Coastal and Estuarine

Hazardous Waste Site Reports

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE

Coastal and Estuarine

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Acronyms and abbreviations

AST	Above-ground Storage Tank
AWQC	Ambient water quality criteria for the protection of aquatic life
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BHC	benzene hexachloride
BNA	base, neutral, and acid-extractable organic compounds
BOD	biological oxygen demand
BSL	brine sludge lagoon
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cfs	cubic feet per second
cm	centimeter
COC	contaminant of concern
COD	chemical oxygen demand
COE	U.S. Army Corps of Engineers
CRC	Coastal Resource Coordinator
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DNAPL	dense non-aqueous phase liquid
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
ERL	Effects Range - Low
ERM	Effects Range - Median
ft	foot
ha	hectare
HMX	cyclotetramethylene tetranitramine
HRS	Hazard Ranking System
HUC	Hydrologic Unit Code
kg	kilogram
km	kilometer
L	liter
LNAPL	light, non-aqueous phase liquid
LOEL	lowest observed effects level
m	meter
mi	mile
m^3/second	cubic meter per second
µg/g	micrograms per gram (ppm)
µg/kg	micrograms per kilogram (ppb)
µg/L	micrograms per liter (ppb)
µR/hr	microroentgens per hour
MEK	methyl ethyl ketone a.k.a. 2-Butanone
mg	milligram
mg/kg	milligrams per kilogram (ppm)
mg/L	milligrams per liter (ppm)
mR/hr	milliroentgens per hour
NAPL	non-aqueous phase liquid
NFA	no further action
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	operable unit
PAH	polycyclic (or polynuclear) aromatic hydrocarbon
PA/SI	Preliminary Assessment/Site Investigation
PCB	polychlorinated biphenyl
PCE	perchloroethylene (aka tetrachloroethylene)
pCi/g	picocuries per gram
PCP	pentachlorophenol

PNRS	Preliminary Natural Resource Survey
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand or parts per trillion
PRP	Potentially Responsible Party
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RDX	cyclonite
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SVOC	semi-volatile organic compound
TCA	1,1,1-trichloroethane
TCE	trichloroethylene
TCL	Target Compound List
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound
<	less than
>	greater than

Introduction

The National Oceanic and Atmospheric Administration (NOAA) regularly evaluates hazardous waste sites that are proposed for addition to the National Priorities List (NPL), a U.S. Environmental Protection Agency (USEPA) listing of sites that have undergone preliminary assessment and site inspection to determine which locations pose the greatest threat. The NPL is compiled under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (United States Code, Title 42, Chapter 103). This volume identifies hazardous waste sites that could impact natural resources for which NOAA acts as a federal trustee under the National Oil and Hazardous Substances Pollution Contingency Plan (commonly referred to as the National Contingency Plan or NCP) (Code of Federal Regulations, Title 40, Part 300). NOAA serves as the federal trustee for marine and estuarine natural resources, including fish, shellfish, corals, marine mammals and the habitats that support these organisms.

Waste site reports of the type included in this volume often represent NOAA's first examination of a site. NOAA has published 377 waste site reports. Appendix Table 1 provides a summary of all the Coastal and Estuarine Hazardous Waste Site Reviews published to date.

Not all hazardous waste sites will affect NOAA trust resources; NOAA is concerned about sites located near trust resources and their habitats in states along the Atlantic Ocean including Puerto Rico and the Virgin Islands, along the Pacific Ocean including Hawaii and the Pacific Islands, the Gulf of Mexico, and the Great Lakes. NOAA works with USEPA to identify, assess, and mitigate the risks posed to natural resources from the release of hazardous chemicals and pollutants. NOAA also works directly with responsible parties to restore injured natural resources through habitat protection and restoration projects.

NOAA uses information from this volume to establish priorities for further site investigations. NOAA's Regional Resource Coordinators will follow up on sites that appear to pose ongoing problems. These scientists work with other agencies and trustees to communicate any concerns to the USEPA. They also review sampling and monitoring plans for the sites, help plan the investigation, and set objectives for site cleanups. This coordinated approach protects all natural resources, not just those for which NOAA is a steward. The USEPA can use the waste site reports to help identify the types of information that may be needed to complete environmental assessments of the sites. Other federal and state trustees can use the reports to help evaluate the potential impacts to their resources.

Each waste site report contains an executive summary and three distinct sections. The first section, Site Background, describes the site, previous site operations and disposal practices, and pathways by which contaminants could migrate to NOAA trust resources. The second section, NOAA Trust Resources, describes the species, habitats, and commercial and recreational fisheries near the site. The final section, Site-Related Contamination, identifies the contaminants of concern to NOAA and describes contaminant distribution at the site.

In addition to the waste site reports, this volume contains a list of acronyms and abbreviations (p. vii) and a glossary of terms (p. 93) that commonly appear throughout the reports. Appendix Table 1 lists all of the waste site reports that NOAA has published to date.

Chemical-Specific Screening Guidelines

Most waste site reports contain a table that focuses on the contaminants in different media that have potential to degrade natural resources. These site-specific tables highlight only a few of the many contaminants often found at hazardous waste sites. We compare the chemical concentrations reported in the tables against published screening guidelines for surface water, groundwater, soil, and sediment. Because contaminant releases from hazardous waste sites to the environment can span many years, we are concerned about long-term effects to natural resources. This is why we compare site contaminant levels against screening guidelines for chronic effects rather than for short-term effects.

Contaminant levels at each site are compared to site-specific or regional-specific criteria (or guidelines) when available. In the absence of such data, the contaminant levels detected in surface water and groundwater are compared to the ambient water quality criteria (AWQC; USEPA 2002, 2006); contaminants detected in sediment are compared to the effects range-low (ERL) values (Long and Morgan 1991) and threshold effects concentrations (TECs; MacDonald et al. 2000a). Only when there is a soil pathway for the migration of contaminants to NOAA trust resources do we examine contaminant levels in soil samples. Chemical concentrations in soil that exceed screening guidelines can indicate a potential source of contamination. Contaminants detected in soil are compared to ecological soil screening levels (USEPA 2005) and values from the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997). Any exceptions to these guidelines are noted in the contaminant table.

