
MA	MA2570024487	Otis Air National Guard/Camp Edwards		
MA	MAD980731483	PSC		
MA	MAD980520621	Resolve, Inc.		
MA	MAD980524169	Rose Disposal Pit		
MA	MAD980525240	Salem Acres		1991
MA	MAD980503973	Shpack Dump		
MA	MAD000192393	Silresim Chemical Corp.		
MA	MAD980731343	Sullivan's Ledge	1987	1989
MA	MAD001002252	W. R. Grace and Co.		
MA	MAD980732168	Well G & H		1990
ME	ME8170022018	Brunswick Naval Air Station	1987	1991
ME	ME9570024522	Loring Air Force Base		
ME	MED980524078	McKin Company	1984	
ME	MED980731475	O'Connor Company	1984	

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 1, cont.				
ME	MED980732291	Pinettes Salvage Yard		
ME	MED980504393	Saco Municipal Landfill	1989	
ME	MED980520241	Saco Tannery Waste Pits		
ME	MED042143883	Union Chemical Company, Inc.		
ME	ME7170022019	U.S. Navy Portsmouth Naval Shipyard		
ME	MED980504435	Winthrop Town Landfill		
NH	NHD980524086	Auburn Road Landfill		1989
NH	NHD064424153	Coakley Landfill	1985	1989
NH	NHD980520191	Dover Municipal Landfill	1987	1990
NH	NHD001079649	Fletcher's Paint Works and Storage	1989	
NH	NHD069911030	Grugnale Waste Disposal Site	1985	
NH	NHD981063860	Holton Circle Ground Water Contamination		
NH	NHD062002001	Kearsarge Metallurgical		
NH	NHD092059112	Keefe Environmental Services		
NH	NHD980503361	Mottolo Pig Farm		
NH	NHD001091453	New Hampshire Plating Co.	1992	
NH	NHD990717647	Ottati & Goss Great Lakes Container Corp		
NH	NH7570024847	Pease Air Force Base	1990	
NH	NHD980671002	Savage Municipal Water Supply	1985	1991
NH	NHD980520225	Somersworth Sanitary Landfill		
NH	NHD980671069	South Municipal Water Supply		
NH	NHD099363541	Sylvester's	1985	
NH	NHD989090469	Tibbetts Road		
NH	NHD062004569	Tinkham Garage		
RI	RID980520183	Central Landfill (Johnston Site)		
RI	RID980731459	Davis GSR Landfill		
RI	RID980523070	Davis Liquid Waste Site	1987	
RI	RI6170022036	Davisville Naval Construction Battalion Ctr	1990	
RI	RID093212439	Landfill and Resource Recovery (L&RR)		
RI	RI6170085470	Newport Naval Education/Training Center	1990	
RI	RID055176283	Peterson/Puritan, Inc.	1987	1990
RI	RID980579056	Picillo Farm	1987	1988
RI	RID980521025	Rose Hill Regional Landfill	1989	
RI	RID980731442	Stamina Mills	1987	1990
RI	RID009764929	Western Sand and Gravel	1987	
RI	RID981063993	West Kingston Town Dump/URI Disposal Area	1992	
VT	VTD981064223	Bennington Municipal Landfill		
VT	VTD980520092	BFI Sanitary Landfill	1989	
VT	VTD003965415	Burgess Brothers Landfill		
VT	VTD980520118	Darling Hill Dump		
VT	VTD000860239	Old Springfield Landfill	1987	1988
VT	VTD981062441	Parker Sanitary Landfill		
VT	VTD980523062	Pine Street Canal		
VT	VTD000509174	Tansitor Electronics, Inc		
Federal Region 2				
NJ	NJD000525154	Albert Steel Drum	1984	
NJ	NJD002173276	American Cyanamid	1985	
NJ	NJD030253355	AO Polymer		
NJ	NJD980654149	Asbestos Site		

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 2, cont.				
NJ	NJD063157150	Bog Creek Farm	1984	1992
NJ	NJD980505176	Brick Township Landfill	1984	
NJ	NJD053292652	Bridgeport Rental & Oil Services (BROS)		1990
NJ	NJD078251675	Brook Industrial Park	1989	
NJ	NJD980504997	Burnt Fly Bog		1992
NJ	NJD048798953	Caldwell Trucking Co.		
NJ	NJD000607481	Chemical Control	1984	
NJ	NJD980484653	Chemical Insecticide Corp	1990	1992
NJ	NJD047321443	Chemical Leaman		1989
NJ	NJD980528889	Chemsol, Inc.		
NJ	NJD980528897	Chipman Chemical	1985	
NJ	NJD001502517	Ciba-Geigy Corp.	1984	1989
NJ	NJD980785638	Cinnaminson		
NJ	NJD094966611	Combe Fill South Landfill		
NJ	NJD000565531	Cosden Chemical	1987	
NJ	NJD002141190	CPS Chemical/Madison Industries		1990
NJ	NJD011717584	Curcio Scrap Metal	1987	
NJ	NJD980529002	Delilah Landfill		
NJ	NJD046644407	Denzer and Schafer X-Ray	1984	1992
NJ	NJD980761373	Derewal Chemical Co.	1985	
NJ	NJD980528996	Diamond Alkali/Diamond Shamrock	1984	
NJ	NJD980529416	D'Imperio Property		
NJ	NJD980529085	Ellis Property		
NJ	NJD980654222	Evor Phillips Leasing		1992
NJ	NJD980761365	Ewan		
NJ	NJ9690510020	FAA Tech Center	1990	
NJ	NJ2210020275	Fort Dix		
NJ	NJD041828906	Fried Industries		
NJ	NJD053280160	Garden State Cleaners	1989	
NJ	NJD980529192	Gems Landfill		
NJ	NJD063160667	Global Sanitary Landfill	1989	1991
NJ	NJD980530109	Goose Farm		
NJ	NJD980505366	Helen Kramer Landfill		1990
NJ	NJD002349058	Hercules, Inc.	1984	1993
NJ	NJD053102232	Higgins Disposal Service Inc.	1989	
NJ	NJD981490261	Higgins Farm	1989	
NJ	NJD980663678	Horseshoe Road Dump	1984	
NJ	NJD980532907	Ideal Cooperage	1984	
NJ	NJD980654099	Imperial Oil Co. Inc./Champion Chemicals		
NJ	NJD981178411	Industrial Latex	1989	
NJ	NJD980505283	Jackson Township Landfill	1984	
NJ	NJ0141790006	Jamaica Bay		
NJ	NJD097400998	JIS Landfill		
NJ	NJD002493054	Kauffman and Minteer	1989	
NJ	NJD049860836	Kin-Buc Landfill	1984	1990
NJ	NJD980505341	King of Prussia		
NJ	NJD002445112	Koppers Company	1984	
NJ	NJD980529838	Krysowaty Farm	1985	
NJ	NJD980505416	Lipari Landfill		
NJ	NJD980505424	Lone Pine Landfill		1992

State	Cerclis	Site Name	Report Date Review	Report Date PNRS
Federal Region 2, cont.				
NJ	NJD085632164	M&T Delisa		
NJ	NJD980654180	Mannheim Avenue Dump		
NJ	NJD980529762	Maywood Chemical Co.		
NJ	NJD002517472	Metaltec/Aerosystems		
NJ	NJ0210022752	Military Ocean Terminal		
NJ	NJD000606756	Mobil Chemical Company	1984	
NJ	NJD980505671	Monroe Township Landfill		
NJ	NJD980654198	Myers Property		
NJ	NJD061843249	N.L. Industries	1984	1992
NJ	NJD002362705	Nascolite		
NJ	NJ7170023744	Naval Air Engineering Center, Lakehurst		
NJ	NJ0170022172	Naval Weapons Station, Earle - Site A		
NJ	NJD980529598	Pepe Field		
NJ	NJD980653901	Perth Amboy's PCB's	1984	
NJ	NJD980505648	PJP Landfill	1984	1990
NJ	NJD981179047	Pohatcong Valley Groundwater Cont.		
NJ	NJD980769350	Pomona Oaks		
NJ	NJD070281175	Price Landfill	1984	1993
NJ	NJD980582142	Pulverizing Services Inc.		
NJ	NJD000606442	Quanta Resources (Allied, Shady Side)		
NJ	NJD980529713	Reich Farms		
NJ	NJD070415005	Renora		
NJ	NJD980529739	Ringwood Site		
NJ	NJD073732257	Roebling Steel Company	1984	1990
NJ	NJD030250484	Roosevelt Drive-In	1984	
NJ	NJD980754733	Sayerville Pesticide	1984	
NJ	NJD980505754	Sayreville Landfill	1984	1990
NJ	NJD070565403	Scientific Chemical Processing, Inc.	1984	1989
NJ	NJD980505762	Sharkey Landfill		1990
NJ	NJD002365930	Shield Allow Corporation		
NJ	NJD980766828	South Jersey Clothing Co.	1989	
NJ	NJD041743220	Swope Oil & Chemical Co.		
NJ	NJD064263817	Syncon Resins	1984	1992
NJ	NJD980769475	T. Fiore Demolition, Inc.	1984	
NJ	NJD980761357	Tabernacle Drum		
NJ	NJD002005106	Universal Oil Products, Inc.	1984	
NJ	NJD980761399	Upper Deerfield Township Slf		
NJ	NJD980529879	Ventron/Velsicol	1984	
NJ	NJD002385664	Vineland Chemical		1990
NJ	NJD054981337	Waldick Aerospace Devices		1990
NJ	NJD001239185	White Chemical Company	1984	
NJ	NJD980529945	Williams Property	1984	1992
NJ	NJD980532824	Wilson Farm		
NJ	NJD045653854	Witco Chemical Corporation		
NJ	NJD980505887	Woodland Township Route 532		
NJ	NJD980505879	Woodland Township Route 72		
NY	NYD072366453	Action Anodizing Site	1989	
NY	NYD980506232	ALCOA Oil and Wastewater Lagoons		

State	Cerclis	Site Name	Report Date Review	Report Date PNRS
Federal Region 2, cont.				
NY	NYD002066330	American Thermostat		
NY	NYD001485226	Anchor Chemical		
NY	NYD980535652	Applied Environmental Services	1985	1991
NY	NYD980507693	Batavia Landfill		
NY	NYD980768675	BEC Trucking		1990
NY	NYD980768683	Bioclinical Laboratories		
NY	NYD980652275	Brewster Wellfield		
NY	NY7890008975	Brookhaven National Lab	1990	
NY	NYD980780670	Byron Barrel and Drum		
NY	NYD981561954	C and J Disposal Site	1989	
NY	NYD010968014	Carrol and Dubies	1989	
NY	NYD981184229	Circuitron Corp. Site		
NY	NYD002044584	Claremont Polychemical		
NY	NYD000511576	Clothier Disposal		
NY	NYD980768691	Colesville Municipal Landfill		
NY	NYD980528475	Cortese Landfill		
NY	NYD980508048	Croton Point Sanitary Landfill		
NY	NYD980780746	Endicott Village Wellfield		
NY	NYD981560923	Forest Glen Subdivision		
NY	NYD002050110	Genzale Plating Site		
NY	NYD091972554	GM Foundry		1989
NY	NYD980768717	Goldisc Site		
NY	NY4571924451	Griffiss AFB		
NY	NYD980785661	Haviland		
NY	NYD980780779	Hertel Landfill		
NY	NYD002920312	Hooker/Ruco		
NY	NYD980763841	Hudson River PCBs (GE)		1989
NY	NYD000813428	Jones Chemicals, Inc.		
NY	NYD980534556	Jones Sanitation	1987	
NY	NYD980780795	Katonah Municipal Well		
NY	NYD986882660	Li Tungsten	1992	1993
NY	NYD053169694	Liberty Heat Treating Co., Inc.		
NY	NYD000337295	Liberty Industrial Finishing	1985	1993
NY	NYD013468939	Ludlow Sanitary Landfill		
NY	NYD010959757	Marathon Battery	1984	1989
NY	NYD000512459	Mattiace Petrochemical	1989	1990
NY	NYD980763742	MEK		
NY	NYD002014595	Nepera Site		
NY	NYD980506810	Niagara 102nd Street		
NY	NYD000514257	Niagara County Refuse		
NY	NYD980664361	Niagara Mohawk Power Corp.		
NY	NYD980780829	Ninety-Third Street School		
NY	NYD980762520	North Sea Municipal Landfill	1985	1989
NY	NYD991292004	Pasley Solvents		
NY	NYD980641047	Pennsylvania Ave. Landfill		
NY	NYD000511659	Pollution Abatement Services		

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 2, cont.				
NY	NYD980654206	Port Washington Landfill	1984	1989
NY	NYD980768774	Preferred Plating Corp.		
NY	NYD002245967	Reynolds Metal Co.		
NY	NYD980507735	Richardson Landfill		
NY	NYD980535124	Rocket Fuel Site - MALTA		
NY	NYD981486954	Rowe Industries	1987	1991
NY	NYD980507677	Sidney Landfill	1989	
NY	NYD980535215	Sinclair Refinery Site		
NY	NYD980421176	Solvent Savers		
NY	NYD980780878	Suffern Wellfield Site		
NY	NYD000511360	Syosset Landfill		
NY	NYD002059517	Tronic Plating		
NY	NYD980509376	Volney		
NY	NYD980535496	Wallkill Wellfield		
NY	NYD980506679	Warwick Landfill Site		
NY	NYD000511733	York Oil		
PR	PRD090416132	Clear Ambient Service	1984	
PR	PRD980640965	Frontera Creek	1984	1991
PR	PRD090282757	GE Wiring		
PR	PRD980512362	Juncos Landfill		
PR	PR4170027383	Naval Security Group Activity Sabana Seca	1989	1991
PR	PRD980301154	Upjohn		
PR	PRD980763775	Vega Alta Public Supply Wells		
USVI	VID982272569	Tutu Wellfield	1993	
Federal Region 3				
DE	DED980494496	Army Creek Landfill	1984	
DE	DED980714141	Chem-Solv, Inc.		
DE	DED980704860	Coker's Sanitation Services Landfills	1986	1990
DE	DED980551667	*Delaware City PVC	1984	
DE	DED000605972	Delaware Sand & Gravel Landfill	1984	
DE	DE8570024010	Dover Air Force Base	1987	1989
DE	DED980693550	Dover Gas and Light Company	1987	
DE	DED980555122	E.I. Du Pont - Newport Landfill	1987	1991/1992[1]
DE	DED980830954	Halby Chemical Company	1986	1990
DE	DED980713093	*Harvey & Knott Drum		
DE	DED980705727	Kent Co. Landfill	1989	
DE	DED980552244	Koppers Company Facilities site	1990	
DE	DED043958388	National Cash Register Corp., Millsboro	1986	
DE	DED058980442	New Castle Spill Site	1984	1989
DE	DED980705255	New Castle Steel	1984	
DE	DED980704894	*Old Brine Sludge	1984	
DE	DED980494603	*Pigeon Point Landfill	1987	
DE	DED981035520	Sealand	1989	
DE	DED041212473	Standard Chlorine of Delaware, Inc.	1986	
DE	DED980494637	Sussex Co. Landfill	1989	
DE	DED000606079	Tybouts Corner Landfill	1984	
DE	DED980705545	Tyler Refrigeration Pit Site		

[1] PNRS updated in 1992.

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 3, cont.				
DE	DED980704951	Wildcat Landfill	1984	
MD	MDD980504187	Aberdeen, Michaelsville Landfill	1986	
MD	MDD980705057	Anne Arundel County Landfill	1989	
MD	MDD980504195	Bush Valley Landfill	1989	
MD	MDD030321178	*Joy Reclamation Co.	1984	
MD	MDD980705164	Sand Gravel & Stone Site	1984	1990
MD	MDD064882889	Mid-Atlantic Wood Preservers		
MD	MDD980704852	Southern Maryland Wood Treating	1987	
MD	MD2210020036	USAAberdeen - Edgewood	1986	
MD	MDD980504344	Woodlawn Co Landfill	1987	
PA	PAD004351003	A.I.W. Frank/Mid-County Mustang		
PA	PAD000436436	Ambler Asbestos Piles		
PA	PAD009224981	American Electronics		
PA	PAD980693048	AMP, Inc.		
PA	PAD987341716	Austin Avenue Radiation Site	1993	
PA	PAD061105128	Bally Township		
PA	PAD980705107	*Bell Landfill		
PA	PAD003047974	*Bendix Flight Systems Site		
PA	PAD980538649	*Berkley Products Dump		
PA	PAD000651810	*Berks Landfill		
PA	PAD047726161	Boarhead Farms	1989	
PA	PAD980508402	*Bridesburg Dump	1984	
PA	PAD980831812	Brown's Battery		1991
PA	PAD980508451	Butler Mine Tunnel	1987	
PA	PAD981034705	*Butz Landfill		
PA	PAD093730174	*Commodore Semiconductor Group		
PA	PAD980419097	Crater Resources, Inc.	1993	
PA	PAD981035009	Croydon TCE	1986	
PA	PAD981038052	Delta Quarries/Stotler		
PA	PAD002384865	Douglassville Disposal Site	1987	
PA	PAD003058047	Drake Chemical		
PA	PAD980830533	Eastern Diversified		
PA	PAD980539712	*Elizabethtown Landfill	1989	
PA	PAD980552913	Enterprise Avenue	1984	
PA	PAAD077087989	Foote Mineral Company	1993	
PA	PAD002338010	Havertown PCP		
PA	PAD980829329	*Hebelka Auto Salvage		
PA	PAD002390748	Hellertown Manufacturing Company	1987	
PA	PAD009862939	Henderson Road		1989
PA	PAD980829493	Jacks Creek/Sitkin Smelting & Refining	1989	
PA	PAD981036049	*Keyser Ave. Borehole	1989	
PA	PAD980508667	*Lackawanna Refuse		
PA	PA2210090054	Letterkenny-Property Disposal Area		
PA	PA6213820503	Letterkenny-Southeast Industrial Area		
PA	PAD046557096	Metal Bank of America	1984	1990
PA	PAD980538763	Middletown Air Field		
PA	PAD980539068	Modern Sanitation Landfill		
PA	PAD980691372	MW Manufacturing		
PA	PA6170024545	Naval Air Develop.		
PA	PAD096834494	North Penn-Area 1		
PA	PAD980229298	Occidental Chemical/Firestone	1989	

State	Cerclis	Site Name	Report Date Review	Report Date PNRS
Federal Region 3, cont.				
PA	PAD002395887	Palmerton Zinc Pile		
PA	PAD980692594	Paoli Railyard	1987	1991
PA	PAD063766828	*Picco Resins		
PA	PAD981939200	Publicker Industries/Cuyahoga Wrecking Plant	1990	
PA	PAD039017694	Raymark		
PA	PAD002353969	Recticon/Allied Steel	1989	
PA	PAD980829261	*Reeser's		
PA	PAD051395499	Revere Chemical Company	1986	
PA	PAD091637975	Rohm and Haas Landfill	1986	
PA	PAD980692487	*Saegertown Industrial Area		
PA	PAD002498632	Spra-Fin, Inc.		
PA	PAD014269971	Stanley Kessler		
PA	PAD000441337	*Strasburg Landfill		
PA		Textron-Lycoming		
PA	PA6143515447	Tinicum National Environmental Center	1986	
PA	PAD073613663	*Tonolli Corp.		
PA	PAD980692024	Tysons Dump #1	1985	
PA	PAD980539407	*Wade (ABM) Site	1984	
PA	PAD980829527	*Welsh/Barkman Landfill		
PA	PAD980537773	William Dick Lagoons		
VA	VAD980551683	Abex Corp.	1989	
VA	VAD042916361	Arrowhead Assoc/Scovill Corp	1989	
VA	VAD990710410	Atlantic Wood Industries	1987	1990
VA	VAD049957913	C&R Battery Co., Inc.	1987	
VA	VAD980712913	Chisman Creek	1984	
VA	VAD007972482	Clarke, L.A. & Son		
VA	VA3971520751	Defence General Supply Center		
VA	VAD003125374	*Greenwood Chemical Site		
VA	VAD980539878	H & H Inc.		
VA	VA7170024684	Naval Surface Weapons Center, Dahlgren Lab.	1993	
VA	VA8170024170	Naval Weapons Station Yorktown	1993	
VA	VAD071040752	Rentokil Inc.		
VA	VAD980831796	Rhinehart tire fire		
VA	VAD003127578	*Saltville		
VA	VAD003117389	Saunders Supply Co.	1987	
VA	VAD980917983	Suffolk City Landfill		
VA	VA3971520751	U.S. Defense General Supply Center		
VA	VAD980705404	*U.S. Titanium		
WV	WVD004336749	*Follansbee		
Federal Region 4				
AL	ALD001221902	Ciba-Geigy Corp	1990	
AL	ALD008188708	Olin Corp. McIntosh Plant	1990	
AL	ALD980844385	Redwing Carriers Inc./Sara.	1989	
AL	ALD095688875	Stauffer Chemical Co. Cold Creek Plt./Lemoyne		1990
AL	ALD007454085	T.H. Agriculture Nutrition Co.		
FL	FLD980728877	62nd Street Dump/Kassouf-Kimerling	1984	1989
FL	FLD980221857	Agrico Chemical Site	1989	
FL	FLD008161994	American Creosote Works	1984	1989
FL	FLD088783865	Bay Drum/Tampa		
FL	FLD980494660	Beulah Landfill		

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 4, cont.				
FL	FLD981930506	Broward County - 21st Manor Dump	1992	
FL	FL5170022474	Cecil Field Naval Air Station	1990	
FL	FLD080174402	Chem-Form Inc.	1990	
FL	FLD050432251	Florida Steel Corporation		
FL	FLD000827428	Gardinier, Inc.		
FL	FLD000602334	Harris Corporation/General Development U	1986	1990
FL	FLD053502696	Helena Chemical Company	1993	
FL	FLD980709802	Hipps Road Landfill		
FL	FLD004119681	Hollingsworth Solderless Terminal Co.		
FL	FL7570024037	Homestead AFB		
FL	FL6170024412	Jacksonville Naval Air Station	1990	
FL	FLD084535442	Munisport Landfill	1984	
FL	FLD004091807	Peak Oil Co.		
FL	FL9170024567	Pensacola Naval Air Station	1990	
FL	FLD980556351	Pickettville Road Landfill	1984	1990
FL	FLD004054284	Piper Aircraft Corp Vero Beach		
FL	FLD000824888	Reeves SE Corp		
FL	FLD980602882	Sapp Battery Salvage		1989
FL	FLD062794003	Schuylkill Metal Corp		
FL	FLD004126520	Standard Auto Bumper Corp.	1989	
FL	FLD010596013	Stauffer Chemical Co., Tarpon Springs	1993	
FL	FLD004092534	Stauffer Chemical Co., Tampa	1993	
FL	FLD000648055	Sydney Mine Sludge Ponds		1989
FL	FL1690331300	USCG Station Key West		
FL	FL6170029952	USN Air Station Key West		
FL	FLD980602767	Whitehouse Waste Oil Pits		
FL	FLD041184383	Wilson Concepts of Florida		
FL	FLD981021470	Wingate Road Municipal Incinerator Dump		
FL	FLD004146346	Woodbury Chemical Co.	1989	
FL	FLD980844179	*Yellow Water Road		
GA	GAD095840674	Cedartown Industries Inc.		
GA	GAD990741092	Diamond Shamrock Corp. Landfill		
GA	GAD990855074	Firestone Tire & Rubber Co. Inc.		
GA	GAD004065520	Hercules Inc.		
GA	GAD980556906	Hercules 009 Landfill		
GA	GAD000827444	International Paper Co.		
GA	GAD099303182	LCP Chemicals - Georgia, Inc.		
GA	GA7170023694	Marine Corps Logistics Base		
GA	GAD001700699	Monsanto Co.		
GA	GAD042101261	T.H. Agriculture & Nutrition Co. Inc.		
GA	GA1570024330	USAF Robins Air Force Base		
GA	GAD003269578	Woolfolk Chemical Works, Inc.		
MS	MSD098596489	Gautier Oil Co. Inc.	1989	
NC	NCD024644494	ABC One Hour Cleaners	1989	
NC	NCD980840409	Charles Macon Lagoon & Drum Storage		
NC	NCD980840342	Dockery Property		
NC	NCD981475932	FCX (Washington Plant)	1989	
NC	NCD981021157	New Hanover City Airport Burn Pit	1989	
NC	NCD981023260	Potter's Septic Tank Service Pits	1989	
NC	NC1170027261	USMC Air Station Cherry Point		
NC	NC6170022580	USMC Camp Lejuene, Site 21	1989	

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 4, cont.				
SC	SCD980844260	Beaufort County Landfill		
SC	SCD980711279	Geiger (C&M Oil)	1984	
SC	SCD058753971	Helena Chemical Co.	1989	
SC	SCD055915086	International Paper/Sampit River		
SC	SCD980310239	Koppers Ashley River		
SC	SCD980310239	Koppers Company, Inc., Charleston Plant	1993	
SC	SC8170022620	Naval Weapons Station - Charleston		
SC	SC1890008989	Savannah River Site (USDOE)	1990	
SC	SCD037405362	Wamchem Inc.	1984	
Federal Region 6				
LA	LAD000239814	American Creosote		
LA	LAD980745632	Bayou Bonfouca		
LA	LAD980745541	Bayou Sorrell	1984	
LA	LAD980501423	Calcasieu Parish Landfill		
LA	LAD057482713	Petro-Processors of Louisiana, Inc.		
LA	LA6170022788	U.S. Navy New Orleans Naval Air Station		
TX	TXD008123168	Aluminum Company of America (Lavaca Bay)		
TX	TXD980864649	Bailey Waste Disposal	1985	1989
TX	TXD980625453	Brio Refining, Inc.	1989	1989
TX	TXD990707010	Crystal Chemical Company	1989	1989
TX	TXD089793046	Dixie Oil Processors	1989	1989
TX	TXD980514814	French Limited	1989	1989
TX	TXD980748453	Geneva Industries/Fuhrmann Energy Corp		
TX	TXD980745582	Harris (Farley Street)		
TX	TXD980514996	Highlands Acid Pit	1989	
TX	TXD980625636	Keown Supply Co.		
TX	TXD980629851	Motco Corp.	1984	
TX	TXD980873343	North Cavalcade		
TX	TXD980873350	Petro-Chemical Systems, Inc.		
TX	TXD980513956	Sikes Disposal Pits	1989	
TX	TXD980873327	Sol Lynn/Industrial Transf		
TX	TXD980810386	South Cavalcade		
TX	TXD062113329	Tex-Tin Corporation	1989	
TX	TXD055143705	Triangle Chemical Company		
Federal Region 9				
AS	ASD980637656	Taputimu Farm, Tutuila Isl.	1984	
CA	CA2170023236	Alameda Naval Air Station	1989	
CA	CAD052384021	Brown & Bryant, Inc. (Arvin Plant)		
CA	CA2170023533	Camp Pendleton Marine Corps Base	1990	1992
CA	CAD009114919	Chevron USA Richmond Refinery		
CA	CAD063015887	Coast Wood Preserving	1984	
CA	CAD055753370	Cooper Drum Company	1993	
CA	CAD980498455	Crazy Horse Sanitary Landfill		
CA	CAD009212838	CTS Printex, Inc.	1989	
CA	CAD029544731	Del Amo	1992	
CA	CAD000626176	Del Norte County Pesticide Storage Area	1984	
CA	CA6170023208	El Toro Marine Corps Air Station	1989	
CA	CAD981159585	Farallon Islands Radioactive Waste Dumps		1990

State	Cerclis	Site Name	Report Date Review	Report Date PNRS
Federal Region 9, cont.				
CA	CA7210020676	Fort Ord	1990	1992
CA	CAD980636914	Fresno Municipal Sanitary Landfill		
CA	CAD980498562	GBF and Pittsburg Dumps	1989/1993[2]	
CA	CA3570024288	Hamilton Air Force Base		
CA	CAD980884209	Hewlett-Packard (620-40 Page Mill Rd)	1989	
CA	CAD058783952	Hexcel Corp. - Livermore		
CA	CA1170090087	Hunters Point Annex	1989	1989
CA	CAD041472341	Intersil Inc./Siemens Components	1989	
CA	CAD980498612	Iron Mountain Mine	1989	1989
CA	CAD000625731	J.H. Baxter		
CA	CAD009103318	Jasco Chemical Corp.	1989	
CA	CAD008274938	Kaiser Steel Corp. (Fontana Plant)		
CA	CAD981429715	Kearney - KPF		
CA	CAD981436363	Levin Richmond Terminal Corp.		
CA	CAT000646208	Liquid Gold	1984	
CA	CAD065021594	Louisiana Pacific Corp		
CA	CA717002475	Mare Island Naval Shipyard		
CA	CAD000074120	MGM Brakes	1984	
CA	CAD009106527	McCormick & Baxter Creosoting Company	1993	
CA	CAD982463812	Middlefield-Ellis-Whisman		
CA	CAD981997752	Modesto Ground Water Contamination		
CA	CA2170090078	Moffett Field Naval Air Station	1986	
CA	CAD008242711	Montrose Chemical Corp.	1985	
CA	CA7170024528	Naval Weapons Station, Concord	1989/1993[2]	1990
CA	CAD981434517	Newmark Ground Water Contamination		
CA	CA7170090016	North Island Naval Air Station		
CA	CA4170090027	Oakland Naval Supply Center		
CA	CAD980636781	Pacific Coast Pipelines	1989	
CA	CA9170027271	Pacific Missile Test Center		
CA	CA1170090236	Point Loma Naval Complex		
CA	CAD982462343	Redwood Shore Landfill		
CA	CAT000611350	Rhone-Poulenc, Inc. - Zoecon	1985	
CA	CA7210020759	Riverbank Army Ammunition Plant	1989	
CA	CAD009452657	Romic Chemical Corp		
CA	CA0210020780	Sacramento Army Depot		
CA	CAD009164021	Shell Oil Co., Martinez Manufact. Complex		
CA	CAD980637482	Simpson - Shasta Ranch		
CA	CAD981171523	Sola Optical USA, Inc.	1989	
CA	CAD059494310	Solvent Service, Inc.		
CA	CAD980894885	South Bay Asbestos Area - Alviso	1985	
CA	CAD009138488	Spectra-Physics, Inc.		
CA	CAD980893275	Sulphur Bank Mercury Mine		
CA	CAD990832735	Synertek, Inc. - Building 1		
CA	CA5570024575	Travis Air Force Base	1990	
CA	CAD009159088	TRW Microwave, Inc. - Building 825		
CA	CAD981436363	United Heckathorn		
CA	CAD981995947	Westminster Tract #2633		
GU	GU6571999519	Andersen Air Force Base	1993	

[2]Waste Site Review updated in 1993.

State	Cerclis	Site Name	Report Date Review	PNRS
Federal Region 9, cont.				
GU	GU7170027323	Naval Station Guam		
HI	HID981581788	Hawaiian Western Steel Limited		
HI	HID980497184	Kailua Landfill		
HI	HID980497226	Kewalo Incinerator Ash Dump		
HI	HI6170022762	MCAS Kanehoe Landfill		
HI	HID980497176	Kapaa Landfill		
HI		Kapalama Canal/Honolulu Harbor		
HI	HI3170024340	Naval Submarine Base		
HI	HID980585178	Pearl City Landfill	1984	
HI	HI2170024341	Pearl Harbor Naval Complex	1992	
HI	HID982400475	Waiakea Pond/Hawaiian Cane Products		1990
Federal Region 10				
AK	AKD009252487	Alaska Pulp Corporation		
AK	AK8570028649	Elmendorf AFB	1990	1990
AK	AK6210022426	Fort Wainwright		
AK	AK7170090099	Naval Air Station Adak	1993	
AK	AKD980978787	Standard Steel & Metals Salvage Yard (USDOT)	1990	1990
AK	AK7170090099	U.S. Navy - Adak Naval Air Station		
ID	IDD000643122	Noranda Mining Inc. (Blackbird Mine)		
OR	ORD009051442	Allied Plating	1987	1988
OR	ORD095003687	Gould Inc.	1984	1988
OR	ORD068782820	Joseph Forest Products		
OR	ORD052221025	Martin Marietta Aluminum	1987	1988
OR	ORD009020603	McCormick-Baxter Creosoting		
OR	ORD980988307	Northwest Pipe & Casing Company	1993	
OR	ORD009025347	Stauffer Chemical Co	1984	
OR	ORD009042532	Taylor Lumber and Treating, Inc.		1991
OR	ORD050955848	Teledyne Wah Chang Albany	1985	1988
OR	ORD009049412	Union Pacific, The Dalles	1990	1990
WA	WAD009045279	ALCOA (Vancouver Smelter)	1989	1989
WA	WAD057311094	American Crossarm & Conduit Co.	1989	1988
WA	WA7170027265	Bangor Ordnance Disposal(Site A)		1991
WA	WA1891406349	Bonneville Power Admin. Ross Complex (USDOE)	1990	1990
WA	WAD980836662	Centralia Landfill	1989	1989
WA	WAD980726301	*Commencement Bay - South Tacoma Channel	1984[3]	
WA	WAD980726368	Commencement Bay Nearshore/Tideflats	1984[3]	1988
WA	WA3890090076	Hanford - 100 Area (DOE)		
WA	WA2890090077	Hanford - 300 Area (DOE)		
WA	WAD980722839	Harbor Island - Lead	1984	1989
WA	WA5170090059	NAS Whidbey Island - Ault Field	1986	1989
WA	WA6170090058	NAS Whidbey Island - Seaplane Base	1986	1989
WA	WA1170023419	Naval Undersea Warfare (4 Areas)		1989
WA	WA2170023426	Manchester Naval Supply Center		
WA	WAD027315621	Northwest Transformer (South Harkness)	1989	1988
WA	WAD009422411	Pacific Wood Treating		
WA	WAD980639215	Quendall Terminals	1985	
WA	WAD980639462	Seattle Municipal Landfill (Kent Highlands)	1989	1988

[3]A single site report was done for both of these sites.

State	Cerclis	Site Name	Report Date Review	Report Date PNRS
Federal Region 10, cont.				
WA	WAD980976328	Strandley/Manning Site		1992
WA	WA5170027291	Subase Bangor	1990	1991
WA	WAD980639256	Tulalip Indian Tribe - Marine Disposal	1992	1991
WA	WA5210890096	USACOE-Hamilton Island Landfill	1992	1991
WA	WA7890008967	USDOE-Hanford Site	1989	1988
WA	WA3170090044	U.S. Navy - Jackson Park Landfill		
WA	WA2170023426	U.S. Navy - Naval Supply Center Puget Sound		
WA	WA4170090001	U.S. Navy - Naval Undersea Warfare Engin. Stn		1989
WA	WA2170023418	U.S. Navy - Puget Sound Naval Shipyard		
WA	WAD009487513	Western Processing	1984	
WA	WAD009248295	Wyckoff Company/Eagle Harbor	1986	1988
WA	WAD009248287	Wyckoff Co./West Seattle (Puget Snd Resources)		1992

Table 2. Acronyms and abbreviations used in Coastal Hazardous Waste Site Reviews

AWQC	Ambient water quality criteria
BHC	benzenehexachloride
BNA	base, neutral, and acid extractable organic compounds
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cm	centimeter
COE	U.S. Army Corps of Engineers
CRC	Coastal Resource Coordinator
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
ER-L	Effects range-low
HMX	cyclotetramethylene tetranitramine
HRS	Hazard Ranking System
IRM	Immediate Removal Measure
kg	kilogram
km	kilometer
l	liter
LOEL	Lowest Observed Effects Level
m	meter
µg/g	micrograms per gram
ug/kg	micrograms per kilogram
µg/l	micrograms per liter
µR/hr	microroentgens/hour
mg	milligram
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
mR/hr	milliroentgens per hour
NATO	North Atlantic Treaty Organization
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	Operable Unit
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	pico Curies per gram (1 pico Curie=10^{-12} Curie)
pCi/l	pico Curies per liter
PCP	pentachlorophenol
PNA, PAH	polynuclear aromatic hydrocarbon
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PRP	Potential Responsible Party
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RDX	cyclonite
REM/year	Roentgen Equivalent Man
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SVOC	semi-volatile organic compound

Table 2. Acronyms and abbreviations, *cont.*

TCL	Target Compound List
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound

1

Blackburn & Union Privileges

Walpole, Massachusetts
CERCLIS #MAD982191363

Site Exposure Potential

Blackburn and Union Privileges, also known as Shaffer Realty Trust or South Street Site, is on 12 hectares in Walpole, Massachusetts on both sides of the Neponset River (Figure 1). The site and nearby lots have been used for commercial and industrial operations since the 1600s, when portions of the site were designated as water privileges to provide access to the Neponset River for water power. Several operations used hazardous substances at the site, including forging, tanning, and cotton-dye processing (inorganic substances); cotton bleaching and synthetic fabric manufacturing (acids and bases); tire and rubber manufacturing (SVOCs); and asbestos products manufacturing (U.S. EPA 1991).

The site is located within the Neponset River drainage basin. The Neponset River flows through the site and discharges to Dorchester Bay and the Atlantic Ocean 36 km downstream of the site.

Groundwater 1 to 9 m beneath the site in the unconsolidated deposits of the School Meadow Brook aquifer/Mine Brook aquifer system flows from east to west, discharging to the Neponset River. The aquifers were named for the tributaries of the Neponset River with which they are "associated" (the nature of this association was not clarified in the available site documentation; NUS 1991).

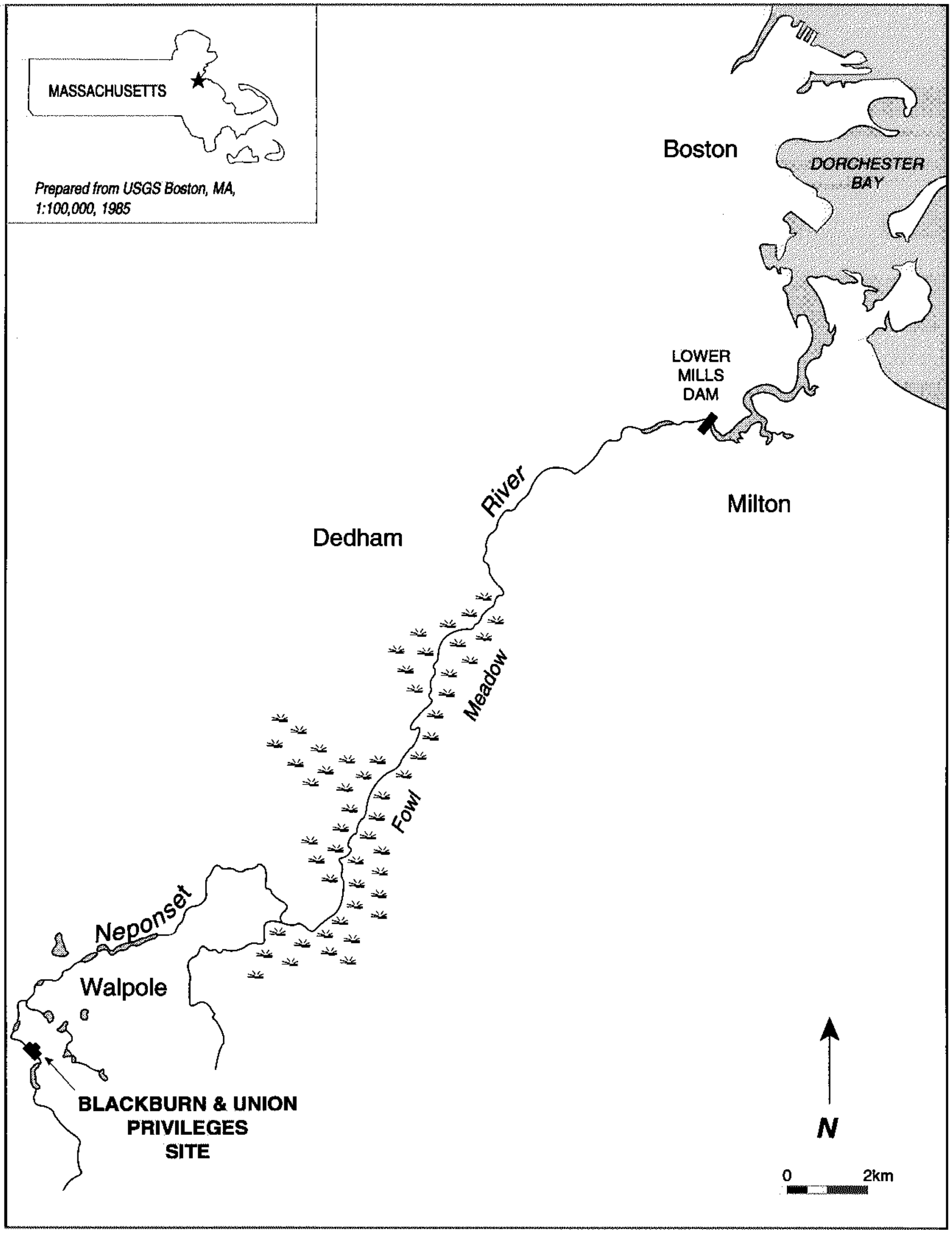

Figure 1. Blackburn & Union Privileges, Walpole, Massachusetts.

Potential pathways of contaminant transport from the site to trust habitats and species include surface runoff, groundwater discharge, and erosion of contaminated soils adjacent to the river. A millrace that formerly diverted water to the site is also a potential pathway for runoff from the site to the Neponset River. There is standing water in the remains of the tail race during periods of high precipitation (NUS 1991). Site-related contaminants have been observed in the Neponset River 3.2 km downstream of the site (U.S. EPA 1991).

NOAA Trust Habitats and Species

The main habitats of concern to NOAA are surface water and associated bottom substrates of the lower Neponset River. Secondary habitats of concern are the upper Neponset River near the site and tidal water and associated bottom habitats of Dorchester Bay. Tidal influence in the Neponset River extends to the Lower Mills Dam in Milton, 30 km downstream of the site. The dam (4 m high and 25 m wide) is not equipped with fish passage facilities and prevents trust species other than American eel from accessing the site. There are currently no plans for restoration (Chase personal communication 1992).

A diverse population of anadromous, estuarine, and invertebrate species use the lower reaches of the Neponset River below the Lower Mills Dam and the intertidal portions of Dorchester Bay (Table 1; Chadwick personal communication 1992; Chase personal communication 1992). Blueback herring and rainbow smelt use the lower saline reaches of the Neponset River and the marine habitat of Dorchester Bay as a spawning, nursery, forage, and migratory area. Blueback herring commonly congregate immediately downstream of the Lower Mills Dam. Dorchester Bay also provides habitat for American lobster and soft shell clam (Chase personal communication 1992).

Surface water of the Neponset River near the site provide a temperate, freshwater aquatic habitat. There are sizable wetlands along the river banks. Fowl Meadow, a valued wetlands habitat for waterfowl and freshwater fish, is approximately 16 km downgradient from the site. There are no known threatened or endangered species in the Neponset River Basin (Bergen personal communication 1992).

There is no commercial fishing in the Neponset River estuary or tidal flat areas at the mouth of the river. Lobster is the only commercial fishery of note in Dorchester Bay, but is not regarded as large scale (Chase personal communication 1992). In the past, there has been limited commercial harvesting of soft shell clams in Dorchester Bay. However, due to bacterial contamination, recent shellfish harvests have failed to meet the state health requirements (Chadwick personal communication 1992).

Table 1. NOAA trust species, habitat use, and commercial and recreational fisheries in the Neponset River below Lower Mills Dam and in the intertidal water of Dorchester Bay.

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Commercial	Recreational
ANADROMOUS/CATADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*	♦	♦	♦		♦
Alewife	*Alosa pseudoharengus*			♦		♦
American eel	*Anguilla rostrata*			♦		
Striped bass	*Morone saxatilis*			♦		♦
Rainbow smelt	*Osmerus mordax*	♦	♦	♦		♦
ESTUARINE FISH						
Atlantic menhaden	*Brevoortia tyrannus*		♦	♦	♦	♦
Atlantic herring[1]	*Clupea harengus*	♦	♦	♦		
Mummichog	*Fundulus heteroclitus*	♦	♦	♦		
Atlantic cod	*Gadus morhua*			♦		
Atlantic silverside	*Menidia menidia*	♦	♦	♦		
Grubby	*Myoxocephalus aenaeus*			♦		
Winter flounder	*Pseudopleuronectes americanus*			♦		♦
Skate	*Raja eglateria*			♦		
Bluefish	*Pomatomus saltatrix*		♦	♦		♦
Windowpane[1]	*Scopthalmus aquosus*		♦	♦		
Pipefish[1]	*Syngnathus fuscus*	♦	♦	♦		
Cunner	*Tautogolabrus adspersus*		♦	♦		
INVERTEBRATES						
American lobster	*Homarus americanus*		♦	♦	♦	
Soft shell clam	*Mya arenaria*	♦	♦	♦	♦	

[1] Species considered likely to occur in the region.