There are no national criteria for sediment comparable to the AWQC established for water. In the absence of national criteria, we compare sediment concentrations to several published screening guidelines (Long and Morgan 1991; MacDonald et al. 1996; MacDonald et al. 2000a; MacDonald et al. 2000b). Studies that associate contaminant concentrations in sediment with biological effects provide guidance for evaluating contaminant concentrations that could harm sediment-dwelling aquatic organisms. These studies include Long and MacDonald 1992; Long et al. 1995; MacDonald et al. 1996; Smith et al. 1996; Long et al. 1998; and Kemble et al. 2000. However, screening guidelines are often based on effects from individual chemicals. Their application may be difficult when evaluating biological effects that could be attributed to combined effects from multiple chemicals, unrecognized chemicals, or physical parameters that were not measured.

NOAA's National Status and Trends Program has used chemical and toxicological evidence from a number of modeling, field, and laboratory studies to determine the ranges of chemical concentrations associated with toxic biological effects (Long and Morgan 1991; Long and MacDonald 1992):

- No Effects Range — the range of concentrations over which toxic effects are rarely observed;
- Possible Effects Range — the range of concentrations over which toxic effects are occasionally observed; and
- Probable Effects Range — the range of concentrations over which toxic effects are frequently observed.

Two slightly different methods (Long and Morgan 1991; MacDonald 1993) were used to determine these chemical ranges. Long and Morgan (1991; Long et al. 1995) compiled chemical data associated with adverse biological effects. The data were ranked to determine where a chemical concentration was associated with an adverse effect (the ERL) — the lower 10th percentile for the data set in which effects were observed or predicted. Sediment samples were not expected to be toxic when all chemical concentrations were below the ERL values.

MacDonald (1993) modified the approach used by Long and Morgan (1991) to include both the "effects" and "no effects" data, whereas Long and Morgan used only the "effects" data. TELs were derived by taking the geometric mean of the 15th percentile of the "effects" data and the 50th percentile of the "no effects" data.

Although different percentiles were used for these two methods, their results closely agree (Kemble et al. 2000). We do not advocate one method over the other, and we use both screening guidelines to help focus cleanup efforts in areas where natural resources may be at risk from site-related contaminants.

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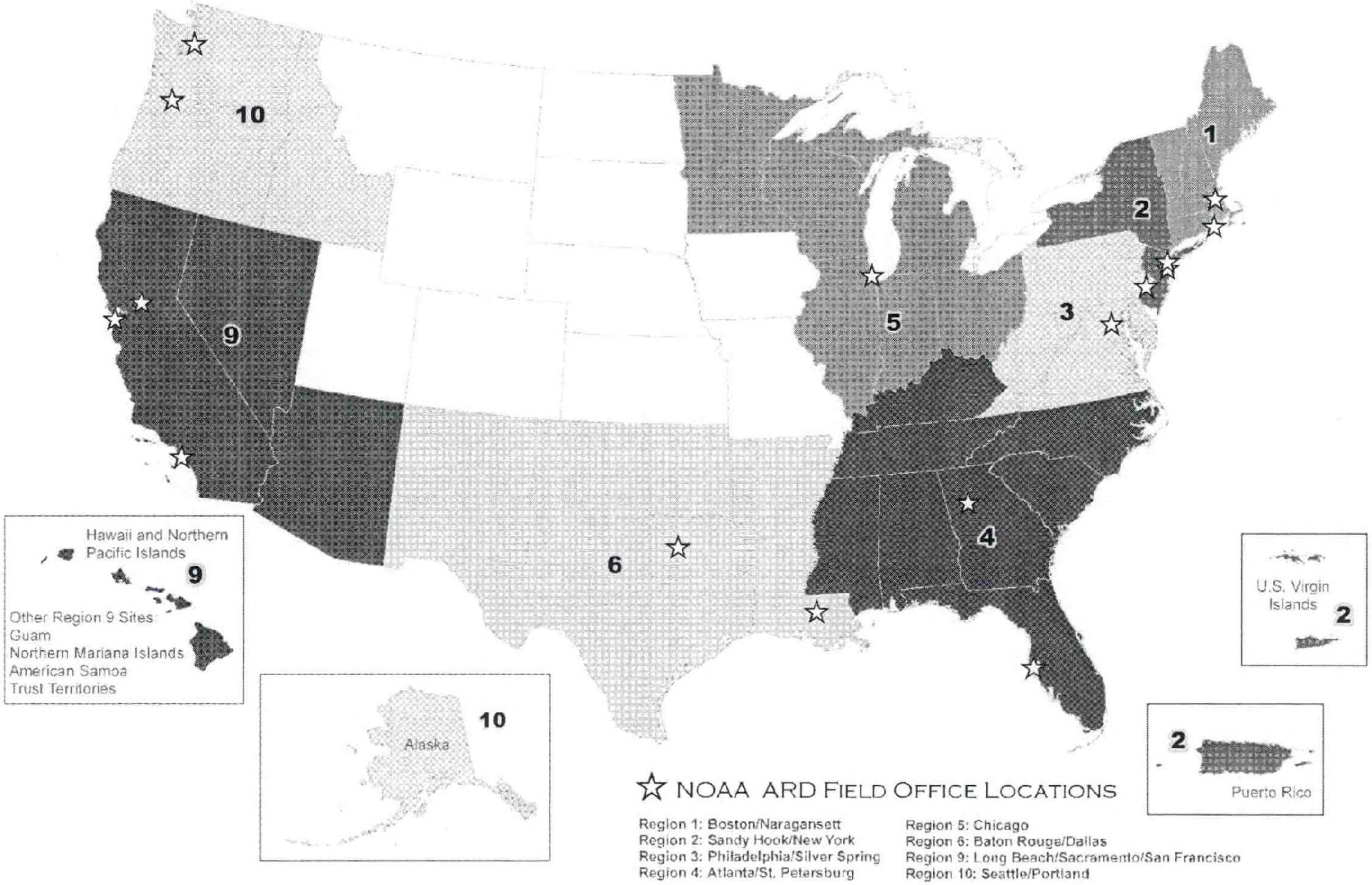

Federal Creosote

Manville, New Jersey

EPA Facility ID: NJ0001900281

Basin: Raritan

HUC: 02030105

Executive Summary

From 1911 to 1957, Federal Creosote in Manville, New Jersey, operated as a wood treating facility where railroad ties and telephone poles were treated with coal tar, also known as creosote. Wastes from the wood treating process were directed into two unlined canals, which in turn were directed to two unlined lagoons. Excess waste materials were drained from one of the lagoons via an exit trench that discharged to an overflow area. In the mid-1960s, residences and a commercial and retail center were developed on the property. PAHs have been detected in soil, groundwater, and sediment samples collected at the site and down-gradient of the site and are the primary contaminants of concern to NOAA. The lower Millstone and Raritan rivers, both of which provide freshwater habitat for NOAA trust resources, are the primary habitats of concern to NOAA. Groundwater and surface water runoff are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Data available from the remedial investigation indicate that it is unlikely that site-related contaminants have reached NOAA trust resources.

Site Background

The Federal Creosote site encompasses approximately 20 ha (49 acres) in a mixed-use residential and commercial area in Manville, Somerset County, New Jersey, near the confluence of the Millstone and Raritan rivers. The Federal Creosote property, which is bordered to the north and south by railroad tracks, is approximately 0.4 km (0.25 mi) northwest of the Millstone River and approximately 0.8 km (0.5 mi) west of the Raritan River (Weston 1999) (Figure 1). In the mid-1960s, a residential area was developed over 14 ha (35 acres) and a commercial and retail center was built over 6 ha (15 acres) of the property (Weston 1999). Potential contaminant sources underlying the housing development include two unlined canals, two unlined lagoons, an unlined exit trench, and an unlined drip area (Figure 2).

From 1911 to 1957, Federal Creosote operated as a wood treating facility where railroad ties and telephone poles were treated with coal tar, also known as creosote. After treatment, the wood products were placed in an unlined drip area for drying. Contaminated wastes from the wood treating process, including sludges, liquids, sediments, and drippings, were directed into two unlined canals, Canal A and Canal B, which in turn were directed to two unlined lagoons, Lagoon A and Lagoon B (Figure 2). Excess waste materials were drained from Lagoon A via an exit trench, which discharged to an area in the northeast portion of the property. Creosote sludge remains in the canals and lagoons underlying the housing development. The lagoons are encountered 0.6 to 1.5 m (1.9 to 4.9 ft) below ground surface bgs), and waste material extends up to 11 m (36 ft) bgs (USEPA 1999). A storm sewer pipe, which drained the facility, discharges to the Millstone River south of the facility via an outfall (Weston 1998).

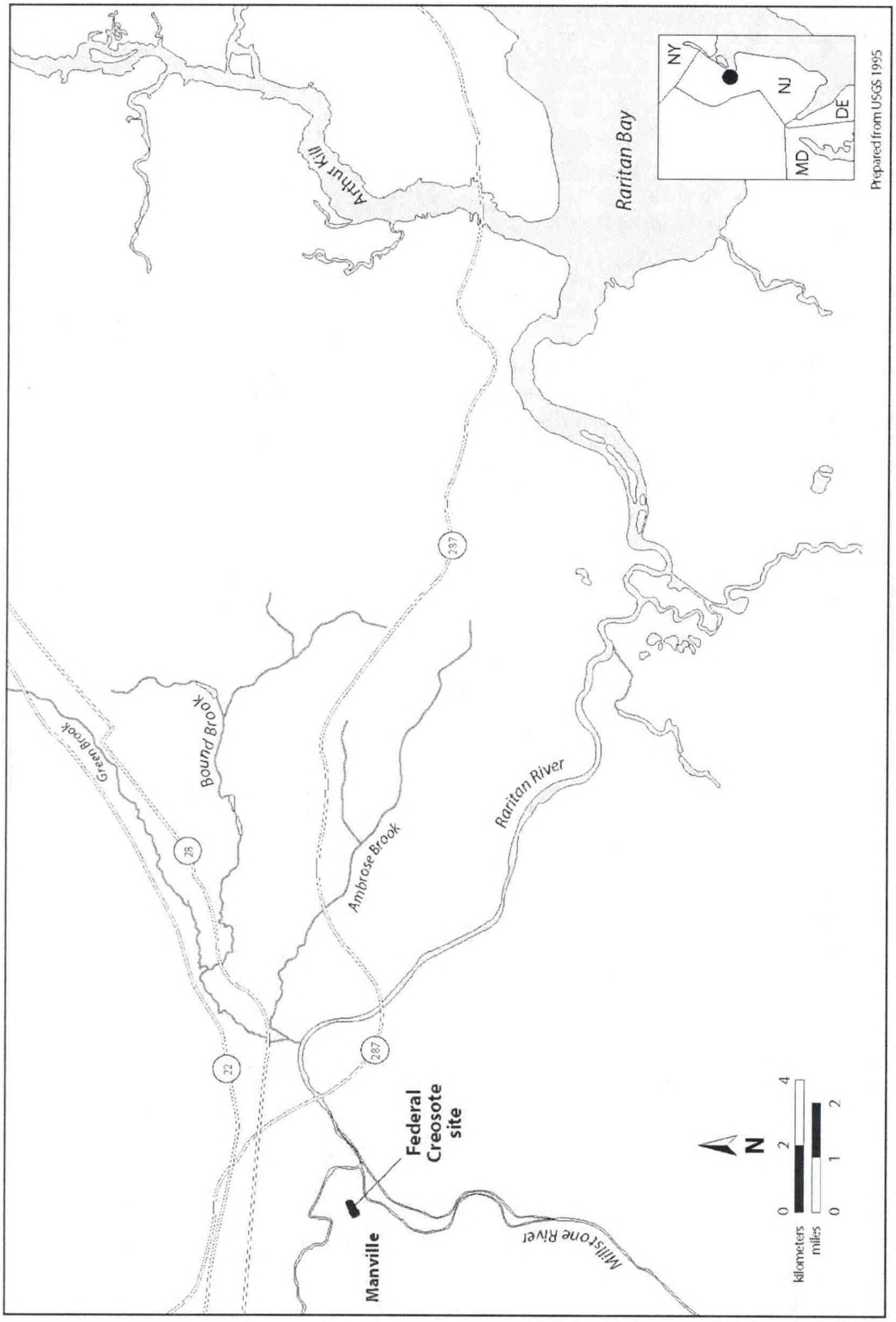

Figure 1. Location of the Federal Creosote site in Manville, New Jersey.