Site-Related Contamination

In 1989, a variety of hazardous substances including VOCs, SVOCs, inorganic substances, and asbestos, were detected in on-site soil, sediment, and groundwater samples collected during site assessment investigations. Two sources of contamination were identified: contaminated soil and the lagoon system. The lagoon system includes two former lagoons used as settling ponds during cotton bleaching operations and a mixing area where waste liquids were pH-adjusted before being discharged to the lagoons (U.S. EPA 1991).

A total of 754 shallow and deep soil samples were collected: 710 samples were analyzed for asbestos and 44 samples were analyzed for TCL parameters (VOCs, SVOCs, and inorganics). A variety of VOCs, SVOCs, and inorganic substances were detected in on-site soils (Table 2; HRS 1991).

Asbestos was detected in both shallow and deep soils at concentrations ranging from not detected (detection limit not provided) to 80% asbestos by weight (U.S. EPA 1991).

Several VOCs, SVOCs, inorganic substances, and asbestos have been detected in groundwater samples collected from 13 on-site wells at concentrations exceeding background concentrations (Table 3; HRS 1991). The concentrations of lead and mercury in on-site groundwater exceeded their respective chronic AWQC (U.S. EPA 1986) by more than a factor of ten. Mercury was also measured in "background" groundwater at a concentration exceeding its AWQC by ten times. However, information on where the "background" groundwater samples were collected was not available. It is possible that these groundwater samples may not have been representative of actual background concentrations.

Several SVOC and inorganic substances were detected in sediment samples collected from the lagoon and mixing area at concentrations exceeding levels shown to cause adverse biological

Table 2. Maximum concentrations (mg/kg) of selected contaminants detected in on-site soil and sediment from the former lagoon system.

Contaminant	On-site Soil	Average U.S. Soil[1]	Lagoon Sediment	ER-L[2]
INORGANIC SUBSTANCES				
Trace Elements				
Antimony	160	1	NA	2
Arsenic	52	5	54	33
Cadmium	21	0.06	22	5
Chromium	506	100	2,500	80
Copper	17,000	30	6,900	70
Cyanide	36	N/D	NA	N/D
Lead	51,000	10	500	35
Mercury	22	0.03	16	0.15
Nickel	450	40	190	30
Zinc	56,000	50	1800	120
ORGANIC COMPOUNDS				
Volatile organic compounds				
Ethylbenzene	2.4	N/D	NA	N/D
Trichloroethene	0.6	N/D	NA	N/D
Xylene	3.8	N/D	NA	N/D
Semivolatile organic compounds				
Anthracene	60	N/D	0.97	0.085
Benzo(a)pyrene	49	N/D	4	0.40
Fluoranthene	150	N/D	5.3	0.60
Naphthalene	43	N/D	0.64	0.34
Phenanthrene	220	N/D	5.4	0.225
Pyrene	120	N/D	8.2	0.35

NA: Not analyzed.
N/D: Not determined.
ND: Not Detected; detection limt not provided.
1: Lindsay (1979).
2: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).

Table 3. Maximum concentrations (µg/l) of selected contaminants detected in on-site groundwater.

Contaminant	Groundwater Background	Groundwater On-site	Chronic AWQC[1]
INORGANIC SUBSTANCES			
Trace Elements			
Arsenic	2	257	190
Copper	6	36	12+
Lead	2	599	3.2+
Mercury	0.2	1.4	0.012
Nickel	15	466	160+
ORGANIC COMPOUNDS			
Volatile			
1,2 Dichloroethene	<5	16	N/D
Styrene	<5	1,100	N/D
Toluene	<5	3,200	5,000
Xylenes (total)	<5	17	N/D
Semivolatile			
Acenaphthene	<10	22	520*
Acenaphthylene	<10	550	N/D
Fluorene	<10	27	N/D
Naphthalene	<10	9,900	620*
Phenanthrene	<10	47	2,560*
Pyrene	<10	13	N/D

1 Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986).
\+ Hardness-dependent criteria (100 mg/l $CaCO_3$ used).
N/D: Not determined.
* Insufficient data to develp criteria; value presented is Lowest Observed Effects Level.
<: Not detected at method detection limit.

effects in other studies (Table 2; Long and Morgan 1990; HRS 1991). Inorganic substances were highest in sediments from the mixing area. SVOCs were highest in sediments from the lagoon. Asbestos has been observed along the banks of the Neponset River and in river sediments 3 km downstream of the site (NUS 1991).

Summary

The Lower Neponset River and Dorchester Bay support a diverse population of anadromous, estuarine, and invertebrate species. NOAA resources, except for American eel, cannot reach the site due to the Lower Mills Dam in Milton, 30 km downstream of the site. Contaminants of potential concern to NOAA if anadromous fish runs are restored include chromium, copper, lead, mercury, nickel, and zinc.

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2

Tutu Wellfield

St. Thomas, U.S. Virgin Islands

CERCLIS #VID982272569

Site Exposure Potential

The 44-hectare Tutu Wellfield site, a group of contaminated public supply wells, is located in a mountainous, semi-rural area of east-central St. Thomas, U.S. Virgin Islands. The site skirts Turpentine Run, an intermittent stream that flows south and discharges to Mangrove Lagoon, 4.5 km downstream (Figure 1). This lagoon is hydraulically connected to the Caribbean Sea and, ultimately, the Atlantic Ocean.

In 1987, a strong odor was detected in one of the public supply wells in the area. The Virgin Islands Department of Planning and Natural Resources requested the U.S. Environmental Protection Agency to sample one hundred area wells. VOCs were detected in approximately 60 percent of the wells, and trace elements were detected in approximately 30 percent of the groundwater wells. Petroleum, waste oils, solvent-based auto flushes, degreasers, antifreeze, kerosene, hydraulic fluids, spent PCE, wastes, dry cleaning fluids, ammonium hydroxide and mineral spirits may have been disposed of via catch basins, floor drains, sump holding tanks, leaching pits, evaporation pits, above-ground tanks, and drum storage areas in the area (U.S. EPA undated).

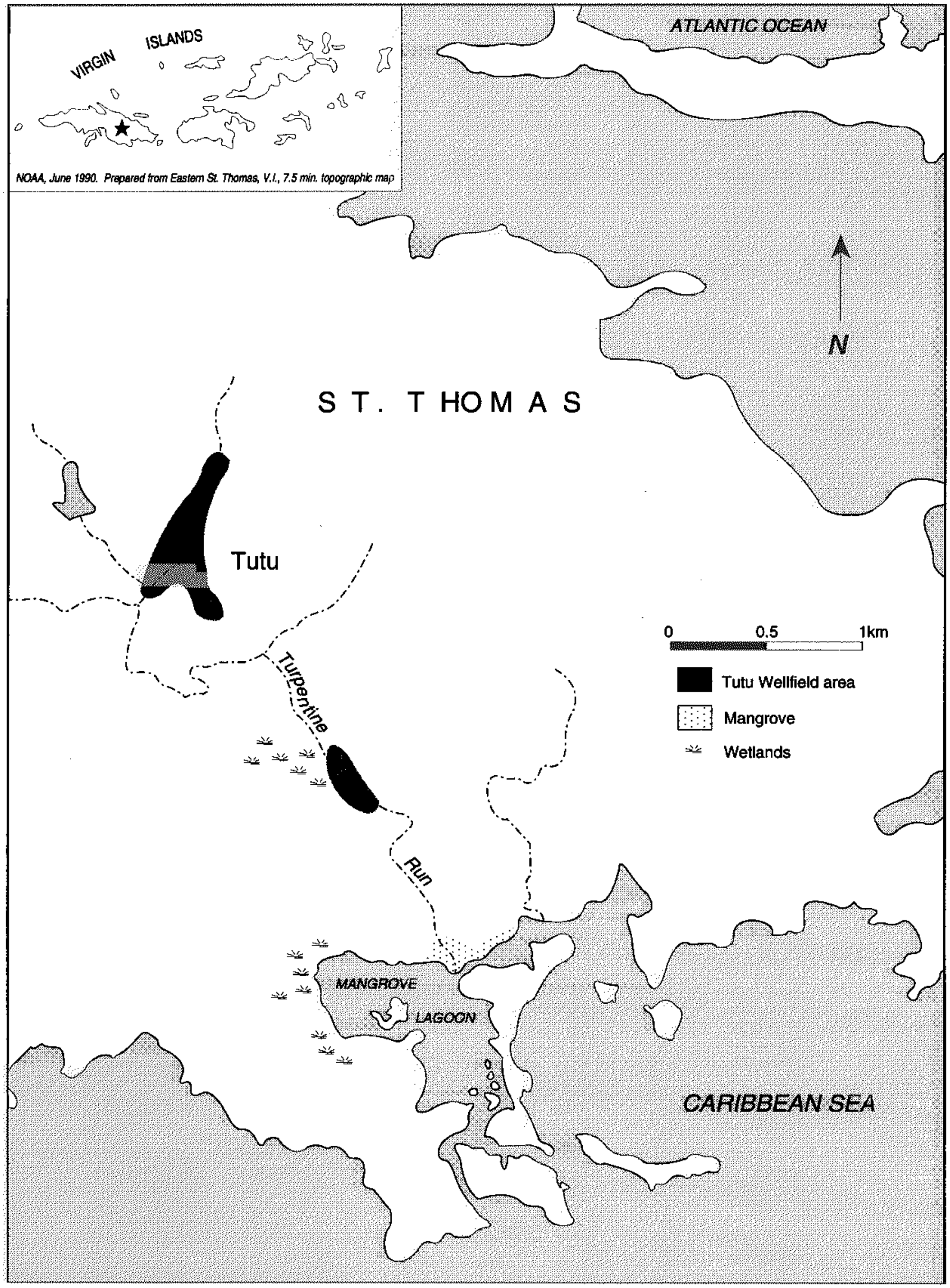

Figure 1. General vicinity of the Tutu Wellfield groundwater sampling sites.

The site overlies two aquifers: the Turpentine Run Basin Alluvium (shallow) and the Water Island and Louisenhoj Formations (deep). The shallow aquifer is 6 to 21 m deep, with the deep bedrock aquifer located directly below. Groundwater samples were collected from the deep aquifer at depths between 24 and 68 m during four monitoring periods (September 1990, May and September 1991, and January 1992). Groundwater generally flows south throughout the Turpentine Run basin. Discharge to Turpentine Run is the primary pathway by which site-related contaminants can migrate to NOAA trust habitats (NUS 1991).

NOAA Trust Habitats and Species

Habitats of concern to NOAA are surface water and associated bottom substrates of Mangrove Lagoon (Boulon 1990; Beets personal communication 1992). Turpentine Run serves as a drainage corridor for eastern St. Thomas and receives various inputs of municipal effluent. Turpentine Run discharges to the northwestern corner of the inner lagoon. Turpentine Run is approximately 1 m wide and 0.3 m deep and is dominated by blue algae. Dissolved oxygen levels are reportedly very low, but no data were available (Beets personal communication 1992). No NOAA trust resources are known to use Turpentine Run because of the severely degraded water conditions.

Mangrove Lagoon is subdivided into three areas known as the inner, middle, and outer lagoons and is bordered by a small fringe of red mangrove (*Rhizopora*). Bottom substrate in the lagoons is composed mainly of carbonate silt, mud, and sand, with varying amounts of organic detritus, peat, and siliceous skeletons derived from diatom algae and sponges. Aquatic vegetation is predominantly turtle grasses (*Thalassia*) and algae (Beets personal communication 1992).

The habitats of the inner lagoon are severely degraded from approximately 1.7 million l of "treated" sewage effluent that are discharged into the inner lagoon each day (Boulon 1990). An undetermined amount of contaminated leachate originating from the St. Thomas Municipal Landfill is also considered likely to accumulate in the inner lagoon via Turpentine Run (Boulon 1990; Beets personal communication 1992).

Surface waters of the inner and middle portions of Mangrove Lagoon are productive and are known to provide nursery and adult habitat for numerous Caribbean reef fish (Table 1). Reef fish in the lagoons use the inshore fringing reef of the outer portion of Mangrove Lagoon for spawning habitat (Beets personal communication 1992). Grunt (*Pomadasyidae*) and parrotfish (*Scaridae*) are the most abundant species in the Mangrove Lagoon system. Other species found in considerable numbers in the lagoon include schoolmaster (*Lutjanus apodus*) and sea bream (*Archosargus rhomboidalis*). Larger species frequently observed in the lagoons include great barracuda (*Sphyaena barracuda*) and yellowtail snapper (*Ocyurus chrysurus*). Great barracuda are abundant in the

Table 1. Marine species that regularly or intermittently use the Mangrove Lagoon and associated mangrove habitats near the site.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground[1]	Nursery Ground	Adult Forage	Comm.	Recr.
Sergeant major	*Abudefduf saxatilis*	♦	♦	♦		
Ocean surgeon	*Acanthurus bahianus*	♦	♦	♦		
Doctorfish	*Acanthurus chirurgus*	♦	♦	♦		
Blue tang	*Acanthurus coeruleus*	♦	♦	♦		
Bonefish	*Albula vulpes*		♦	♦		♦
Redspotted hawkfish	*Amblycirrhitus pinos*	♦	♦	♦		
Sea bream	*Archosargus rhomboidalis*	♦	♦	♦		
Porkfish	*Anisotremus virginicus*	♦	♦	♦		
Hardhead silversides	*Atherinomorous stipes*	♦	♦	♦		
Frillfin goby	*Bathygobius soporator*	♦	♦	♦		
Jolthead porgy	*Calamus bajonado*	♦	♦	♦		
Sharpnose puffer	*Canthigaster rostrata*	♦	♦	♦		
Yellow jack	*Caranx bartholomaei*		♦	♦		
Blue runner	*Caranx crysos*		♦	♦		
Bar jack	*Caranx ruber*		♦	♦		
Snook	*Centropomas undecimalis*	♦	♦	♦		♦
Foureye butterfish	*Chaetodon capistratus*	♦	♦	♦		
Bridled goby	*Coryphopterus glaucofraenum*	♦	♦	♦		
Spotfin mojarra	*Eucinostomus argenteus*	♦	♦	♦		
Green moray	*Gymnothorax funebris*	♦	♦	♦		
Grunt	*Haemulon* spp.	♦	♦	♦		
Slippery dick	*Halichoeres bivittatus*	♦	♦	♦		
Longjaw squirrelfish	*Holocentrus ascensionis*	♦	♦	♦		
Grouper	*Hypoplectrus* spp.	♦	♦	♦	♦	
Dwarf herring	*Jenkinsia lamprotaenia*	♦	♦	♦		
Schoolmaster	*Lutjanus apodus*	♦	♦	♦	♦	
Gray snapper	*Lutjanus griseus*		♦	♦	♦	
Dog snapper	*Lutjanus jocu*		♦	♦	♦	
Lane snapper	*Lutjanus synagris*		♦	♦	♦	
Tarpon	*Megalops atlanticus*		♦	♦		♦
Yellowtail damselfish	*Microspathodon chrysurus*	♦	♦	♦		
Yellowtail snapper	*Ocyurus chrysurus*		♦	♦	♦	
Gray angelfish	*Pomacanthus arcuatus*	♦	♦	♦		
French angelfish	*Pomacanthus paru*	♦	♦	♦		
Parrotfish	*Scaridae* spp.	♦	♦	♦		
Striped parrotfish	*Scarus croicensis*	♦	♦	♦		
Princess parrotfish	*Scarus taeniopterus*	♦	♦	♦		
Redtail parrotfish	*Sparisoma chrysopterum*	♦	♦	♦		
Bucktooth parrotfish	*Sparisoma radians*	♦	♦	♦		
Great barracuda	*Sphyaena barracuda*		♦	♦		
Bluehead	*Thalassoma bifasciatum*	♦	♦	♦		

[1] Spawning occurs within the inshore fringing reef of outer Mangrove Lagoon.

lagoons from April to May (Boulon 1990). No data were available for invertebrate species.

Snapper (*Lutjanidae*), the only commercial fishery in the area, are commercially fished outside Mangrove Lagoon, which, with its surrounding surface water, supports a popular sport fishery for bonefish (*Albula vulpes*), tarpon (*Megalops atlantica*), and snook (*Centropomas undecimalis*). There are currently no landing restrictions, nor health advisories for the consumption of fish in the area (Beets personal communication 1992).

Site-Related Contamination

Investigations have focused on groundwater sampling. Samples collected in September 1990 were analyzed for trace elements and organic compounds. All subsequent samples were analyzed only for organic compounds. Minimal soil samples have been collected and analyzed for organic compounds. No off-site surface water, sediment, or biota sampling has been conducted.

No organic compounds were detected in any of the groundwater samples at concentrations exceeding chronic freshwater or marine AWQC by a factor of ten (U.S. EPA 1986). Five trace elements were measured infrequently in groundwater at concentrations exceeding screening criteria. Cadmium, lead, and silver concentrations exceeded their respective freshwater screening criteria. However, the measured concentrations of silver were qualified in the data report as estimated concentrations (Geraghty & Miller 1991). Copper and nickel concentrations exceeded the marine AWQC in several samples, but did not exceed the screening criteria for freshwater (Table 2).

Table 2. Maximum trace element concentrations (µg/l) in groundwater at the Tutu Wellfield site compared to chronic AWQC[1].

	Groundwater	AWQC[2]	
		freshwater	marine
Trace Elements			
Cadmium	11	1.1+	9.3
Copper	59	12+	2.9
Lead	33	3.2+	8.5
Nickel	95	160+	8.3
Silver	18	.12	.92

1: Ten times the AWQC is used for screening purposes to account for dilution in surface water.
2: Ambient water quality criteria for the protection of aquatic organisms. Chronic criteria presented (U.S. EPA 1986).
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ used)

Summary

Numerous hazardous wastes were disposed of at this site in a manner that could permit them to enter the main drainage system of the area via surface runoff or groundwater discharge. This drainage system empties into Mangrove Lagoon, an important habitat for NOAA trust resources in the area. Elevated levels of organics and metals have been detected in groundwater near the site, and it is of some concern to NOAA that these groundwater contaminants, as well as other site-related contaminants, could migrate to Mangrove Lagoon via the drainage system.

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3

Austin Avenue Radiation Site

Lansdowne, Pennsylvania
CERCLIS #PAD987341716

Site Exposure Potential

The Austin Avenue Radiation Site is located in Lansdowne, Pennsylvania, about 1 km northeast of Darby Creek (Figure 1). The W.L. Cummings Radium Processing Company conducted a radium refining operation from 1915 to 1925 at a warehouse on the corner of Union and Austin avenues. Radium-containing ores were unloaded from rail cars and processed to remove the radium, with the wastes products (radium tailings) apparently stored at the warehouse for an unknown length of time (Grayson 1992). A residential duplex and a wood shop are near the warehouse, which, along with the backyard area, and a nearby railroad right-of-way, are believed to have been contaminated with radium tailings (Lee 1991).

Discarded radium tailings from the Austin Avenue site may have been used in the 1920s to make concrete, stucco, and mortar for sidewalks, homes, and other structures (Grayson 1992). The Austin Avenue warehouse is the suspected source of elevated radiation measured at 40 sites in Delaware County, Pennsylvania (Voltaggio 1992). These contaminated properties are located in six municipalities within a 4-km radius of the Austin Avenue site.

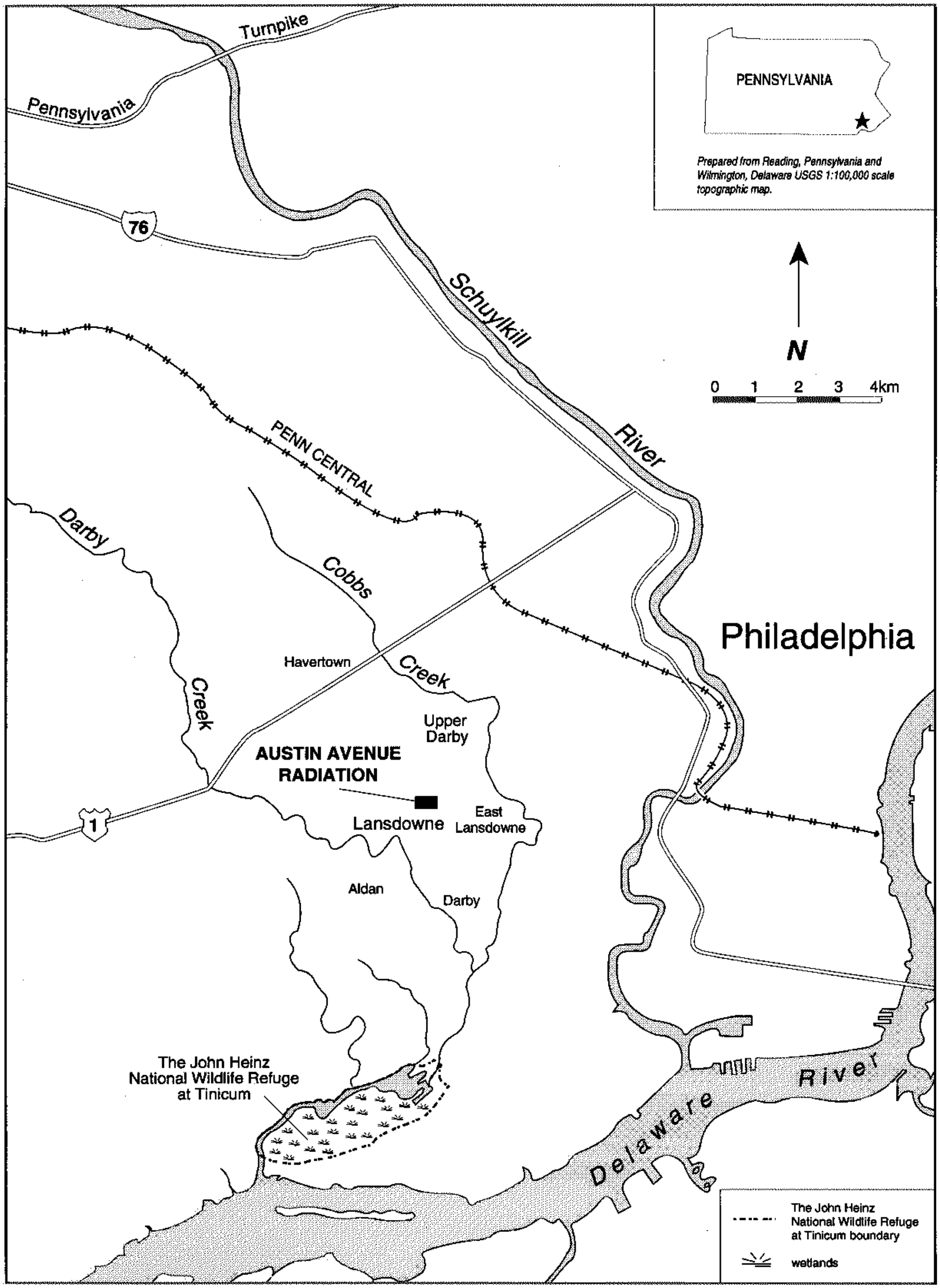

Figure 1. The Austin Avenue site in Lansdowne, Pennsylvania.

The structurally unsound warehouse was dismantled as part of an EPA Emergency Removal (U.S. EPA 1992). A public health advisory was issued by the Agency for Toxic Substances and Disease Registry in 1991 to inform EPA, the State of Pennsylvania, and the public of a potentially significant environmental hazard to human health in the vicinity of the Austin Avenue site (Johnson 1991).

Darby and Cobbs creeks are the two major surface water bodies near the site. Darby Creek is about 1 km southwest of the site, and Cobbs Creek is about 2 km east of the site. Cobbs Creek joins Darby Creek approximately 4 km south of the site, and Darby Creek continues for another 10 km before it enters the Delaware River. The Delaware River flows into the Atlantic Ocean approximately 150 km downstream from Darby Creek. Surface runoff and groundwater migration pathways from the site to Darby or Cobbs Creek were not described in any of the available documents.

NOAA Trust Habitats and Species

Primary habitats of concern to NOAA are the surface water, bottom substrates, and associated wetland habitats of Darby Creek and the Delaware River. Cobbs Creek is the secondary habitat of concern. The John Heinz National Wildlife Refuge at Tinicum extends 2 km upstream from the confluence of Darby Creek and the Delaware River and continues northeast to 6 km downstream from the site. This approximately 205-hectare wetland area represents the largest freshwater tidal marsh in Pennsylvania (Tiner and Wilen 1988; Mitchell 1992). Tidal amplitude in the lower portions of the refuge range from 1.5 to 2.0 m. Salinities in the refuge commonly range from 0 to 5 ppt and fluctuate throughout the year, depending on rainfall, saltwater intrusion, and urban runoff. The upper limit of tidal influence extends into Darby Creek, approximately 3 km downstream from the site. Bottom substrates in Darby Creek are mostly gravel and sand with areas of mixed cobble. The creek averages 12 m wide near the site. The stream gradient of Darby Creek is about 3 meters per kilometer. Cobbs Creek's water quality has been degraded by the extensive residential and commercial development in riparian areas (Kaufmann 1992).

Wetland vegetation of the John Heinz National Wildlife Refuge at Tinicum is dominated by the invasive emergent species common reed (*Phragmites australis*). Other wetland vegetation species less widely distributed in the refuge include cattail (*Typha* spp.), wild rice (*Zizania aquatica*), tearthumb (*Polygonum arifolium*), and purple loosestrife (*Lythrum salicaria*). The marsh area has been subject to considerable habitat disturbance, including discharge from a sewage treatment plant, discharges of stormwater runoff, industrial and residential development, and the presence of Route 95, a major interstate highway (Nugent 1992).

The Delaware River has been a spawning site for over 60 species of fish (De Sylva et al. 1962). Near the site, Darby Creek, including the John Heinz National Wildlife Refuge at Tinicum, and the Delaware River support diverse and abundant populations of NOAA trust resources (Table 1; Kaufmann 1992; Lupine 1992; Mitchell 1992). These species are likely to migrate into Darby Creek and reside for extended periods during sensitive life stages. Shallow bays and creek channels in the marsh area provide productive spawning and nursery habitat for numerous anadromous and resident freshwater fishes. Trust resources commonly found in the marsh area include alewife, blueback herring, white perch, striped bass, and mummichog (Kaufmann 1992; Mitchell 1992). Anadromous blueback herring and alewife use the tidal marsh area as a spawning and nursery habitat. Blue crab are also abundant in the marsh and have been identified in Darby Creek several kilometers upstream of the wildlife refuge (Kaufmann 1992). American eel are abundant throughout the drainage (Kaufmann 1992; Mitchell 1992). Atlantic sturgeon are rare and use the Philadelphia reach of the Delaware River as a migratory corridor (Kaufmann 1992).

The reach of the Delaware River near the site also supports an estimated 10,000 federally endangered shortnose sturgeon (Kaufmann personal communication 1993; O'Herron personal communication 1993). Although shortnose sturgeon commonly stay in the deeper central channels of the river, field investigations have tracked individuals by radio-telemetry into nearshore habitats farther upstream in the metropolitan core of Philadelphia. Although unconfirmed, shortnose sturgeon may use the shallow water habitats of Darby Creek for foraging during adult and juvenile life stages (O'Herron personal communication 1993).

Except for small harvests of blue crab, American shad, and blueback herring, there is minimal commercial fishing in the reach of the Delaware River near the site. Most commercial fishing begins about 90 km south of the site where the Delaware River begins to widen into Delaware Bay and brackish conditions predominate. High levels of marine traffic in the Delaware River limit commercial fishing activity. There is a significant sport fishing effort in Darby Creek and the Delaware River. In Darby Creek, a put-in/take-out rainbow trout and brown trout fishery receives the greatest sport effort. A total of 6,600 rainbow and brown trout, which are not NOAA trust resources, are annually released in Darby Creek approximately 900 m from the site (Kaufmann 1992). Striped bass is the favored recreational species in the Delaware River near Darby Creek. Alewife and blueback herring are also fished recreationally. In recent years, a sport fishery for the white perch has developed in the Delaware River and is expected to increase (Lupine 1992). The majority of sport fishing near the wildlife refuge is directed toward carp and catfish; neither species is under NOAA's trust (Mitchell 1992).

The Pennsylvania Bureau of Water Quality currently has an advisory on the human consumption of several species that are fished for recreational purposes in the Delaware River due to excessive levels of PCBs and chlordane. White perch, blue crab, and American eel are NOAA trust resources included in the advisory (Kaufmann 1992; Soldo 1992).

Site-Related Contamination

Limited sampling was conducted at the Austin Avenue Radiation site. The Pennsylvania Department of Environmental Protection visited the site twice in 1991. During the site visits, radon monitoring was conducted and an unknown number of soil samples were collected from the vicinity of the warehouse (Lee 1991).

Gamma radiation was detected in the warehouse, associated structures, and the tailings pile at the Austin Avenue site. Gamma radiation dose rates ranged from 190 µR/hr to a maximum rate of 1,200 µR/hr measured in the tailings pile (Voltaggio 1991).

In 1991, EPA tested over 100,000 residences in Lansdowne and surrounding towns for gamma radiation. Elevated radiation levels were detected at 29 sites, with 800 µR/hr the maximum radiation dose measured. (The EPA action level for human health is 0.1 REM/year for gamma radiation, equivalent to 11.4 µR/hr [Lee 1991]). The warehouse at Austin Avenue is believed to be the source of the radiation.

Radium-226, radium-228, and uranium-238 were measured in soil samples at concentrations of 10.5, 3.3, and 6.8 pCi/g, respectively (Lee 1991). The estimated background level of both radium and uranium in Pennsylvania soils is 1.2 pCi/g. Federal regulations state that the concentrations of radium-226 in soils shall not exceed the background concentration by more than 5 pCi/g, averaged over the first 15 cm of soil below the surface of an area of 100 m^2 (Johnson 1991). The regulations do not specify which background values should be used (regional, state, or local), however.

No data were provided regarding sampling of groundwater or surface water near the site. From the documents reviewed, it did not appear that water sampling was conducted. Screening guidelines for gamma radiation in aquatic environments were not available in the literature.

Summary

The site is believed to be the source of elevated levels of gamma radiation in the area: elevated levels of radium-226, radium-228 and uranium-238 were detected in samples taken within a 4-km radius of the site. Two streams that join and ultimately empty into the Delaware River are within this radius. One of these streams and the Delaware River are considered primary habitat for NOAA trust resources and the other stream is considered secondary habitat. While no data currently exist there is a potential that radiation contamination could have migrated to these streams either via surface water runoff or groundwater.

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3

Crater Resources, Inc.

Conshohocken, Pennsylvania

CERCLIS #PAD980419097

Site Exposure Potential

The 1.6-hectare Crater Resources, Inc. site is about 2 km west of the Schuylkill River in Conshohocken, Pennsylvania (Figure 1), in the Philadelphia metropolitan area. The Schuylkill River enters the Delaware River 36 km downstream from the site, and the Delaware River continues for about 85 km before reaching Delaware Bay.

The site was quarried for an undocumented period of time until its purchase by Alan Wood Steel, Inc. in 1918. From 1918 to 1978, the quarry was used for disposal of phenolic and tar wastes from the Alan Wood Steel coke and chemical works in nearby Swedeland. There is only limited documentation on the quantities discharged, but during 1977, 230 m^3 per day of wastes containing cyanide, phenol, and ammonia were discharged into the quarry via a fixed pipeline. For 50 years, over 3.5 million m^3 of waste are calculated to have discharged to the quarry. In 1978, Alan Wood Steel sold the property to Alabama By-Products Corporation, which in turn sold the property to CRI and Gulph Mills Golf Course. From 1978 to 1980, the site was used for the disposal of untreated coke wastes, cooling water, and waste ammonia liquor at a rate of approximately 330 m^3/day. Samples of sludge collected from the quarry in 1979 contained numerous phenolic compounds and PAHs.

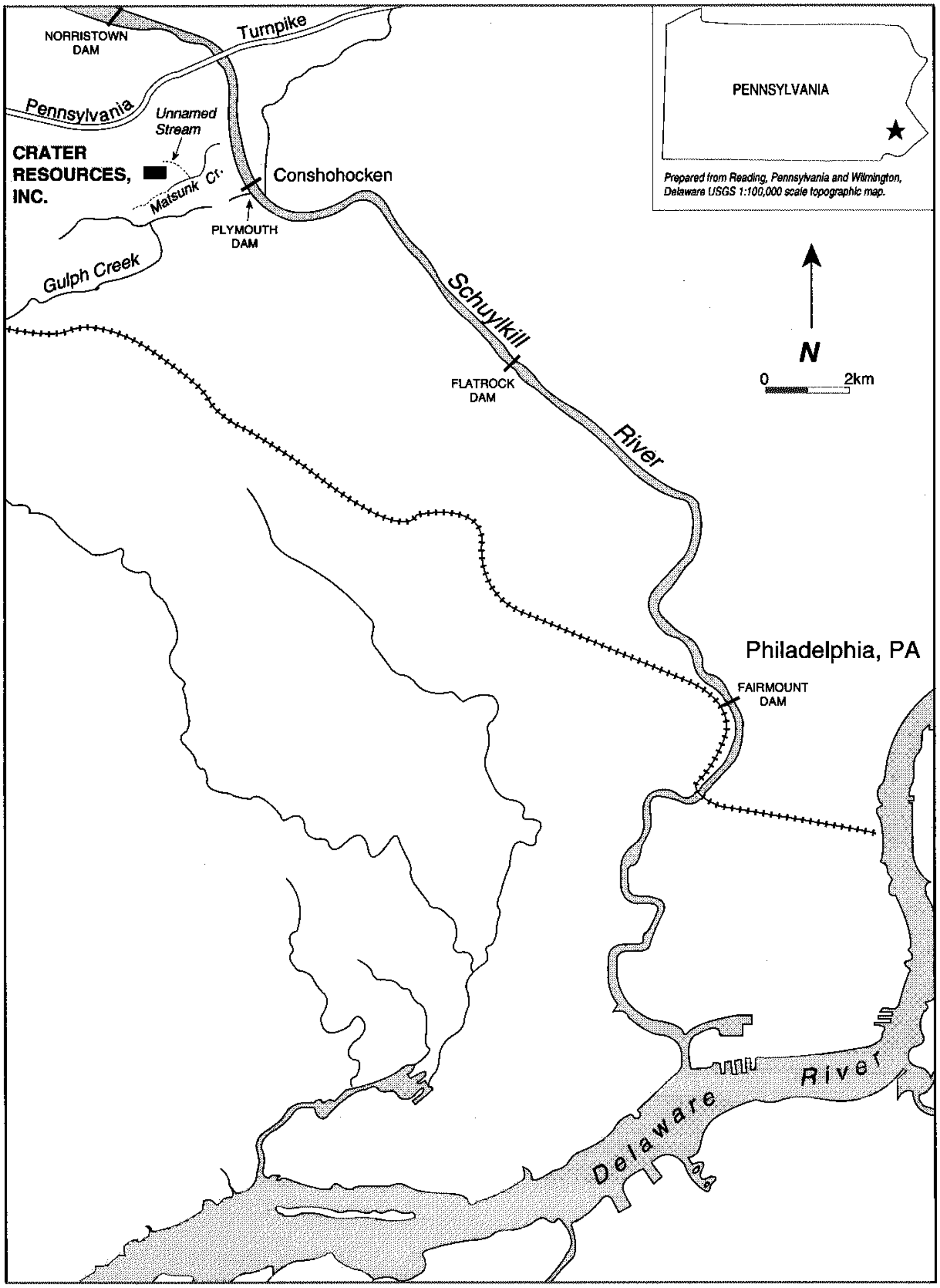

Figure 1. The Crater Resources, Inc. site in Conshohocken, Pennsylvania.

Groundwater and surface runoff are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Soils in the area are of the Beltsville silt loam series and overlie a low-permeability, varied clay substance. The distance to the water table from the lowest point of waste disposal in the quarry was estimated to be 3 to 5 m (NUS 1983). The aquifer underlying the site consists of Conestoga Formation limestone; there are several other limestone formations near the site. These carbonate units can be quite permeable to groundwater due to karst features such as sinkholes and solution channels. Groundwater flows towards Matsunk Creek under natural conditions (NUS 1983). However, continuous groundwater pumping from nearby quarries north of the site has altered groundwater flow in the direction of the pumping. A small, unnamed stream, approximately 60 m northeast of the quarry, flows to the southeast and discharges into Matsunk Creek 1.5 km west of the Schuylkill River (NUS 1983). The Preliminary Assessment did not specify whether the lagoons in the quarry drain into the unnamed stream. Matsunk Creek flows toward the Schuylkill River but could not be traced on the U.S. Geological Survey topographical map (USGS 1983) closer than 0.5 km west of the river. It is likely that the creek enters culverts underneath a railroad area and enters the Schuylkill River at an undesignated location.

NOAA Trust Habitats and Species

The Schuylkill River is the habitat of concern to NOAA. Near the site, the river is a low-gradient, warmwater river, averaging approximately 1- to 2-m deep and 100- to 250-m wide. The Schuylkill River is considered the most heavily used water body for wastewater assimilation in Pennsylvania. There are also high levels of agricultural runoff to the river. Because of these factors, the river is generally considered to have low water quality (Soldo personal communication 1990; Kaufmann personal communication 1992). River substrate is predominantly gravel/cobble in riffle reaches and silt in pool reaches. There are heavy aquatic plant beds throughout the river, with the dominant plant species being Eurasian water milfoil *(Myriophyllum spicatum)* and pickerelweed *(Pontederia cordata)*. There are no appreciable wetlands near the site (Kaufmann personal communication 1992).

Dam construction on the Schuylkill River eliminated natural anadromous fish migration into this reach of the river, which is corroborated by sampling data gathered between 1983 and 1984 (Soldo personal communication 1990). There are three dams on the Schuylkill River downstream from the site: Plymouth Dam (1.5 km), Flatrock Dam (10 km), and Fairmount Dam (22 km). Only Fairmount Dam has fish passage facilities. Because of legal and financial complexities associated with government ownership of Flatrock and Plymouth dams, scheduled improvements to these dams have been delayed and will probably not be pursued for five to ten years (Ellam personal communication 1992). Restoration of the Plymouth Dam would involve breaching the structure. Restoration of the Flatrock Dam would involve installing fish ladders and hydraulic heads suitable for fish passage (Kaufmann personal communication 1990). The U.S. Fish and Wildlife Service stocks American shad above the Fairmount Dam as part of their Susquehanna and Delaware Basin Anadromous Fishery Restoration Projects, but this effort is not permanent (St. Pierre personal communication 1992). Due to limited information, it is not known whether NOAA trust resources use Matsunk Creek.

Catadromous American eel represent the only NOAA trust resource potentially at risk. American eel were found in upstream habitats north of the site during sampling in the Schuylkill River by the Pennsylvania Fish Commission in 1983 (Table 1; Kaufmann personal communication 1990; Soldo personal communication 1990). Flatrock Dam represents the furthest upstream point of migration for shad on the Schuylkill River (St. Pierre personal communication 1992).

A consumption advisory is in effect for the Schuylkill River due to high concentrations of PCBs, chlordane, and DDT. American eel are the only NOAA trust resources included in the advisory. Below the Flatrock Dam game limits are imposed for recreational landings of American shad, striped bass, white perch, and several warmwater species. No federally protected species are known to frequent nearby habitats of concern.

Site-Related Contamination

Results from a preliminary site investigation on May 9, 1983 indicate that groundwater in the vicinity of the site and surface water in the on-site lagoons contain elevated concentrations of site-related contaminants (NUS 1983). Trace elements are the primary contaminants of concern to NOAA trust resources. Maximum concentrations of trace elements detected in the groundwater

Table 1. Major NOAA trust species that use the Schuylkill River.

Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage
CATADROMOUS/ANADROMOUS SPECIES				
American eel	*Anguilla rostrata*			♦
Species with potential for restoration				
Blueback herring	*Alosa aestivalis*	♦	♦	♦
Alewife	*Alosa pseudoharengus*	♦	♦	♦
American shad	*Alosa sapidissima*	♦	♦	♦
Striped bass	*Morone saxatilis*	♦	♦	♦

and surface water are presented in Table 2, along with freshwater chronic AWQC (U.S. EPA 1986). PAHs and other organic compounds were not detected in groundwater or surface water samples. Soil samples were not collected from the site, nor were surface water or sediment samples collected from the unnamed stream draining the area.

Eleven samples were collected during the preliminary site investigation (Figure 2). One groundwater sample was collected from each of three monitoring wells in the vicinity of the quarry. Maximum concentrations of copper, lead, mercury, and zinc in groundwater samples exceeded their respective screening guidelines by at least ten times (Table 2). One surface water and one solid material sample were collected from each of the four lagoons within the quarry. Maximum concentrations of lead, mercury, and zinc in surface water exceeded their respective screening guidelines. There were measurable concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc present in the solid material samples collected from the lagoons. PAHs were detected in solid material samples at a maximum concentration of 3,700 mg/kg (wet weight).

Summary

Several contaminants of concern to NOAA exceeded screening criteria in on-site samples of groundwater and surface water, and were also found in the one solid material sample. These contaminants included copper, lead, mercury, and zinc in groundwater; lead, mercury, and zinc in surface water, and arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc in the solid material. The Schuylkill River is the

Table 2. Maximum concentrations of trace elements detected in groundwater and surface water samples collected at the CRI site compared with ambient water quality criteria.

	Groundwater µg/l	Surface Water µg/l	AWQC[1] µg/l
Trace Elements			
Copper	350	ND	12+
Lead	80	10	3.2+
Mercury	0.80	0.20	0.012
Nickel	1200	ND	160+
Zinc	7900	420	110+

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U. S. EPA 1986).
ND: Not detected at method detection limit.
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ used).

nearest habitat known to be used by NOAA trust resources. Due to the presence of downstream dams, the American eel is the only NOAA resource that currently uses the river near the site. However, future plans to remove one of the dams and install a fish ladder at the other dam could open up the area to anadromous fish such as the American shad. While no data currently exist indicating that contaminants have migrated from the site to the river, potential pathways for such migration do exist in the form of groundwater and one creek.

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3

Foote Mineral Company

East Whiteland Township, Pennsylvania

CERCLIS #PAD077087989

Site Exposure Potential

The 43-hectare Foote Mineral Company site is north of the intersection of Routes 202 and 30 in East Whiteland Township, Chester County, Pennsylvania (Figure 1). The site is approximately 800 m north of Valley Creek, which discharges to the Schuylkill River 15 km downstream in Valley Forge National Historical Park. The Schuylkill River flows into the Delaware River 45 km further downstream.

Established in 1942, the mineral company has manufactured solution and anhydrous forms of lithium halides and processed lithium metal.

From 1932 to 1944, the site was a limestone quarry and processing site. At least seven disposal and waste storage areas used for effluent and liquid/slurry disposal and storage were identified at the site (Pennsylvania Department of Environmental Resources [PADER] undated).