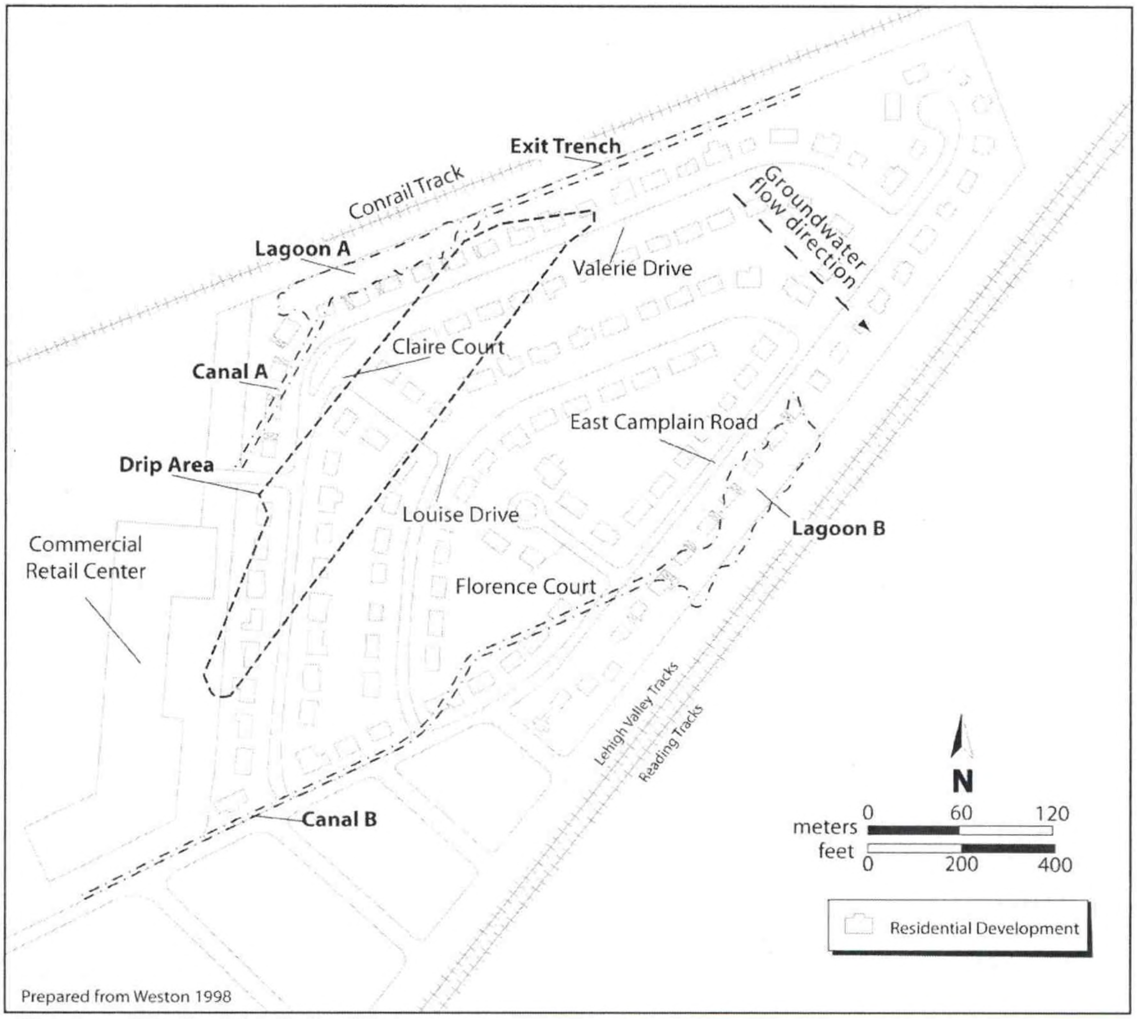

Figure 2. Detail of the Federal Creosote property.

Polycyclic aromatic hydrocarbons (PAHs) have been detected in soil, groundwater, and sediment samples collected at the site and down-gradient of the site during investigations conducted by the New Jersey Department of Environmental Protection (NJDEP) and the U.S. Environmental Protection Agency (USEPA). Arsenic and lead were also detected in soil samples during these investigations. In 1996, the NJDEP discovered creosote contamination seeping into the basement sump of a private residence. In January 1997, excavation to repair a sewer line in the same residential development revealed creosote contamination around the line. Soil and gravel contaminated with creosote have been observed in test pits at the site approximately 0.3 to 1.5 m (1 to 4.9 ft) bgs in the area of the Lagoon A exit trench. Areas containing solid or liquid creosote wastes have been observed underlying the site as well (Weston 1998, 1999).

During a three-phase site investigation conducted by the USEPA from 1997 to 1998, elevated concentrations of PAHs associated with creosote were detected in the lagoons, canals, drip area, groundwater underlying the site, and sediment from the Millstone River down-gradient of the site (Weston 1998). The Federal Creosote site was proposed to the National Priorities List (NPL) on July 28, 1998, and was placed on the NPL on January 1, 1999 (USEPA 2005). In 2000, the New Jersey Department of Health and Senior Services and the Agency for Toxic Substances and Disease Registry completed a public health assessment (ATSDR 2000) for the site. Cleanup activities continue at the site (USEPA 2005).

Groundwater and surface water runoff are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Groundwater beneath the site is encountered approximately 0.3 to 10 m (1 to 33 ft) bgs and flows to the southeast toward the Millstone River (Weston 1998). Surface water runoff from the site is directed to a storm sewer system that discharges directly into the Millstone River via stormwater outfalls (Weston 1998). Based on the results of the remedial investigation, it is unlikely that site-related contaminants have impacted NOAA trust resources.

NOAA Trust Resources

The habitats of concern to NOAA are the lower Millstone and Raritan rivers, both of which provide freshwater riverine habitat for NOAA trust resources that include anadromous and catadromous fish species. In the vicinity of the site, both rivers are of moderate size, ranging from 40 to 60 m (131 to 197 ft) in width and up to 6 m (20 ft) in depth. The Millstone River converges with the Raritan River approximately 1.6 km (1 mi) east of the Federal Creosote property. The Raritan River continues to flow approximately 32 km (20 mi) before discharging into Raritan Bay, an estuary of the Atlantic Ocean (Figure 1).

NOAA trust resources present in the Millstone and Raritan rivers in the vicinity of the site (Table 1) include the anadromous alewife, American shad, and striped bass, as well as the catadromous American eel, which is ubiquitous throughout the Raritan River basin (Barno 2000). Alewife, American shad, and striped bass spawn in the upper reaches of the Millstone and Raritan rivers. In the vicinity of the site, the Millstone River would be expected to provide habitat for adults migrating to spawning grounds, as well as nursery areas for outmigrating juveniles. American eel enter the Raritan River as juveniles and reside in the watershed for much of their adult life (Barno 2000).

The NJDEP is presently engaged in an American shad restoration program on the Raritan River. From 1992 to 1997, adult American shad from the Delaware River basin were transplanted to the Raritan River in efforts to reestablish a spawning population. As a result, naturally spawning populations of shad are returning to both the Raritan and Millstone rivers. The NJDEP currently monitors adult fish migrating through fish passage facilities at a dam located approximately 6 km (4 mi) downstream of the Federal Creosote site. Water quality improvements have resulted in reestablished populations of alewife and striped bass in the Raritan River (Barno 2000).

No commercial fishing occurs in the vicinity of the site and recreational fishing is limited (Barno 2000).

Table 1. NOAA trust resources present in the Millstone and Raritan Rivers near the Federal Creosote site (Weston 1998, 1999).

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Alewife	*Alosa pseudoharengus*		♦	♦		
American shad	*Alosa sapidissima*		♦	♦		
Striped bass	*Morone saxatilis*		♦	♦		
CATADROMOUS FISH						
American eel	*Anguilla rostrata*		♦	♦		

The NJDEP has issued a statewide fish and shellfish consumption advisory for polychlorinated biphenyls (PCBs) and dioxins. The fish consumption advisory restricts consumption of several fish and shellfish species in the Raritan Bay complex, approximately 15 km (9 mi) downstream of the Federal Creosote property. A fish consumption advisory is in effect for the entire length of Bound Brook because of PCB and dioxin contamination. Bound Brook (Figure 1) is a tributary of the Raritan River approximately 5 km (3 mi) downstream of the Federal Creosote property. The NJDEP recommends that the general public and high-risk individuals avoid consuming all fish species from Bound Brook. The NJDEP has also issued a statewide freshwater fish consumption advisory for mercury. The fish consumption advisory for the Raritan River at the confluence of the Millstone River recommends that the general public consume no more than one meal per week of largemouth bass and that high-risk individuals consume no more than one meal per month. The advisory also recommends that high-risk individuals consume no more than one meal per week of channel catfish (NJDEP 2004).

Site-Related Contamination

From 1997 to 1998, the USEPA collected more than 1,400 soil samples from the Federal Creosote property and properties adjacent to the site. In addition, groundwater samples were collected from monitoring wells and public water supplies at the property and adjacent to the property. Sediment samples were taken from the Millstone River down-gradient of the Federal Creosote property. Soil samples were analyzed for metals and PAHs. Groundwater samples were analyzed for PAHs and volatile organic compounds. Sediment samples were analyzed for PAHs. The site-related contaminant data summarized below was generated prior to data generated during the remedial investigation. The results of the remedial investigation indicate that NOAA resources present near the site are not being impacted by contaminants migrating from the site.

The primary contaminants of concern to NOAA are PAHs. Table 2 summarizes maximum concentrations of contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such site-specific or regionally specific guidance, the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs; MacDonald et al. 2000); the screening guidelines for groundwater are the ambient water quality criteria (AWQC; USEPA 2002); and the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997). In this case, regionally

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Federal Creosote site (Weston 1998, 1999). Contaminant values in bold exceed or are equal to screening guidelines.

	Soil (mg/kg)			Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	ORNL -PRG[a]	New Jersey RDCSCC[b]	Ground-water	AWQC[c]	New Jersey GWQS[d]	Sedi-ment	TEC[e]
METALS/INORGANICS								
Arsenic	**16**	9.9	20	N/A	150	0.02	N/A	9.79
Lead	**4,800**	40.5	400	N/A	2.5[f]	5	N/A	35.8
PAHs								
Acenaphthene	**5,400**	20	3400	**1,800**	520[g]	400	**1.8**	0.290[h]
Acenaphthylene	2,000	NA	NA	96	NA	NA	**0.37**	0.160[h]
Anthracene	**17,000**	NA	10,000	ND	NA	2,000	**1.6**	0.0572
Benz(a)anthracene	**3,500**	0.1[i]	0.9	460	NA	NA	**2.3**	0.108
Benzo(a)pyrene	**1,900**	0.1[i]	0.66	ND	NA	NA	**1.5**	0.15
Benzo(b)fluoranthene	**1,600**	0.1[i]	0.9	ND	NA	NA	ND	NA
Benzo(k)fluoranthene	**1,800**	0.1[i]	0.9	ND	NA	NA	ND	13.4[h]
Chrysene	**3,700**	NA	9	410	NA	NA	**1.8**	0.166
Dibenz(a,h)anthracene	**330**	0.1[i]	0.66	N/A	NA	NA	**0.35**	0.033
Fluoranthene	**13,000**	NA	2,300	**2,300**	NA	300	**8.6**	0.423
Fluorene	**8,700**	NA	2,300	**1,800**	NA	300	**3.3**	0.0774
Indeno(1,2,3-cd)pyrene	**870**	0.1[i]	0.9	3.5	NA	NA	**0.64**	0.330[h]
2-Methylnaphthalene	6,000	NA	NA	N/A	NA	NA	N/A	NA
Naphthalene	**21,000**	0.1[i]	230	**19,000**	620[g]	NA	ND	0.176
Phenanthrene	**25,000**	0.1[i]	NA	5,000	NA	NA	**11**	0.204
Pyrene	**9,000**	0.1[i]	1,700	**1,500**	NA	200	**5.3**	0.195

a: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).
b: Human health criteria for New Jersey Residential Direct Contact Soil Cleanup Criteria (RDCSCC; NJDEP 1999).
c: Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.
d: New Jersey Groundwater Quality Standard (GWQS; NJDEP 1993).
e: Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).
f: Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L CaCO3.
g: Lowest observable effects level (LOEL) (USEPA 1986).
h: Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.
i: Canadian Council of Ministers of the Environment (CCME) environmental quality guidelines for agricultural land uses (CCME 2003).
N/A: Not analyzed for.
NA: Screening guidelines not available.
ND: Not detected.

specific screening guidelines include the New Jersey residential direct contact soil cleanup criteria (RDCSCC; NJDEP 1999) and the New Jersey groundwater quality standards (GWQS; NJDEP 1993). Exceptions to these screening guidelines, if any, are noted in Table 2. Only maximum concentrations that exceeded one or more relevant screening guidelines are discussed below. When known, the general sampling location of a sample that exceeded a screening guideline is also provided.

Sediment

PAHs were detected in sediment samples collected from the Millstone River near stormwater outfalls down-gradient of the site at concentrations that exceeded screening guidelines. The maximum concentrations of anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, phenanthrene, and pyrene exceeded the TECs by one order of magnitude. The maximum concentrations of acenaphthene, acenaphthylene, and indeno(1,2,3-cd)pyrene exceeded the TECs by factors of six, two, and two, respectively (Table 2).