The site is relatively flat with a slight southward grade toward Valley Creek. Groundwater and surface runoff are the potential pathways by which contaminants from the site could migrate to NOAA trust habitats. A soil profile at an on-site well indicated descending layers of clay,

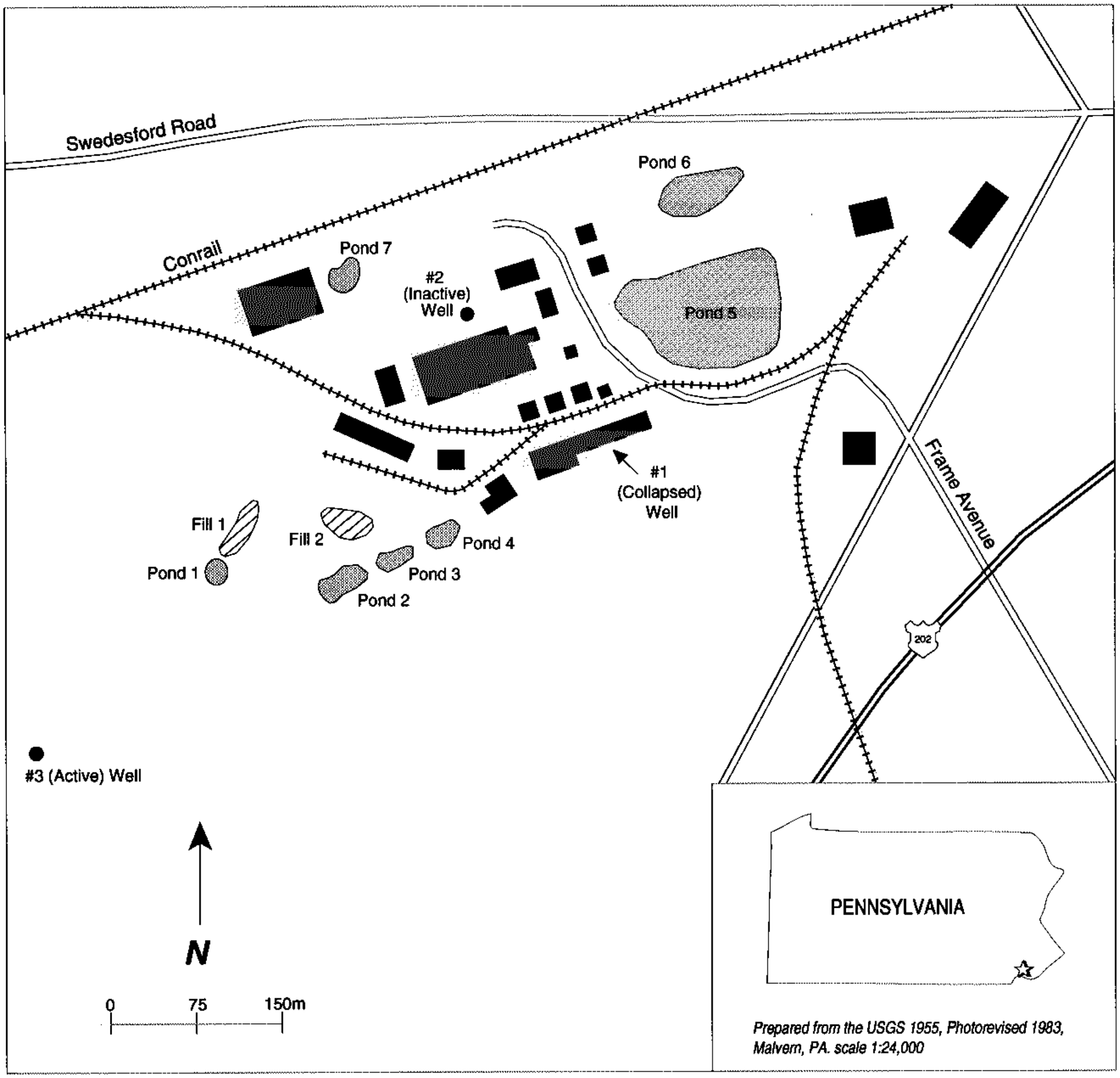

Figure 1. The Foote Mineral Company in East Whiteland Township, Pennsylvania, showing pond and fill areas of the site (PADER undated.)

sandstone, and limestone. Although no groundwater studies have identified the aquifers, water was struck at 24 m, 62 m, and 94 m during the drilling of an on-site well (PADER undated).

Information on the rate or direction of groundwater flow beneath the site was not available. The slight grade from the site toward Valley Creek suggests that surface runoff could flow from the site into the creek, but this has not been confirmed.

NOAA Trust Habitats and Species

The primary habitat of concern to NOAA is the Schuylkill River. Secondary habitats of concern include Valley Creek and its associated riparian wetlands. At its confluence with Valley Creek, the Schuylkill River is approximately 110 m wide and 1 to 2 m deep, with a cobble and silt substrate. Although the upper portions of the Schuylkill River are classified as a "scenic river" (Arnold personal communication 1993), the river is considered the most heavily used water body for wastewater assimilation in Pennsylvania. Moreover, high levels of agricultural runoff affect the river. The river is thus generally considered to have low water quality (Soldo personal communication 1990; Kaufmann personal communication 1992). Schuylkill River substrate is predominantly gravel/cobble in riffle reaches and silt in pool reaches. There are heavy aquatic plant beds throughout the river, with the dominant plant species being Eurasian water milfoil (*Myriophyllum spicatum*) and pickerel-weed (*Pontederia cordata*). There are no appreciable wetlands near the site (Kaufmann personal communication 1992).

During a NOAA site visit in the spring of 1990, Valley Creek was less than 1 m deep, clear, and swift-flowing with a sand and gravel substrate (Craig personal communication 1990). The Valley Creek stream corridor is lined with narrow bands of wetlands, primarily of palustrine deciduous forested scrub shrub, palustrine emergent, and riverine open-water types (Tiner 1984; EVS Consultants, Inc. 1990).

The four dams on the Schuylkill River downstream of the confluence with Valley Creek (Norristown Dam [11.5 km], Plymouth Dam [17.5 km], Flatrock Dam [25.5 km], and Fairmount Dam [38 km]) eliminate natural anadromous fish migration into this reach of the river. Sampling data gathered between 1983 and 1984 corroborated this assertion (Soldo personal communication 1990). Only Fairmount Dam has fish passage facilities. Because of legal and financial complexities associated with government ownership of Flatrock and Plymouth dams, scheduled improvements to these dams have been delayed and will probably not be pursued for five to ten years (Ellam personal communication 1992). Restoration of the Plymouth Dam would involve breaching the structure. Restoration of the Flatrock Dam would involve installing fish ladders and hydraulic heads suitable for fish passage (Kaufmann personal communication 1990). Should financial resources be allocated and these dams restored, the Philadelphia Electric utility would install a fish ladder at their Norristown Dam. The U.S. Fish and Wildlife Service stocks American shad above the Fairmount Dam as part of their Susquehanna Anadromous Fishery Restoration Project, but this effort is not permanent (St. Pierre personal communication 1992).

Catadromous American eel are the only NOAA trust resource potentially at risk. Although American eel were not found in Valley Creek during sampling by the Pennsylvania Fish Commission in 1984, the Commission observed the species in the Schuylkill River between Norristown and Perkiomen Creek (1 km upstream from the Valley Creek confluence) in 1983 (Table 1; Kaufmann personal communication 1990; Soldo personal communication 1990). This information suggests that American eel could migrate near the site.

A consumption advisory is in effect for the Schuylkill River due to high concentrations of PCBs, chlordane, and DDT. American eel are the only NOAA trust resources included in the advisory. Below the Flatrock Dam, game limits are imposed for the recreational landings of American shad, striped bass, white perch, and several warmwater species. No federally protected species are known to frequent nearby habitats of concern.

Site-Related Contamination

On-site and residential groundwater wells were sampled for chromium and lithium during preliminary investigations of the Foote site. Chromium (170 to 200 µg/l) was detected in only one groundwater well (the Gross well) at concentrations exceeding its freshwater chronic AWQC (11 µg/l) by a factor greater than 15 (U.S. EPA 1986). Although lithium was also detected in groundwater samples (up to 12,500 µg/l), there are no screening guidelines for this substance (PADER undated). The effect of low concentrations of lithium on aquatic life is unknown.

Summary

The Schuylkill River is the primary habitat of concern to NOAA. Four dams on the river

Table 1. NOAA trust resources that use the Schuylkill River and Valley Creek.

Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage
CATADROMOUS SPECIES				
American eel	*Anguilla rostrata*			♦
Historical fisheries that may be restored				
Blueback herring	*Alosa aestivalis*	♦	♦	♦
Alewife	*Alosa pseudoharengus*	♦	♦	♦
American shad	*Alosa sapidissima*	♦	♦	♦
Striped bass	*Morone saxatilis*	♦	♦	♦

downstream of the confluence with Valley Creek presently restrict anadromous fish runs to 26 km from the site. American eel is the only trust resource potentially using Valley Creek near the site. Restoration of anadromous fish runs may be pursued in the next five to ten years. Chromium detected in one groundwater well on the site exceeded the freshwater chronic AWQC value by a factor of more than 15 (U.S. EPA 1986). The direction of groundwater flow and surface water runoff from the site has not been established.

References

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3

Naval Surface Weapons Center, Dahlgren Laboratory

Dahlgren, Virginia

CERCLIS #VA7170024684

Site Exposure Potential

The Naval Surface Weapons Center, Dahlgren Laboratory (NSWC Dahlgren) is on the west bank of the Potomac River in Dahlgren, Virginia, about 70 km south of Washington, D.C. (Figure 1). The 17-km^2 site is bisected by Upper Machodoc Creek, which flows to the east into the Potomac River (Figure 2). The northern portion of the site (the Main Site) is drained by Gambo Creek, a tidal estuary with 90 hectares of associated wetlands. Gambo Creek flows into the Potomac River, which enters the Chesapeake Bay approximately 75 km from the site.

NSWC Dahlgren was established in 1918 as a proving ground for naval ordnance. Waste materials have been produced throughout the site as a result of both ordnance and non-ordnance activities. During the Initial Assessment Study, 36 potentially contaminated sites were identified on both the Main Site and on the Explosives Experimental Area south of Machodoc Creek. Based on

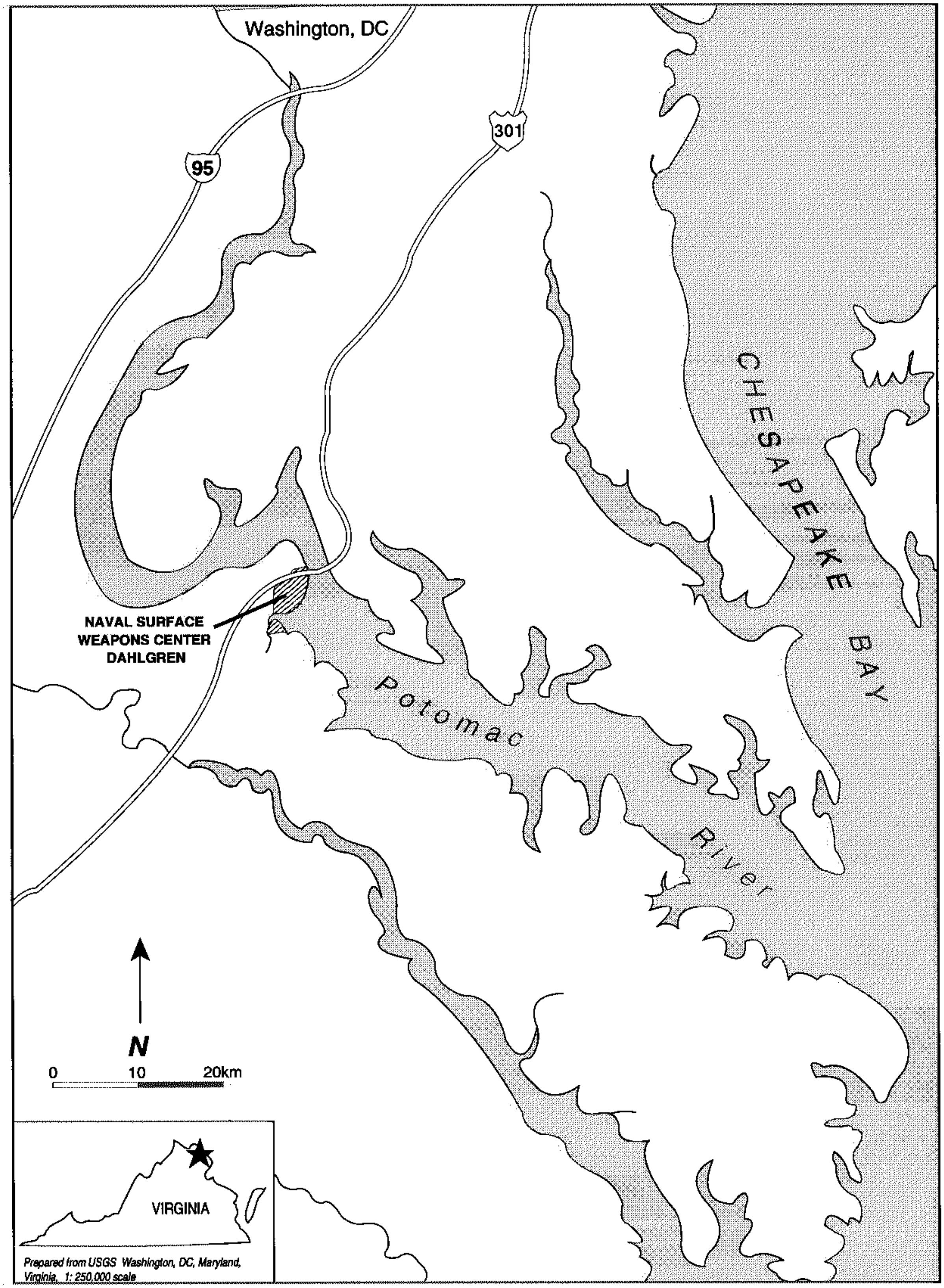

Figure 1. General vicinity of the Naval Surface Weapons Center site, Dahlgren, Virginia.

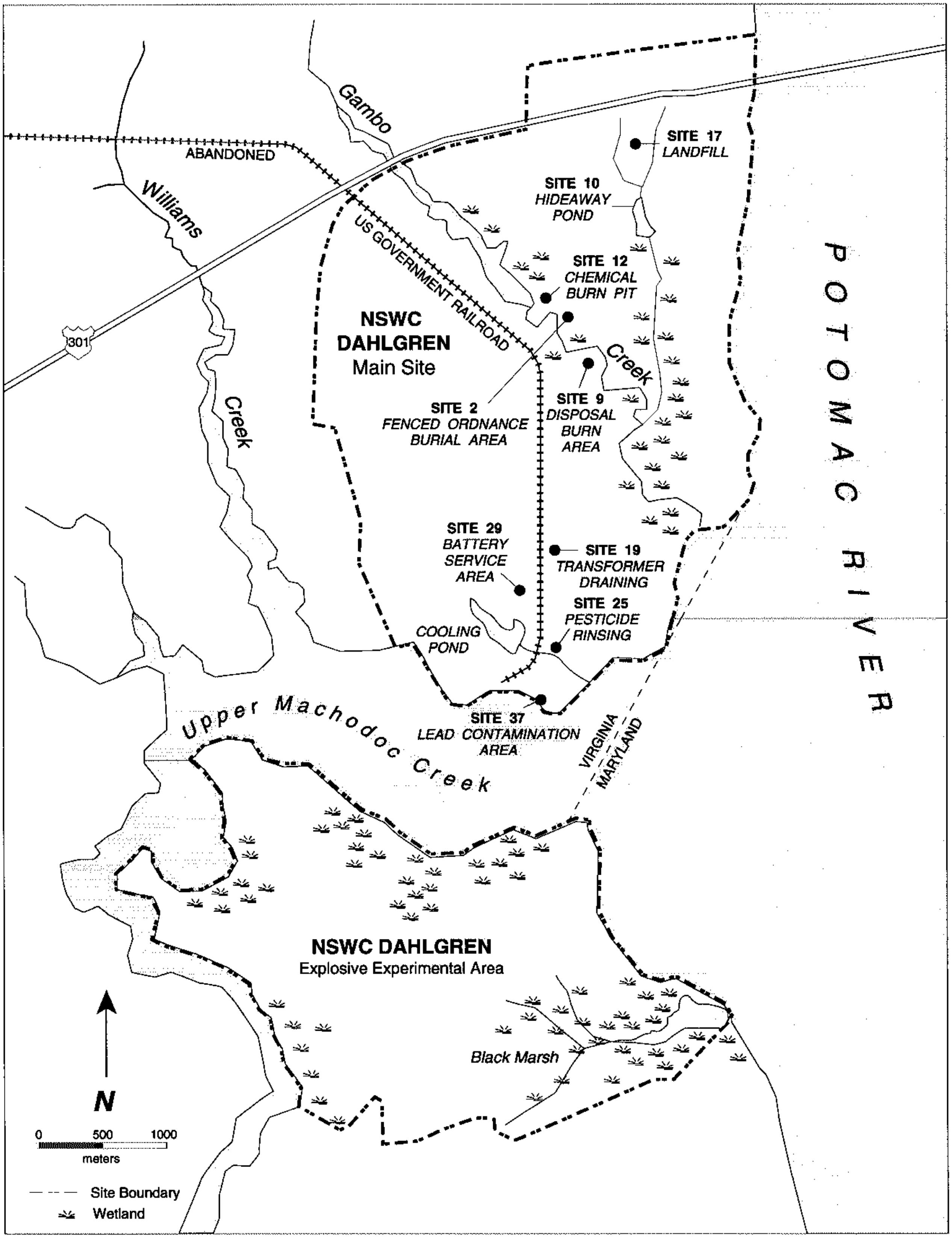

Figure 2. Detail of the Naval Surface Weapons Center, including the location of the waste disposal sites.

the study, six sites were investigated during the subsequent Confirmation Study. Plans for a remedial investigation at NSWC Dahlgren include the six sites previously investigated and three more sites (Figure 2; NUS 1992). Table 1 describes the past waste disposal practices at these sites.

Surface water runoff and groundwater migration are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Sites 2, 9, and 12 are near wetlands that border Gambo Creek. Site 12, the Chemical Burn Pit, is about 180 m from the creek in a depression that collects precipitation. The pit overflows during heavy rains, and before burning, the water in the pit was pumped out and deposited onto the ground surface near the pit. Site 17 is about 90 m upgradient from Site 10, Hideaway Pond, between two unnamed tributaries that lead to the pond. Site 10 is drained by an

Table 1. Types and quantities of wastes disposed of at eight sites at NSWC Dahlgren.[1]

Site	Dates of Operation	Types and Quantities of Wastes
Site 2 Fenced Ordnance Burial Area	From 1970 to an unknown date	Unknown quantities of scrap metal with explosives residues were disposed of, along with triple-rinsed pesticide containers, and asbestos pipe wrappings. Drums containing misch metal, composed of radioactive thorium and magnesium, were stored and possibly disposed of at this site.
Site 9 Disposal/Burn Area	Approximately 1951 to 1984	Various chemical and municipal wastes were dumped and burned. The actual type and quantity of wastes were unknown.
Site 12 Chemical Burn Pit	Approximately 1970 to 1980	Small metered quantities of decontaminated chemical warfare agents were disposed of in plastic quart containers and burned every 3 to 4 weeks. An estimate of the total number of containers disposed of was not given.
Site 17 Old Sanitary Landfill	For 3 to 4 years during the early 1970s	Municipal wastes were disposed of at this site. An anonymous phone call reported that unknown quantities of mercury were buried in canisters at the site.
Site 19 Transformer Draining Area	During the 1950s	Transformer oil containing unknown concentrations of PCBs was drained onto the ground. It was estimated that approximately 3,800 liters of oil were dumped at this site.
Site 25 Pesticide Rinsing Area	Dates were not available	Pesticide containers were rinsed and wash water was dumped onto a paved area where it was channeled to a french drain.
Site 29 Battery Service Area	An unknown date until 1985	Unknown quantities of waste acids from lead-acid storage batteries were drained into an unlined pit containing limestone.
Site 37 Lead Contamination Area	Dates were not available	Unknown quantities of sand from machine gun range traps were placed along the shoreline as fill. This sand may have been contaminated with lead and trace elements.

1 Since no wastes were disposed of at Site 10, Hideaway Pond, it is not included in this table.

unnamed stream that flows for about 1.5 km and then joins Gambo Creek. Site 19 is 1 km from the Potomac River. Surface drainage from Site 29 ultimately reaches the cooling pond about 75 m south of the site. At Site 25, a french drain was historically used for draining pesticide waste from the site. The drain is approximately 100 m upgradient from an unnamed creek that flows for about 500 m before entering the Potomac River. Site 37, on the banks of Machodoc Creek near the Potomac River, is subject to washout during flooding.

Three principal geologic units underlie the site. The surficial unit, the Nanjemoy Formation, is about 45 m thick and consists of silty fine sands and clays with low permeability. The surficial aquifer is separated from the underlying Aquia Greensand Formation and Potomac Group by a clay aquiclude that restricts downward movement of groundwater. Groundwater from Sites 12, 9, and 19 flows towards Gambo Creek, while groundwater below Sites 17 and 25 flows towards the nearest creek or tributary.

NOAA Trust Habitats and Species

Habitats of concern to NOAA are the surface water, associated bottom substrates, and estuarine emergent wetlands of Gambo Creek, the unnamed creek draining Hideaway Pond, and the Potomac River. Salinities in the Potomac River near the site range from 3 to 9 ppt throughout the year depending on rainfall, saltwater intrusion, and surficial runoff. Gambo Creek is tidally influenced as far inland as the northern border of the site. The substrate composition of Gambo Creek is primarily sand and hard clay (Swihart personal communication 1992).

Surface water near the site provides spawning, nursery, and adult habitat for numerous species (Table 2; Swihart personal communication 1992). Six species of anadromous fish use the Potomac River for migratory and adult habitat: blueback herring, hickory shad, alewife, American shad, white perch, and striped bass. Extensive wetlands containing saltmarsh cordgrass (*Spartina alterniflora*) border Gambo Creek and provide nursery habitat for these species. White perch use the creek and its associated wetlands for spawning, nursery, and adult habitat (Swihart personal communication 1992). Information was not available on the accessibility of Hideaway Pond to NOAA trust resources. Estuarine and marine species that are likely to use Gambo Creek and the Potomac River include anchovy, menhaden, gizzard shad, killifish, spot, silverside, croaker, bluefish, hogchoker, and mummichog. There are catadromous American eel throughout the area. There are oyster beds offshore of the site in the Potomac River (O'Brien & Gere Engineers Inc. 1986). Blue crab are abundant near NSWC Dahlgren in the Potomac River and the associated wetlands (Swihart personal communication 1992).

were only conducted at Sites 9, 10, 12, 17, 19, and 25. The types of media samples collected and chemical parameters analyzed at these sites were based on the source and type of contamination at each site. Table 3 gives the maximum concentrations of contaminants measured.

Leachate and groundwater samples were collected from Site 9 and analyzed for several parameters, but analyses did not include pesticides, PCBs, PAHs, or trace elements.

Groundwater, surface water, soil, sediment, and fish tissue samples were collected near Site 17, including Hideaway Pond and its two tributaries. The samples were analyzed for mercury only. Mercury was not detected in any of the surface water samples; however, the detection limit (0.10 µg/l) was an order of magnitude above the chronic freshwater AWQC of 0.025 µg/l (U.S. EPA 1986). Half of the sediment samples contained mercury concentrations greater than or equal to 0.01 mg/kg (wet weight). These concentrations of mercury in sediments are not directly comparable to the screening guideline, which is expressed in mg/kg on a dry weight basis (higher mercury concentrations would be expected if expressed on a dry weight basis). Although mercury was not detected in any of the five soil samples collected from Site 17, the detection limit of 0.5 mg/kg (wet weight) is higher than the average mercury concentration of 0.03 mg/kg (dry weight) in U.S. soils (Lindsay 1979). During past studies, mercury was detected at a maximum concentration of 1.9 mg/kg in fish tissues collected from Hideaway Pond. The action level set by the U.S. Food and Drug Administration for protection of human health is 1 mg/kg (Fred C. Hart Associates, Inc. 1983).

Soil, groundwater, and pit water samples were collected from Site 12 and analyzed for several parameters, but tests did not include pesticides, PCBs, or trace elements. Base-neutral extractable organic compounds were measured in one sample of each media type from Site 12. The only contaminant detected was di-n-octylphlalate in the soil sample at a concentration of 280 ug/kg (wet weight).

At Site 19, 52 soil samples from 28 locations and three groundwater samples were collected and analyzed for PCBs. The samples were not tested for pesticides or trace elements. PCBs were detected in soils at a maximum concentration of 84 mg/kg (wet weight) from nine sampling locations, but were not detected in groundwater samples. However, the detection limit of 10 µg/l was much higher than the screening guideline, which is ten times the AWQC of 0.03 µg/l.

At Site 25, soil samples were collected from 34 locations and groundwater samples were collected from four monitoring wells; the maximum concentrations of pesticides found in soil and groundwater were measured in these samples (Table 3). Pesticides were found in soils throughout the site; over half the sampling locations contained detectable concentrations of DDT, DDD, DDE, and dieldrin. Screening guidelines for these pesticides in soils were not available. DDT, DDD, and DDE were detected in one

Table 2. Major species inhabiting the surface waters and tidal marshes of Gambo Creek and the Potomac River near NWSC Dahlgren.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
ANADROMOUS/CATADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*		♦	♦	♦	
Hickory shad	*Alosa mediocris*		♦	♦		
Alewife	*Alosa pseudoharengus*		♦	♦	♦	
American shad	*Alosa sapidissima*		♦	♦	♦	
American eel	*Anguilla rostrata*			♦	♦	
White perch	*Morone americana*	♦	♦	♦	♦	♦
Striped bass	*Morone saxatilis*		♦	♦	♦	♦
MARINE/ESTUARINE SPECIES						
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Atlantic menhaden	*Brevoortia tyrannus*		♦	♦		
Gizzard shad	*Dorosoma cepedianum*	♦	♦	♦		
Mummichog	*Fundulus heteroclitus*	♦	♦	♦		
Killifish	*Fundulus* spp.	♦	♦	♦		
Spot	*Leiostomus xanthurus*	♦	♦	♦		♦
Silversides	*Menidia* spp.	♦	♦	♦		
Atlantic croaker	*Micropongonias undalatus*	♦	♦	♦		
Bluefish	*Pomatus saltatrix*			♦	♦	♦
Hogchoker	*Trinectes maculatus*	♦	♦	♦		
INVERTEBRATE SPECIES						
Blue crab	*Callinectus sapidus*	♦	♦	♦	♦	♦
American oyster	*Crassotrea virginica*	♦	♦	♦	♦	♦

The Potomac River supports a diverse commercial fishery. Near the site, blue crab is the most important commercial species, followed by bluefish and American eel. Anadromous species and oysters are also caught near the site, although they are not a significant component of the commercial catch. Striped bass and bluefish are the most popular fish caught recreationally. Oyster beds in areas of the Potomac River may be closed on occasion due to fecal contamination, although all oyster beds on the river are currently open (Holbrook personal communication 1992). Some of the oyster beds in the Upper Machodoc Creek are closed due to sewage effluent that is discharged into Williams Creek (Wright personal communication 1992). There is currently a catch and release advisory posted by the Captain of NWSC Dahlgren for fish caught in Hideaway Pond due to high mercury concentrations that have been measured in fish tissue (Wray personal communication 1992).

Site-Related Contamination

Mercury, pesticides, and PCBs are the major contaminants of concern to NOAA. During the Confirmation Study, contaminant investigations groundwater sample collected from a monitoring well downgradient of the Pesticide Rinse Area. Dieldrin and endrin were not detected in groundwater samples, but their detection limits were at least two orders of magnitude greater than their respective AWQCs (Table 3).

Summary

Mercury, pesticides, and PCBs have been detected in samples taken from various media at six Dahlgren sites. In particular, mercury was detected in one location at concentrations almost double the action level set by the U.S. Food and Drug Administration for protection of human health. NOAA is concerned that site contaminants could harm nearby wetlands habitats and finfish species in Gambo Creek, the unnamed creek draining Hideaway Pond, and commercial fisheries for eel, shellfish, and finfish in the Potomac River.

Table 3. Maximum concentrations of contaminants measured in water, soil, and sediments from the NWSC Dahlgren site compared with screening guidelines

Contaminant	Ground-water µg/l	AWQC[1] µg/l	Soil mg/kg*	Average U.S. Soil[2] mg/kg	Sediment mg/kg*	ER-L[3] mg/kg
Trace Elements						
Mercury	0.70	0.025	<0.50	0.03	0.08	0.15
Organic Compounds						
DDT	2.0	0.001	110	NA	NT	0.001
DDD	4.0	NA	92	NA	NT	0.002
DDE	2.0	NA	130	NA	NT	0.002
Dieldrin	<1.0	0.0019	160	NA	NT	0.00002
Aldrin	<1.0	NA	2.4	NA	NT	NA
Endrin	<1.0	0.0023	7.0	NA	NT	0.00002
PCBs	<10	0.03	84	NA	NT	0.05

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
*: Expressed as mg/kg wet weight.
NA: Screening guidelines not available.
NT: Not tested.

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3

Naval Weapons Station Yorktown

Yorktown, Virginia

CERCLIS #VA8170024170

Site Exposure Potential

The 4,000-hectare Naval Weapons Stations (NWS) Yorktown facility on the York-James Peninsula in Virginia is bordered by the York River to the northeast and King Creek on the northwest (Figure 1). The York River is a tidal estuarine system that flows to Chesapeake Bay. Tributaries to the river include King, Felgates, Indian Field, and Ballard creeks. The Colonial National Historic Park is immediately southeast of the site; Highway 64 forms the southwestern site boundary.

Since 1918, the facility has been used for weapons maintenance, production, and storage. Asbestos, waste oils, paint, solvents, scrap metal, batteries, ordnance compounds, hydraulic and transmitting fluids, and pesticides have been disposed of or stored here. Twenty potential hazardous waste sites have been identified and grouped into six watersheds: Lee Pond, Roosevelt Pond, Felgates Creek, Indian Field Creek, Ballard Creek, and the York River (Figure 2; Table 1).

Surface water runoff and groundwater discharge to the creeks and rivers are potential sources of contaminant migration. Surface water runoff enters on-site storm water systems and open surface-water ditches and drains, and may discharge to on-site wetlands, creeks, and the York River.

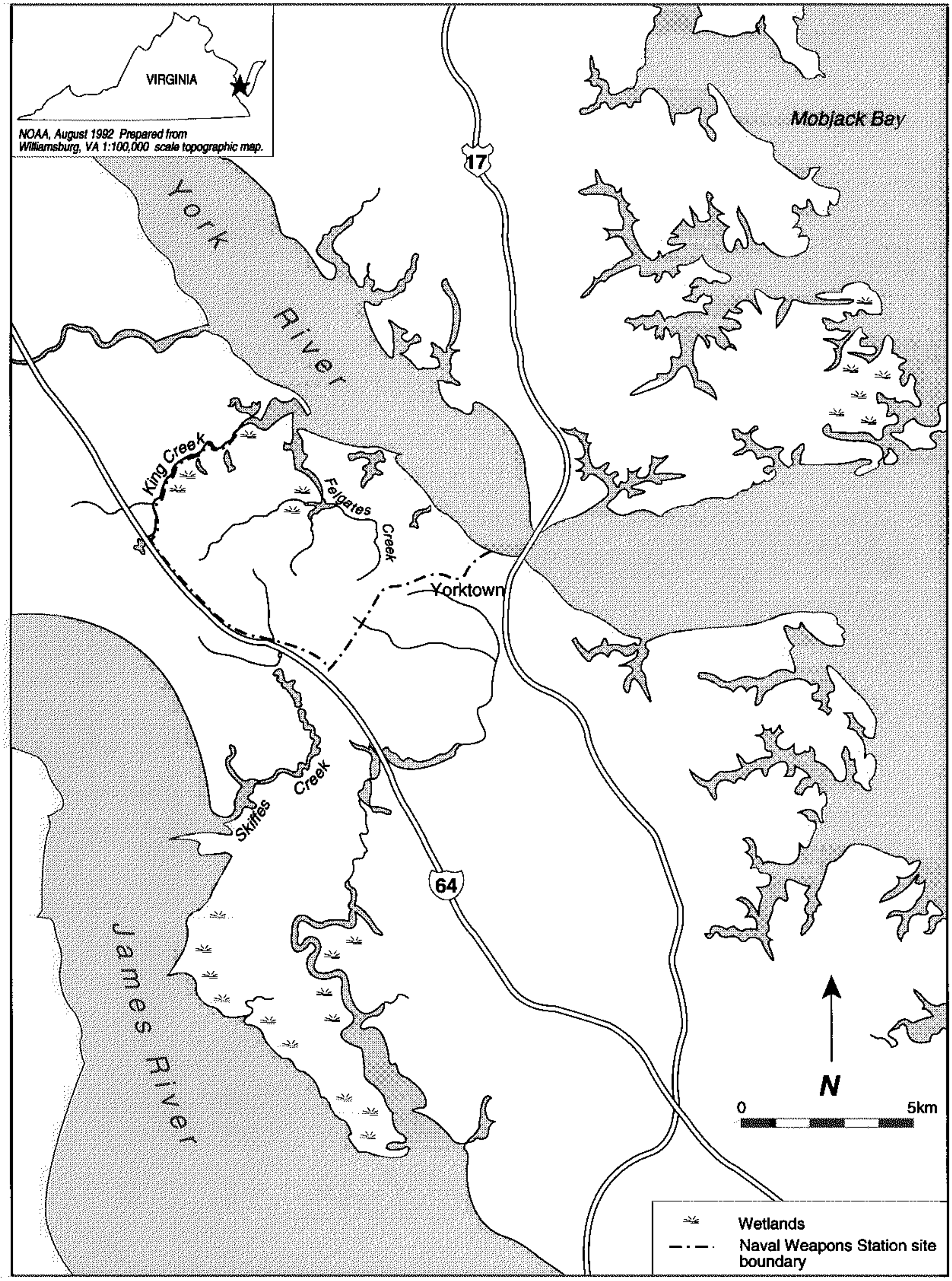

Figure 1. The Naval Weapons Station site, Yorktown, Virginia.

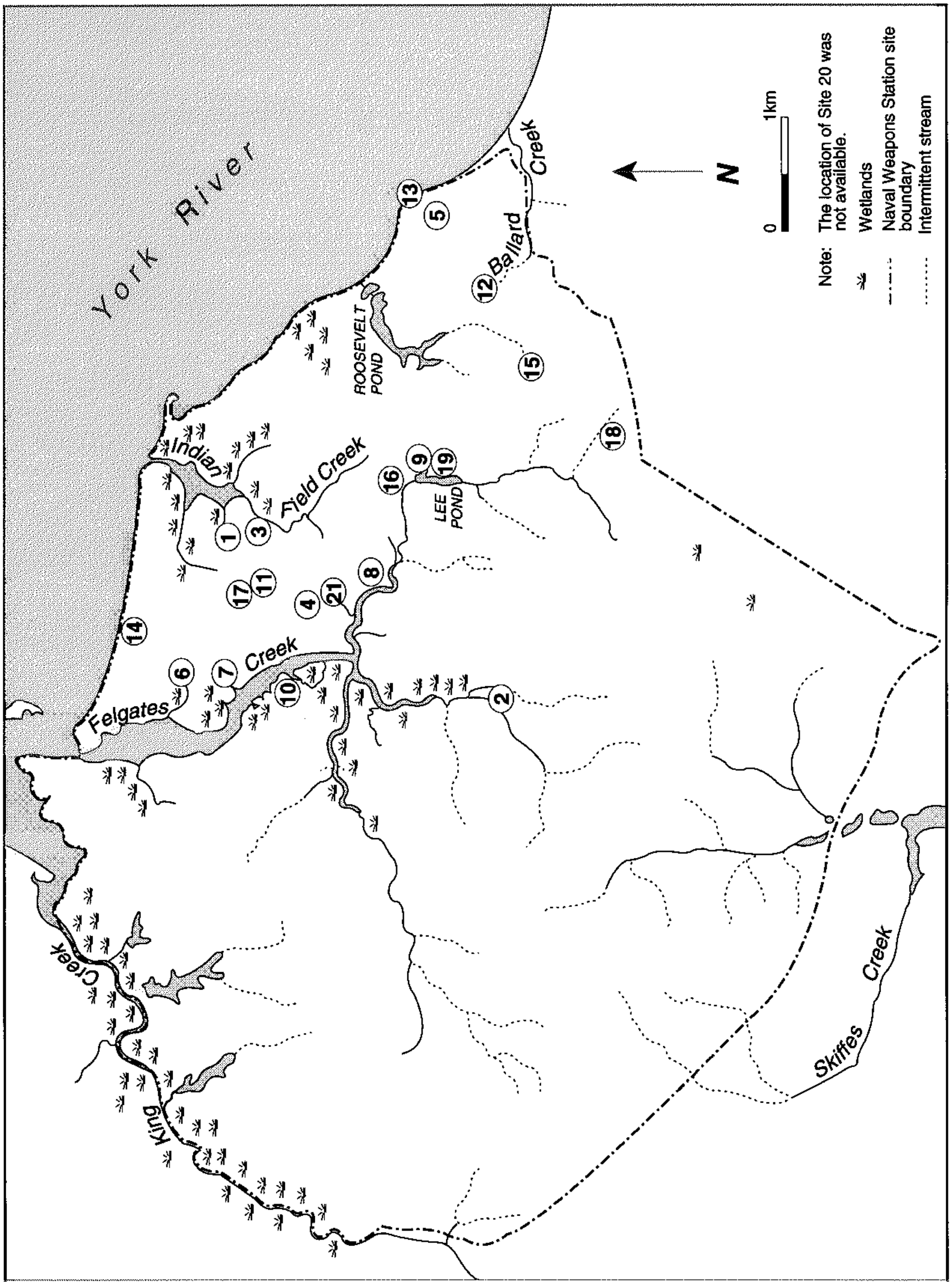

Figure 2. Detail of Naval Weapons Station Yorktown and station locations (Baker Environmental Inc. 1991; U.S.G.S. 1984a,b,c,e).

There are three major aquifers on the peninsula: the water-table, upper artesian, and principal artesian aquifers. Although there is no information on the depths, flow directions, and discharge points of the aquifers, well-drained soils increase the site's potential for contaminating the water

Table 1. Site names, periods of operation, and types of wastes disposed of at 20 hazardous waste sites identified at NWS Yorktown.

Site of Concern	Period of Operation	Types of Wastes Disposed or Spilled
LEE POND WATERSHED		
Site 9: Explosive Contaminated Wastewater Discharge Drainage Area	Late 1930s	trichloroethylene, TNT, RDX, HMX
Site 16: West Road Landfill	1950s-1960s	batteries, banding material, PCB-contaminated pressure transmitting fluid, chemicals
Site 18: Building 476 Discharges	1940s-1960s	mercury, nickel, cadmium, lead
Site 19: Conveyor Belt Soils at Building 10	1940-1970s	TNT, RDX
ROOSEVELT POND WATERSHED		
Site 15: Electrical Shop Disposal Area	1973	copper and other wires, concrete, telephone poles, metals
FELGATES CREEK WATERSHED		
Site 2: Turkey Road Landfill	1940-1981	mercury and zinc-carbon batteries, construction rubble, missile hardware, electrical devices, empty oil drums
Site 4: Burning Pad Residue Landfill	1940-1975	burning pad residues (e.g., TNT, RDX, 2,4-DNT), weapon batteries, fly ash, mine casings, electrical equipment, PCBs
Site 6: Explosive Contaminated Wastewater Impoundment	1942-1975	solvents (e.g., trichloroethylene, trichloroethane, cyclohexanone), explosive residues (e.g., TNT, RDX, 2,4-DNT)
Site 7: Plant 3 Explosive Contaminated Waste-water Discharge Area	1945-1975	explosive residues (e.g., TNT, RDX), trichloroethylene, cyclohexane
Site 8: NEDED Explosive Contaminated Waste-water Discharge Area	1940-1975	spent/neutralized acids, trichloroethylene, acetone, cyclohexane, explosive residues (e.g., TNT, RDX, 2,4-DNT, HMX)
Site 10: Felgate Crossing Fill Area	1940s	plaster-filled mines, ordnance steel, inactive military hardware
Site 21: Battery and Drum Disposal Area	Unknown	VOCs, trace elements, pesticides, BNAs, PCBs
INDIAN FIELD CREEK WATERSHED		
Site 1: Dudley Road Landfill	1965-1981	asbestos, oil, grease, paint, solvents, explosive contaminated carbon, appliances, scrap metal, plastics, lumber, packaging wastes, waste oil
Site 3: Group 16 Magazines Landfill	1940-1970	grease trap wastes, sludge from boiler cleaning operation, solvents (e.g., trichloroethylene, methylene chloride), Imhoff tank skimmings (oils)
Site 11: Aberdeen. Explosives Pits	1930-1950	TNT, RDX, HMX
Site 17: Holm Road Landfill	1950s-1960s	PCB-contaminated hydraulic fluids, batteries from underwater weapons, scrap metals
BALLARD CREEK WATERSHED		
Site 12: Barracks Road Landfill	1925-mid-1960s	garbage, scrap wood, explosive contaminated packaging, solvents
YORK RIVER WATERSHED		
Site 5: Surplus Transformer Storage Area	1940-1981	PCBs
Site 13: Building Rubble Disposal Site	Demolished in 1977	asbestos
Site 14: Aviation Field	1930s	munitions

table aquifer. Shallow groundwater can potentially discharge to nearby surface water features or migrate downward toward the upper and principal artesian aquifers through leaks or cracks in the confining layers.

NOAA Trust Habitats and Species

Habitats of concern to NOAA are the surface water, associated bottom substrates, and estuarine emergent wetlands associated with King, Felgates, Indian Field, and Ballard creeks, and the York River. Surface water and substrates of Roosevelt and Lee Ponds are potential secondary habitats of concern (Figure 2). Roosevelt Pond discharges directly to the York River, while Lee Pond flows into Felgates Creek.

Salinities in the York River near the site range from 15 to 20 ppt and fluctuate throughout the year depending on rainfall, saltwater intrusion, and urban runoff. The creeks entering the base from the York River are tidally influenced about 2 km inland from the river. The York River's substrate consists mainly of mud and sand; submerged aquatic vegetation in the river near the facility is primarily eel grass (*Zostera marina*; Olney personal communication 1992).

Wetlands and creeks within the base provide nursery and adult habitat for numerous trustee species (Table 2; Olney personal communication 1992; O'Reilly personal communication 1992). No one plant community dominates the brackish water marsh wetlands associated with King Creek, although large stands of saltmarsh cordgrass (*Spartina alterniflora*) predominate towards the more saline mouth of the creek. Felgates Creek branches into three prongs about 3 km from its narrow mouth, with saltmarsh cordgrass, cattail (*Typha spp.*), and saltmarsh bulrush (*Scirpus robustus*) dominating the marsh vegetation. Saltmarsh cordgrass also dominates the fringing marshes of Indian Field Creek (Silberhorn 1981).

Five species of anadromous fish use the York River for migratory and adult habitat: blueback herring, alewife, American shad, white perch, and striped bass (Olney personal communication 1992; O'Reilly personal communication 1992). Spot and Atlantic croaker commonly use this reach of the river during the spring and summer for adult forage and juvenile rearing. Resident species of the York River include large numbers of hogchoker, weakfish, and oyster toadfish. Historically there are an unknown amount of eastern oyster found in this reach of the river. There are catadromous American eel throughout the area.

Although limited data were available regarding the resource use of the creeks within the site, tidal exchange and proximity to the York River would suggest that trust species regularly use the creeks. Anadromous fish using the York River for migratory and adult habitat are considered likely to use the creeks throughout the base as nursery habitat.

Table 2. Major species that use theYork River near the Yorktown site.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm.	Recr.
ANADROMOUS /CATADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*		◆	◆	◆	
American shad	*Alosa sapidissima*		◆	◆	◆	
Alewife	*Alosa pseudoharengus*		◆	◆	◆	
American eel	*Anguilla rostrata*		◆	◆	◆	
White perch	*Morone americana*		◆	◆		
Striped bass	*Morone saxatilis*		◆	◆	◆	◆
ESTUARINE /MARINE FISH						
Bay anchovy	*Anchoa mitchilli*	◆	◆	◆	◆	
Atlantic manhaden	*Brevoortia tyrannus*		◆	◆	◆	
Weakfish	*Cynoscion regalis*	◆	◆	◆	◆	◆
Gizard shad	*Dorosoma cepedianum*	◆	◆	◆	◆	
Banded killifish	*Fundulus diaphanus*	◆	◆	◆		
Mummichog	*Fundulus heteroclitus*	◆	◆	◆		
Spot	*Leiostomus xanthurus*		◆	◆	◆	◆
Rough silverside	*Membras martinica*		◆	◆		
Atlantic silverside	*Menidia menidia*		◆	◆		
Inland silverside	*Menidia beryllina*		◆	◆		
Atlantic croaker	*Micropongonias undulatus*		◆	◆	◆	◆
Oyster toadfish	*Opsanus tau*	◆	◆	◆		
Summer flounder	*Paralichthys dentatus*	◆	◆	◆	◆	◆
Bluefish	*Pomatomus saltatrix*		◆	◆	◆	◆
Winter flounder	*Pseudopleuronectes americanus*	◆	◆	◆		◆
Northern puffer	*Sphoeroides maculatus*		◆	◆		◆
Hogchoker	*Trinectes maculatus*	◆	◆	◆		
INVERTEBRATES						
Blue crab	*Callinectus sapidus*	◆	◆	◆	◆	◆
Eastern oyster	*Crassostrea viginica*		◆	◆	◆	◆
Hardshell clam	*Mercenaria mercenaria*	◆	◆	◆	◆	◆
Softshell clam	*Mya arenaria*	◆	◆	◆	◆	◆

Juvenile (elvers) American eel periodically occur in high concentrations in the creeks. Numerous estuarine and marine species use the creeks within the site, including blue crab, eastern oyster, flounder, killifish, mummichog, silverside, soft shell clam, and weakfish (Loftin personal communication 1993). Roosevelt and Lee ponds provide habitat for numerous freshwater fishes. Although NOAA trust finfish and invertebrates are restricted from entering these ponds by several downstream barriers, American eel can breach the barriers and use both ponds (Loftin personal communication 1993; Wilson personal communication 1993).