Groundwater

PAHs were detected in groundwater samples collected from monitoring wells in Lagoon B and a residence in the area of Lagoon B at concentrations that exceeded screening guidelines. The maximum concentration of naphthalene exceeded the AWQC by one order of magnitude. The maximum concentration of acenaphthene exceeded the AWQC by a factor of 3.5 and the GWQS by a factor of 4.5. The maximum concentrations of fluoranthene and pyrene both exceeded the GWQS by a factor of 7.5, while the maximum concentration of fluorene exceeded the GWQS by a factor of six (Table 2).

Soil

Metals and PAHs were detected in soil samples collected from the site at concentrations that exceeded screening guidelines. Arsenic and lead were detected at the site but the exact sample locations could not be determined from the documents reviewed for this report. The maximum concentration of lead exceeded the ORNL-PRG by two orders of magnitude and the RDCSCC by one order of magnitude. The maximum concentration of arsenic slightly exceeded the ORNL-PRG (Table 2).

The maximum concentrations of the PAHs acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, phenanthrene, and pyrene were detected in soil samples from Lagoon B. The maximum concentration of phenanthrene exceeded the ORNL-PRG by five orders of magnitude. The maximum concentrations of benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene exceeded the ORNL-PRGs by four orders of magnitude and the RDCSCC by three orders of magnitude. The maximum concentration of pyrene exceeded the ORNL-PRG by four orders of magnitude and the RDCSCC by a factor of five. The maximum concentrations of indeno(1,2,3-cd)pyrene exceeded the ORNL-PRGs by three orders of magnitude and the RDCSCC by two orders of magnitude. The maximum concentration of chrysene exceeded the RDCSCC by two orders of magnitude. The maximum concentration of acenaphthene exceeded the ORNL-PRG by two orders of magnitude and the RDCSCC by a factor of 1.5. The maximum concentrations of fluoranthene, fluorene, and anthracene exceeded the RDCSCC by factors of 5.5, 3.5, and 1.5, respectively. No screening guidelines are currently available for comparison to the concentrations of acenaphthylene and 2-methylnaphthalene detected in the soil samples (Table 2).

Naphthalene and dibenz(a,h)anthracene were detected in soil samples collected from Lagoon A. The maximum concentration of naphthalene exceeded the ORNL-PRG by five orders of magnitude and the RDCSCC by one order of magnitude. The maximum concentration of dibenz(a,h)anthracene exceeded the ORNL-PRGs by three orders of magnitude and the RDCSCC by two orders of magnitude (Table 2).

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Lightman Drum Company

Winslow Township, New Jersey

EPA Facility ID: NJD014743678

Basin: Mullica-Toms

HUC: 02040301

Executive Summary

The Lightman Drum Company site (Lightman Drum) is in Winslow Township, Camden County, New Jersey. Beginning in 1974, Lightman Drum operated as a drum recycling business and industrial waste hauler. Metals, PAHs, pesticides, and VOCs have been detected in surface water, sediment, groundwater, and soil at the site; metals are the primary contaminants of concern to NOAA. The habitat of concern to NOAA is Pump Branch, a headwater tributary of the Mullica River. Wetlands associated with Pump Branch are present west of the Lightman Drum property. The catadromous American eel is likely to be found in Pump Branch in the vicinity of the site. Surface water runoff is the primary pathway for the migration of contaminants from the site to NOAA resources and groundwater transport is a secondary pathway.

Site Background

The Lightman Drum Company site (Lightman Drum) is in a mixed rural and residential area of Winslow Township, Camden County, New Jersey. The Lightman Drum property, which is approximately 6 ha (15 acres) in area, is bordered to the north and south by farmlands, to the east by Cedar Brook Road, and to the west by wetlands associated with the headwaters of Pump Branch (Figure 1). Pump Branch is a headwater tributary of the Mullica River. Wetlands are present at the western end of the property and approximately 4 ha (10 acres) of the property are wooded. Pump Branch is approximately 12 m (39 ft) west of the site and exhibits continuous flow approximately 0.8 km to 1.6 km (0.5 to 1 mi) downgradient of the property.

Beginning in 1974, Lightman Drum operated as a drum recycling and industrial waste hauling business. Possible sources of contamination at the site include drum storage areas, an unlined waste storage pit, and underground storage tanks (USTs), which were used to store drum contents and diesel fuel (Figure 2) (INTEX 1989).

When operations first began at the Lightman Drum site, empty used drums and drums containing wastes such as paints, inks, glues, solvents, pesticides, and waste oils were accepted and stored throughout the property until they were reconditioned and sold (ATSDR 2001). In 1978, the New Jersey Department of Environmental Protection (NJDEP) issued a one-year permit to allow Lightman Drum to store wastes on the property; NJDEP did not renew the permit (USEPA 2000; Golder 2005a). In 1978, the facility began emptying drums containing waste into two 19,000 L (5,019 gal) USTs. After 1979, the facility was authorized to accept only empty drums (ATSDR 2001).

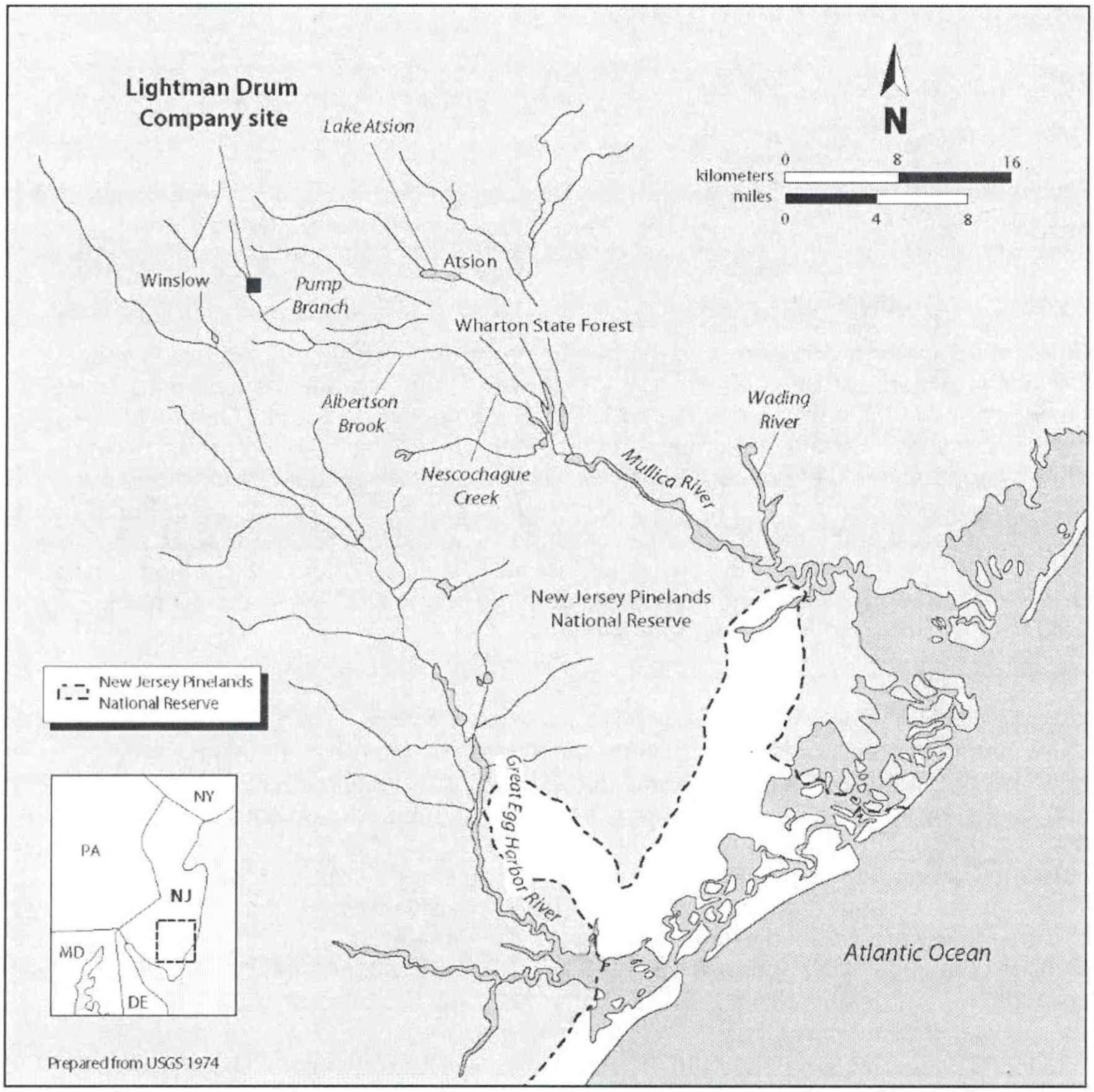

Figure 1. Location of the Lightman Drum Company site, Winslow Township, New Jersey.

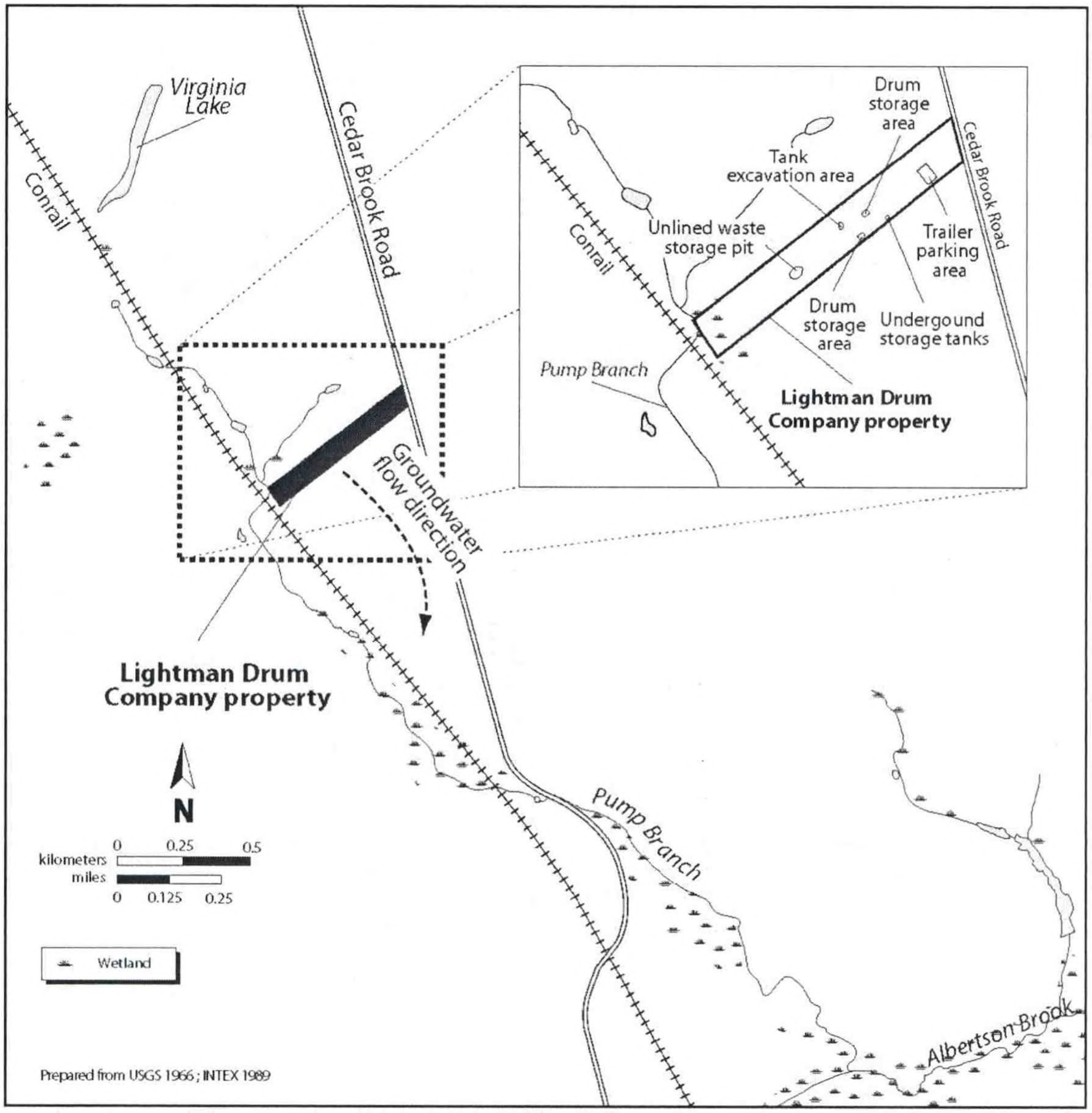

Figure 2. Detail of the Lightman Drum Company property.

Metals, polycyclic aromatic hydrocarbons (PAHs), pesticides, and volatile organic compounds (VOCs) were detected in soil and groundwater at the site during investigations conducted by the New Jersey Department of Environmental Protection (NJDEP). In 1984, the NJDEP inspected the site and discovered that a UST previously excavated from the site had several holes in it. Stained soil was also observed in the area where the UST had been removed (INTEX 1989).