The York River supports important recreational and commercial fisheries. Species commercially harvested in greatest numbers include American shad, Atlantic croaker, summer flounder, bay anchovy, bluefish, weakfish, and blue crab (O'Reilly personal communication 1992). Popular sport fisheries include striped bass, weakfish, spot, Atlantic croaker, summer flounder, and northern puffer. Recreational and commercial crabbers harvest blue crab from March through November. There are no closures or health advisories for fish consumption reported for the area (Olney personal communication 1992).

There are no known endangered or threatened species near the site, although several species of endangered sea turtles (e.g., green, hawksbill, loggerhead, and Atlantic ridley turtles) feed in Chesapeake Bay. It is possible that any of these species may occasionally migrate up the York River near the site.

Site-Related Contamination

Data collected during preliminary site investigations indicate that soil, groundwater, surface water, and sediment at the base are contaminated with trace elements, PAHs, pesticides, PCBs, and ordnance compounds (Baker Environmental, Inc. 1992). VOCs were also measured in on-site media, but at concentrations less than those known to threaten NOAA resources. The maximum concentrations of the trace elements detected at the site are summarized in Tables 3 and 4, along with applicable screening guidelines (Lindsay 1979; U.S. EPA 1986; Long and Morgan 1990). Contaminant data were available for sites in the Lee Pond, Felgates Creek, Indian Field Creek, Ballard Creek, and York River watersheds. Not all media were collected at all sites within these watersheds, and not all contaminants were analyzed in all media.

Lead and zinc were the only trace elements detected in soils collected from sites in the Lee Pond watershed at concentrations exceeding the average U.S. soil concentrations. Trace elements were not detected in groundwater, surface water, or sediment from the pond at concentrations exceeding screening guidelines. The total PAH concentration (150 mg/kg) in sediments collected from the pond exceeded the ER-L concentration (4 mg/kg); PAHs were not detected in any other media sampled within the watershed at high concentrations. The pesticide BHC was measured in groundwater (0.084 μg/l) from sites in the watershed and in surface water (0.057 μg/l) and sediment (16 mg/kg) from Lee Pond. There are no screening guidelines for BHC in any of these media. Concentrations of heptachlor detected in groundwater (0.024 μg/l) and of dieldrin detected in sediments (0.014 mg/kg) from Lee Pond were up to two orders of magnitude greater than their screening guidelines.

Concentrations of arsenic, cadmium, copper, lead, mercury, and zinc in soils from sites in the Felgates Creek watershed exceeded average U.S. soil concentrations. Except for arsenic and cadmium, these trace elements were also measured in groundwater from these sites at concentrations

Table 3. Maximum concentrations of trace elements in soils and sediments collected from four watersheds at the site.

	Soil (mg/kg)					Sediment (mg/kg)				
	Lee Pond	Felgates Creek	Indian Field Creek	Ballard Creek	Average U.S.[1]	Lee Pond	Felgates Creek	Indian Field Creek	Ballard Creek	ER-L[2]
Trace Elements										
Arsenic	NT	11	NT	NT	5	7.5	13	NT	7.4	33
Cadmium	ND	2.6	NT	NT	0.06	ND	1.3	NT	7.2	5
Chromium	8	38	NT	NT	100	28	110	NT	63	80
Copper	NT	47	NT	NT	30	10	21	NT	570	70
Lead	14	92	NT	NT	10	32	170	NT	250	35
Mercury	NT	3.3	NT	NT	0.03	NT	ND	NT	0.68	0.15
Nickel	7.3	22	NT	NT	40	ND	14	NT	24	30
Silver	NT	ND	NT	NT	0.05	0.3	7.3	NT	2.4	1
Zinc	56	1,000	NT	NT	50	110	140	NT	730	120
Ordnance Compounds										
2,4-DNT	3.1	ND	NT	NT	NA	ND	17	ND	ND	NA
HMX	ND	ND	NT	NT	NA	ND	44	ND	ND	NA
RDX	2.7	850	NT	NT	NA	ND	ND	1.1	ND	NA
TNT	1430	3400	NT	NT	NA	ND	1240	ND	2.7	NA

1: Lindsay (1979).
2: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
NA: Screening level not available.
ND: Not detected at method detection limit.
NT: Not tested.

Table 4. Maximum concentrations of trace elements in groundwater and surface water collected from four watersheds at the site.

	Groundwater (µg/l)				Surface Water (µg/l)				
	Lee Pond	Felgates Creek	Indian Field Creek	Ballard Creek	Lee Pond	Felgates Creek	Indian Field Creek	Ballard Creek	AWQC[1]
Trace Elements									
Arsenic	ND	83	7.5	ND	ND	9.4	3.7	ND	36
Cadmium	NT	85	1.0	ND	9	ND	NT	4	9.3
Chromium	ND	260	ND	ND	6	8	14	6	50
Copper	5.1	82	ND	ND	4	13	ND	6	2.9*
Lead	1.8	110	1.1	ND	ND	85	82	ND	8.5
Mercury	NT	0.33	ND	ND	NT	ND	0.26	0.2	0.025
Nickel	NT	75	13	11	6	ND	ND	15	8.3
Silver	ND	15	ND	ND	ND	9.4	18	ND	0.92
Zinc	72	19,000	140	16	44	73	31	110	86
Ordnance Compounds									
2,4-DNT	NT	ND	ND	ND	ND	ND	ND	ND	NA
HMX	NT	ND	0.72	ND	0.17	1.7	ND	ND	NA
RDX	NT	ND	9.0	0.011	23	2.0	ND	ND	NA
TNT	NT	ND	0.13	0.05	19	0.55	ND	9.0	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (U.S. EPA 1986).
*: Acute criteria presented; chronic criteria not available.
ND: Not detected at method detection limit.
NT: Not tested.

exceeding marine AWQC by an order of magnitude. Total PAHs (17 mg/kg) and PCBs (0.94 mg/kg) were detected in soils collected from sites in the Felgates Creek watershed. There are no screening guidelines for PAHs or PCBs in soils. Two pesticides were measured in media from sites in the watershed at high concentrations: BHC in groundwater (0.006 µg/l), surface water (190 µg/l), and sediment (6.5 mg/kg) from Felgates Creek; and endosulfan sulfate in soils (0.61 mg/kg).

Trace elements were not tested in soils from the sites or in sediments from the creek and were not detected at elevated concentrations in groundwater from sites in the Indian Field Creek watershed. However, lead, mercury, and silver were measured in surface water from Indian Field Creek at concentrations exceeding marine chronic AWQC. BHC (2.3 mg/kg) was detected in sediment from Indian Field Creek, but was either not detected or not tested for in other media from the watershed.

Soils collected from the one site identified in the Ballard Creek watershed were not analyzed for trace elements. Concentrations of trace elements in groundwater did not exceed ten-times marine chronic AWQC, although they were measured in surface water and sediments from the creek at concentrations exceeding applicable screening guidelines. Sediments from Ballard Creek also contained elevated concentrations of total PAHs (23 mg/kg), BHC (0.084 mg/kg), DDT (0.062 mg/kg), and chlordane (2.8 mg/kg). These organic compounds exceeded available screening guidelines by one to three orders of magnitude.

Soil was the only medium collected from the York River shoreline. PCBs were measured at a maximum concentration of 1.9 mg/kg at Site 5.

Ordnance compounds, including TNT, RDX, HMX, and 2,4 -DNT were detected in samples of different media types collected throughout the Yorktown site (Tables 3 and 4). The highest concentrations of ordnance compounds in soil were detected in samples collected from Sites 6, 7, and 19. Screening guidelines for ordnance compounds in soils and sediments were not available. RDX was detected at the highest concentrations in groundwater and surface water. In general, the maximum concentrations of ordnance compounds in groundwater and surface water were found in samples collected from Sites 4 and 9, respectively. Screening guidelines have not been developed for ordnance compounds in surface water.

Summary

The creeks and wetlands around the base are vital nursery grounds and adult foraging habitat: 60 percent of commercial and recreational fish and shellfish depend on these types of habitats during at lease one stage of their life cycles. Soils and groundwater are contaminated by trace metals, PAHs, PCBs, and pesticides. Except for PCBs, all of these contaminants have been detected in either surface water or sediments in these habitats. These contaminants are extremely persistent in aquatic systems and may threaten sensitive life stages of NOAA trust species or their supporting habitat.

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4

Helena Chemical Company

Tampa, Florida

CERCLIS #FLD053502696

Site Exposure Potential

The Helena Chemical Company site is in Tampa, Hillsborough County, Florida (Figure 1). The 3.2-hectare site is bordered to the south by the Seaboard Coastline Railroad, to the west by 71st Street, to the north by 14th Avenue, and to the east by Orient Road. The site is relatively level and is in a mixed industrial-residential area beyond the 500-year flood zone. However, the site occasionally floods in heavy rains due to saturation of the surficial aquifer (NUS 1990). The site is about .5 km west of the Tampa Bypass Canal, which discharges into the Palm River, about 2 km downstream from the site. The Palm River enters McKay Bay 4 km below the confluence of the river and the canal. The confluence of Palm River and McKay Bay is about 3 km from Hillsborough Bay. The site is about 64 km from the Gulf of Mexico. Stauffer Chemical Company is immediately southeast (downstream) of the Helena site. No culverts or drainage pathways could be identified which would allow drainage between the Stauffer Chemical Company site and the Helena Chemical Company site (NUS 1988).

The site was built for sulfur production in 1929. It was purchased from Flas Sulphur in 1967 and converted to an agricultural chemical manufacturing operation that included pesticide production. In 1981, the agricultural chemical manufacturing shifted to Helena Chemical Company's Cordele,

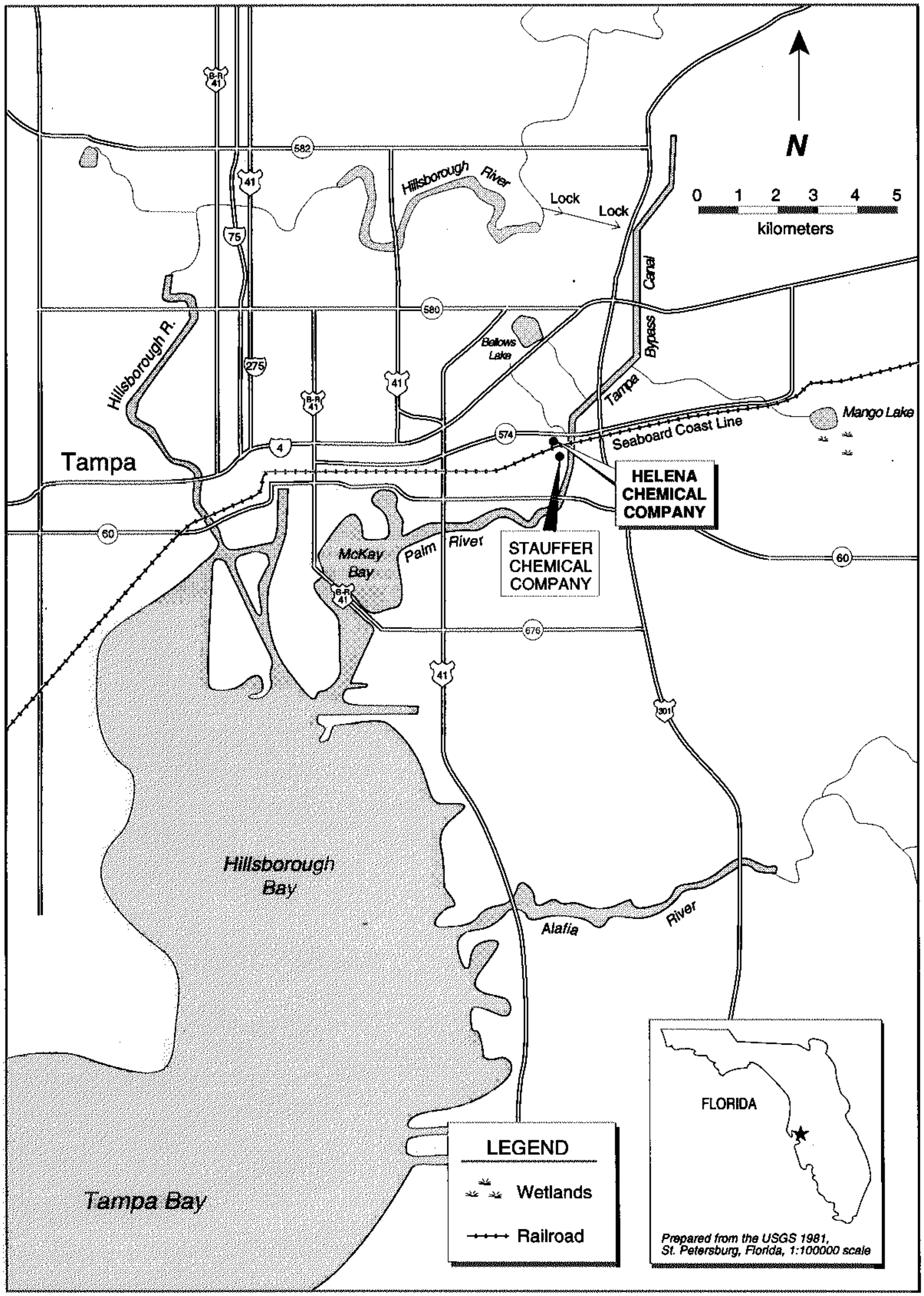

Figure 1. Helena Chemical Company, Tampa, Florida.

Georgia facility. Site operations mostly ceased but continued to involve repacking bulk agricultural chemicals, warehousing, distribution, and the manufacture of liquid fertilizers on a demand basis. Several potential sources of contamination have been identified on the site, including three tanks from the former pollution control system, an unlined retention pond, and areas of contaminated soils. Surface water and groundwater are potential pathways for migration of contaminants to NOAA trust habitats.

Drains in the pesticide manufacturing areas emptied into the first tank of the pollution control system. The size and construction of this tank is unknown. Wastes from the first tank were mixed with caustic soda in a second tank constructed of poured concrete and rebar, measuring 1.8 m wide by 2.4 m long by 1.8 m deep. The mixture was then transferred to a third tank, constructed of concrete blocks, poured cement, and rebar, measuring 3.0 m wide by 6.1 m long by 1.8 m deep. This tank was equipped with a circulation pump and aeration system for liquid phase evaporation. The sludge was removed from tank three and shipped to an approved hazardous substances landfill off-site. In 1981, the pollution control system was closed and the three tanks were cleaned and scrubbed. The first tank was filled with concrete. The above-ground portions of the second and third tanks were knocked down and the remaining structures were filled with sand and gravel and capped with concrete. These tanks remain on-site (Figure 2; NUS 1990).

The 970-m^2 retention pond, with an estimated volume of 890 m^3, is at the southeast corner of the site. Drainage on the site is directed to a concrete culvert which channels into the pond. There is no liner or leachate collection system. A concrete spillway at the southeast corner of the pond allows overflow to leave the site, go under Orient Road, and proceed east to the Tampa Bypass Canal. The pond has overflowed more than once a year since 1979 (NUS 1990).

Groundwater contamination in the surficial aquifer could discharge into the canal, or enter the Upper Floridan aquifer, which is the public water supply. The unconfined surficial aquifer occurs within terrace deposits, and flows south and southwest, except locally to streams and ponds. The terrace deposits average 7.6 m thick. The Hawthorn Formation of clay provides a semi-permeable confining layer 7.6 to 10.7 m below ground surface. The limestone formations containing the Upper Floridan aquifer are below the Hawthorn Formation. Groundwater in the Upper Floridan aquifer flows south to southwest. On-site, the status of the clay separating the surficial aquifer from the Upper Floridan aquifer is unknown. However, the clay layer thins near the canal. This confining layer was breached several times during construction of the canal, leaving the limestones of the Upper Floridan aquifer in contact with the canal water (NUS 1988).

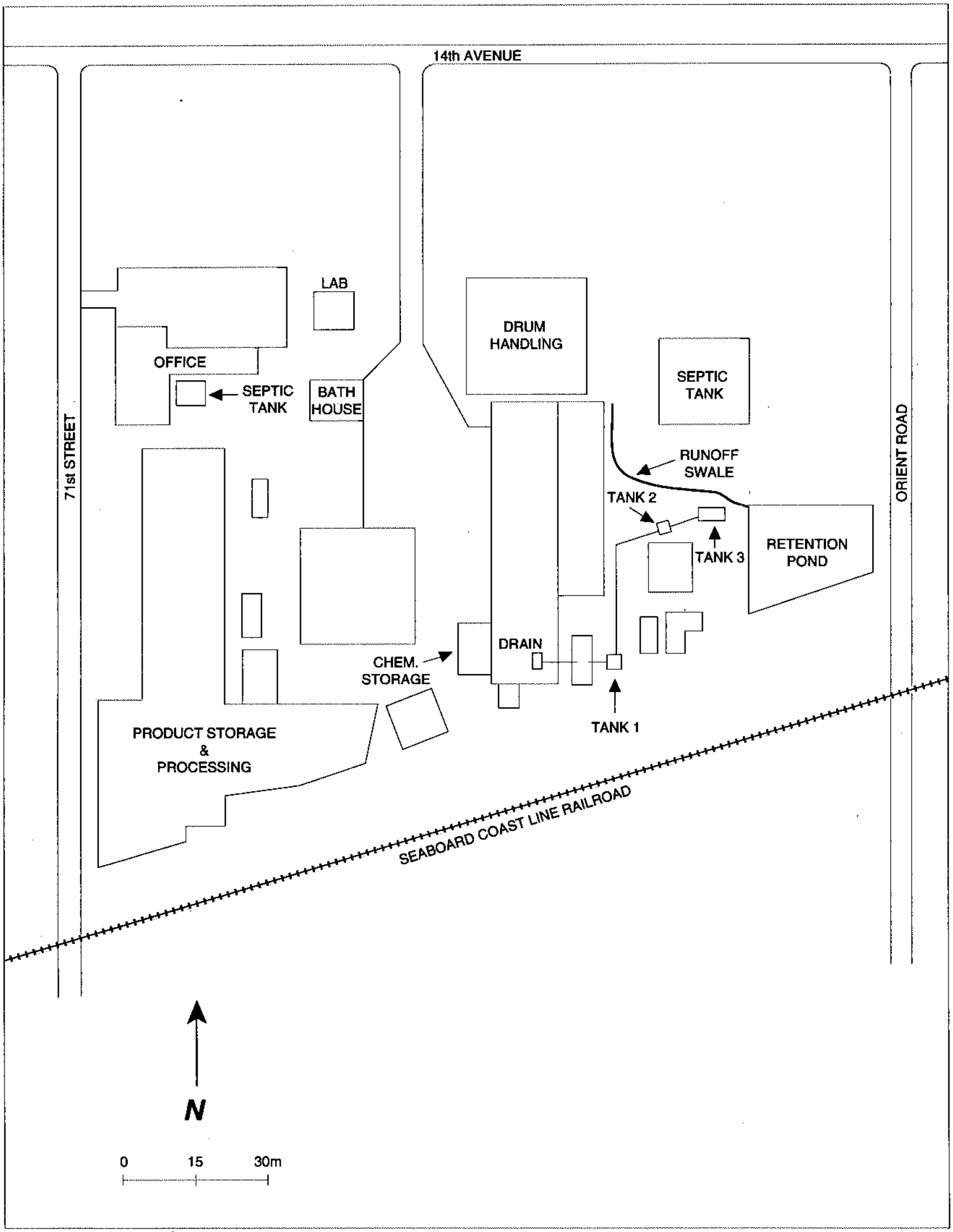

Figure 2. Site map showing components of the waste treatment system and holding areas (NUS 1990).

NOAA Trust Habitats and Species

Habitats of primary concern to NOAA are surface waters and associated bottom substrates of the Palm River, McKay Bay, and Hillsborough Bay. Secondary habitats of concern are surface waters and associated bottom substrates of the Tampa Bypass Canal. The Palm River and McKay Bay are tidally influenced estuarine systems that are generally less than 8 m deep. Salinities in McKay Bay generally range from 22 to 25 ppt and fluctuate throughout the year depending on rainfall, saltwater intrusion, and urban runoff (Estevez 1989). The tidal amplitude in McKay Bay is generally less than 1 m (McMichael personal communication 1992). Water-quality problems in the Tampa Bypass Canal and Palm River include low dissolved oxygen levels (annual averages ranging from 1.8 to 3.2 mg/l between 1980 and 1983) and high coliform counts, elevated nutrient and chlorophyll a concentrations, and elevated biological oxygen demand. General water-quality conditions tend to worsen toward McKay Bay, which is more urbanized and has more point sources (Wolfe 1990). The bottom substrate is dominated by silty sand (Dial and Deis 1986).

The tidally influenced reaches of the Palm River, McKay Bay, and Hillsborough Bay provide nursery and adult habitat for fish and invertebrates (Table 1; Beccasio et al. 1982; Kunneke and Palik 1984; McMichael personal communication 1992). Estuarine-dependent species that are economically important include red and black drum, spotted seatrout, snook, sheepshead, southern flounder, Florida pompano, striped mullet, and gulf menhaden. Most of these species are offshore or coastal spawners whose larvae move inshore with the currents. Juveniles remain in protected estuaries until sexual maturity (Kunneke and Palik 1984). Snook and red drum juveniles use the upper reaches of estuaries and commonly use brackish streams and canals and tidal freshwater streams (Gilmore et al. 1983; Peters and McMichael 1987). Finfish species known to occur in greatest numbers in McKay Bay include tidewater silversides, striped mullet, longnose killifish, bay anchovy, spot, scaled sardine, and pinfish (Wolfe 1990; McMichael personal communication 1992). There are blue crab in McKay Bay and likely in the tidally influenced portions of the Palm River (McMichael personal communication 1989). There have been no monitoring studies in the Tampa Bypass Canal to determine the presence of marine species, but it is believed that there are few, if any, marine species to be found in the canal. The Palm River would most likely be the nearest habitat to be used by NOAA trustee resources (McMichael personal communication 1992).

Species targeted for commercial harvest in Hillsborough Bay include blue crab, menhaden, mullet, pink shrimp, spot, and spotted seatrout. Striped mullet is the most important commercial species in the bay. Generally, species in McKay Bay are fished recreationally, including red drum, sheepshead, snook, and spotted seatrout. There are no restrictions on these fisheries other than general regulations regarding take limit and minimum size. Periodically, blue crab is harvested

Table 1. NOAA trust fish and invertebrate species that use Hillsborough Bay, McKay Bay, and the Palm River.

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
MARINE/ESTUARINE FISH SPECIES						
Bay anchovy	*Anchoa mitchilli*		♦	♦		
Sheepshead	*Archosargus probatocephalus*			♦		♦
American eel	*Anguilla rostrata*			♦		
Silver perch	*Bairdiella chrysoura*		♦	♦		
Gulf menhaden	*Brevoortia patronus*		♦	♦	♦	
Crevelle jack	*Caranx hippos*		♦	♦		
Snook	*Centropomus undecimalis*		♦	♦		♦
Sand seatrout	*Cynoscion arenarius*		♦	♦		
Spotted seatrout	*Cynoscion nebulosus*		♦	♦	♦	♦
Lady fish	*Elops saurus*		♦	♦		
Mojarra	*Eucinostomus* spp.		♦	♦		
Gulf killifish	*Fundulus grandis*	♦	♦	♦		
Longnose killifish	*Fundulus similis*	♦	♦	♦		
Scaled sardine	*Harengula jaguana*		♦	♦		
Pinfish	*Lagodon rhomboides*		♦	♦		
Spot	*Leiostomus xanthurus*		♦	♦	♦	
Gray snapper	*Lutjanus griseus*			♦		
Tarpon	*Megalops atlanticus*		♦	♦		
Tidewater silverside	*Menidia peninsula*		♦	♦		
Southern kingfish	*Menticirrhus americanus*			♦		
Atlantic croaker	*Micropogonias undulatus*			♦		
Striped mullet	*Mugil cephalus*		♦	♦	♦	
Atlantic thread herring	*Opisthonema oglinum*		♦	♦		
Pigfish	*Orthopristis chrysoptera*		♦	♦		
Gulf flounder	*Paralichthys albigutta*		♦	♦		
Southern flounder	*Paralichthys lethostigma*		♦	♦		
Black drum	*Pogonias cromis*		♦	♦		
Bluefish	*Pomatomus saltatrix*		♦	♦		
Red drum	*Sciaenops ocellatus*		♦	♦		♦
Spanish mackerel	*Scomberomorus maculatus*		♦	♦		
Florida pompano	*Trachinotus carolinus*		♦			
INVERTEBRATE SPECIES						
Blue crab	*Callinectes sapidus*		♦	♦	♦	
American oyster	*Crassostrea virginica*	♦	♦	♦		
Spiny lobster	*Panulirus argus*		♦			
Pink shrimp	*Penaeus duorarum*		♦		♦	
Common rangia	*Rangia cuneata*	♦	♦	♦		

from McKay Bay (McMichael personal communication 1992). In the region, most commercial and recreational fishing activities concentrate in Tampa Bay and in Old Tampa Bay, both south and west of Hillsborough Bay (Beccasio et al. 1982; McMichael personal communication 1992).

The surface waters of Hillsborough and Tampa bays provide habitat for several threatened and endangered species. The federally endangered West Indian manatee (*Trichechus manatus*) uses these bays as a habitat on a seasonal basis. Several federally protected species of turtles are found in this area. These include the threatened green turtle (*Chelonia mydas*) and loggerhead turtle

(*Caretta caretta*), along with the endangered hawksbill turtle (*Eretmocheyls imbricata*), Kemp's ridley turtle (*Lepidochelys kempi*), and the leatherback turtle (*Dermochelys coriacea*; Beccasio et al. 1982).

Site-Related Contamination

Pesticides were the predominant site contaminants, although some trace element contamination was also observed (Table 2). Arsenic was detected in soil and pond sediment collected from the site in unknown concentrations. Arsenic was also detected in the groundwater (46 µg/l), but at concentrations below the chronic AWQC for the protection of freshwater organisms. Zinc was found at 1,600 µg/l in the groundwater, more than ten times the freshwater chronic AWQC.

Organochlorine pesticides were detected in soil, sediment, and groundwater. Organophosphate pesticides were detected in soil only. No pesticides were detected in surface water samples from the retention pond.

The highest concentrations of pesticides were generally found in the soil and included aldrin, heptachlor epoxide, delta-BHC, endosulfan I, 4,4'-DDT and its associated degradation products, endrin, toxaphene, methyl parathion, malathion, parathion, and EPN (ethyl-p-nitrophenyl thionobenzenephosphonate). DDT and its metabolites were the primary sediment contaminants with concentrations that exceeded the ER-L concentration of Long and Morgan (1990) by more than 10,000 times. Toxaphene was also a sediment contaminant (260 mg/kg).

Groundwater contaminants included alpha-BHC. beta-BHC, BHC, endrin, endosulfan sulfate, and dieldrin. Endrin and dieldrin contamination exceeded the freshwater chronic AWQC by more than 100 times. The only surface water sample taken was from the retention pond (Table 2).

Documentation noted that, of the pesticides detected, alpha-BHC, endrin, toxaphene, methyl parathion, malathion, parathion and EPN were attributable to on-site activities (NUS 1990).

Summary

Arsenic, zinc, and organo-chlorine pesticides were detected in soil, sediment, and groundwater associated with the site. The closest habitat of concern to NOAA is the Palm River, 2 km downstream of the site, with McKay and Hillsborough bays also of concern.
Overflow from an unlined retention pond that holds surface water runoff from the site empties into the Tampa Bypass Canal. Groundwater in the contaminated surficial aquifer could discharge into the canal.

Table 2. Maximum concentrations of contaminants in samples collected for the Final Screening Site Inspection Report of June 1990 and HRS Documentation Record of August 1991.

Chemicals	Soil mg/kg	Sediment mg/kg	ER-L1 mg/kg	Groundwater µg/l	Surface water µg/l	AWQC2 µg/l
INORGANIC SUBSTANCES						
Arsenic	D	D	33	46	ND	190
Zinc	ND	D	120	1,600	ND	110+
PESTICIDES						
Organo-chlorine pesticides						
Aldrin	.36	ND	NA	ND	ND	NA
Heptachlor epoxide	.63	ND	NA	ND	ND	NA
Alpha-BHC	ND	ND	NA	0.79	ND	NA
Beta-BHC	ND	ND	NA	0.68	ND	NA
Delta-BHC	.20	ND	NA	0.49	ND	NA
Endosulfan I (alpha)	.88	ND	NA	ND	ND	0.056
4,4'-DDT	100	.67	0.001	ND	ND	0.001
4,4'-DDE	41	34	0.002	ND	ND	NA
4,4'-DDD	150	190	0.002	ND	ND	NA
DDT Total	210	220	0.003	ND	ND	NA
Endrin	.37	ND	0.00002	3.50	ND	0.0023
Endosulfan sulfate	ND	ND	NA	0.28	ND	NA
Toxaphene	3,900	260	NA	ND	ND	0.0002
Dieldrin	ND	ND	0.00002	0.78	ND	0.0019
Organo-phosphate pesticides						
Methyl parathion	3.8	ND	NA	ND	ND	NA
Malathion	1.8	ND	NA	ND	ND	0.1
Parathion	5.3	ND	NA	ND	ND	0.013
EPN	1.4	ND	NA	ND	ND	NA

1: Effects range-low; the concentration representing the lowest 10-percentile concentration for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
2: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1986).
D: Detected, but concentration is unknown.
ND: Not detected at method detection limit.
NA: Screening level not available.
+: Hardness-dependent (100 mg/kg $CaCO_3$ used).

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4

Stauffer Chemical Company

Tarpon Springs, Florida

CERCLIS #FL010596013

Site Exposure Potential

The 65-hectare Stauffer Chemical site is on the north bank of the Anclote River near Tarpon Springs in Pinellas County, Florida (Figure 1). The facility is about 1 km from the mouth of the Anclote River, a tidal estuary that flows into the Gulf of Mexico. The Anclote Key State Preserve is located in the Anclote Keys, about 7 km west of the site.

From 1950 to 1981, the facility manufactured elemental phosphorus from phosphate ore, disposing over 450,000 metric tons of processing wastes on the site. Waste scrubber material was deposited in unlined lagoons, and 900 drums containing approximately 31 metric tons of roaster fines were buried 1 to 2 m below the surface in several areas near the river (Figure 2). Slag discharged to a concrete-lined pit was also used to fill a portion of Myers Cove for construction of an access road. In 1986, activities at the site were decreased to decommission the plant. At that time, precipitated material containing calcium fluoride was dredged from two of the waste lagoons and deposited in piles 12 m from the Anclote River (NUS 1988).

Groundwater discharge and surface water runoff are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. There is groundwater in two

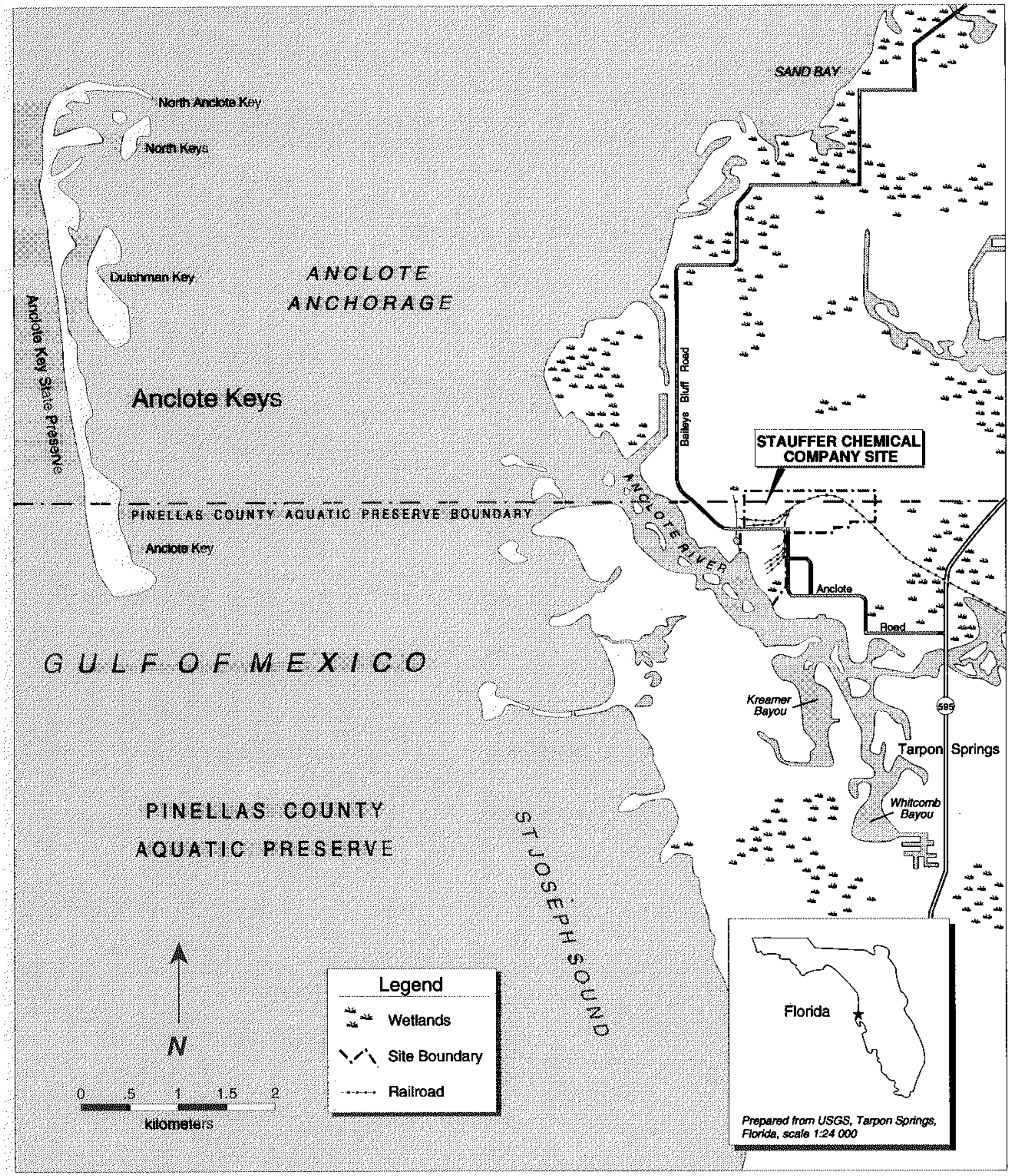

Figure 1. The Stauffer Chemical Company site, Tarpon Springs, Florida.

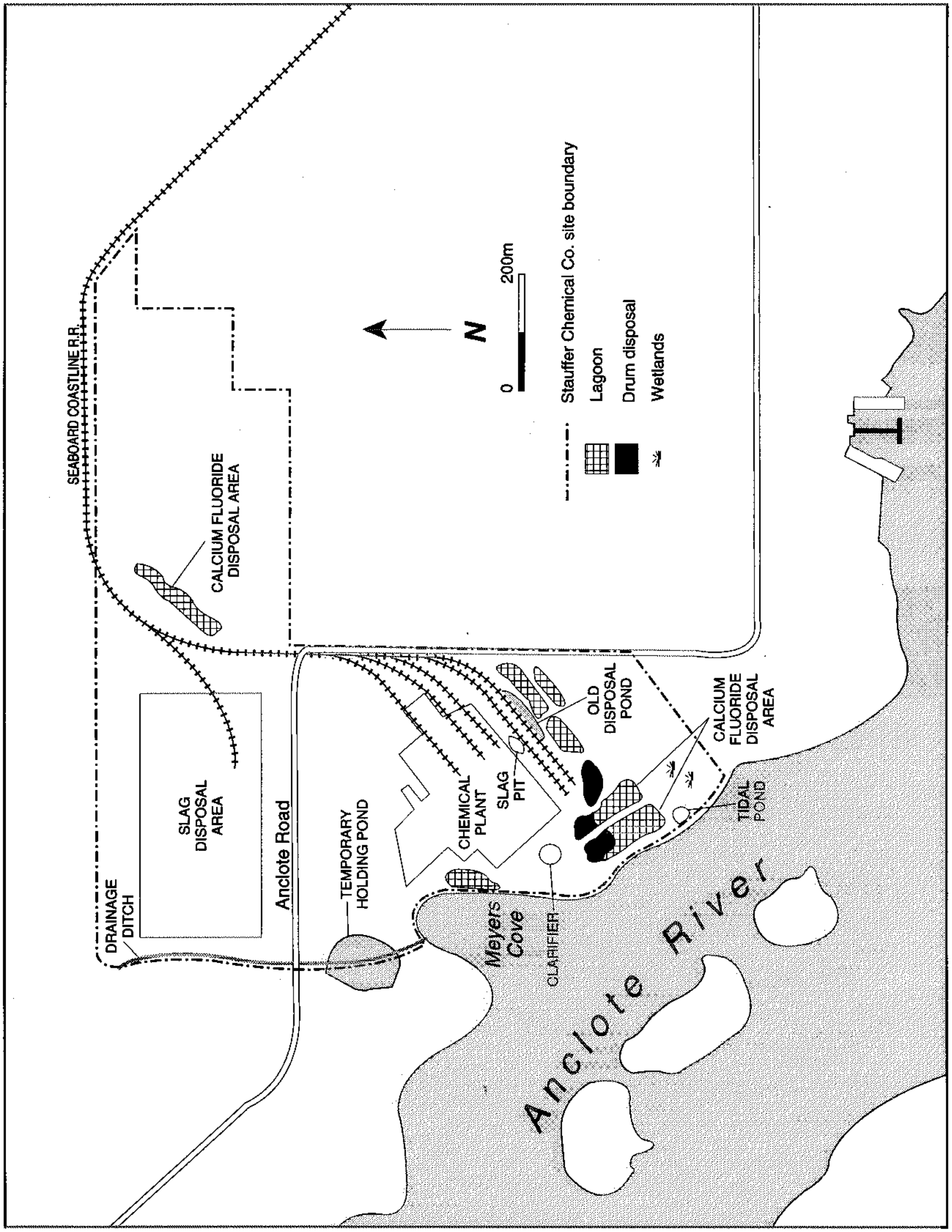

Figure 2. Detail of Stauffer Chemical Company site (NUS 1988; EPA 1991).

aquifers separated by a semi-confining layer that allows an interchange of water between the two zones. The primarily sand surficial aquifer is about 2.5 m below land surface; the primarily limestone Floridan aquifer is about 5 to 11 m below land surface. Even though there is a semi-confining layer, there is no significant vertical gradient between the surficial and Floridan water-bearing zones. The geological formations dip southwesterly from the site, and groundwater flows generally southwest towards the Anclote River. Groundwater quality and water levels near the site may be significantly affected by tidal influences due to the site's proximity to the estuary.

Surface water features on the site include a drainage ditch leading to Myers Cove, a tidal pond with a culvert leading to the river, and a series of lagoons. The drainage ditch runs through a temporary sludge holding pond, and the tidal pond is surrounded with dredge material. Although there is no direct outlet from the lagoons, they are unlined and may be discharging to the groundwater (NUS 1988). Surface water drains from the site directly to the Anclote River.

NOAA Trust Habitats and Species

Habitats of concern to NOAA are surface water and associated bottom substrate of the Anclote River and Anchorage and the Gulf of Mexico. The lower Anclote River is tidally influenced as far as 23 km upstream. A 4.5-m deep ship channel has been dredged from the river mouth to the city of Tarpon Springs. In the lower reaches of the Anclote River, the river meanders through swampy, tidally affected lowlands bordered by several large developments. The river broadens to an average width of 460 m from Tarpon Springs to the Gulf of Mexico, with a mean depth, except for a dredged channel, of about 1 m. Salinity in the mouth of the Anclote River ranges from 0.8 ppt to 32.7 ppt. Salinities in Anclote Anchorage vary seasonally with rainfall and runoff, and diurnally with the tides, generally falling within 14 to 31 ppt. Water quality is generally good in the lower Anclote River above Tarpon Springs (Wolfe 1990).

Aquatic habitats near the site are likely to support diverse and abundant populations of NOAA trust resources; however, there have been no recent ecological studies to identify the Anclote River's aquatic resources. NOAA resources are likely both to migrate and reside near the site for extended periods during sensitive life stages. According to biologists at the South Florida Management District and the Florida Department of Environmental Regulation, limited state funding hindered proposed investigations of the Anclote River. Investigations in the area have been postponed indefinitely (Flannery personal communication 1992; McMichael personal communication 1992; Wolfe personal communication 1992). The most recent sampling studies, done in 1971, identified a variety of trophic levels in the Anclote River and included as many as 112 species of fish. Finfish species found in greatest numbers included anchovy, drum, flounder, grunt, herring, jack, pompano, killifish, mojarra, mullet, porgy, sea catfish, stingray, and tarpon (NUS 1988).

Anclote Anchorage, a shallow area of seagrass beds, is about 4 km west of the site (Figure 1). This anchorage is thought to provide suitable breeding habitat for marine species. Some of the numerous clam and scallop shellfish beds in the estuary are harvested by local residents. The Anclote Key State Preserve is on the Anclote Keys, islands that are west of the Anclote Anchorage. The offshore area south of the Anclote Anchorage is designated as the Pinellas County Aquatic Preserve, a state aquatic preserve (NUS 1988). No information was available to determine the extent of commercial or recreational harvests from these areas.

Surface water surrounding Hillsborough and Pinellas counties provides habitat for several threatened and endangered species. There are several federally protected species of turtles in this area, including the threatened green (*Chelonia mydas*), loggerhead (*Caretta caretta*), the endangered hawksbill (*Eretmocheyls imbricata*), Kemp's ridley (*Lepidochelys kempi*), and the leatherback turtles (*Dermochelys coriacea*) (Beccasio et al. 1982). The extent to which these species use surface water near the site is unknown. The Florida Power & Light Corporation's Anclote Plant is at the mouth of the river. The cooling canal for the plant, about 1.5 km upstream of the site, is a wintering area for the federally endangered West Indian manatee (*Trichechus manatus*) (NUS 1988).

Site-Related Contamination

Data collected during preliminary site investigations indicate that soil, groundwater, surface water, and sediments are contaminated at the Stauffer site (NUS Corporation 1988, 1989). The primary contaminants of concern to NOAA are trace elements, fluoride, and PAHs. Maximum concentrations of the trace elements detected in media from on-site locations are summarized in Table 1, along with applicable screening guidelines.

The highest trace element concentrations in soils were detected near the lagoons, the temporary holding pond, the clarifier, and the southern calcium fluoride piles. PAHs were found in one of five surface samples collected near the lagoons (646 µg/kg) and in one background subsurface sample from the northeast corner of the site (252 µg/kg). Screening criteria were not available for PAHs in soils.

Groundwater samples were collected throughout the site at three depths below the water table: from temporary wells immediately below the water table, from the surficial aquifer, and from the Floridan aquifer. High concentrations of trace elements were detected at all depths. Nickel, chromium, and copper were detected at high concentrations in groundwater samples from a site downgradient across the Anclote River. Because the detection limit for silver was not available, no conclusions could be drawn about silver concentrations in the groundwater. Trace

Table 1. Maximum concentrations of trace elements at the Stauffer site with applicable screening criteria.

	Water (µg/l)			Soil (mg/kg)		Sediment (mg/kg)	
	Groundwater	Surface Water	AWQC[1]	Soils	Average U.S.[2]	Sediment	ER-L[3]
Trace Elements							
Arsenic	210	500	36	340	5	8.5	33
Cadmium	100	ND	9.3	66	0.06	ND	5
Chromium	130	80	50	130	100	30	80
Copper	320	ND	2.9*	ND	30	ND	70
Fluoride	71,000	17,000	NA	410,000	NA	18,000	NA
Lead	110	150	8.5	440	10	21	35
Mercury	0.4	ND	.025	1.1	0.03	ND	0.15
Nickel	240	89	8.3	45	40	14	30
Silver	ND	ND	0.92	9.8	0.05	2.4	1
Zinc	330	470	86	1200	50	62	120

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effects range-low ; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
ND: Not detected; detection limit not available.
NA: Screening guidelines not available.
*: Chronic criterion not available; acute criterion presented.

element concentrations were below detection limits (not specified) at off-site monitoring wells situated upgradient from the site. ^{222}Radon was detected in groundwater samples at a maximum concentration of 3,112 pCi/l. Concentrations of ^{222}radon were detected at similar concentrations in monitoring wells situated upgradient from the site. Concentrations of ^{222}radon in groundwater from Sarasota County, Florida have been traced to a phosphate-bearing geological formation (NUS 1988).

Surface water samples were collected in the Anclote River at seven sites: three locations near the site, one location 1 km to the southeast, one location 0.5 km to the northwest, one location in the Anclote Anchorage, and one background location approximately 3 km southeast of the Stauffer site. In surface water, nickel and lead were detected at concentrations exceeding the marine AWQC at a sampling location near the tidal pond/dredge area. Surface water samples from the Anclote Anchorage were the only other samples to contain detectable concentrations of the contaminants listed in Table 2; arsenic (500 µg/l) was detected at concentrations exceeding the screening criteria. Detection limits were not specified in the study so no conclusions could be drawn about concentrations of cadmium, copper, mercury, and silver in surface water samples.

Sediment samples were also collected from the above seven Anclote River sites and from three more locations in the drainage ditch. Concentrations of trace elements in all sediments were below ER-L screening guidelines, except for a sample collected from Myers Cove that contained 2.4 mg/kg silver, double the screening guideline for silver in sediments of 1 mg/kg. Concentrations of cadmium, copper, and mercury were below detection limits in all sediment samples.

Maximum concentrations of fluoride in groundwater, soil, and surface water were detected in samples collected near the southern calcium fluoride piles. Maximum fluoride concentrations in sediment were found in a sample collected from a background area east of the site in the Anclote River. A high fluoride concentration (9,100 mg/kg) was also detected in sediment collected near the southern calcium fluoride piles. Since screening guidelines were not available for fluoride no conclusions could be drawn about these concentrations.

Elevated concentrations of gross alpha and gross beta radiation were detected in groundwater (23 pCi/l), surface water (280 pCi/l), and sediments (21 pCi/g). According to the Florida Department of Health and Rehabilitative Services Office of Radiation Control, elevated concentrations of gross alpha and gross beta radiation in tidal areas primarily result from analytical interference of ^{40}potassium in seawater (NUS 1988).

Summary

Trace elements, fluoride, and PAHs have been detected in the Stauffer site's soil, sediment, surface water, and groundwater. There were particularly high concentrations of trace elements found in groundwater beneath the site. Site contaminants could harm the endangered manatee, several threatened species of turtles, plus finfish and shellfish in county and state aquatic preserves, the Anclote River, Anclote Anchorage, and the Gulf of Mexico.

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4

Stauffer Chemical Company

Tampa, Florida

CERCLIS #FLD004092534

Site Exposure Potential

The 16-hectare Stauffer Chemical Company site in Tampa, Florida, is bordered to the north by the Seaboard Coastline Railroad and a construction-materials plant, to the east by the Tampa Bypass Canal, and to the west by Orient Road. The south edge is bordered by the newly constructed Hillsborough County Jail (Figure 1). From 1951 to 1986, the site was used for pesticide formulation in dust, granule, and liquid forms. The eastern and southern portions of the site are heavily wooded and overgrown. The Tampa Bypass Canal discharges into the Palm River, about 2 km downstream from the site. The Palm River enters McKay Bay 4 km below the confluence of the river and the canal. The confluence of the Palm River and McKay Bay is about 3 km from Hillsborough Bay. The site is about 64 km from the Gulf of Mexico. Although Helena Chemical Company is immediately northwest of Stauffer, no culverts or drainage pathways could be identified that would allow drainage from the Helena site to the Stauffer site (NUS 1988b).

Seven areas on the site were used for waste disposal from 1953 to 1973 (Figure 2). Hazardous substances buried included toxaphene, methyltrithion, and parathion. Toxaphene wastes from a 30,000- to 38,000-l tank car leak were

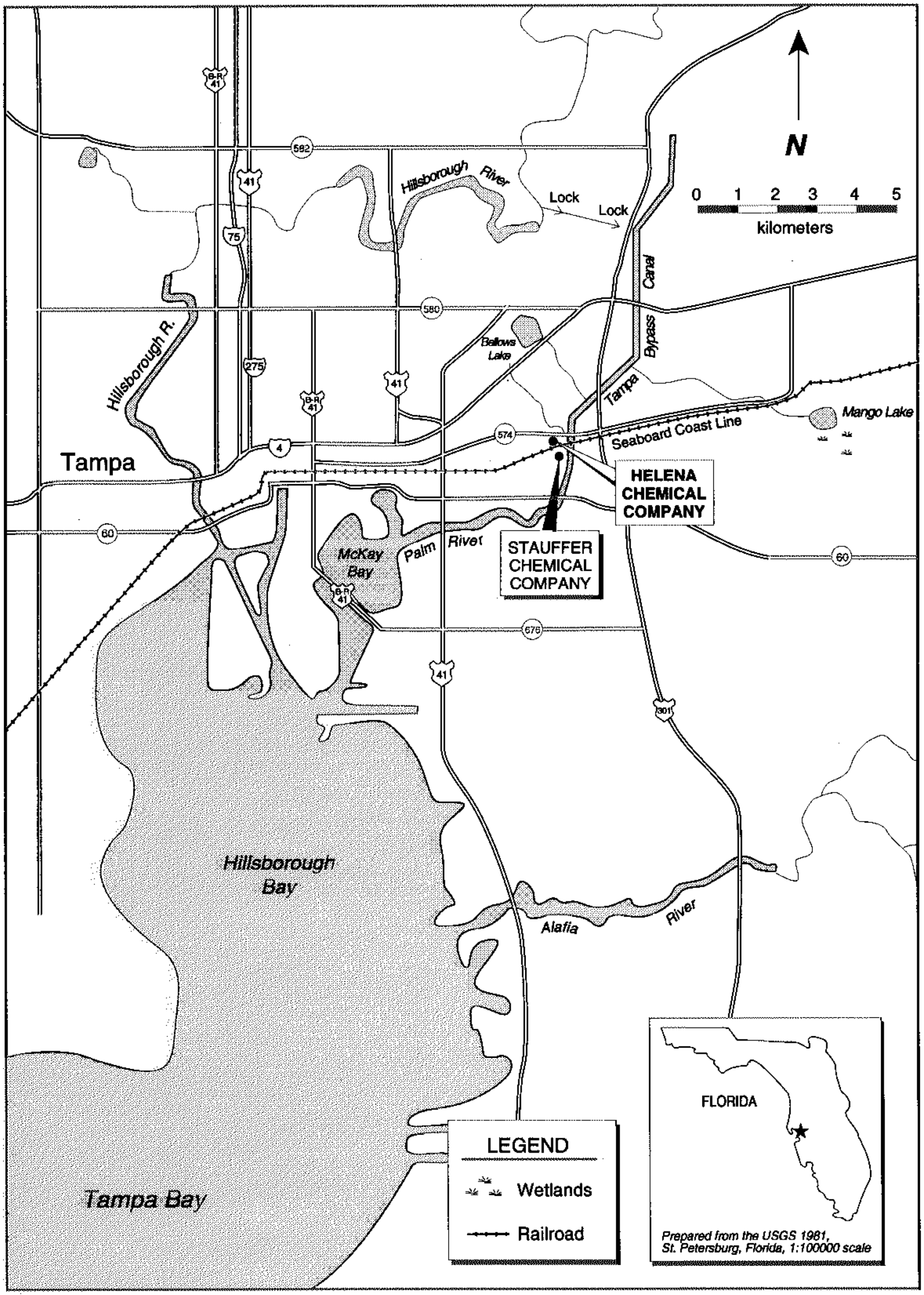

Figure 1. The Stauffer Chemical Company site, Tampa, Florida.

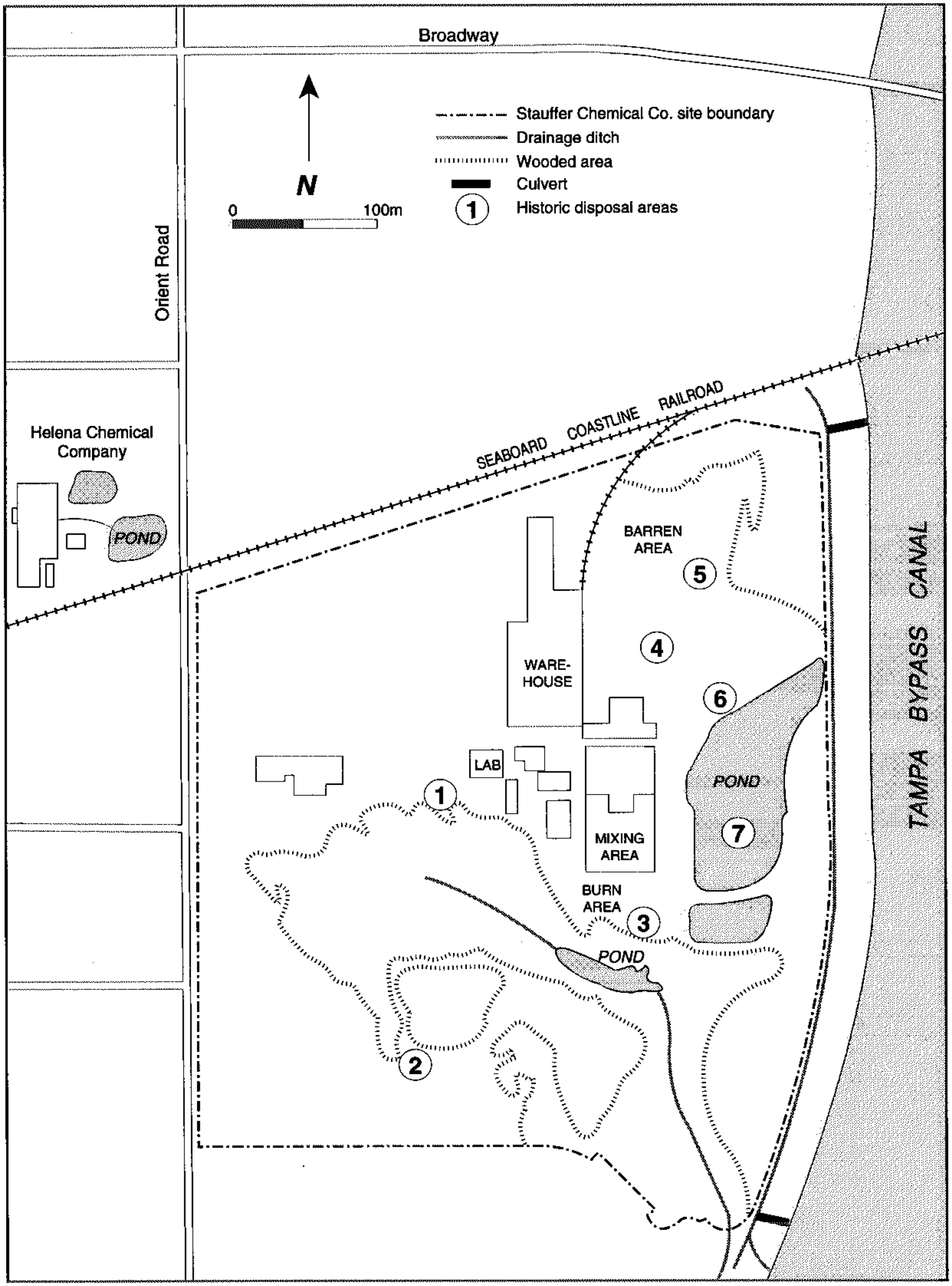

Figure 2. Detail of the Stauffer Chemical Company site, Tampa, Florida.

buried in Area One. Contaminant containment and disposal methods are not known. Areas Two and Three were used in 1967 for the disposal of methyltrithion in drums of unknown size. Twenty to thirty drums were buried in Area Two and 50 were buried in Area Three. Empty parathion drums were crushed and buried in Area Four. Area Five was the location of open sulfur piles. Open trash was burned in Area Six. The northern pond, suspected of receiving surface water runoff, is the seventh disposal area. Disposal Areas Four, Five, and Six are all within a region that is barren of vegetation (NUS 1988b).

The site's gentle eastward slope allows for drainage; surface water and groundwater are potential pathways for migration of contaminants to NOAA trust habitats. The site elevation ranges from 4.5 to 7.6 m above mean sea level. The north-central portion of the site drains east to the northern pond. The pond can overflow into a drainage ditch that parallels the canal and flows southward, but there is no other known direct connection between the pond and the drainage ditch. Within the site, two stormwater culverts lead from the drainage ditch to the canal. A separate drainage ditch flows from the wooded area toward the canal, but does not converge with the drainage ditch that parallels the canal within the area of the site. It is not known whether these ditches converge further south of the site.

The hydrogeology of the area is characterized by an unconfined surficial aquifer within terrace deposits that have an average thickness of 7.6 m. The surficial aquifer flows south and southwest, except near the on-site drainage ditch and the ponds. The Hawthorn Formation of clay, 7.6 to 10.7 m below ground surface, provides a semi-permeable confining layer. Limestone formations below the clay confining layer contain the Upper Floridan aquifer, which supplies public water. This aquifer has a south-to-southwest directional flow. The clay confining layer that separates the surficial aquifer from the Upper Floridan aquifer is present at the western portion of the site, but pinches out at the eastern portion near the canal. During construction of the canal, this confining layer was breached several times, leaving the limestone of the Floridan aquifer in contact with canal water. Contaminants in the surficial aquifer could potentially move downgradient and discharge into the canal or enter the Upper Floridan aquifer where the confining layer has been breached (NUS 1988b).

NOAA Trust Habitats and Species

Habitats of primary concern to NOAA are the surface water and associated bottom substrates of the Palm River, McKay Bay, and Hillsborough Bay. Secondary habitats of concern are the surface water and associated bottom substrates of the Tampa Bypass Canal. The Palm River and McKay Bay are tidally influenced estuarine systems that are generally less than 8 m deep.

Salinities in McKay Bay generally range from 22 to 25 ppt and fluctuate throughout the year, depending on rainfall, saltwater intrusion, and urban runoff (Estevez 1989). The tidal amplitude in McKay Bay is generally less than 1 m (McMichael personal communication 1992). Water-quality problems in the Tampa Bypass Canal and Palm River include low dissolved oxygen levels (annual averages ranging from 1.8 to 3.2 mg/l between 1980 and 1983), high coliform counts, nutrient and chlorophyll a concentrations, and biological oxygen demand. General water-quality conditions tend to worsen toward McKay Bay, where urbanization is greater (Wolfe 1990). Bottom substrate is dominated by silty sand (Dial and Deis 1986).

The tidally influenced reaches of the Palm River, McKay Bay, and Hillsborough Bay provide nursery and adult habitat for fish and invertebrates (Table 1; Beccasio et al. 1982; Kunneke and Palik 1984; McMichael personal communication 1992). Economically important, estuarine-dependent species include red and black drum, spotted seatrout, snook, sheepshead, southern flounder, Florida pompano, striped mullet, and gulf menhaden. Most of these species are offshore or coastal spawners whose larvae move inshore with the currents. Juveniles remain in protected estuaries until sexual maturity (Kunneke and Palik 1984). Species such as snook and red drum juveniles use the upper reaches of estuaries and commonly use brackish streams and canals and tidal freshwater streams (Gilmore et al. 1983; Peters and McMichael 1987). Finfish species known to occur in greatest numbers in McKay Bay include tidewater silverside, striped mullet, longnose killifish, bay anchovy, spot, scaled sardine, and pinfish (Wolfe 1990; McMichael personal communication 1992). Blue crab are known to occur in McKay Bay and likely reside in the tidally influenced portions of the Palm River (McMichael personal communication 1989). There have been no studies in the Tampa Bypass Canal to determine the presence of marine species, but it is believed that there are few, if any, marine species in the canal due to poor water quality. The Palm River would most likely be the nearest habitat to be used by NOAA trustee resources (McMichael personal communication 1992).

Species targeted for commercial harvest in Hillsborough Bay include blue crab, menhaden, mullet, pink shrimp, spot, and spotted seatrout. Striped mullet is the most important commercial species in Hillsborough Bay. Generally, any species in McKay Bay is fished recreationally. Species typically sought are red drum, sheepshead, snook, and spotted seatrout. There are no restrictions on these fisheries other than general regulations regarding take limit and minimum size. Periodically, blue crab is harvested from McKay Bay (McMichael personal communication 1992). In the region, most commercial and recreational fishing activities concentrate in Tampa Bay and in Old Tampa Bay, both south and west of Hillsborough Bay (Figure 1; Beccasio et al. 1982; McMichael personal communication 1992).

Table 1 NOAA trust fish and invertebrates that use Hillsborough Bay, McKay Bay, and the Palm River.

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
MARINE/ESTUARINE SPECIES						
Bay anchovy	*Anchoa mitchilli*		♦	♦		
Sheepshead	*Archosargus probatocephalus*			♦		♦
American eel	*Anguilla rostrata*			♦		
Silver perch	*Bairdiella chrysoura*		♦	♦		
Gulf menhaden	*Brevoortia patronus*		♦	♦	♦	
Crevelle jack	*Caranx hippos*		♦	♦		
Snook	*Centropomus undecimalis*		♦	♦		♦
Sand seatrout	*Cynoscion arenarius*		♦	♦		
Spotted seatrout	*Cynoscion nebulosus*		♦	♦	♦	♦
Lady fish	*Elops saurus*		♦	♦		
Mojarra	*Eucinostomus* spp.		♦	♦		
Gulf killifish	*Fundulus grandis*	♦	♦	♦		
Longnose killifish	*Fundulus similis*	♦	♦	♦		
Scaled sardine	*Harengula jaguana*		♦	♦		
Pinfish	*Lagodon rhomboides*		♦	♦		
Spot	*Leiostomus xanthurus*		♦	♦	♦	
Gray snapper	*Lutjanus griseus*			♦		
Tarpon	*Megalops atlanticus*		♦	♦		
Tidewater silverside	*Menidia peninsula*		♦	♦		
Southern kingfish	*Menticirrhus americanus*			♦		
Atlantic croaker	*Micropogonias undulatus*			♦		
Striped mullet	*Mugil cephalus*		♦	♦	♦	
Atlantic thread herring	*Opisthonema oglinum*		♦	♦		
Pigfish	*Orthopristis chrysoptera*		♦	♦		
Gulf flounder	*Paralichthys albigutta*		♦	♦		
Southern flounder	*Paralichthys lethostigma*		♦	♦		
Black drum	*Pogonias cromis*		♦	♦		
Bluefish	*Pomatomus saltatrix*		♦	♦		
Red drum	*Sciaenops ocellatus*		♦	♦		♦
Spanish mackerel	*Scomberomorus maculatus*		♦	♦		
Florida pompano	*Trachinotus carolinus*		♦			
INVERTEBRATE SPECIES						
Blue crab	*Callinectes sapidus*		♦	♦	♦	
American oyster	*Crassostrea virginica*	♦	♦	♦		
Spiny lobster	*Panulirus argus*		♦			
Pink shrimp	*Penaeus duorarum*		♦		♦	
Common rangia	*Rangia cuneata*	♦	♦	♦		

The surface waters of Hillsborough and Tampa bays provide habitat for several threatened and endangered species. The federally endangered West Indian manatee (*Trichechus manatus*) uses these bays as a habitat on a seasonal basis. There are also several federally protected species of turtles in this area, including the threatened green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), endangered hawksbill turtle (*Eretmocheyls imbricata*), Kemp's ridley turtle (*Lepidochelys kempi*), and leatherback turtle (*Dermochelys coriacea*) (Beccasio et al. 1982).

Site-Related Contamination

The primary contaminants of concern to NOAA are trace elements and pesticides (NUS 1988a). Data collected during the site investigation indicated that on-site soil, sediment, groundwater, and surface water contained elevated concentrations of these contaminants. The maximum concentrations of trace elements, PAHs, and pesticides detected in soil, sediment, groundwater, and surface water are presented in Table 2 with their respective screening guidelines (Lindsay 1979; U.S. EPA 1986; Long and Morgan 1990).

Trace elements were detected in all media tested on-site. Lead and zinc concentrations in the surface soil samples collected on-site were higher than average U.S. soil concentrations for these substances (Table 2). Arsenic, copper, nickel, and zinc concentrations in the subsurface soil samples were also higher than average for U.S. soils. The sediment samples collected from the on-site drainage ditch and pond area had copper, lead, and zinc concentrations which exceed effects-range low (ER-L) values by a factor of two or more (Long and Morgan 1990). Arsenic, chromium, copper, nickel, and zinc contamination in groundwater exceeded the freshwater chronic ambient water quality criteria by more than ten times (U.S. EPA 1986). However, trace element concentrations in on-site surface water did not exceed the screening guidelines (Table 2).

Concentrations of DDT, DDE, and DDD were particularly high in sediment samples (8,700 mg/kg, 710 mg/kg, and 3,600 mg/kg, respectively). These concentrations of DDT compounds are much higher than those shown to be toxic in other studies (Long and Morgan 1990). The concentrations of BHC pesticides were also elevated in soils, groundwater, and surface water. Chlordane and endrin were detected in the surface soil at 12 mg/kg and 4.9 mg/kg, respectively. Chlordane, toxaphene, endrin, and heptachlor were detected in the subsurface soil at concentrations of 0.93 mg/kg, 0.41 mg/kg, 3.7 mg/kg, and 0.05 mg/kg respectively. The concentrations of DDT and dieldrin in groundwater and surface water samples exceeded the screening guidelines by more than 100 times. The surface water was also contaminated by aldrin at 0.21 mg/kg.

There is no analytical evidence to indicate that the contamination on the Stauffer Chemical Company site was due to the adjacent Helena Chemical Company (NUS 1988a).

Summary

Trace elements and pesticide concentrations detected in the Stauffer site's soil, sediment, and groundwater exceed screening guidelines, by more than 100 times in the cases of DDT and endrin detected in groundwater and surface water samples. Site contaminants could harm nearby endangered manatees and several threatened species of turtles, plus commercial and recreational fisheries for finfish and shellfish in the Palm River, McKay Bay, Hillsborough Bay, and the Tampa Bypass Canal.

Table 2. Maximum concentrations of contaminants in samples collected at the Stauffer Chemical Company Site (NUS 1988b).

	Soil (mg/kg)			Sediment (mg/kg)		Water (µg/l)		
	Surface	Subsurface	Average U.S.[1]	On-site	ER-L[2]	Groundwater	Surface water	AWQC[3]
INORGANIC SUBSTANCES								
Arsenic	ND	9.8	5	5.5	33	3,800	20	190
Chromium	12	33	100	62	80	22,000	27	11
Copper	23	220	30	190	70	4,400	360	12+
Lead	31	ND	10	460	35	70	320	3.2+
Mercury	ND	ND	0.03	ND	0.15	0.32	R	0.012
Nickel	ND	51	40	13	30	5,800	31	160+
Zinc	840	260	50	220	120	11,000	2,400	110+
ORGANIC COMPOUNDS								
Total PAHs	0.718	1.942	NA	0.34	4.0	ND	ND	NA
Pesticides								
Alpha BHC	3.0	1.0	NA	ND	NA	27.0	0.18	NA
Beta BHC	0.077	0.053	NA	ND	NA	3.2	0.24	NA
Delta BHC	1.3	0.05	NA	ND	NA	4.0	0.18	NA
Gamma BHC	ND	3.2	NA	ND	NA	6.6	0.11	NA
4,4'-DDE	2.9	11	NA	710	2	2.5	0.23	NA
4,4'-DDD	12	18	NA	3,600	2	17	2.7	NA
4,4'-DDT	340	12	NA	8,700	1	4.1	2.9	0.001
Dieldrin	4	12	NA	320	0.02	0.53	0.41	0.0019
Chlordane	12	0.93	NA	ND	0.5	ND	ND	0.0043
Toxaphene	ND	0.41	NA	ND	NA	ND	ND	NA
Endrin	4.9	3.7	NA	ND	0.02	ND	ND	0.0023
Heptachlor	ND	0.05	NA	ND	NA	ND	ND	0.0038
Aldrin	ND	ND	NA	ND	NA	ND	0.21	NA

1: Lindsay (1979).
2: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
3: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1986).
ND: Not detected at method detection limit.
NA: Screening level not available.
R: Value rejected during QA/QC.
+: Hardness-dependent. (100 mg/kg $CaCO_3$ used).

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4

Koppers Company, Inc., Charleston Plant

Charleston, South Carolina

CERCLIS #SCD980310239

Site Exposure Potential

The Koppers Company, Inc., Charleston Plant is located in the Charleston Heights district of Charleston, South Carolina. The southern part of the site is built on part of an estuarine emergent wetland that extends south of the site (Figure 1). The site is bordered to the west by the Ashley River, to the east by Interstate Highway 26, to the north by private industrial facilities, and to the south by the wetland. The site is 8 km upriver of Charleston Harbor, which opens into the Atlantic Ocean about 14 km downstream of the site (NUS 1986).

From 1925 to 1975, the Koppers Company Forest Product Facility conducted milling, wood preserving, and wood pole storage operations at the site. The wood preservative process generated oily sludge, fungicide, and trace element wastes that were disposed in on-site landfills. In 1975, the site was sold to Braswell Shipyard Company, who leased portions of the property to Pepper Industries Inc. and Federal Services Industries of Waldorf, Maryland. Pepper Industries Inc. transported and stored hazardous wastes at the site until 1983, when the corporation abandoned the property, leaving behind 980,000 l of hazardous wastes in seven storage vessels. Federal Services

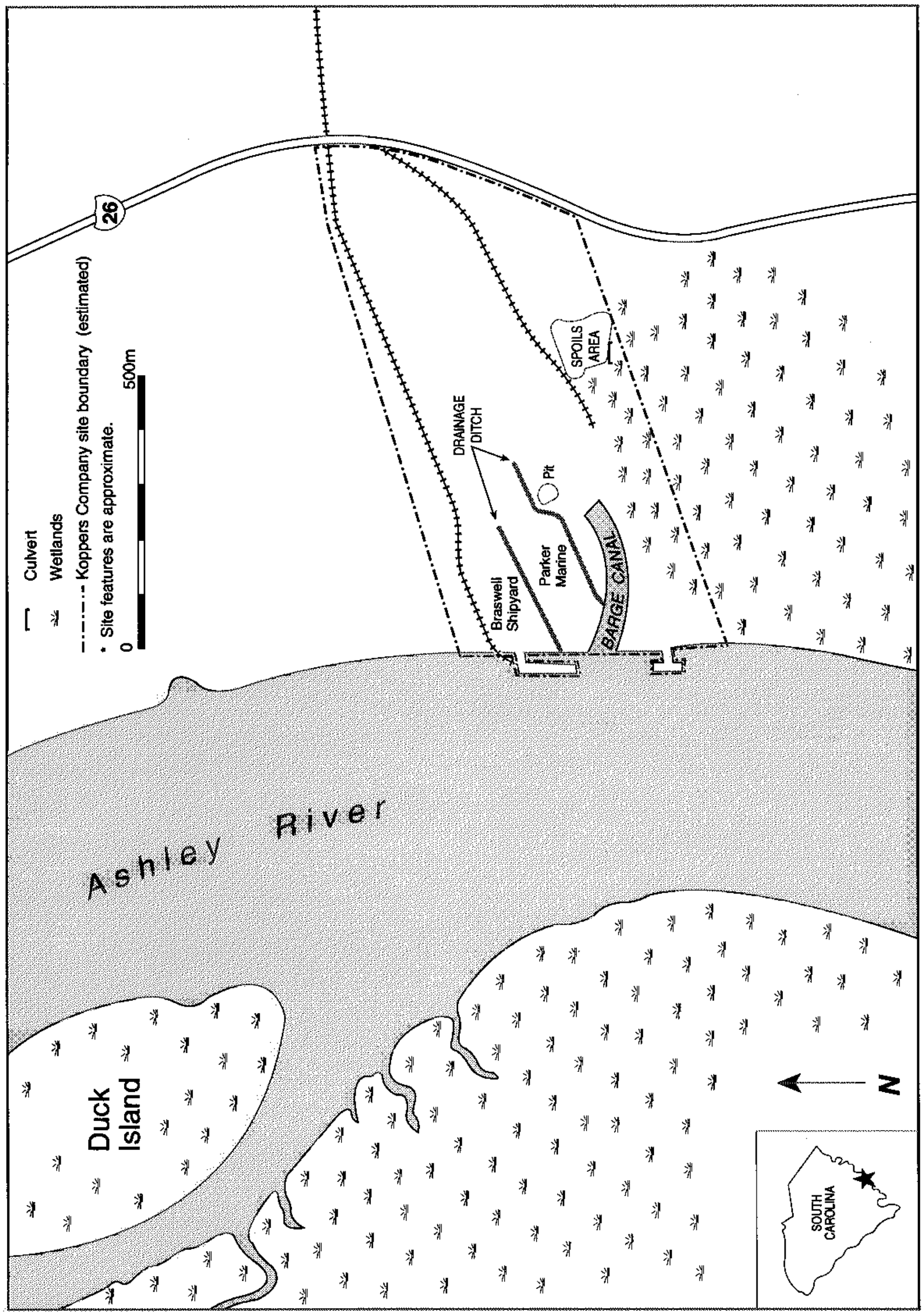

Figure 1. The Koppers Company site in Charleston, South Carolina (U.S.G.S. 1979; NUS 1991).

Industries used their portion of the property to store oily wastes in tanks. A South Carolina Department of Health and Environmental Control site inspection conducted at an unknown date during the early 1980s discovered a hole in the containment wall surrounding the tanks; oily wastes had saturated the soil and pooled in several areas. Cleanup of the Federal Services Industries property began in May 1985 with unknown results (NUS 1986). Southern Dredging Company and Parker Marine are believed to be the current tenants of the site (NUS 1991).

Three major contaminated areas have been identified based on sampling and aerial photographs. The area east of the Southern Dredging office probably served as an unlined pit for dipping poles in wood preservative (pit in Figure 1). The region now occupied by Parker Marine was likely a drip pad and storage area for poles after treatment with preservatives. The third region is the spoils area where sediments from dredging of the Barge Canal are impounded (Figure 1; NUS 1991).

The site is located on a relatively flat, brackish, tidal marsh area with a change in elevation of 3 m (NUS 1986). Surface water runoff is the major migration pathway for contaminants. Surface water runoff flows to storm water drainage ditches on the site, which lead to a canal directly connected to the Ashley River (NUS 1986). There have been no known direct discharges of wastes to the Ashley River. A 120-cm diameter culvert diverts excess runoff from the sediment impoundment area to the wetland south of the site. Dark stains were observed on the soil outside the bermed area (NUS 1988).

Groundwater is a potential pathway for migration of contaminants to trust habitats, but this has not been confirmed. Shallow groundwater of unknown depth at the site is likely to flow west, potentially discharging to the Ashley River at the western boundary of the site. This shallow aquifer may be tidally influenced. There are four formations below the shallow groundwater aquifer. The Black Mingo Formation, at 82 m to 365 m below ground surface, is composed of alternating sandstone, limestone, and clay that contains potable water. The gradient is to the southeast with unknown discharge points. Removal of groundwater by industries has resulted in a zone of depression and subsequent saltwater intrusion. Below the Black Mingo Formation, the Peedee Formation, Black Creek Formation, and Middendorf Formation contain potable water that is not used as drinking water in the study area (NUS 1988).

NOAA Trust Habitats and Species

Habitats of primary concern to NOAA are Ashley River surface water, bottom substrate, and wetlands. Habitats of secondary concern are the surface water and substrate of Charleston Harbor.

Salinities in the river near the site range from 17 to 22 ppt and fluctuate throughout the year depending on rainfall, saltwater intrusion, and urban runoff. Ashley River substrate is primarily mud and sand (Van Dolah personal communication 1992).

The lower Ashley River supports diverse, abundant populations of NOAA trust resources that are likely to migrate close to the site where sensitive early life stages may reside for extended periods. There are estuarine emergent wetlands contiguous to the southern perimeter of the site and the opposite bank of the Ashley River. This wetland provides nursery and adult habitat for numerous fish and invertebrate species (Table 1; NOAA 1991; Van Dolah personal communication 1992). The dominant vegetation includes smooth cordgrasses (*Spartina alterniflora*) and rushes (*Juncus spp.*; Van Dolah personal communication 1992).

Trust resources in significant numbers near the site include spot, Atlantic croaker, spotted sea trout, red drum, American oyster, and blue crab. Spot and Atlantic croaker are commonly present in the area from early spring to early winter and occur in greatest numbers during the spring and summer. Spotted sea trout are present year-round and may spawn near the site from April to October. Red drum commonly use the river from late August to late October. Bay anchovy spawn in the river, and American oyster are abundant in both the Ashley River and Charleston Harbor. Blue crab use the Ashley River and the wetlands near the site for mating. There are catadromous American eel throughout the area (NOAA 1991; Van Dolah personal communication 1992).

The endangered anadromous shortnose sturgeon may migrate into Charleston Harbor and the Ashley River. Details about resource use of the area by this species were unavailable (Van Dolah personal communication 1992).

Blue crab is the only commercial fishery in the area. Charleston Harbor and the Ashley River provide significant nursery and adult forage habitat for penaid shrimp, which represent a significant offshore commercial fishery. Popular sport fisheries near the site include striped bass, spot, Atlantic croaker, flounder, spotted sea trout, and blue crab. There are no restrictions on fisheries other than general regulations on take limit and minimum sizes (Van Dolah personal communication 1992). However, shellfishing is closed in the Ashley River due to excessive levels of fecal coliform.

Site-Related Contamination

Data collected during site screening activities indicated that on-site soil, surface water, and sediments contain elevated concentrations of contaminants of concern to NOAA (NUS 1986). The primary contaminants of concern are trace elements, PAHs, and PCBs. The maximum concentrations of trace elements and PAHs

Table 1. NOAA fish and invertebrate species commonly found in Charleston Harbor and the Ashley River, Charleston, South Carolina.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm.	Recr.
ANADROMOUS/CATADROMOUS SPECIES						
Shortnose sturgeon [1]	*Acipenser brevirostrum*					
Atlantic sturgeon	*Acipenser oxyrhynchus*			◆		
Blueback herring	*Alosa aestivalis*			◆		
American shad	*Alosa sapidissima*			◆		
American eel	*Anguilla rostrata*		◆	◆		
Striped bass	*Morone saxatilis*		◆	◆		◆
ESTUARINE SPECIES						
Bay anchovy	*Anchoa mitchilli*	◆	◆	◆		
Sheepshead	*Archosargus probatocephalus*		◆	◆		
Atlantic menhaden	*Brevoortia tyrannus*		◆	◆		◆
Atlantic spadefish	*Chaetodipterus faber*		◆	◆		
Spotted sea trout	*Cynoscion nebulosus*	◆	◆	◆		◆
Sheepshead minnow	*Cyprinodon variegatus*	◆	◆	◆		
Mummichog	*Fundulus heteroclitus*	◆	◆	◆		
Spot	*Leiostomus xanthurus*		◆	◆		◆
Atlantic silverside	*Menidia menidia*		◆	◆		
Southern kingfish	*Menticirrhus americanus*		◆	◆		
Atlantic croaker	*Micropogon undulatus*		◆	◆		◆
Striped mullet	*Mugil cephalus*		◆	◆		
Summer flounder	*Paralichthys dentatus*		◆	◆		◆
Southern flounder	*Paralichthys lethostigma*		◆	◆		◆
Black drum	*Pogonias cromis*		◆	◆		
Bluefish	*Pomatomus saltatrix*		◆			◆
King mackerel	*Scomberomorus cavalla*		◆	◆		
Spanish mackerel	*Scomberomorus maculatus*		◆	◆		
Red drum	*Sciaenops ocellatus*		◆	◆		◆
INVERTEBRATE SPECIES						
Blue crab	*Callinectes sapidus*	◆	◆	◆	◆	◆
American oyster	*Crassostrea virginica*	◆	◆	◆		
Hardshell clam	*Mercenaria mercenaria*	◆	◆	◆		
Grass shrimp	*Palaemontes pugio*	◆	◆	◆		
Brown shrimp	*Penaeus aztecus*		◆	◆		
Pink shrimp	*Penaeus duorarum*		◆	◆		
White shrimp	*Penaeus setiferus*		◆	◆		
Common rangia	*Rangia cuneata*	◆	◆	◆		

1. This species is federally endangered.

detected in soils, surface water, and sediments along with their respective screening guidelines are presented in Tables 2 and 3 (Lindsay 1979; U.S. EPA 1986; Long and Morgan 1990). No groundwater samples were collected at the site.

Trace elements were detected in soil, surface water, and sediment samples. The soil samples were collected from the former wood preservative pit, the south bank of the canal near its confluence with the Ashley River, and the dredging spoils area. Trace elements detected in these samples included arsenic, chromium, copper, and lead at concentrations higher than average U.S. soil concentrations for these substances. Mercury was detected in the dredging spoils and nickel and silver were measured in the canal soil sample at elevated concentrations. These trace elements, in addition to zinc, were also detected in the surface water and sediment samples collected from the drainage ditch at its confluence with the canal at concentrations exceeding screening guidelines. High concentrations of several of these trace elements were also measured in surface water collected from the canal, sediment from the adjacent wetland, and surface water and sediment samples from the Ashley River. The concentrations of trace elements measured in the sediment sample from the Ashley River were generally higher than those measured in sediments from the wetland and drainage ditch. It was unclear in the available documentation whether the samples from the river were collected upstream or downstream of the site.

PAHs were detected in the soil, surface water, and sediment samples. The PAH-contaminated soil samples were collected from the northeastern bank of the canal, the former wood preservative pit, and the dredging spoils. Both sediment and surface water samples collected from the drainage ditch at its confluence with the canal had elevated concentrations of PAHs. The canal surface water samples containing detectable PAHs were collected from the northeastern portion of the canal. Sediment samples from the wetland adjacent to

Table 2. Maximum concentrations of contaminants in soil and sediment samples collected on and near the Koppers site.

	Soil (mg/kg)				Sediment (mg/kg)			
	Wood preservative pit	Dredging spoils area	Barge canal	Ave. U.S.[1]	Drainage ditch	Wetland	Ashley River	ER-L[2]
INORGANIC SUBSTANCES								
Arsenic	15	39	ND	5	7.1	44	230	33
Chromium	43	71	170	100	270	300	790	80
Copper	19	210	21	30	160	310	650	70
Cyanide	ND	ND	0.35	NA	ND	ND	1.3	NA
Lead	14	140	400	10	390	63	200	35
Mercury	ND	0.29	ND	0.03	0.44	0.28	27	0.15
Nickel	ND	ND	35	40	93	130	ND	30
Silver	ND	ND	6.5	NA	ND	ND	ND	1
Zinc	66	250	48	50	540	380	2,000	120
ORGANIC COMPOUNDS								
Total PAHs	190,000	760	180	NA	3,200	140	ND	4.0
PCB (1260)	ND	ND	ND	NA	4.0	ND	ND	0.050

1: Lindsay (1979).
2: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
ND: Not detected at method detection limit.
NA: Screening level not available.

Table 3. Maximum concentrations of contaminants in surface water samples collected at and near the Koppers site.

	Drainage Ditch µg/l	Barge Canal µg/l	Ashley River µg/l	AWQC[1] µg/l
INORGANIC SUBSTANCES				
Arsenic	7	12	ND	36
Chromium	44	230	27	50
Copper	76	230	49	2.9+
Cyanide	ND	16	ND	5.2
Lead	18	16	ND	8.5
Nickel	ND	180	33	8.3
Silver	11	62	13	0.92*
Zinc	190	170	150	86
ORGANIC COMPOUNDS				
Total PAHs	74	160	ND	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (U.S. EPA 1986).
+: Acute criteria presented; chronic criteria not available.
*: Proposed criteria.
ND: Not detected at method detection limit.
NA: Screening level not available.

the site were also contaminated with PAHs. No PAHs were found in the Ashley River surface water or sediment samples.

Additional contaminants measured in media at and near the site at concentrations exceeding available screening guidelines were cyanide and the PCB Aroclor 1260. Cyanide was detected in soil collected from the canal bank (0.35 mg/kg), in a surface water sample (16 µg/l) collected from the northeastern portion of the canal, and in sediment (1.3 mg/kg) collected from the Ashley River. Aroclor 1260 (4 mg/kg) was detected in a sediment sample collected from the on-site drainage ditch at its confluence with the canal.

Summary

Trace elements, PAHs, and PCBs were detected above screening guidelines in soil, surface water and/or sediment on the site. Drainage ditches on the site empty either directly into the Ashley River or through the Barge Canal. The Ashley River near the site supports a variety of NOAA trust resources, including spotted sea trout, spot, Atlantic croaker, red drum, and blue crab. The extent to which contamination has migrated off-site and affected NOAA resources and habitats has not been determined.

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9

Cooper Drum Company

South Gate, California

CERCLIS #CAD055753370

Site Exposure Potential

The 1.5-hectare Cooper Drum Company site is in an urban section of South Gate, California. The site is about 650 m west of the Los Angeles River and 20 km upstream of San Pedro Bay, which is contiguous with the Pacific Ocean (Figure 1). The site is surrounded by industrial property to the north and east, residential and commercial areas to the west, and an old school to the south.

There have been drum recycling operations at the Cooper site since 1941. Drums previously used for storing petrochemical products and other hazardous substances are delivered to the site and subsequently reshaped, flushed with acids and caustics, and painted. Since 1971, under the ownership of the Cooper Drum Company, approximately 36,000 l of liquid hazardous wastes have been generated each month at the site. Waste materials resulting from the recycling activities include hydrochloric acid, sodium hydroxide, and paint wastes. All liquid wastes are currently recirculated through a hardpipe system to steel-lined tanks (CA DHS 1992).

Direct discharges, groundwater, and surface water runoff are the potential pathways of contaminant transport from the site to NOAA resources and associated habitats. Since 1984, at least three

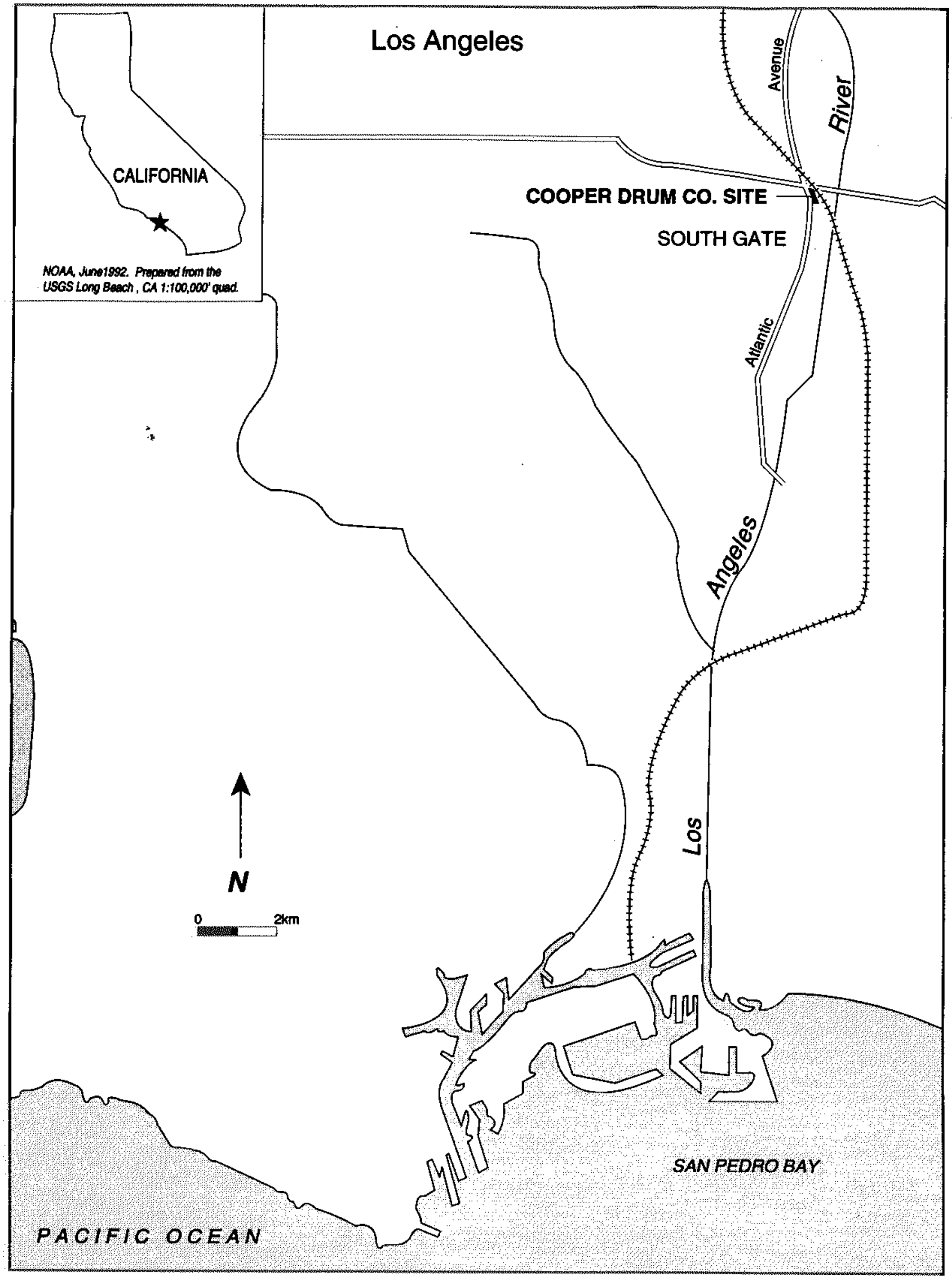

Figure 1. The Cooper Drum Co. site in South Gate, California.

direct releases of hazardous wastes to on- and off-site soils have been documented. Approximately 180 tons of contaminated soils were removed from the site after the first documented release. Off-site contaminated soils were also reportedly removed following the two subsequent releases, but information on the quantity of soils excavated was not available. In addition, waste materials may have been discharged directly via unlined concrete sumps (Ecology and Environment 1988, 1989).

Perched groundwater is thought to occur 24 m below ground surface at the Cooper site. There are five deeper aquifers (the Exposition, Gage, Jefferson, Lynwood, and Silverado aquifers) beneath the site at depths ranging from 30 to 185 m below ground surface. There are hydraulic connections between the Exposition and Gage aquifers and the Lynwood and Silverado aquifers. Groundwater in the Silverado aquifer generally flows southwest from the site. Data on the direction of groundwater flow was not available for any of the other aquifers (Ecology and Environment 1988, 1989).

Industrial wastewaters from the site are discharged to a sewer system in accordance with Los Angeles County Sanitation Department regulations. Overland surface water runoff from the site is clarified on-site and discharged to a storm drain in accordance with Los Angeles Regional Water Quality Control Board permit regulations. However, the facility has been cited on several occasions for violating permit discharge limits for both wastewater and storm drain discharges. In addition, at least some component of surface water runoff discharges from the site to a nearby street (Ecology and Environment 1988, 1989).

NOAA Trust Habitats and Species

The primary habitats of NOAA concern in the vicinity of the Cooper Drum Site are surface water and associated bottom substrates of San Pedro Bay, and, to a lesser degree, the tidal water of the Los Angeles River. San Pedro Bay is considered important spawning, nursery, and adult habitat for trust resources (Johansen personal communication 1991). Pilings, oil platforms, kelp beds, breakwaters, and cobble/sand substrates provide diverse marine habitats for numerous demersal and pelagic fish and invertebrate species. Over 130 different fish and invertebrate species have been identified in San Pedro Bay; dominant species are presented in Table 1 (Allen 1976; Crooke personal communication 1991; Cross personal communication 1991; Hagner personal communication 1991; Helvey personal communication 1991).

The majority of surface water in the Los Angeles River is the result of secondary and tertiary effluent from the Los Angeles metropolitan area. It is considered unlikely that the Los Angeles River provides suitable habitat for any NOAA trust resources (Johnson personal communication 1991; Maxwell personal communication 1992). Tidal influence is limited to approximately 2 km

Table 1. Species, habitat use, and commercial and recreational fisheries in San Pedro Bay.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
RESIDENT FISH						
Poacher	*Agonidae*			♦		
Silverside	*Atherinidae*	♦	♦	♦	♦	♦
Blenny	*Blennidae*	♦	♦	♦		
Left-eye flounder	*Bothidae*	♦	♦	♦		♦
Clinid	*Clinidae*	♦	♦	♦		
Sculpin	*Cottidae*	♦	♦	♦		♦
Surf perch	*Embiotocidae*	♦	♦	♦	♦	♦
Anchovy	*Engraulidae*	♦	♦	♦	♦	♦
Flying fish	*Exocoetidae*			♦		
Goby	*Gobiidae*	♦	♦	♦		
Striped mullet	*Mugil cephalus*		♦	♦		
Smoothhound	*Mustelus* spp.			♦		
Sea bass	*Paralabrax* spp.		♦	♦		♦
Right eye flounder	*Pleuronectidae*	♦	♦	♦		♦
Damselfish	*Pomacentridae*		♦	♦		
Midshipmen	*Porichthys* spp.	♦	♦	♦		
Skate	*Rajidae*		♦	♦		
Guitarfish	*Rhinobatidae*		♦	♦		
Drum	*Sciaenidae*	♦	♦	♦	♦	♦
Mackerel	*Scombridae*		♦	♦	♦	♦
Scorpionfish	*Scorpaenidae*	♦	♦	♦		♦
Rockfish	*Sebastes* spp.	♦	♦	♦		♦
California barracuda	*Sphyraena argentea*			♦		♦
Pipefish	*Syngnathidae*	♦	♦	♦		
INVERTEBRATE SPECIES						
Rock crab	*Cancer antemnarius*	♦	♦	♦	♦	♦
Abalone	*Haliotis* spp.	♦	♦	♦		
Bay mussel	*Mytilis edulis*	♦	♦	♦		
Spiny lobster	*Panulirus interruptus*	♦	♦	♦	♦	♦
Littleneck clam	*Protothaca staminea*	♦	♦	♦		
Kelp crab	*Pugettia producta*	♦	♦	♦		
Octopus	*Octopodidae*	♦	♦	♦		♦
Platform mussel	*Septifer bifurcatus*	♦	♦	♦		
Urchin	*Strongylocentrous* spp.	♦	♦	♦		
Tunicate	*Styela* spp.	♦	♦	♦		
Pismo clam	*Tivela stultorum*	♦	♦	♦		♦
Gaper clam	*Tresus nuttali*	♦	♦	♦		♦

upstream of the river's confluence with San Pedro Bay.

There is no commercial or recreational fishing in the Los Angeles River. There are commercial bait fisheries in San Pedro Bay for northern anchovy, topsmelt, mackerel, and queenfish, but mid-water and bottom trawlers are not allowed into the bay (Crooke personal communication 1991). Commercial and recreational harvesting of white croaker is banned in the area because of DDT and PCB contamination (Pollock personal communication 1991). A related advisory is in effect warning people to limit consumption of fish taken from the Palos Verdes/San Pedro Bay area (Pollock personal communication 1991). Commercial and sport abalone fishing is closed from Vincente to Dana Point, California (Crooke personal communication 1991). A health advisory, probably based on fecal coliform counts, is in effect for eating shellfish from San Pedro Bay (Crooke personal communication 1991).

There is sport fishing in San Pedro Bay at numerous piers and other shoreline features, on party boats and fishing barges, and from private boats (Oliphant personal communication 1987). The majority of activity is focused away from Los Angeles Harbor and closer to the San Pedro Bay breakwater. Species regularly caught by anglers include kelp bass, sand bass, queenfish, rockfish, surfperch, California halibut, and diamond turbot. Spiny lobster and rock crab are caught regularly by sport fishermen near Los Angeles Harbor (Crooke personal communication 1991).

Site-Related Contamination

Data collected during preliminary site investigations indicate that on-site soil and off-site groundwater contain elevated concentrations of inorganic substances and organic compounds. Past wastewater discharges from the site also contained high concentrations of trace elements (Ecology and Environment 1988, 1989). Primary contaminants of concern to NOAA include trace elements, PCBs, and petroleum hydrocarbons. Secondary contaminants of concern include VOCs.

Lead (30 mg/kg) and zinc (2,500 mg/kg) were detected in on-site soil at concentrations exceeding average U.S. soil concentrations for these substances (10 and 50 mg/kg, respectively; Lindsay 1979). PCBs (31 mg/kg) and petroleum hydrocarbons (up to 90,000 mg/kg) were also measured in on-site soil. It was unclear whether these contaminated soils were removed from the site during the previous excavation activities. There is no information on whether off-site groundwater was analyzed for trace elements and PCBs. Lead concentrations up to 460,000 µg/l and zinc concentrations up to 79,000 µg/l measured in wastewater discharged from the site exceeded freshwater and marine acute AWQC (U.S. EPA 1986) by up to three orders of magnitude (Ecology and Environment 1988, 1989).

On-site soil contained VOCs (including perchloroethylene, trichloroethane, trichloroethylene, acetone, and methyl ethyl ketone) at a total concentration exceeding 1,700,000 µg/kg. There are no screening guidelines for VOCs in soils. In 1987, four municipal wells less than 500 m downgradient of the site were closed because groundwater samples from these wells contained perchloroethylene at concentrations up to 14 µg/l, exceeding the maximum concentration limit (5 µg/l) and local background concentrations (2 µg/l). These wells were screened in the Silverado aquifer; data on potential contaminants in the perched aquifer were not available (Ecology and Environment 1988, 1989).

Summary

San Pedro Bay is the habitat of concern to NOAA; the Los Angeles River is unlikely to provide suitable habitat for NOAA resources. Lead, zinc, PCBs, and petroleum hydrocarbons were measured in on-site soil above screening criteria. Lead and zinc were measured in wastewater discharges above their respective AWQC. Elevated levels of VOCs were measured in soil, and four municipal wells located downgradient of the site were closed due to the presence of perchlorethylene. It is not known to what degree contaminants from the site can potentially reach trust resources in San Pedro Bay.

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9

GBF/Pittsburg Landfill

Antioch, California

CERCLIS #CAD980498562

Site Exposure Potential

The 24-hectare GBF/Pittsburg Landfill site is in Antioch, California (Figure 1) about 4 km south of the San Joaquin River. The site consists of two former landfills: the Pittsburg Landfill and the GBF Landfill (Figure 2). The San Joaquin River merges with the Sacramento River about 8 km north of the site and subsequently enters Suisun Bay 3.5 km further downstream. Suisun Bay connects the delta region of the Sacramento and San Joaquin rivers with San Francisco Bay.

The Pittsburg Landfill has operated as a municipal solid waste disposal site since the late 1940s. Since 1960, GBF Landfill has operated as both a municipal waste disposal site and an industrial and chemical (solid and liquid) waste disposal site. The sites were consolidated into the Contra Costa Landfill, which operated as a Class III solid waste facility.

Hazardous liquid wastes were disposed of in ten solar evaporation ponds. These unlined, uncovered ponds allowed wastes to evaporate into the air and percolate into the ground. Wastes disposed of in these ponds included waste oils, chlorinated and non-chlorinated solvents, acids, pesticides, PCBs, and beryllium and phosphorous wastes. There is only limited information about

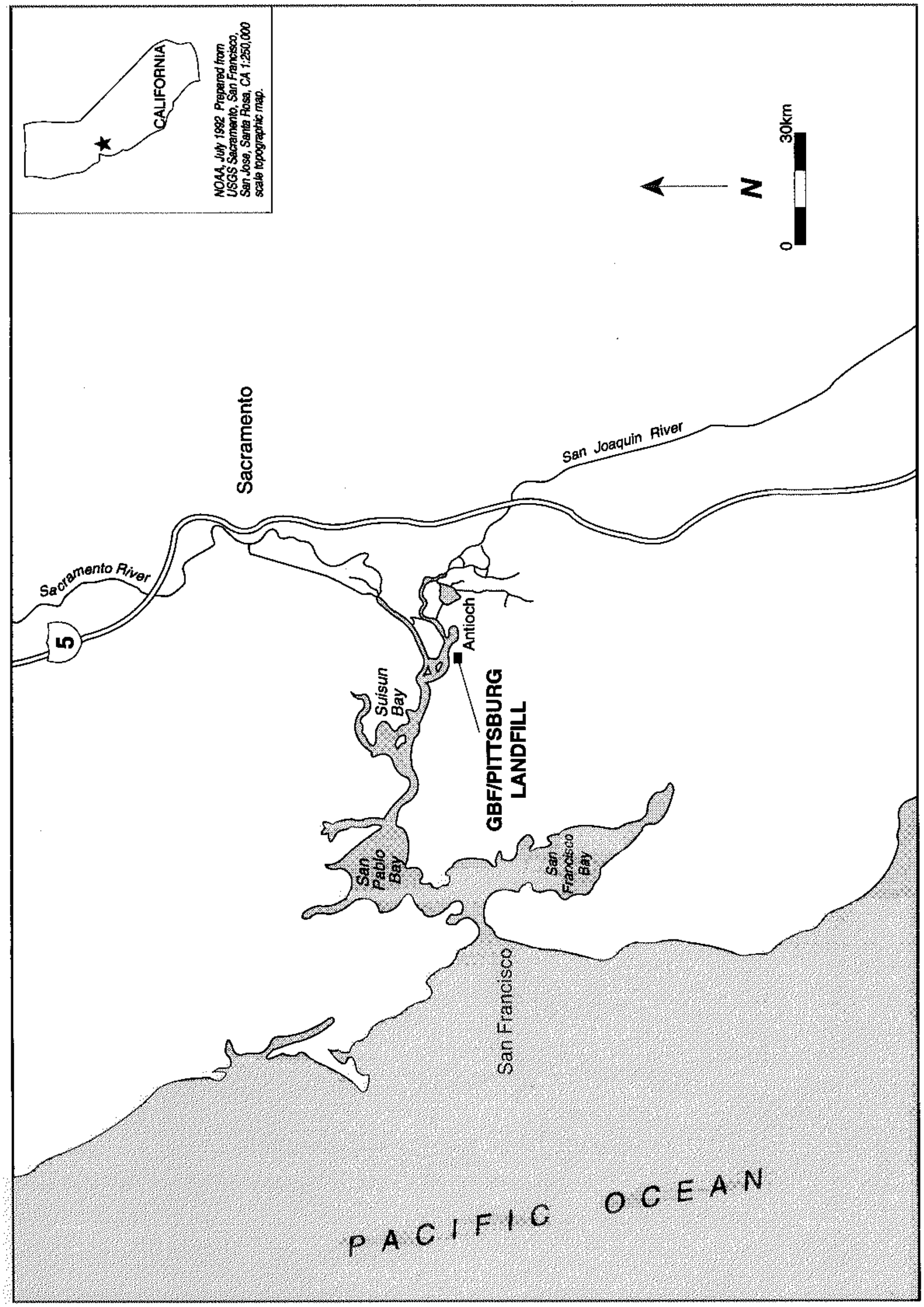

Figure 1. The GBF/Pittsburg site in Antioch, California.

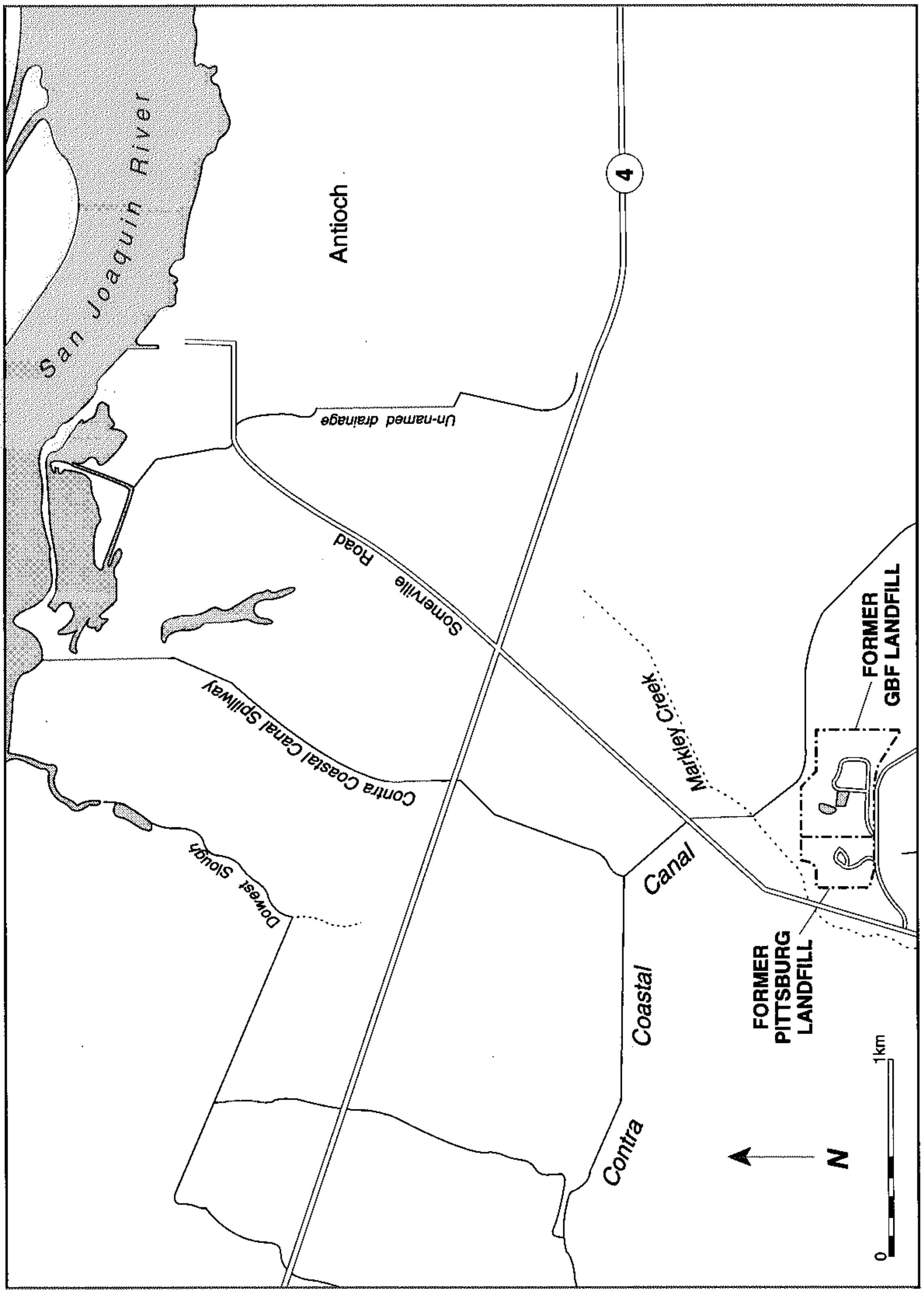

Figure 2. Detail of the GBF/Pittsburg site.

spills and hazardous materials disposed of at the landfill. A June 1968 inspection report cited an area of the Pittsburg site where synthetic liquid rubber was reportedly discharged regularly. A March 1975 inspection report documented the disposal of approximately 9,100 kg of oil thickener in the Pittsburg Landfill.

Both the former GBF and Pittsburg landfills have had numerous fires, explosions, odor complaints, and related violations associated with previous waste disposal activities, particularly during the 1960s and 1970s. Metal surfaces on landfill structures and residential buildings north and east of the GBF disposal site were reported to be corroded in 1973. In the early 1970s, the local community filed additional complaints of strong oil and chemical odors, burning eyes, and irritated lungs.

Contaminant migration pathways include groundwater flow to the San Joaquin River and surface water runoff to Markley Creek. There is groundwater beneath the site from 6 to 100 m below the ground surface. Regional groundwater flows north towards the San Joaquin River and Suisun Bay (U.S. EPA 1987).

Markley Creek is an intermittent stream 60 m northwest and downgradient of the site (U.S. EPA 1987). The creek intersects the Contra Costa Canal where the majority of stream flow is diverted into the canal through a mechanized siphon (USGS 1978, 1980; Kokkos personal communication 1992). Runoff from the canal should theoretically reach the San Joaquin River during high rain events via the 3.5- km Contra Costa Canal Spillway, about 1 km downstream from the siphon. Historically, the canal overflows into the spillway about twice a year. Downstream flow in the spillway is now impeded by a series of inoperable gates. Due to extended drought conditions in northern California, there are no plans to restore the gate system in the spillway (Kokkos personal communication 1992).

NOAA Trust Habitats and Species

Habitats of concern to NOAA are surface water, associated bottom substrates, and wetlands of the San Joaquin and Sacramento rivers, and Suisun Bay. Suisun Bay is a transition zone between the freshwater ecosystems of the Sacramento and San Joaquin rivers and the saltwater ecosystem of San Francisco Bay. Salinities within this tidal area generally range from 2 to 16 ppt, but fluctuate throughout the year due to rainfall, saltwater intrusion, and agricultural runoff (Nichols and Pamatmat 1988). Near the site, the San Joaquin River is 0.8 to 5 km wide, 4.5 to 9 m deep, and has a silty sand substrate (Rugg 1988).

The surface waters of the San Joaquin and Sacramento rivers, and Suisun Bay near the site provide spawning, nursery, and adult habitat for numerous species (Table 1; Kholhorst 1992). There are estuarine-emergent wetlands at the confluence of the San Joaquin and Sacramento rivers and Suisun Bay. Vegetation here is primarily bulrush

(*Scirpus* spp.), cattail (*Typha augustifolia*), and rush (*Juncus* spp.; Kholhorst 1992). Parts of the Suisun Bay wetlands were designated as a California Wetland Preserve in 1984 (Lee et al. 1984).

Suisun Bay is a migration corridor and nursery area for seven species of anadromous fish: green sturgeon, white sturgeon, delta smelt, chinook salmon, steelhead trout, striped bass, and American shad (Table 2; Bybee 1990; Kholhorst 1992). Winter-run chinook salmon have been designated as a federally threatened species; the U.S. Fish and Wildlife Service is petitioning for similar status for delta smelt (Martin Marietta 1992). All seven of these species spawn in the Sacramento and San Joaquin rivers upstream of the site. The confluence of these rivers is an important congregation area during upstream and downstream anadromous fish migrations, particularly for chinook salmon, steelhead trout, and sturgeon.

These species and American shad spawn in the upper reaches and tributaries of the Sacramento and San Joaquin rivers, with the largest populations found in the mainstem of the Sacramento River. Striped bass and delta smelt spawn in Suisun Bay. During periods of high salinity, Dungeness crab and bay shrimp are also present near the site (Wooster 1989; Kholhorst 1992).

There are no commercial fisheries near the site, although commercial bait fishing for Bay shrimp extends into the lower reaches of Suisun Bay during periods of abnormally high salinity (Hergeshell 1989). All anadromous fish, except delta smelt, are fished recreationally during seasonal runs. In general, chinook salmon are fished in the fall and steelhead trout during the winter. These fisheries are not restricted other than by general regulations on take limit and minimum sizes (Wolcott 1989; Kholhorst 1992).

Table 1. Fish species in the San Joaquin River, Upper Suisun Bay, and Sacramento River near the site.

Species		Habitat				Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Migratory Route	Comm. Fishery	Recr. Fishery
ANADROMOUS SPECIES							
Green sturgeon	*Acipenser medirostris*		♦	♦	♦		♦
White sturgeon	*Acipenser transmontanus*		♦	♦	♦		♦
American shad	*Alosa sapidissima*		♦	♦	♦		♦
Delta smelt	*Hypomesus transpacificus*	♦	♦	♦			
Striped bass	*Morone saxatilis*	♦	♦	♦	♦		♦
Steelhead trout	*Oncorhynchus mykiss*		♦	♦	♦		♦
Chinook salmon	*Oncorhynchus tshawytscha*		♦	♦	♦		♦
NON-ANADROMOUS SPECIES							
Shiner perch	*Cymatogaster aggregata*	♦	♦	♦			
Starry flounder	*Platichthys stellatus*		♦	♦			
INVERTEBRATE SPECIES							
Dungeness crab	*Cancer magister*		♦	♦			
Bay shrimp	*Crangon franciscorum*			♦		♦	

Site-Related Contamination

Trace elements and pesticides are the contaminants of primary concern to NOAA identified at the site in preliminary investigations. Trace elements were measured in on-site groundwater at concentrations that exceeded chronic AWQC by one to two orders of magnitude (U.S. EPA 1986; Mark Group 1991; Table 2). High concentrations of pesticides were detected in groundwater, though AWQC are not available for screening comparison (Table 2). Elevated concentrations of acetone (440,000 µg/l) were detected in groundwater, but VOCs are not normally of concern to NOAA trust resources due to their volatility and comparatively low toxicity. No data were available regarding the levels of contaminants in on-site soil. PCBs have been disposed of at the site, but there have been no analyses for these substances. In addition, the threat to natural resources posed by many of the waste products disposed at the site (e.g., oil thickener and liquid rubber) may be poorly characterized by normal chemical testing.

Table 2. Maximum concentrations (µg/l) of contaminants at the GBF/Pittsburg Landfill Site (Mark Group 1991).

		AWQC	
Contaminant	Groundwater	Fresh. Chronic	Marine Chronic
ORGANIC COMPOUNDS			
Pesticides			
2,4-D	120,000	N/D	N/D
2,4,5-T	5,400	N/D	N/D
Silvex	720	N/D	N/D
Dicamba	6,700	N/D	N/D
Dichlorprop	3,100	N/D	N/D
INORGANIC SUBSTANCES			
Trace Elements			
Cadmium	260	1.1*	9.3
Chromium	520	11	50
Copper	4,100	12*	N/D
Lead	190	3.2*	8.5
Mercury	3.7	0.012	0.025
Nickel	4,700	160*	8.3
Silver	190	0.12	0.92
Zinc	1,300	110*	86

N/D: Not determined
* : Hardness-dependent criteria (100 mg/kg $CaCO_3$ used).

Summary

A plume of groundwater contaminated with pesticides and trace metals is migrating toward the San Joaquin River and Suisun Bay may threaten sensitive life stages of several trust resources in these habitats. These areas are used as a migratory corridor, transition zone, and nursery ground for seven species of anadromous fish, including a federally threatened run of chinook salmon. Other contaminants may also be present in the groundwater. Elevated levels of VOCs may not pose a toxic threat to NOAA trust resources but could increase the likelihood that other contaminants of concern will migrate.

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9

McCormick & Baxter Creosoting Company

Stockton, California

CERCLIS #CAD009106527

Site Exposure Potential

The 12-hectare McCormick & Baxter Creosoting Company site is in an industrial portion of the Port of Stockton, San Joaquin County, California (Figure 1). The site is bounded by Old Mormon Slough to the north, Washington Street and Interstate Highway 5 to the east, and a railroad spur to the south (Figure 2). In 1970, Mormon Slough was partially filled during construction of Interstate 5, which subsequently divided the slough into a western segment (Old Mormon Slough) and an eastern segment (New Mormon Slough). Both sloughs are tributaries to the San Joaquin River. Old Mormon Slough discharges to the San Joaquin River about 500 m downstream of the site at the Turning Basin. The river flows into the Pacific Ocean 150 km further downstream.

From 1942 to 1990, the McCormick & Baxter Creosoting Company operated a wood preserving facility at the site. The main processing area covered the north-central portion of the site. Treated and untreated wood was stored throughout the south-central, east, and southeast portions of the site. Creosote and oil-borne solutions were the primary products used during wood treating operations. The contaminants associated

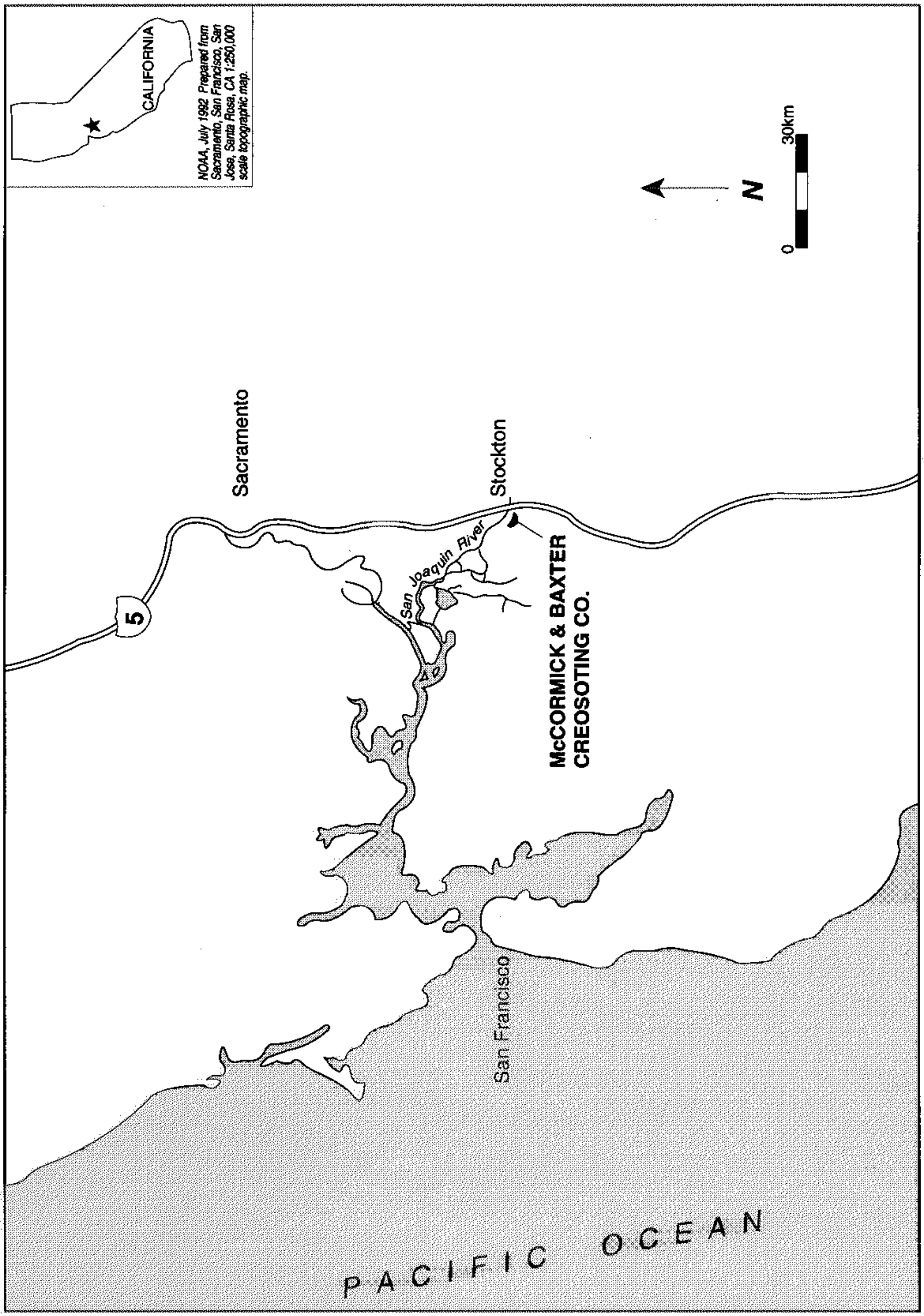

Figure 1. The McCormick & Baxter Creosoting site, Stockton, California.

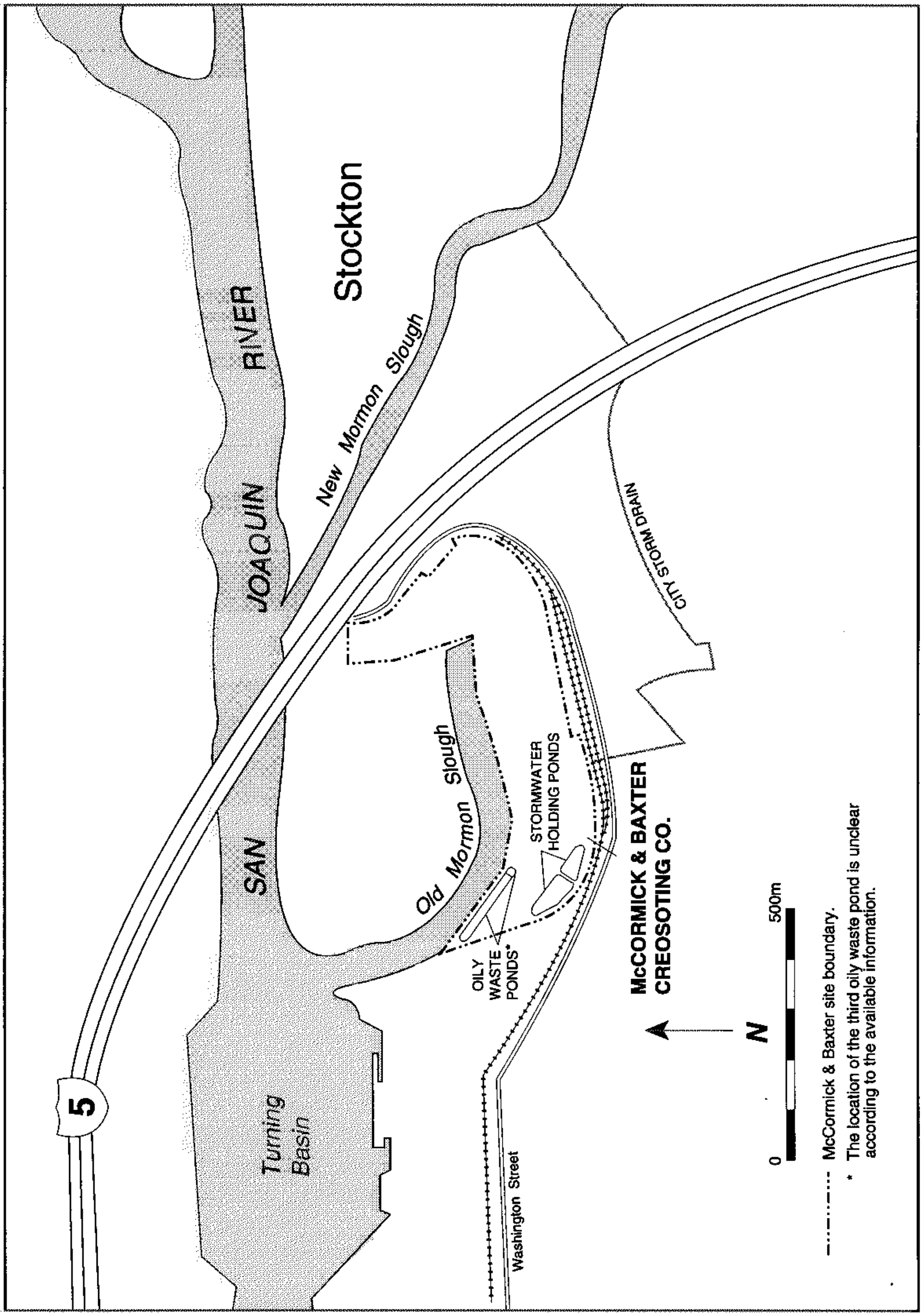

Figure 2. Features around the McCormick & Baxter site (USGS 1987; Ecology and Environment 1991).

with these products include PCP, butane, ether, ammoniacal copper arsenate, ammoniacal copper-zinc arsenate, diammonium phosphate, ammonium sulfate, boric acid, chromium, copper, arsenic, and zinc. Waste solutions from treatment processes and surface water runoff contained PAHs, PCP, and arsenic residues (Ecology and Environment 1991).

The mostly unpaved site has two clay-lined stormwater collection ponds in its southwest corner. In the past, there were also three contiguous oily waste ponds in the northwest corner. The oily waste ponds, which cover an area of 1,700 m^2 and are located less than 12 m from Old Mormon Slough, were used from the early 1940s until 1980 for storage of PCP or creosote-contaminated sludge. Oily wastes from these holding ponds were reportedly transferred to trucks for off-site disposal during site operations. In 1981, approximately 635,000 kg of contaminated soils were removed from the ponds, which were then covered with approximately one foot of clean fill (Ecology and Environment 1991).

The two stormwater collection ponds were built from 1977 to 1979; their combined volume is 8,300,000 l. Since 1979, stormwater runoff has reportedly been pumped from 17 underground rainwater and process wastewater sumps to the collection ponds, where it has been discharged to the Stockton Regional Wastewater Control Facility. A dike was also reportedly constructed around the site during the late 1970s to inhibit the off-site transport of stormwater runoff to Old Mormon Slough (Ecology and Environment 1991).

A fish kill in the New Mormon Slough in 1977 was probably caused by stormwater runoff from the site entering the slough via the City of Stockton storm sewer system. Limited data were available about the numbers and types of fish killed (Sanford personal communication 1992).

Surface water runoff, direct discharge, and groundwater discharge are potential pathways of contaminant transport from the site to NOAA resources and associated habitats. Before construction of the stormwater holding ponds, surface water runoff from the site collected in on-site storm sewer drains and discharged directly into New Mormon Slough and the Stockton Regional Wastewater Control Facility. In 1971, the company obtained a NPDES permit to discharge some wastewater directly to Old Mormon Slough. However, some of the site-related storm drains that discharged to New Mormon Slough were excluded from the permit order. All on-site storm sewer drains were reportedly closed upon completion of the stormwater holding ponds (Ecology and Environment 1991).

Shallow groundwater near the site is less than 15 m below ground surface and generally flows to the east. Groundwater in the deep aquifer is about 18 to 43 m below ground surface and flows to the southeast. Groundwater in the shallow aquifer has a downward vertical gradient due to large withdrawals of water from industrial wells in the area (Ecology and Environment 1991).

NOAA Trust Habitats and Species

The primary habitats of concern to NOAA are the surface water and associated bottom substrates of the San Joaquin River and Mormon Slough. The slough is approximately 6 m deep and tidally influenced near the site. Excessive organic loading has caused a low dissolved oxygen problem in the slough (Proctor personal communication 1992). Salinities near the site are generally 3 ppt, but fluctuate throughout the year from rainfall, saltwater intrusion, and agricultural runoff. The Stockton shoreline has limited vegetation and is primarily composed of riprap, pier, and piling. Trust species migrate to habitats near the site and reside there for extended periods during sensitive life stages. No endangered or threatened species use habitats near the site (Kholhorst personal communication 1992).

Surface water near the site provides spawning, nursery, and adult habitat for anadromous species (Table 1; Kholhorst personal communication 1992). Five species of anadromous fish use the San Joaquin River for migratory and adult habitat. Striped bass are considered resident to the area. Even though surface water near the site is tidally influenced, salinities are higher upstream due to the input of agricultural-related organic salts. Striped bass and delta smelt use downstream locations for spawning because of lower salinities, generally migrating back to the area of the site as juveniles after one to two years (Kholhorst personal communication 1992). White sturgeon and, less commonly, American shad migrate through the area to reach spawning grounds about 30 km upstream of the site in the San Joaquin River. A small run of chinook salmon migrates past the site to reach upstream spawning areas. There are no invertebrate species of concern to NOAA near the site (Kholhorst personal communication 1992).

There is a small commercial bait fishery for threadfin shad near the site that is restricted to dip netting. There are no other commercial

Table 1. Fish species present in the San Joaquin River near the McCormick & Baxter Creosoting site.

Species		Habitat				Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Migratory Route	Comm. Fishery	Recr. Fishery
ANADROMOUS SPECIES							
White sturgeon	*Acipenser transmontanus*		♦	♦	♦		♦
American shad	*Alosa sapidissima*		♦	♦	♦		♦
Delta smelt	*Hypomesus transpacificus*						
Striped bass	*Morone saxatilis*		♦	♦	♦		♦
Chinook salmon	*Oncorhynchus tshawytscha*		♦		♦		♦

fisheries in the San Joaquin River although there is an intense recreational striped bass fishery in the area. Largemouth bass and white catfish are also popular recreational fisheries; shore angling is popular near the site. There are no restrictions on these fisheries other than general regulations regarding take limit and minimum sizes (Kholhorst personal communication 1992).

Since 1972, a limited consumption health advisory has been in effect for white catfish, largemouth bass, and striped bass due to excessive levels of mercury contamination in the area (Kholhorst personal communication 1992).

Site-Related Contamination

The primary contaminants of concern to NOAA are trace elements, PCP, and PAHs. Dioxin is also a potential contaminant of concern since it freqently contaminates technical-grade PCP (Eisler 1989). Data from preliminary site investigations indicate that soil, groundwater, and surface water at the site contain elevated concentrations of site-related contaminants (Ecology and Environment 1991). Maximum concentrations of these inorganic substances and organic compounds are summarized in Table 2, along with applicable screening guidelines. Sediment

Table 2. Maximum concentrations of contaminants of concern at the site.

	Water (μg/l)				Soils (mg/kg)	
	Ground-water	Surface water runoff	Stormwater pond influent	AWQC[1]	Soil	Average U.S.[2]
INORGANIC SUBSTANCES						
Trace Elements						
Arsenic	86	7,800	6,200	190	2,400	5
Copper	NR	2,100	7,000	12+	1,900	30
Chromium	2,470	NR	1,400	11	1,300	100
ORGANIC COMPOUNDS						
SVOCs						
PCP	67,000	46,000	29,000	13	5,100	NA
Total PAHs	11,000	2,300	2,000	NA	9,270	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1986).
2: Lindsay (1979).
NR: Data not reported; not clear in site documentation if constituent was analyzed for.
NA: No value available.

samples were not collected from Old and New Mormon sloughs in October 1987.

Soil, groundwater, and surface water results were reported only for arsenic, chromium, copper, PCP, and PAHs. These were the only chemical constituents analyzed in soils, but it was not clear in the available site documentation whether groundwater or surface water samples were analyzed for other chemical constituents. Because only summarized chemical data were available for review, it was also not possible to evaluate the frequency and distribution of contaminants measured at concentrations exceeding screening guidelines for any medium.

Concentrations of arsenic, chromium, and copper measured in subsurface soil exceeded average U.S. soil concentrations for these elements. Highest concentrations were reportedly measured in the north-central area of the site and near the oily waste ponds. Of these trace elements, only chromium was measured in on-site groundwater at a concentration exceeding its freshwater chronic AWQC by a factor greater than ten. Concentrations of arsenic and copper detected in surface water runoff samples collected from unspecified locations at the site exceeded their screening criteria by up to two orders of magnitude. These inorganic substances and chromium were also measured in inflow from the stormwater holding ponds at concentrations greater than screening criteria.

PCP was measured in on-site soils at high ppm concentrations; because there are no screening guidelines for PCP in soils no conclusions can be drawn about these concentrations. PCP was detected in on-site groundwater at a concentration exceeding its AWQC by three orders of magnitude. This organic compound was also measured in the surface water runoff on site and in the surface water runoff entering the stormwater holding ponds (referred to as "influent samples") at high concentrations. In 1977, a fish kill in the New Mormon Slough was attributed to stormwater runoff from the site entering the slough via the City of Stockton storm sewer system. An estimated 50 to 100 catfish were killed, along with less than 25 striped bass (Fransen personal communication 1992). Subsequent sampling of the New and Old Mormon sloughs indicated that PCP concentrations in the surface water ranged from 0.2 to 3,900 µg/l and exceeded its screening criterion. In addition, PCP was detected at a concentration of 6.2 million µg/l in an on-site storm drain sampled as part of the fish kill investigation.

No conclusions can be drawn about the high ppm concentrations measured of total PAHs in on-site soils because are no screening guidelines for PAHs in soils. In groundwater, naphthalene (9,300 µg/l) exceeded its screening criterion (620 µg/l) by a factor greater than ten. Phenanthrene (2,100 µg/l) was also detected in groundwater but there is no screening criterion for this compound. Individual PAHs were not detected in the surface water runoff or influent samples from the site at concentrations exceeding available AWQC. However, total PAHs were detected in these samples at high ppb concentrations.

Summary

Trace elements, PCP, and PAHs were detected above screening criteria in soil, groundwater, and surface water. NOAA is concerned about the possible presence of dioxin in environmental media. The San Joaquin River near the site provides spawning, nursery, and adult habitat for anadromous species. Striped bass are resident in the area. A bioassessment in habitats of concern to NOAA is needed to determine the effects of site-related contamination.

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9

Naval Weapons Station Concord

Concord, California

CERCLIS #CA7170024528

Site Exposure Potential

The Naval Weapons Station (NWS) at Concord, California has operated since 1942 and is the U.S. Navy's major ammunition transshipment port on the West Coast. NWS Concord is on the south shore of Suisun Bay, about 50 km northeast of San Francisco (Figure 1). Suisun Bay connects to San Francisco Bay through San Pablo Bay, about 15 km west of the facility. San Francisco Bay flows directly into the Pacific Ocean.

The 5,200-hectare NWS is divided into two principal areas: the Tidal Area and the Inland Area (Figure 2). The Tidal Area encompasses about 3,100 hectares along Suisun Bay, plus seven islands and two islets of the Seal Islands in the bay north of the station. The Tidal Area contains the four Remedial Action Subsites composed of the eight parcels also known as the "litigation sites." The Tidal Area is used for ordnance operations and includes a pier, rail car complex, facilities for ammunition segregation and transfer, warehouses, support buildings, landfill, woodhogger, and dunnage yard. Most of the islands are leased for agriculture and recreational hunting. Industrial activity continues at six nearby contaminated properties owned by Allied-Signal, Inc., Chemical & Pigment Company,

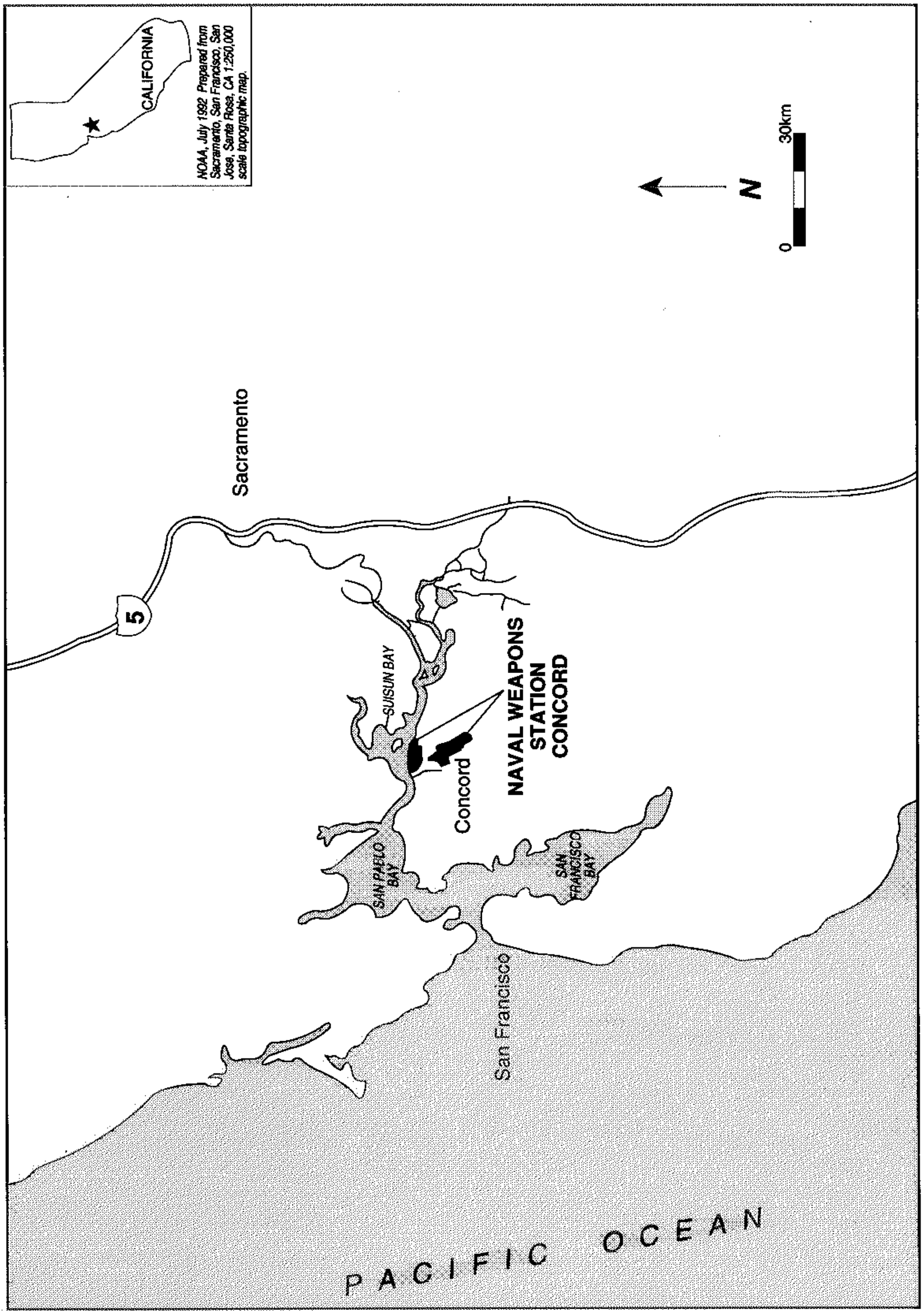

Figure 1. Naval Weapons Station Concord, Concord, California.

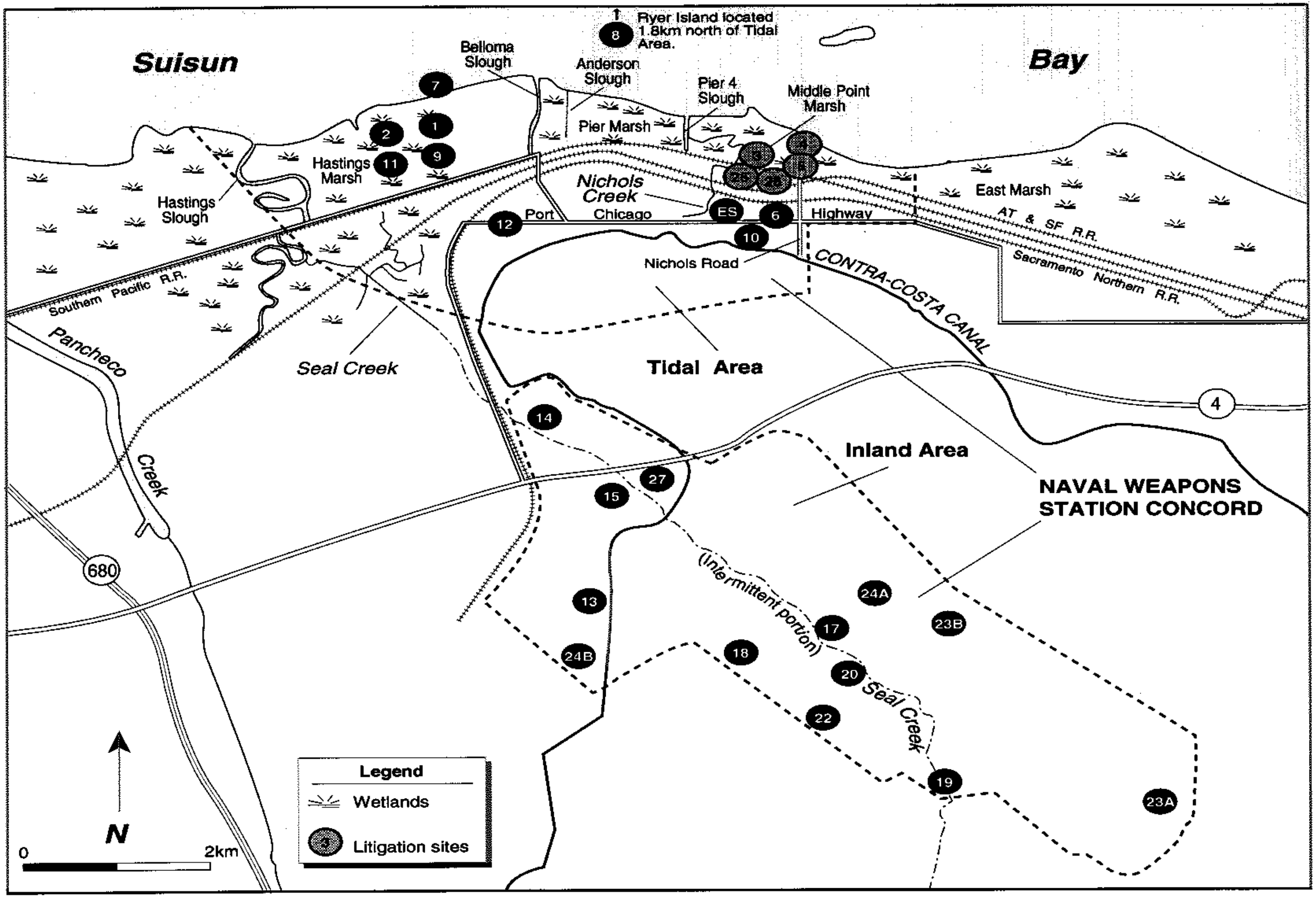

Figure 2. The Naval Weapons Station in Concord, California (Ecology and Environment 1983; Lee et al. 1986; IT Corporation 1991). Site locations are approximate.

Sacramento Northern Railroad Company, Atchison, Topeka & Santa Fe Railroad Company, and the Southern Pacific Transportation Company. The 2,100-hectare Inland Area, used primarily for ammunition storage, includes production facilities and the Weapons Quality Engineering Center. At least 28 potentially contaminated sites have been identified within these two areas: 15 in the Tidal Area and 13 in the Inland Area (Ecology and Environment 1983; IT Corporation 1992; PRC and J.M. Montgomery 1992; Table 1).

An Initial Assessment Study of the Concord site was completed in 1983 (Ecology and the Environment 1983). A remedial investigation and a feasibility study were completed in 1986 and 1988, respectively, for sites in the eastern portion of the Tidal Area (Kendall and Lunz 1986; Lee et al. 1988). Remedial investigations are in progress for Sites 1, 2, 9, and 11 of the Tidal Area, and for all sites in the Inland Area except Site 15 (IT Corporation 1992; PRC and J.M. Montgomery 1992).

Surface water runoff, direct discharge, and groundwater are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Surface water within the Tidal Area that may receive overland flow from source areas include the Contra Costa Canal, several creeks and sloughs, mosquito control ditches, and wetlands. Except for the Contra Costa Canal, which flows south away from the site, these surface water features discharge either directly or indirectly to Suisun Bay (Lee et al. 1986). Seal Creek, an intermittent stream that traverses the Inland Area and eventually discharges to the bay, may receive surface water runoff from both the Tidal and Inland areas via sumps and drainage ditches. Direct discharges to Suisun Bay may also occur as a result of tidal flooding of the Tidal Area sites. Waste materials have also been observed in the Tidal Area wetlands (IT Corporation 1992).

Shallow groundwater beneath the Tidal Area ranges from immediately below ground surface to 1.5 m below ground surface (IT Corporation 1992). Beneath the Inland Area, shallow groundwater occurs from 9 to 12 m below ground surface (PRC and J.M. Montgomery 1992). Shallow groundwater throughout the NWS generally flows north toward Suisun Bay.

NOAA Trust Habitats and Species

Suisun Bay is the primary NOAA trust habitat of concern near NWS Concord. Secondary potential habitats of concern include the on-site wetlands, ditches, sloughs, and creeks (Figure 2). Suisun Bay is a transition zone between the saltwater ecosystem of San Francisco Bay and the freshwater ecosystems of the Sacramento and San Joaquin rivers, which drain into Suisun Bay about 20 km east of the NWS. Salinities in the vicinity of the site generally range from 2 to 16 ppt, but fluctuate as a result of tides, rainfall, saltwater

Table 1. Waste disposal areas, periods of use, and waste types and quantities identified at NWS Concord.

Disposal Area	Period of Use	Waste Types	Estimated Waste Quantity
TIDAL AREA SITES			
Tidal Area Landfill (Site 1)*	1944-1979	solvents, acids, paints, creosote, asbestos, ordnance, general wastes	30,000,000 kg
R Area Disposal Site (Site 2)*	1940s-1976	paints, solvents, inert ordnance	590,000 kg
Coke Pile (CP; Site 6)*	20 years[a]	spent coke, inorganic substances	1,100 m^3
1944 Explosion Docks (Site 7)	1944	unexploded ordnance	unknown
Ryer Island (Site 8)	1944	unexploded ordnance	2 boxcars
Froid & Taylor Roads Site (Site 9)*	1944-1979	ordnance, scrap metal	46 m
Nichols Road Site (Site 10)	at least since 1962[a]	spent coke	38 m^3
Wood Hogger Site (Site 11)*	1968-1973	PCP-contaminated wood	20 tons
Port Chicago Site (Site 12)	1930s-1976	unknown	unknown
Litigation Sites			
Kiln Site (KS; Site 3)*	unknown	inorganic substances	unknown (2 ha)[b]
Allied Site A (AA; Site 4)*	20 years[a]	inorganic substances	unknown (1.2 ha)[b]
Allied Site B (AB; Site 5)*	20 years[a]	inorganic substances	unknown (2 ha)[b]
K-2 (Site 25)*	unknown	refinery wastes, coke debris	unknown (2 ha)[b]
G-1 (Site 26)*	20 years[a]	refinery wastes	unknown (2.4 ha)[b]
ES*	20 years[a]	inorganic substances	unknown
INLAND AREA SITES			
Burn Area (Site 13)	1944-1979	powder, flares, napalm	230,000 kg
Kinne Boulevard Wells (Site 14)	1960s	fuel oil, miscellaneous chemicals	unknown
Railroad Classification Yard (Site 15)	unknown	methyl bromide vials, spent ordnance	4 10-cm vials; several casings
Building IA-24 (Site 17)	1950s-1974	battery acid, lead	380,000 l
Building IA-25 (Site 18)	1950s-present	paints, solvents	3,800 l
Seal Creek Disposal Area (Site 19)	1950s-present	asphalt, construction debris, miscellaneous wastes	77 m^3
Old Homestead, Seal Creek (Site 20)	pre-1943[a]	household debris	4 m^3
Building 7SH5 (Site 22)	1950s-1970s	solvents, paints, cleaners	1,900 L
Inland Area EOD (Site 23A)	1940s-1959	explosives	<900 kg
Eagle's Nest EOD (Site 23B)	1959-1970s	explosives	<900 kg
Pistol Firing Range (Site 24A)	25 years[a]	ammunition	<9,000 kg
Aircraft Firing Range (Site 24B)	unknown	ammunition	<9,000 kg
Building IA-20 (Site 27)	1964-1968	Freon 113, hydraulic fluids	unknown

[a]Actual period of use unknown.
[b]Approximate area of contaminated soil.
*Contaminant data available for these sites only.

intrusion, and agricultural runoff (Nichols and Pamatmat 1988).

There are four major wetlands along Suisun Bay within the boundaries of the NWS: Hastings Marsh in the western portion of the Tidal Area; Pier and Middle Point marshes in the north-central section of the Tidal Area; and East Marsh in the eastern portion of the Tidal Area (Figure 2). Hastings Marsh is drained primarily by Hastings Slough, which traverses the westernmost portion of the marsh and receives discharge from

Seal Creek. Middle Point Marsh is traversed by Nichols Creek, which receives periodic discharges from the Contra Costa Canal during flooding. The Pier and Middle Point marshes are also drained by the Belloma, Anderson, and Pier 4 sloughs. In addition, there is a series of mosquito control ditches throughout the four major wetlands.

A majority of these four wetland areas are north of the Southern Pacific and ATSF railroads (Figure 2). This area is tidally influenced and the wetlands are primarily brackish water. There is a 1-m tidal range within these wetlands (Lee et al. 1986). The brackish water wetlands are dominated by five plant community types: saltwort (*Salicornia*) and saltgrass (*Distichlis*) dominate the upland areas, bulrush (*Scirpus*) dominates the wetlands that are periodically inundated, while rush (*Juncus*) and cattail (*Typha*) dominate the deeper-water habitats near Suisun Bay and in some areas along the Port Chicago Highway and Frontage Road. Wetlands south of the Southern Pacific Railroad are freshwater and it is not known whether they are subject to direct tidal action. They include the southern portions of Hastings and Middle Point marshes, plus small pockets of freshwater wetlands in low-lying areas.

Suisun Bay forms a migration corridor and nursery area for seven species of anadromous fish: green sturgeon, white sturgeon, delta smelt, chinook salmon, steelhead trout, striped bass, and American shad (Table 2; Bybee personal communication 1990; Kholhorst personal communication 1992). The winter-run chinook salmon is a federally threatened species. The U.S. Fish and Wildlife Service is currently petitioning for similar status for delta smelt (IT Corporation 1992). All seven anadromous species spawn in the Sacramento and San Joaquin rivers upstream of the site, as well as in their tributaries. The largest populations are in the mainstem of the Sacramento River. The confluence of the San Joaquin and Sacramento rivers is an important congregation area during upstream and downstream anadromous fish migrations, particularly for chinook salmon, steelhead trout, and sturgeon. Striped bass and delta smelt are known to spawn in Suisun Bay. During periods of high salinity, Dungeness crab and bay shrimp are also present near the site (Wooster personal communication 1989; Kholhorst personal communication 1992).

Little is known about species use of the habitats within the on-site wetlands, ditches, sloughs, and creeks, although the sloughs are the principal access points for any fish species entering the on-site wetlands. Water levels within the sloughs are extremely low during dry periods, restricting fish from entering the wetlands from the sloughs. Low water levels in Hastings Slough also likely limit the upstream migration of trust species to the lower reaches of Seal Creek. In addition, high water temperatures and low dissolved oxygen may limit the use of the on-site sloughs by fish. Although it is possible that striped bass use the wetlands on the NWS for nursery habitat, the dominant fish community in these wetlands is likely to be a freshwater minnow-type species (*cyprinids*; Lee et al. 1986; Wooster personal communication 1989). The Contra Costa Canal is an irrigation system hydraulically connected to

Table 2. Selected fish species present in San Pablo Bay, Suisun Bay, and the Sacramento River near Naval Weapons Station Concord, Concord (Bybee personal communication 1990; Kholhorst personal communication 1992).

Species		Habitat				Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Migratory Route	Comm.	Recr.
ANADROMOUS SPECIES							
Green sturgeon	*Acipenser medirostris*		♦	♦	♦		♦
White sturgeon	*Acipenser transmontanus*		♦	♦	♦		♦
American shad	*Alosa sapidissima*		♦	♦	♦		♦
Delta smelt	*Hypomesus transpacificus*	♦	♦	♦			
Striped bass	*Morone saxatilis*	♦	♦	♦	♦		♦
Steelhead trout	*Oncorhynchus mykiss*		♦	♦	♦		♦
Chinook salmon	*Oncorhynchus tshawytscha*		♦	♦	♦		♦
NON-ANADROMOUS SPECIES							
Shiner perch	*Cymatogaster aggregata*	♦	♦	♦			
Starry flounder	*Platichthys stellatus*		♦	♦			
INVERTEBRATE SPECIES							
Dungeness crab	*Cancer magister*		♦	♦			
Bay shrimp	*Crangon spp.*			♦		♦	

on-site wetlands only during flooding events (Lee et al. 1986). It is unlikely that this canal provides habitat for any NOAA trust species.

There are no commercial fisheries near the site, although commercial bait fishing for Bay shrimp extends into the lower reaches of Suisun Bay during periods of abnormally high salinity (Hergeshell personal communication 1989). Sport fishing for anadromous fish, except delta smelt and winter-run chinook salmon, coincides with seasonal runs. In general, chinook salmon are caught in the fall and steelhead trout during the winter. There are no restrictions on these fisheries other than general regulations on take limit and minimum sizes (Wolcott personal communication 1989; Kholhorst personal communication 1992).

In 1984, NWS Concord and the U.S. Fish and Wildlife Service designated Middle Point Marsh as a Wetland Preserve along with four other mainland wetlands and six island areas. The locations of the other wetland areas designated as Wetland Preserves were not clear in the documentation. A National Wildlife Refuge may be established on the areas designated as Wetland Preserve (O'Neil 1986).

Site-Related Contamination

Data collected during site investigations indicate that groundwater and surface water (Table 3), and soil and sediment (Table 4) at the NWS Concord site contain elevated concentrations of site-related contaminants (Lee et al. 1986, 1988; IT Corporation 1991, 1992). Some of these contaminants were also detected in tissue samples of clams (*Corbicula fluminea*) collected from the site (Table 5; Lee et al. 1986; IT Corporation 1992). The primary contaminants of concern to NOAA are trace elements, arsenic, pesticides, PCBs, and PAHs. Secondary contaminants of concern include explosive compounds.

Contaminant data were available only for eleven sites in the Tidal Area (Table 1). Four of these sites (Sites 1, 2, 9, and 11) are in Hastings Marsh; contaminant data for these sites were compiled from site investigations conducted from 1988 to 1991 (IT Corporation 1991, 1992). The remaining seven sites (Sites 3, 4, 5, 6, 25, 26, and ES) are in or near Middle Point Marsh; data from these sites were compiled from 1984 site investigations (Lee et al. 1986, 1988). Not all contaminants were analyzed for in all media.

Bioaccumulation studies using the Asiatic clam (*C. fluminea*) were conducted for Middle Point Marsh during 1984 and 1986 and for Hastings Marsh during 1988 and 1989. Tissues were analyzed for trace elements, VOCs, pesticides, and PCBs. Not all analytes were tested for during each study. No toxicity tests have been conducted at the site.

Background samples were collected for all media. However, concentrations of several trace elements in these samples exceeded their screening guidelines by up to three orders of magnitude. The background sampling locations were located close to a working pier area that may have exhibited local contamination. Therefore, measured background concentrations probably do not represent background conditions.

Concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc in soils collected from the Tidal Area sites in Hastings Marsh exceeded average U.S. concentrations for these inorganic substances in soils. Except for arsenic, these trace elements were also detected in groundwater from sites in Hastings Marsh at concentrations exceeding chronic AWQC (U.S. EPA 1986) by factors greater than ten. Fewer trace elements were detected in surface water samples from these sites, but detection limits for many of the trace elements in surface water were greater than their AWQC. Except for cadmium and silver, all of the trace elements detected in soils were also measured at elevated concentrations in sediments from the Tidal Area sites in Hastings Marsh. Concentrations of chromium, copper, lead, mercury, silver, and zinc measured in tissues of *C. fluminea* collected from several locations in Hastings Marsh were greater than those concentrations measured in clam tissues collected from site background locations.

Arsenic, cadmium, copper, lead, mercury, nickel, and zinc were detected in soil samples collected from Tidal Area sites in Middle Point Marsh at concentrations greater than average U.S. soils concentrations. Of these trace elements, concentrations of cadmium, copper, and lead detected in groundwater samples exceeded their AWQC by

Table 3. Maximum concentrations of trace elements detected in groundwater and surface water samples from Tidal Area sites in Hastings and Middle Point marshes at NWS Concord.

	Groundwater (µg/l)			Surface Water (µg/l)		AWQC[1] (µg/l)
	Hastings Marsh Sites[2]	Middle Point Marsh Sites[3]	Site Background[2,3]	Hastings Marsh Sites[4]	Site Background[5]	
Arsenic	140	57	7.6	7	<10	36
Cadmium	190	40	<3.0	<5	<100	1.1+
Chromium	1,400	NT	NR	<10	<200	11
Copper	170	220	46	19	<500	2.9*
Lead	130	240	58	<48	<10	3.2+
Mercury	0.56	NT	NR	<0.3	0.3	0.012
Nickel	3,400	NT	NR	130	<800	8.3
Silver	110	NT	NR	<7	<100	0.12
Zinc	5,000	200	120	110	<400	86

1 Because the site is part of an estuarine system, the data presented are the lower of freshwater and marine chronic AWQC (U.S. EPA 1986).
2 Data compiled from 1990 and 1991 sampling events (IT Corporation 1991, 1992).
3 Data compiled from 1984 through 1987 sampling events (Lee et al. 1986, 1988).
4 Data compiled from 1988, 1989, and 1990 sampling events (IT Corporation 1992).
5 Data compiled from 1988 and 1989 sampling events; 1990 data were not presented (IT Corporation 1992).
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ used).
*: Acute criterion presented; chronic criterion not available.
< Not detected at detection limit shown.
NR: Data not reported; it was not clear in the available documentation if the chemical was analyzed for.
ND: Not detected at method detection limit.
NT: Not tested.

Table 4. Maximum concentrations of trace elements detected in soil and sediment samples collected from Tidal Area sites located in Hastings and Middle Point marshes at NWS Concord.

	Soil (mg/kg)				Sediment (mg/kg)			
	Hastings Marsh Sites[1]	Middle Point Marsh Sites[2]	Site Background[1,2]	Average U.S.[3]	Hastings Marsh Sites[4]	Middle Point Marsh Sites[2]	Site Background[4]	ER-L[5]
Arsenic	530	1,500	93	5	38	3,500	52	33
Cadmium	9.0	88	3	0.06	2.3	70	1.4	5
Chromium	150	NT	81	100	84	NT	NR	80
Copper	4,800	11,000	10,000	30	640	1,400	98	70
Lead	4,700	7,800	170	10	1,600	530	180	35
Mercury	0.79	NT	0.43	0.03	1.5	NT	NR	0.15
Nickel	240	260	87	40	110	104	NR	30
Silver	3.6	NT	<3.0	0.05	<2.2	NT	NR	1
Zinc	5,500	85,000	3,700	50	640	5,600	190	120

1 Data compiled from 1989 through 1991 sampling eventts (IT Corporation 1992).
2 Data compiled from 1984 through 1987 sampling events (Lee et al. 1986, 1988).
3 Lindsay (1979).
4 Data compiled from 1990 sampling event (IT Corporation 1992).
5 Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
< Not detected at detection limit shown.
NR: Data not reported; it was not clear in the available documentation if the chemical was analyzed for.
NT: Not tested.

Table 5. Maximum concentrations of trace elements measured in tissues of *Corbicula fluminea* collected from Tidal Area sites located in Hastings and Middle Point marshes at NWS Concord.

	Hastings Marsh Sites[1] mg/kg	Middle Point Marsh Sites[2] mg/kg	Site Background[1] mg/kg
Arsenic	ND	2.6	ND
Cadmium	<0.7	2.7	<0.3
Chromium	4.2	NT	1.3
Copper	14	88	12
Lead	1.1	9.2	<0.5
Mercury	0.2	NT	<0.5
Nickel	ND	10	ND
Silver	5.2	NT	<0.5
Zinc	53	280	21

1 Data compiled from 1988 and 1989 sampling events (IT Corporation 1992).
2 Data compiled from 1984 and 1986 sampling events (Lee et al. 1986, 1988).
< Not detected at detection limit shown.
ND: Not detected at method detection limit.
NT: Not tested.

factors greater than ten. All of the trace elements detected in soils from the sites sampled in Middle Point Marsh were also measured at elevated concentrations in sediment samples collected from these sites. Surface water samples were not collected from any of the Tidal Area sites in Middle Point Marsh. Arsenic, cadmium, copper, lead, nickel, and zinc were detected in clam tissues from locations in the marsh at concentrations greater than those measured in site background clam tissues.

Beta-BHC (12 mg/kg), dieldrin (34 mg/kg), DDT (0.62 mg/kg), and chlordane (0.42 mg/kg) were detected in soils from Tidal Area sites in Hastings Marsh. PCBs (1,800 mg/kg) were also detected in soils from these sites. These organic compounds were not analyzed for in media from the Tidal Area sites in Middle Point Marsh; there are no screening guidelines for pesticides or PCBs in soils.

Concentrations of pesticides and PCBs exceeding screening guidelines were not detected in any groundwater or surface water samples collected from the Tidal Area sites.

PAHs were detected at a maximum total concentration of 190 mg/kg in soils from the sites in Hastings Marsh. Only low concentrations of these organic compounds were detected in soils from Middle Point Marsh. There are no screening guidelines for PAHs in soils. Concentrations of PAHs exceeding screening guidelines were not detected in any groundwater or surface water samples collected from the Tidal Area sites.

Explosive compounds, including diphenylamine (130 μg/kg), nitrobenzene (1,000 μg/kg), and 2,6-dinitrotoluene (160 μg/kg) were detected in soil samples collected from sites in Hastings Marsh. These compounds were not analyzed for in media from the sites in Middle Point Marsh.

However, since there are no screening guidelines for explosive compounds in soil, no conclusions could be drawn about these concentrations. Explosive compounds were not detected in any groundwater or surface water samples analyzed from the Tidal Area sites.

Summary

NOAA is mainly concerned about contamination in Suisun Bay and wetland habitats near the bay. Bioassessments have shown that contaminants are mobile and have accumulated in biological receptors in the wetlands. No toxicity testing has been done and no investigations have been conducted in Suisun Bay. Sediments and biota in these habitats need to be sampled and analyzed for both inorganic and organic contaminants.

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9

Andersen Air Force Base

Yigo, Guam

CERCLIS #GU6571999519

Site Exposure Potential

Andersen Air Force Base, on Guam in the western Pacific, is about 6,000 km west of Hawaii and 2,500 km southeast of Japan (Figure 1). The base has operated since the 1940s and was used for military, logistical, and air support during the Korean and Vietnam wars. Today, it supports strategic air command operations. The main portion of the base occupies about 6,100 hectares on the northern portion of the 540-km^2 island and consists of the North Field, an operational airfield, and the Northwest Field, an inactive airfield. Andersen South and Harmon Annex are detached activities that occupy about 2,000 hectares south of the main portion of the base (Figure 1). There are 38 disposal sites within the main base and annex areas; 15 of these were addressed in the RI/FS because of the nature of contamination or potential for contaminant migration. Table 1 provides background information and summarizes disposal activities for each of these 15 sites. Materials disposed of include waste fuels, cleaning compounds, construction debris, organic chemicals, pesticides, and fertilizers (SAIC 1990; U.S. EPA 1991).

The topography of Northern Guam consists of a marine limestone plateau 90 to 180 m above sea level that overlies the volcanic island core. Sinkholes from 1 to 20 m deep, closed depressions,

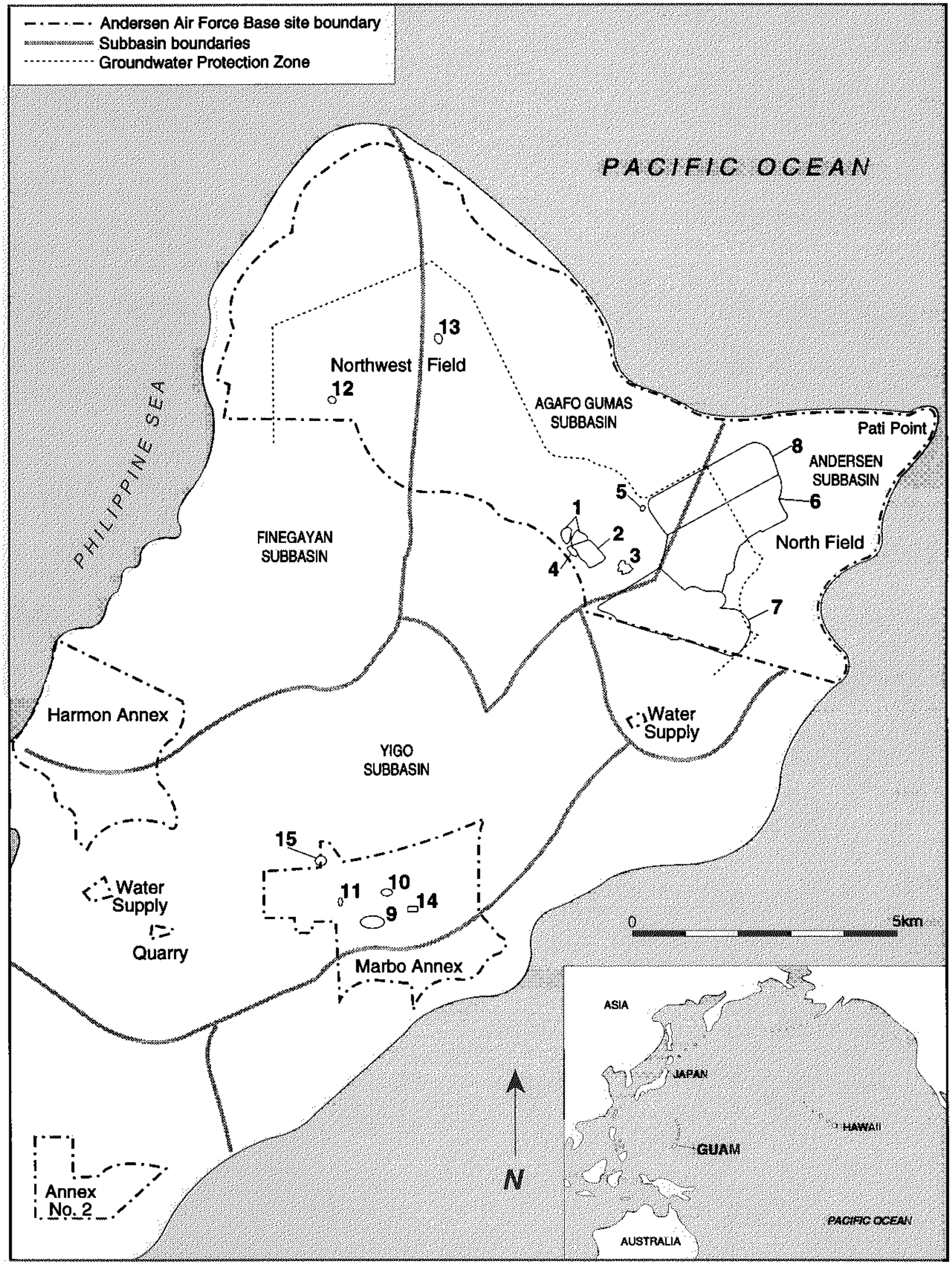

Figure 1. Andersen Air Force Base and sites 1 through 15 in the northern portion of Guam (SAIC 1990).

Table 1. Activities with potential contamination or contaminant migration and their associated wastes at the Andersen Air Force Base (SAIC 1990).

Activity	Size (ha.)	Types of Wastes	Hydrologic Subbasin	Disposal Methods
1 Landfill 1945-Present	8	Sanitary trash, waste POL, waste chemicals	Agafo Gumus	Area/pit fill
2 Landfill 1947-1974	16	Sanitary trash, waste POL, waste chemicals, waste solvents, pesticides, scrap metal, construction debris, UXO[2]	Agafo Gumus	Trench fill with burning
3 Waste Pile 1947-1977	3	Chemical/industrial wastes, sanitary trash, waste POL, pesticides, scrap metal, construction debris	Agafo Gumus	Area fill
4 Waste Pile	NA	Asphalt tar	Agafo Gumus	Drum disposal area; drums rusted, leaking
5 Fire Training Area 1958-1988	NA	Waste fuels, oils, and solvents	Agafo Gumus	Contaminated fuels burned during training exercises in unlined berm area
6 Stormwater Drainage System 1940s-Present	NA	Runoff from industrial shops may contain residue of sulfuric acid, ethylene glycol, aircraft-cleaning compound, alodine solution, chromic acid, paint stripper, detergent, boiler blowdown, pesticides, fertilizers	Andersen	Dry wells in natural low area to rapidly remove surface runoff; will collect surface contaminants from nearby areas
7 Stormwater Drainage System 1940s-Present	NA	Runoff from industrial shops containing residues of ethylene glycol, pesticides, fertilizers	Andersen	Dry wells in natural low area to rapidly remove surface runoff; will collect surface contaminants from nearby areas
8 Stormwater Drainage System 1940s-Present	NA	Runoff from industrial shops may contain residues of alodine solution, chromic acid, paint stripper, detergent, aircraft-cleaning compound, pesticides, fertilizers	Andersen Agafo Gumus	Dry wells in natural low area to rapidly remove surface runoff; will collect surface contaminants from nearby areas
9 Waste Pile 1945-1962	5	Sanitary trash, waste POL, solvents, scrap vehicles and equipment, construction debris, waste dry-cleaning fluids	Yigo	Area fill
10 Waste Pile	2	Construction debris	Yigo	Area fill
11 Waste Pile	0.8	Construction debris, auto bodies	Yigo	Area fill, trench fill
12 Chemical Disposal 1952-1956	NA	Sanitary trash, waste oils, solvents	Finegayan	Area fill
13 Landfill 1966	0.8	Sanitary trash, construction debris	Agafo Gumus	Trench
14 Former Marbo Laundry Facility	NA	Halogenated hydrocarbons	Yigo	NA
15 Borrow Pit	2	organic chemicals	Yigo	NA
NA: Not available.				

and solution caverns are the primary features of the terrain. Due to the highly porous limestone and extremely permeable soils, there is no surface water on the site, which is bordered by the Pacific Ocean. The Northern Guam lens aquifer underlying the base supplies drinking water to at least 50 percent of the population and is recharged by rainwater. Depth to water in the 150- to 240-m freshwater lens varies with sea level changes, tidal fluctuations, and seasonal fluctuations. Because of the aquifer's importance to the surrounding population, EPA designated a groundwater protection zone in 1986 to preserve and protect resources. Over half of the base lies in this protection zone (SAIC 1990; U.S. EPA 1991).

The Pacific Ocean is downgradient and near hazardous substance sources on the base. Groundwater is the only pathway for contaminant migration off-site near the base. The karst features provide quarry locations and dump sites for refuse by the base. There are several disposal areas within 300 m of the intertidal zone (U.S. EPA 1991). Given the topography, it is likely that groundwater discharges to the ocean. Areas of concern at the base overlie four of the six groundwater subbasins on Guam. The Finegayan, Agafo Gumus, Andersen, and Yigo subbasins are separated by hydrologic divides. Contaminants associated with groundwater are not expected to cross subbasin boundaries. The Air Force Installation Restoration Program indicated that groundwater flow in the four subbasins is as follows: west towards the Pacific Ocean in the Finagayan Subbasin, north towards the Pacific Ocean in the Agafo Gumus Subbasin, north and northeast towards the Pacific Ocean in the Andersen Subbasin, and south-southwest towards the Pacific Ocean in the Yigo Subbasin (SAIC 1990).

NOAA Trust Habitats and Species

Habitats of concern to NOAA include surface water, bottom substrates, and fringe reef habitats associated with approximately 29 km of coastline on the northern end of Guam. The majority of the coastline is bordered by fringing reef. Seaward portions of reef flats typically consist of well-developed algal (*Porolithon*) ridges intersected and undercut by numerous surge channels. There are lagoons measuring up to 1 m deep at mean low tide between the reefs and the beaches. Much of the habitat within the lagoons is a sandy substrate that supports extensive stands of seagrasses (*Halodule uninnervis*) and functions to consolidate bottom sediments. Portions of the lagoons have no seagrasses and commonly contain various corals and thin areas of sand. Outside of the fringe reefs, bottom substrates are typically hard-bottomed, consolidated limestone with scattered staghorn (*Acropora*) and coral (*Pocillopora*) populations. The outer reef slope of Guam drops off steeply (DAF 1992).

As many as 841 fish species have been recorded in the marine habitat surrounding Guam. Near the site, reef habitats support diverse, abundant populations of NOAA trust resources (Table 2).

The majority of these species are resident to the reef habitat and occur during sensitive live stages. Fish fauna include a variety of trophic types, including herbivores, omnivores, carnivores, and some planktivores. Species commonly occurring near the site include squirrelfish, grouper, jack, snapper, emperor, sweetlip, goatfish, rudderfish, wrasse, parrotfish, surgeonfish, and rabbitfish (DAF 1992). Surface water surrounding the northern side of the island near the site is an important source area for reseeding Guam's central and southern reefs with larvae and juveniles of fish and invertebrates (DAF 1992; Davis personal communication 1992).

The federally threatened green sea turtle (*Chelonia mydas*) actively nests along the beaches surrounding the site. Although the Hawksbill sea turtle (*Erectmocheyls imbricata*), a federally endangered species, is also thought to nest on these beaches, this behavior is undocumented (DAF 1992; Davis personal communication 1992).

There are no known commercial and recreational fisheries close to the base, although commercial trolling fisheries are a major economic source for Guam. Five species comprise the usual catch: wahoo, skipjack tuna, mahi mahi, yellowfin tuna, and blue marlin. About 225,000 metric tons of fish were harvested between October 1985 and September 1986. In 1987, the economic value of fish species harvested from both offshore and onshore fisheries exceeded $1.6 million (U.S. EPA 1991). The base has recently proposed that approximately 5.5 km of coastline around Pati Point be designated as a protected Marine Resources Preserve (DAF 1992).

Table 2. Selected NOAA trust fish and invertebrates that use the reef habitat near Andersen Air Force Base, Guam (DAF 1992).

Species		Habitat Use		Fisheries	
Common Name	Scientific Name	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
Surgeonfish	*Acanthurids*	♦	♦	♦	♦
Cardinalfish	*Apagonids*	♦	♦		
Triggerfish	*Balistids*	♦	♦		
Blenny	*Blennies*	♦	♦		
Jack	*Carangids*	♦	♦	♦	♦
Butterflyfish	*Chaetodontids*	♦	♦		
Goby	*Gobiids*	♦	♦		
Sweetlips	*Haemulids*	♦	♦	♦	♦
Squirrelfish	*Holocentrids*	♦	♦	♦	♦
Rudderfish	*Kyphosids*	♦	♦	♦	♦
Wrasse	*Labrids*	♦	♦	♦	♦
Emperor	*Lethrinids*	♦	♦	♦	♦
Snapper	*Lutjanids*	♦	♦	♦	♦
Filefish	*Monacanthids*	♦	♦		
Goatfish	*Mullids*	♦	♦	♦	♦
Angelfish	*Pomacanthids*	♦	♦		
Damselfish	*Pomacentrids*	♦	♦		
Parrotfish	*Scaridae* spp.	♦	♦	♦	♦
Grouper	*Serranids*	♦	♦	♦	♦
Rabbitfish	*Siganids*	♦	♦	♦	♦
Puffer	*Tetradontids*	♦	♦		

Site-Related Contamination

Trace elements and pesticides are the contaminants of primary concern to NOAA. Data collected during preliminary site investigations indicate that soils and groundwater contain elevated concentrations of contaminants at many of the 15 waste sites sampled at the base (SAIC 1990). The maximum concentrations of trace elements detected in soils and groundwater and their respective screening criteria are presented in Table 3 (Lindsay 1979; U.S. EPA 1991).

Soil samples from all six sites in the Agafo Gumus subbasin were contaminated with trace elements. Maximum concentrations of arsenic, cadmium, chromium, copper, lead, nickel, silver, and lead were above the average U.S. soil concentrations for these elements. Groundwater samples from the Agafo Gumus subbasin contained concentrations of cadmium, chromium, copper, silver, and zinc that exceeded marine AWQC by at least a factor of ten. Groundwater from Site 5, the fire training area, contained dieldrin (0.13 µg/l) at a concentration that exceeded the screening guideline (0.019 µg/l) by an order of magnitude. DDT was detected in one groundwater sample (0.14 µg/l) at a concentration exceeding its AWQC (0.001 µg/l). However, DDT was not detected in a duplicate sample collected from the same well, and it was concluded that the detection was a false positive.

Soil samples were not collected from the Andersen subbasin. The sites of concern are three stormwater drainage wells that receive runoff from 15 different shops in the area. Groundwater samples were collected from both installed and pre-existing wells at these sites. Nickel and silver concentrations exceeded AWQC for these elements by more than ten times. High concentrations of dieldrin (0.12 µg/l) were detected in samples collected from two different wells.

There were high concentrations of arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc in soils at most of the five sites in the Yigo subbasin, with maximum concentrations of these trace elements exceeding their respective screening criteria by several orders of magnitude. Two soil samples from Site 14, the former laundry facility, contained semi-quantified concentrations of PCBs (20 and 50 mg/kg, respectively). These results are considered semi-quantified because they were detected while performing a test for semi-volatile organics that is not specifically calibrated for PCBs. Groundwater samples collected from the Yigo subbasin contained concentrations of lead, nickel, and zinc that exceeded their respective marine AWQC. DDT and DDD were detected in groundwater samples collected north of Site 11 at concentrations of 1.3 µg/l and 0.23 µg/l, respectively, well above the marine AWQC for DDT of 0.001 µg/l.

The chemical disposal site in the Finegayan subbasin, Site 12, contained concentrations of trace elements in the soils that exceeded the screening criteria for all of the elements listed in Table 3. Groundwater samples were not collected directly at the disposal site but from areal wells within the subbasin. Concentrations of copper, lead, nickel, and zinc in groundwater samples exceeded their respective marine AWQC.

Summary

The base is surrounded by fringing coral reef systems that support a rich, diverse flora and fauna. Coral polyps depend on sunlight and can only grow in nearshore, relatively shallow waters. Additionally, federally threatened green sea turtles nest along beaches surrounding the base. Groundwater at the base is contaminated with trace metals, PCBs, and pesticides. The karst, limestone geology of the region provides a rapid groundwater pathway for contaminant transfer to the coast. These persistent contaminants may enter the nearshore coastal zone, which is the only area delicate coral reef ecosystems can grow and develop, and threaten sensitive life stages of reef inhabitants. The reefs surrounding Andersen are also vital because they are a source of larvae

Table 3. Maximum concentrations of trace elements in soil and groundwater at the site.

Soil (mg/kg)	Agafo Gumus Subbasin	Andersen Subasin	Yigo Subbasin	Finegayan Subbasin	Average U.S. Soil[1]
Trace Elements					
Arsenic	31	NT	50	44	5
Cadmium	17	NT	93	26	0.06
Chromium	1,200	NT	750	210	100
Copper	2,700	NT	2,300	21,000	30
Lead	1,000	NT	15,700	4,300	10
Nickel	100	NT	230	84	40
Silver	74	NT	1.6	55	0.05
Zinc	1,400	NT	10,000	22,000	50
Groundwater (µg/l)					AWQC[2] (µg/l)
Trace Elements					
Arsenic	ND	2	NT	2	36
Cadmium	330	NT	NT	NT	9.3
Chromium	4,500	NT	NT	40	50
Copper	120	20	NT	120	2.9
Lead	77	22	70	45	8.5
Nickel	ND	150	200	70	8.3
Silver	20	20	NT	NT	0.92
Zinc	3,100	160	130	160	86

1: Lindsay (1979)
2: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (U.S. EPA 1986).
ND: Not detected.
NA: Not available.
NT: Not tested.

and juveniles for propagating and reseeding Guam's central and southern reefs.

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10

Naval Air Station Adak

Adak Island, Alaska

CERCLIS #AK7170090099

Site Exposure Potential

The Naval Air Station (NAS) Adak site is located on Adak Island, Alaska, near the center of the Aleutian Island chain (Figure 1) about 1,950 km southwest of Anchorage (ESEI 1986). Adak Island is part of the Andreanof Group of the Aleutian Island Chain, which separates the Bering Sea from the Pacific Ocean. NAS Adak occupies 24,705 hectares on the northern portion of the island and is surrounded by the Bering Sea. Drainage from NAS Adak flows into Kuluk Bay, Sweeper Cove, Shagak Bay, and the Bering Sea.

NAS Adak provides services and material support for aviation activities and operating forces of the U.S. Navy. During an Initial Assessment Study, 32 potentially contaminated waste sites were identified at NAS Adak (ESEI 1986). Before the base was proposed for addition to the National Priorities List, the U.S. Navy began a RI for seven sites that were found to pose serious threats to human health or the environment (URS 1991). The seven sites include Palisades Lake Landfill, Old Hazardous Waste Storage Area, Firefighting Training Area and Burn Pits, Power Plant No. 3 and Waste Oil Pit, Trout Creek Disposal Area, White Alice Quarry Disposal Area,

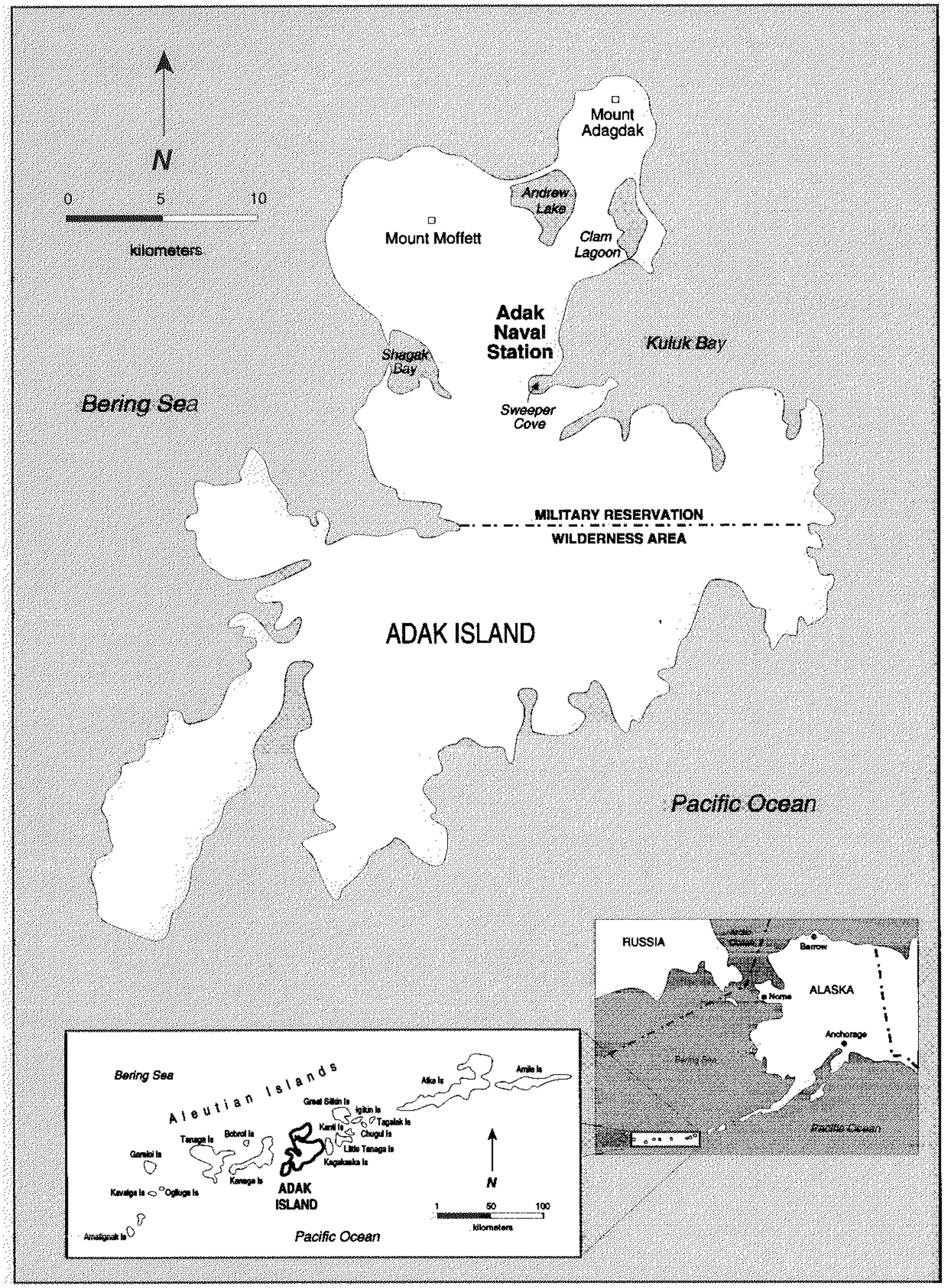

Figure 1. NAS Adak, Adak Island, Alaska (URS 1991).

and White Alice PCB Spill Area (Table 1). In addition, a March 1991 RCRA Facility Assessment identified eight solid waste management units, several of which are included in the seven RI sites.

Surface water runoff and groundwater migration are the potential pathways of contaminant transport from the waste sites to NOAA trust resource habitats. Surficial soils on Adak Island consist of silty-clayey sands, gravel, and volcanic ash from 1.5 to 15 m deep. These soils range from impermeable volcanic ash to highly permeable sands and gravels. Underlying the soils are predominantly impermeable materials of volcanic origin. The geologic formations beneath the site are not conducive to aquifer development, although there may be water-bearing zones in localized unconsolidated deposits throughout the site. Localized groundwater flow in shallow water table aquifers would be expected to move toward nearby streams, lakes, and bays (ESEI 1986).

Table 1. Major activities and associated wastes at seven sites located at NAS Adak.

Site	Activity	Types of Waste
Site 11: Palisades Lake Landfill	1940s to 1970: Primary disposal area on Adak Island (2 hectares, 1.5 m deep).	Petroleum, oils, lubricants (1,700,000 l); chlorinated solvents (230,000 l); nonchlorinated solvents (180,000 l); paint waste, sanitary trash, lead and mercury batteries (8,400 total), construction debris, and mercury (23 kg).
Site 15: Old Hazardous Waste Storage Area	1950s to 1984: Storage yard for supplies (0.7 hectares).	Materials stored included paints, chlorinated and nonchlorinated solvents, transformers, and oils. Approximately 570 l of transformer oils containing PCBs were spilled.
Site 16: Firefighting Training Area and Burn Pits	1970 to 1989: Three burn pits were utilized for firefighting training and waste oil disposal (each pit is approximately 15 m in diameter).	Solvents, petroleum, oil, and lubricants (410,000 l).
Site 17: Power Plant No. 3 and Waste Oil Pit	1950 to 1981: An area (unknown size) downgradient of the power plant received waste oil until an unlined waste oil pit was constructed in the mid 1960s.	Waste turbine lubrication oil from the power plant (unknown quantities).
Site 20: Trout Creek Disposal Area Site 21A: White Alice Quarry Upper Disposal Area Site 22: White Alice PCB Spill Area	1980 to 1982: Demolition materials from the dismantling of the White Alice Complex, a military communications network, were dumped (unknown size).	7,600 l of transformer oil containing PCBs were allegedly dumped in one or all of the three areas.

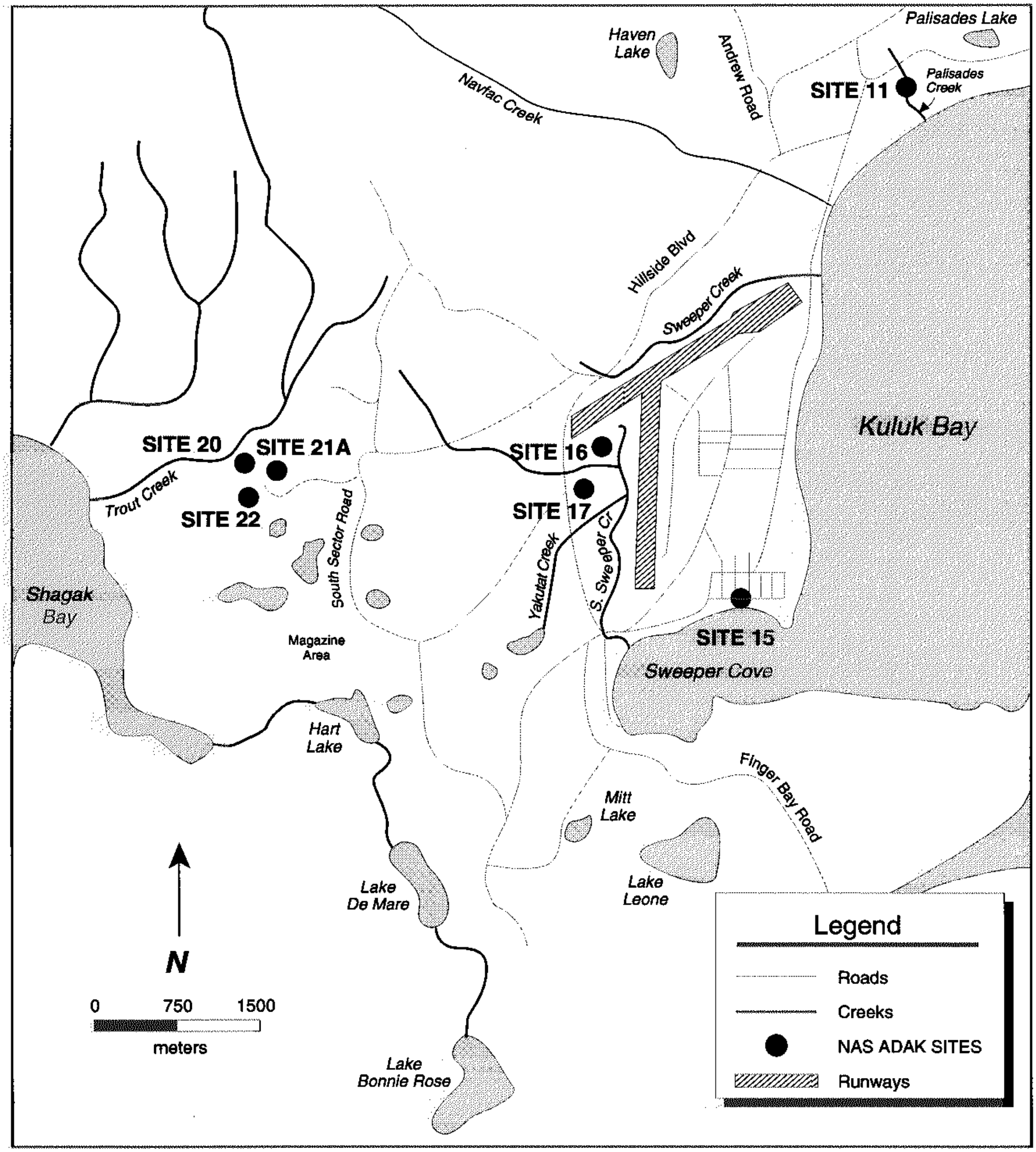

Figure 2. Location of seven waste sites at NAS Adak (URS 1991).

The Navy focused its pre-NPL investigations on the seven waste sites at NAS Adak (Figure 2). Site 11 (Palisades Lake Landfill) is located in a large ravine and the adjacent coastal upland area adjoining Kuluk Bay. Palisades Creek flows through the landfill before discharging into Kuluk Bay. Site 5 (Old Hazardous Waste Storage Area) is about 120 m north of Sweeper Cove on relatively flat ground. An unlined drainage channel along the east boundary of the site directs storm runoff from the northeast portion of the site toward Sweeper Cove. Site 16 (Firefighting Training Area and Burn Pits) is bordered to the east by South Sweeper Creek. Surface water from this site either accumulates in depressions or flows to South Sweeper Creek, which enters Sweeper Cove about 2 km downstream. Surface water from Site 17 (Power Plant No. 3 and Waste Oil Pit) drains into Yakutat Creek and flows for about 300 m before discharging into South Sweeper Creek. Site 20 (Trout Creek Disposal Area) consists of a steep hillside and a portion of the Trout Creek floodplain at the base of the hill. Trout Creek drains to Shagak Bay about 1.5 km from Site 20. Site 21A (the upper White Alice Quarry Disposal Area) is within 460 m of Trout Creek, which receives surface runoff from the site. Site 22 (White Alice PCB Spill Area) is situated on a level hilltop about 300 m from Trout Creek. Water drains from this site's hillsides in the form of seeps and springs, which discharge via drainage channels to Trout Creek to the north, and Shagak Bay to the southwest (URS 1991).

NOAA Trust Habitats and Species

Habitats of concern to NOAA are the surface water, bottom substrates, and associated wetlands of South Sweeper Creek, Yakutat Creek, and Trout Creek. Numerous unidentified streams that discharge to South Sweeper may also be of concern to NOAA. Secondary habitats of concern are the surface water and substrates of Shagak and Kuluk Bay, and Sweeper Cove.

South Sweeper Creek is the largest of the four creeks in the site investigations. The creek is a brackish (5 to 15 ppt), tidally influenced stream that flows in a southerly direction and discharges into Sweeper Cove. The creek was dredged periodically in the 1950s to alleviate hydric soil conditions within the area and is widest (about 6 m) at the point of discharge. Historically, the creek supported a run of coho salmon and was actively fished by sportsfishermen. Recently, the salmon run has declined substantially for unknown reasons. This creek also supports a Dolly Varden run (Fritz personal communication 1993). Stickleback in South Sweeper Creek represent an important component of the forage base. The creek is also presumed to support numerous estuarine infaunal invertebrates and forage fishes typical of sub-boreal latitudes. Beach wild rice (*Elymus arenarius*) is the predominant vegetation along the stream channels of South Sweeper Creek near the site (URS 1991; Klett personal communication 1993a).

Near Site 17, Yakutat Creek flows north-northeast before joining South Sweeper Creek. A spillway about 30 m upstream from the confluence of Yakutat and South Sweeper creeks limits all upstream migration of NOAA trust resources in Yakutat Creek. There are heavy stands of beach wild rice along Yakutat Creek. Areas of presumably oil-stained, stressed vegetation were observed during site investigation along Yakutat Creek (URS 1991). Additionally, Arctic rushes (Juncus articus) are found along the eastern portion of the site. Like South Sweeper Creek, Yakutat Creek presumably provides habitat for a variety of stream invertebrates and forage fish that are typical of temperate, sub-boreal, aquatic ecosystems (URS 1991; Klett personal communication 1993a).

Trout Creek is a perennial, rapidly flowing stream that averages 1 m and less wide. The creek meanders in a westerly direction north of Sites 20, 21A, and 22, and subsequently descends into Shagak Bay. The creek is well-oxygenated, maintains gravel substrates, and provides spawning and nursery habitat for Dolly Varden and pink salmon. Other fish, such as stickleback, also reside in Trout Creek. Wetlands associated with Trout Creek are seasonally flooded and characterized by emergent vegetation (URS 1991; Klett personal communication 1993a).

Palisades Creek, near Site 11, is a small, perennial, freshwater stream that is primarily fed by snowmelt and rain. The creek flows through Site 11, drops steeply, and descends into Kuluk Bay (an approximate 30 m drop at an approximate 60° angle). The extreme stream gradient makes the creek inaccessible to all NOAA trust resources (Klett personal communication 1993a).

Pink salmon (the most abundant species), chum salmon (the least abundant species), and coho, use the larger stream systems and surrounding marine water of Adak (Table 2). Sockeye salmon use the streams associated with lake habitat for spawning runs, depending on the species, from July through September. Chinook salmon do not use the local streams of Adak Island for spawning habitat. The anadromous variety of Dolly Varden is commonly found in Adak's streams and generally spawns from June through September, and subsequently over-winters in the local lake systems (Klett personal communication 1993a).

Pacific herring, Pacific ocean perch, ling cod, and rockfish, a popular recreational fishery, use the nearshore waters of Shagak and Kuluk bays and Sweeper Cove. Pacific halibut are commonly found in both intertidal nearshore and open-water offshore zones surrounding Adak Island. Pacific halibut is one of the island's most important commercial and recreational fisheries and is subject to restricted seasons (Klett personal communication 1993a).

Numerous marine mammals are both resident and frequent visitors to marine habitats surrounding Adak island. Three pinnipeds, the northern fur seal (*Callorhinus ursinus*), the federally threatened Steller sea lion (*Eumetopias jubata*), and the Pacific harbor seal (*Phoca vitulina linnaeus*), and the sea otter (*Enhydra lutris*) use

Table 2. Selected NOAA trust fish species that use surface water surrounding NAS Adak, Alaska.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
ANADROMOUS FISH						
Pink salmon	*Oncorhynchus gorbuscha*	♦	♦	♦	♦	♦
Chum salmon	*Oncorhynchus keta*	♦	♦	♦	♦	♦
Coho salmon	*Oncorhynchus kisutch*	♦	♦	♦	♦	♦
Sockeye salmon	*Oncorhynchus nerka*	♦	♦	♦	♦	♦
Chinook salmon	*Oncorhynchus tshawytscha*			♦	♦	♦
Dolly varden	*Salvelinus malma*	♦	♦	♦		♦
MARINE FISH						
Pacific halibut	*Hippoglossus stenolepis*		♦	♦	♦	♦
Pacific herring	*Clupea harengus pallasi*	♦	♦	♦	♦	♦
Stickleback	*Gasterosteus* spp.	♦	♦	♦		
Ling cod	*Ophidon elongatus*	♦	♦	♦	♦	♦
Rockfish	*Sebastes* spp.	♦	♦	♦		♦
Pacific ocean perch	*Sebastes alutus*	♦	♦	♦		♦

marine habitats associated with the island (Klett personal communication 1993b).

Fur seals visit the water around the island in the spring when they migrate south from the Bering Sea and in the fall when they return north. They have been observed in Adak Strait west of the island as they pass through the Aleutians, but are not known to haul out on the island itself. Fur seals often feed close to shore and are unlikely to remain near the island over extended periods of time. Steller sea lions and Pacific harbor seals are year-round residents of the Aleutians and both feed close to shore, although harbor seals appear to be more restricted to coastal foraging than sea lions. Harbor seals frequently use Sweeper Cove, Clam Cove, Shagak Bay, and presumably, all embayments on the island. Harbor seals generally are less particular about where they haul out than are sea lions, but avoid people in their haulouts. Harbor seals are not adept climbers and prefer low flat rocks barely above the water for haulout locations. Steller sea lions use the waters around Adak for foraging and many terrestrial habitats in the western-central Andreanofs for haulouts and rookeries. One of the 24 Steller sea lion rookeries in the Aleutian Islands is located at Lake Point/ Cape Yakak, at the southern tip of the Yakak peninsula on southwest Adak Island. Rookery sites are most important in the summer breeding season for mating and pupping, but can be used year-round as haulouts. About 4,000 sea otters use the nearshore waters surrounding the base and are regular visitors to Clam Lagoon and Sweeper Cove (Klett personal communication 1993b).

All of the large cetaceans may pass through off Adak Island. The small- to medium-sized cetaceans would be more likely to come closer to shore to feed, but are highly mobile and would not linger there.

Site-Related Contamination

Data collected during the remedial investigation indicated that soils, groundwater, surface water, and sediments at NAS Adak contain elevated concentrations of site-related contaminants (URS 1991). The primary contaminants of concern to NOAA are trace elements, PAHs, and PCBs. The maximum concentrations of contaminants detected in media collected from the seven waste sites at NAS Adak are presented in Table 3.

At Site 11, trace elements were the major contaminants of concern. Groundwater samples collected from Site 11 contained copper and mercury at concentrations that exceeded their respective freshwater chronic AWQC by at least ten times. Concentrations of copper, mercury, and zinc in surface water also exceeded their respective AWQCs. Palisades Creek sediment collected downstream from the landfill contained the maximum concentrations of all trace elements, except for mercury, found in sediments collected from the seven waste sites (Table 3).

Data presented in the 1991 Draft RI may only be used to form a qualitative picture of contamination on the island. The concentrations reported below, therefore, may not accurately represent current levels of contamination. In addition, the Navy excavated sites 15, 20, and 21A during the fall of 1992. PCB-contaminated soils were removed from these areas and stockpiled in a central location.

Only soil and groundwater samples were collected at Site 15; groundwater from the site contained concentrations of copper, lead, mercury, silver, and PCBs that exceeded their respective AWQCs by at least ten times. Concentrations of copper (2,600 mg/kg), lead (1,600 mg/kg), and zinc (8,000 mg/kg) in surface soils were 100 times higher than U.S. average soil concentrations (Lindsay 1979). Elevated concentrations of total PAHs (280 mg/kg) and PCBs (5,900 mg/kg) were detected in surface soils collected from Site 15.

At Site 16, surface water contained concentrations of cadmium, chromium, copper, lead, and zinc that exceeded their respective AWQCs. Concentrations of cadmium, silver, and zinc in soils exceeded the average U.S. soil concentrations for those elements by more than 100 times. The PAH compound naphthalene was detected in soils (25 mg/kg) and in groundwater (5.6 µg/l) at Site 16. Elevated concentrations of PCBs were detected in soils (56 mg/kg) and groundwater (0.80 µg/l).

At Site 17, groundwater and surface water contained the maximum concentrations of chromium, copper, mercury, and nickel detected in samples collected from the seven waste sites (Table 3). Elevated concentrations of lead (1,100 µg/l), zinc (15,000 µg/l), naphthalene (5 µg/l), and PCBs (2.8 µg/l) were also detected in surface water samples collected from Site 17.

The maximum concentrations of PCBs in surface water, soil, and sediment from NAS Adak were

Table 3. Maximum concentrations of contaminants of concern at seven of the waste sites located at NAS Adak.

	Water			Soil		Sediment	
	Ground water µg/l	Surface Water µg/l	AWQC[1] µg/l	Soils mg/kg	Average U.S.[2] mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES*							
Trace Elements							
Cadmium	6	30	1.1+	6.6	0.06	3.8	5
Chromium	650	230	11	850	100	100	80
Copper	1500	2900	12+	2600	30	540	70
Lead	90	1100	3.2+	3000	10	600	35
Mercury	0.3	5.7	0.012	1.4	0.03	0.73	0.15
Nickel	700	200	8.3	600	40	34	30
Silver	3	7	0.12	170	0.05	ND	1.0
Zinc	630	15,000	86	8000	50	890	120
ORGANIC COMPOUNDS							
PAHs							
Naphthalene	12	5.0	NA	25	NA	2.7	0.34
Total PAHs	77	5.0	NA	280	NA	18	4
PCBs							
Aroclor 1254	2.1	ND	0.014	ND	NA	ND	0.05
Aroclor 1260	0.8	18	0.014	9,000	NA	16,000	0.05

* These values are from the 1991 Draft RI. The Navy believes that there is considerable uncertainty in 1991 data quality. Contamination levels will be reevaluated during the RI.
1: Ambient water quality criteria for the protection of aquatic organisms. The lower value of the marine or freshwater chronic criteria are presented (EPA 1986), because waste sites are located near both marine and freshwater environments.
2: Lindsay (1979).
3: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
ND: Not detected; detection limit not available.
NA: Screening guidelines not available.
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ assumed).

found in samples collected from Sites 20, 21A, and 22. Concentrations of PCBs in surface water collected from the Trout Creek floodplain at Site 20 and from the hillside draining Site 22 were 18 µg/l and 6 µg/l, respectively. Maximum concentrations of PCBs in surface soils collected from Sites 20, 21A, and 22 were 16 mg/kg, 9,000 mg/kg, and 1,100 mg/kg, respectively. Sediments collected from the Trout Creek floodplain contained 16,000 mg/kg of PCBs.

Summary

High levels of PCBs, trace elements, and PAHs have been measured in on-site media. PCBs and some of the trace elements may have accumulated in resources of concern to NOAA. Site contaminants are also potentially toxic to NOAA resources. Although PCB-contaminated soils were removed from sites 15, 20, and 21A, PCBs may have migrated off-site in the past. Biological receptors, sediments, and surface water in South Sweeper Creek, Trout Creek, Shagak Bay, and Kuluk Bay near Palisades Creek should be analyzed for contaminants of concern.

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10

Northwest Pipe and Casing Company

Clackamas, Oregon

CERCLIS #ORD980988307

Site Exposure Potential

The 21-hectare Northwest Pipe and Casing Company site in Clackamas, Oregon is about 5.5 km east of the Willamette River (Figure 1). The site is near Deer Creek, which flows into Mt. Scott Creek 2.4 km downstream of the site. Mt. Scott Creek flows 3.2 km northwest into Kellogg Creek, which discharges to Kellogg Lake 2 km farther downstream (Figure 2). Kellogg Lake is 1 km long and discharges to the Willamette River. The Willamette River flows north 30 km into the Columbia River; the Columbia River discharges directly to the Pacific Ocean an additional 160 km downstream.

From 1956 to 1985, pipe-coating operations were conducted at the site. Waste materials from site operations included coal tar, coal tar epoxy, cement mortar and slurry, asphalt, and bitumastic jet primer. Unknown amounts of these waste materials were burned, spilled, or buried on the site. Drums of waste oils and solvents may also have been buried on the site, and there is a pile of waste material in the northwestern portion of the site (Ecology and Environment, Inc. 1990).

Surface water runoff, groundwater, and direct discharge are the potential pathways of contaminant transport from the site to NOAA resources and associated habitats. Drainage ditches along

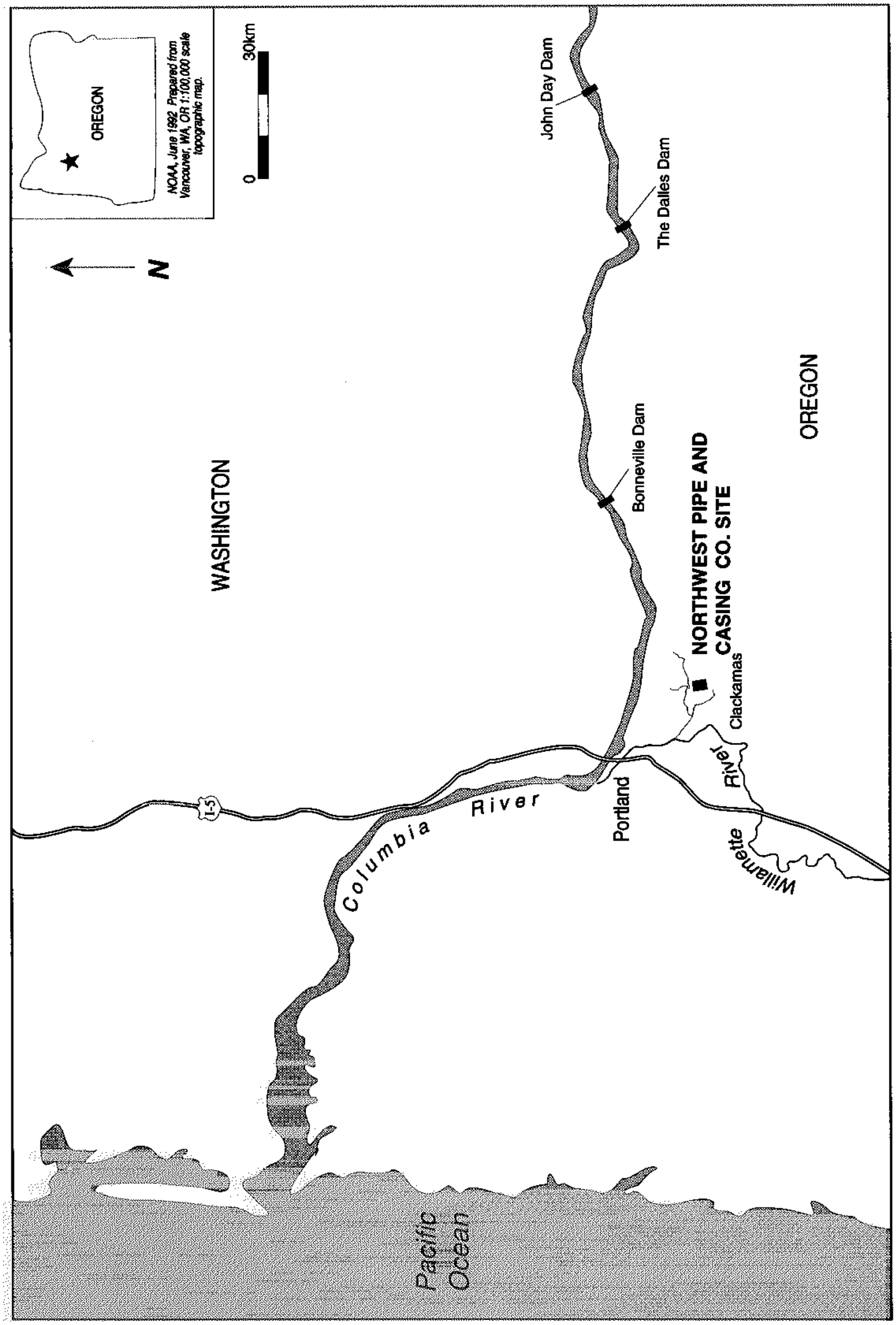

Figure 1. Northwest Pipe and Casing Company, Clackamas, Oregon.

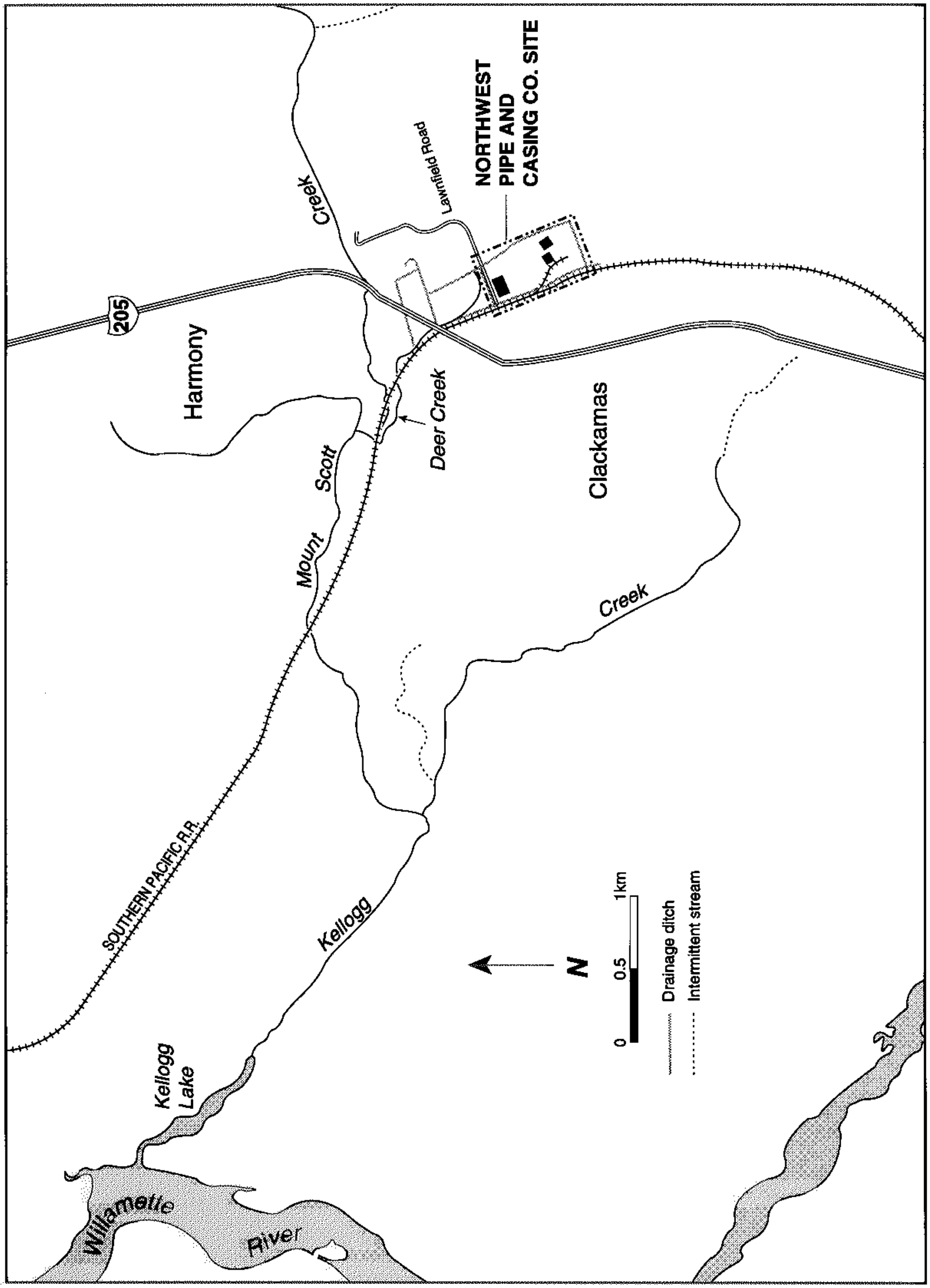

Figure 2. Features of the Northwest Pipe and Casing Company site.

the western and eastern site boundaries (Figure 2) receive surface water runoff from the site. Water in these ditches flows north, reportedly discharging to Deer Creek 75 m north of the site. A low-lying area in the southwest corner of the site is also reportedly subject to flooding, and surface water discharged to a floor drain in an on-site warehouse drains directly to the ground beneath the building. Groundwater is 11 to 60 m below ground surface; information on the number and types of aquifers was not available. However, shallow groundwater is subject to artesian conditions, and may be within 1 m of ground surface. Shallow groundwater flows primarily northwest from the site toward Deer and Mt. Scott creeks, but a small component of groundwater flows southwest (Ecology and Environment, Inc. 1990).

There may also have been direct discharges to on-site surface water. A former pond and swamp area reportedly existed in the central portion of the site; waste products generated during site operations may have been used as fill material, although information was not available on historical discharge points for these surface water features. In addition, at least one drum with unknown contents was observed partially submerged in a pond near the western site boundary, but the exact location of the pond or its discharge point was not available (Ecology and Environment, Inc. 1990).

NOAA Trust Habitats and Species

The habitats of primary concern to NOAA are the surface water and associated bottom substrates of Deer Creek, Mt. Scott Creek, Kellogg Creek, and Kellogg Lake. Secondary habitats of concern are the surface water and associated bottom substrate of the Willamette River. The creeks and river provide habitat for some anadromous and resident NOAA trustee species, many of which are likely to migrate close to the site and reside there for extended periods during sensitive life stages (Table 1; Massey personal communication 1992; Melcher personal communication 1992; Ward personal communication 1992).

Deer, Mt. Scott, and Kellogg creeks have low-velocity flow and primarily gravel and sand substrates. A dam equipped with fish passage facilities at the confluence of Kellogg Lake and Kellogg Creek allows anadromous species to migrate upstream. Mt. Scott and Kellogg creeks provide spawning, nursery, and adult habitat for anadromous steelhead trout and coho salmon and resident cutthroat trout (Massey personal communication 1992). These anadromous and resident species probably also use Deer Creek near the site.

Other significant anadromous species in the Willamette River include white sturgeon, Pacific lamprey, chinook salmon, and American shad (Ward personal communication 1992). These species are known to use the Willamette River as a

Table 1. Fish species present in Deer Creek, Mt. Scott Creek, Kellogg Creek, Kellogg Lake, and the Willamette River near the Northwest Pipe and Casing Company site.

Species		Habitat				Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Migration Route	Adult Forage	Comm.	Recr.
ANADROMOUS SPECIES							
White sturgeon	*Acipenser transmontanus*		♦	♦	♦		
American shad	*Alosa sapidissima*		♦	♦	♦		
Pacific lamprey	*Lampetra tridentatus*				♦	♦	
Coho salmon[1]	*Oncorhynchus kisutch*	♦	♦	♦			
Steelhead trout[1]	*Oncorhynchus mykiss*	♦	♦	♦			
Sockeye salmon	*Oncorhynchus nerka*		♦	♦			
Chinook salmon	*Oncorhynchus tshawytscha*	♦	♦	♦			
RESIDENT SPECIES							
Cutthroat trout[1]	*Oncorhynchus clarki*	♦	♦	♦			

[1]Species known to be present in Mt. Scott Creek, Kellogg Creek, and Kellogg Lake; likely to be present in Deer Creek.

migratory corridor to upstream spawning grounds. Out-migrating juvenile salmonids use the Willamette River near the site as nursery habitat.

Deer Creek, Mt. Scott Creek, Kellogg Creek, and Kellogg Lake are protected spawning habitat for coho salmon and steelhead trout. These habitats are restricted year-round to all recreational and commercial fishing for these species. Cutthroat trout are fished recreationally in the vicinity of the site. The Willamette River supports an important recreational fishery for salmon, steelhead trout, white sturgeon, and American shad. Although there is no commercial fishing near the site, there is a small commercial fishery for pacific lamprey in the Willamette River (Melcher personal communication 1992).

Site-Related Contamination

Data collected during preliminary site investigations indicate that on- and off-site soils, groundwater, surface water, and sediments contain elevated concentrations of site-related contaminants (Ecology and Environment, Inc. 1990). The primary contaminants of concern to NOAA are trace elements, PCBs, and PAHs. Maximum concentrations of these inorganic substances and organic compounds are summarized in Tables 2 and 3, along with applicable screening guidelines.

Elevated concentrations of copper, lead, and zinc were detected in soil, groundwater, surface water, and sediment. These concentrations frequently exceeded their respective screening guidelines

Table 2. Maximum concentrations of contaminants of concern in soils and sediments (mg/kg) at the Northwest Pipe and Casing Company site.

	Soil				Sediment						
					Drainage Ditches				Mt. Scott Creek		
	On-site	Off-site	Site back-ground	Ave. U.S.[1]	Up-stream	On-site	Down-stream	Deer Creek	Up-stream	Down-stream	ER-L[2]
INORGANIC SUBSTANCES											
Trace Elements											
Arsenic	13	4.8	2.5	5	3.4	12	7.5	5.1	9.4	4.9	33
Chromium	120	40	29	100	31	42	24	30	59	27	80
Copper	160	35	21	30	370	78	92	32	23	27	70
Lead	28	74	20	10	540	180	120	12	13	29	35
Mercury	<0.12	<0.13	<0.13	0.03	<0.15	0.23	<0.13	<0.22	0.16	<0.17	0.15
Nickel	99	24	20	40	17	24	19	21	41	22	30
Zinc	810	203	78	50	200	1,200	270	290	160	150	120
ORGANIC COMPOUNDS											
PCBs											
Aroclor 1254	1,000	ND	<1.0	NA	4.3	1.2	2.5	0.10	<0.44	<0.51	0.05*
PAHs											
Total PAHs	18	2.8	ND	NA	7.5	13	26	<1.0	<0.92	0.34	4.0

1: Lindsay (1979).
2: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
*: Criteria presented is for total PCBs.
NA: Screening level not available.
ND: Not detected; detection limit not available.
<: Not detected at detection limit shown.

(Lindsay 1979; U.S. EPA 1986; Long and Morgan 1990). Concentrations of these trace elements generally decreased with distance from the site, although copper and zinc were the only trace elements detected at high concentrations in surface water or sediment of Deer Creek and Mt. Scott Creek downstream of the site. Other trace elements (arsenic, chromium, mercury, and nickel) were occasionally detected in on- and off-site soil, groundwater, surface water, and sediment at concentrations exceeding screening guidelines.

Concentrations of trace elements in background soil, groundwater, surface water, and sediment samples were quite variable. Background soil samples collected immediately southwest of the site had high concentrations of lead and zinc. Given that the southwestern corner of the site is reportedly subject to flooding and that some component of shallow groundwater flows southwest from the site, these soils may not be representative of background conditions. Trace elements were not detected at concentrations exceeding screening criteria in groundwater samples collected from upgradient monitoring wells or in surface water samples collected from Mt. Scott Creek upstream of its confluence with Deer Creek. Background sediment samples were collected from drainage ditches near the eastern

Table 3. Maximum concentrations of contaminants of concern in groundwater and surface water(µg/l) at the Northwest Pipe and Casing Co. site.

	Groundwater				Surface Water						
					Drainage Ditches			Deer Creek	Mt. Scott Creek		AWQC[1]
	Up-grad.	On-site	Down-grad.	Floor Drain	Up-stream	On-site	Down-stream		Up-stream	Down-stream	
INORGANIC SUBSTANCES											
Trace Elements											
Arsenic	ND	13	ND	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	190
Chromium	9.7	290	<3.0	110	<4.1	<7.6	<4.4	<4.0	6.0	<5.0	11
Copper	28	330	28	260	<3.0	32	<3.0	<3.0	<3.0	21	12^{+}
Lead	20	64	5.0	490	<4.6	65	<1.1	<1.3	<1.3	<2.3	3.2^{+}
Mercury	ND	ND	ND	ND	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.012
Nickel	ND	160	ND	75	<16	<16	<16	<16	<16	<16	160^{+}
Zinc	260	1,200	2,300	4,800	38	220	61	110	37	54	110^{+}
ORGANIC COMPOUNDS											
PCBs											
Aroclor 1254	ND	15	ND	3.3	ND	ND	ND	ND	ND	ND	0.03*
PAHs											
Total PAHs	ND	17,000	ND	95	ND	ND	ND	ND	ND	ND	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1986).
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ used).
*: Criteria presented is for total PCBs.
grad: Gradient.
NA: Screening level not available.
ND: Not detected; detection limit not available.
<: Not detected at detection limit shown.

site boundary and Mt. Scott Creek upstream of its confluence with Deer Creek. The background sediments collected from the drainage ditches had high concentrations of copper, lead, and zinc. Because of the proximity of these drainages to the site, these sediments may not be representative of background conditions.

PCBs (primarily Aroclor 1254) were measured in on-site soil and groundwater samples at concentrations exceeding screening guidelines. Concentrations of PCBs in sediments collected from the on-site drainage ditches and Deer Creek exceeded the ER-L value. PCBs were not detected in sediments from Mt. Scott Creek, but detection limits were greater than the screening guideline.

PAHs were measured in on-site soils, but screening guidelines were not available. Concentrations of individual PAHs measured in on-site groundwater did not exceed ten-times chronic AWQC. PAHs were measured at a total concentration of 17,000 µg/l in on-site groundwater, but no screening criterion for total PAHs was available.

PAHs were not detected in soils or groundwater collected from off-site sampling locations. Concentrations of total PAHs in sediments from the on-site drainage ditches exceeded their ER-L value. PAHs were not detected in sediments collected downstream of the site in Deer and Mt. Scott creeks.

Summary

Trace metals, PCBs, and PAHs are discharged directly to on-site surface water. On- and off-site soil, groundwater, surface water, and sediment contain concentrations of copper, lead, zinc, PCBs, and PAHs above screening guidelines. Arsenic, chromium, mercury, and nickel were occasionally detected above screening guidelines. PCBs and PAHs exceeded ER-L guidelines in on-site soil, sediments and groundwater samples. Mt. Scott and Kellogg creeks are important habitats for trust species: coho salmon, steelhead trout, and resident cutthroat trout use these areas for spawning, nursery, and forage. Deer Creek, Mt. Scott Creek, Kellogg Creek, and Kellogg Lake are protected spawning habitat for coho salmon and steelhead trout. Levels of contaminants in these receptor habitats have not been measured.

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