A Phase I remedial investigation and a Phase II remedial investigation were completed at the site in 1989 and 1990, respectively, by a contractor hired by Lightman Drum (ATSDR 2001). The Lightman Drum site was proposed to the National Priorities List on July 22, 1999, and was placed on the list on October 22, 1999 (USEPA 2005a). In 2001, the New

Jersey Department of Health and Senior Services and the Agency for Toxic Substances and Disease Registry completed a public health assessment (ATSDR 2001) for the site. In 2005, Golder Associates completed a remedial investigation and feasibility study that was initiated by the U.S. Environmental Protection Agency (USEPA) in 2000 (Golder 2005a, 2005b).

Surface water runoff is the primary pathway for the migration of contaminants from the site to NOAA trust resources; groundwater transport is a secondary pathway. Surface water runoff flows to the south, southwest, and northwest toward the wetlands and Pump Branch, which are adjacent to the property. The soil at the site is well drained with poor filtering capacity (INTEX 1989) and groundwater is encountered beneath the site at approximately 1 to 5 m (3 to 16 ft) below ground surface (INTEX 1989, 1990). Groundwater beneath the site generally flows to the south-southeast before turning south-southwest toward Pump Branch approximately 1.1 km (0.7 mi) downgradient from the Lightman Drum property (Golder 2005a).

NOAA Trust Resources

The habitat of primary concern to NOAA is Pump Branch, a headwater tributary of the Mullica River (Figure 1). As shown on Figure 2, Pump Branch flows to the southeast approximately 14 km (8.9 mi) and empties into Albertson Brook. Albertson Brook flows to the east approximately 10 km (6 mi) and discharges into Nescochague Creek. Nescochague Creek flows to the southeast for approximately 6.8 km (4.2 mi) before entering the Mullica River. The Mullica River basin drains the majority of the New Jersey Pinelands National Reserve. The New Jersey Pinelands National Reserve encompasses part of Camden county and portions of six other counties in southern New Jersey.

Pump Branch is a small, low-gradient stream. The lower reach of Pump Branch flows through the Wharton State Forest approximately 6 km (4 mi) downstream of the Lightman Drum site. Wharton State Forest is within the New Jersey Pinelands National Reserve (Pinelands). The section of the stream that flows through the state forest passes through substantial hardwood and cedar swamp wetlands and pitch pine lowlands (USFWS 1997). New Jersey Pinelands streams are generally tea-colored and naturally acidic. Eighty-nine percent of annual stream discharge in the Pinelands can be attributed to groundwater discharge (USFWS 1997).

The NOAA trust resource likely present in Pump Branch in the vicinity of the site is the catadromous American eel, which is ubiquitous throughout the entire Mullica River basin (Smith 2005). American eel enter rivers as juveniles and reside in freshwater habitats throughout their adult lives, migrating widely in most river systems. The American eel is capable of traversing lowhead dams and small waterfalls. Because of this ability, they are able to access the upper reaches of streams when other anadromous species are blocked (Carberry 2000; Smith 2005).

No commercial or recreational fishing occurs in the vicinity of the site. Recreational fishing of warmwater fish species including largemouth bass, chain pickerel, brown bullhead, and sunfish does occur in the upper Mullica River in the Wharton State Forest (Carberry 2000; Smith 2005).

The New Jersey Department of Environmental Protection (NJDEP) has issued a statewide consumption advisory for fish and shellfish because of PCB and dioxin contamination

(NJDEP 2005). The fish consumption advisory for the Mullica River recommends reduced consumption of American eel for the general public and no consumption for high-risk individuals. The NJDEP has also issued a statewide consumption advisory for freshwater-fish due to mercury contamination (NJDEP 2005). In the Pinelands Region, it is recommended that the general public consume no more than one meal per month of largemouth bass and chain pickerel, and no more than one meal per week of brown bullhead, yellow bullhead, and sunfish. NJDEP also recommends that high-risk individuals not consume largemouth bass, chain pickerel, brown bullhead or yellow bullhead, and to eat no more than one meal per month of sunfish.

Site-Related Contamination

Four surface water, eight sediment, 23 groundwater, and 139 soil samples were collected from the Lightman Drum property and adjacent properties during a remedial investigation conducted by Golder Associates from 2002 to 2005 (Golder 2005a, 2005b). All samples were analyzed for metals, semivolatile organic compounds including PAHs, VOCs, pesticides, and PCBs (Golder 2005a, 2005b). The primary contaminants of concern to NOAA are metals. Secondary contaminants of concern are PAHs, VOCs, and pesticides.

Table 1 provides a summary of the maximum concentrations of contaminants of concern to NOAA detected during the site investigations, and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of site-specific or regionally specific guidance, the screening guidelines for water are the ambient water quality criteria (AWQC; USEPA 2002); the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs; MacDonald et al. 2000); the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997) and the USEPA's ecological soil screening guidelines (USEPA 2005b). Exceptions to these screening guidelines, if any, are noted in Table 1. Only maximum contaminant concentrations that exceeded the screening guidelines, or contaminants for which there are currently no screening guidelines, are discussed below. When known, the general sampling locations are provided. The general areas where samples were collected are depicted in Figure 2.

Surface Water

Two metals were detected in surface water samples collected from the Lightman Drum site that exceeded screening guidelines (Table 1). The maximum concentrations of copper and lead were detected in samples taken from Pump Branch, approximately 1.4 km (0.9 mi) down-gradient from the Lightman Drum property. Copper concentrations exceeded the AWQC by a factor of three, while lead concentrations exceeded the AWQC by a factor of nine.

Sediment

Four metals were detected in sediment samples taken from the Lightman Drum site at concentrations that exceeded screening guidelines; another metal was detected for which no screening guideline is currently available (Table 1).

Table 1. Maximum concentrations of contaminants of concern to NOAA at the Lightman Drum Company site (Golder 2005a, 2005b). Contaminant values in bold exceed or are equal to screening guidelines.

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	ORNL-PRG[a]	Groundwater	Surface Water	AWQC[b]	Sediment	TEC[c]
METALS/INORGANICS							
Arsenic	3.2	9.9	2.3	11	150	**11**	9.79
Cadmium	**1.5**	0.36[d]	**96**	ND	0.25[e]	0.43	0.99
Chromiumf	**910**	0.4	**28**	3.8	11	15.1	43.4
Copper	21	60	**63**	**25**	9[e]	**150**	31.6
Lead	**54**	40.5	2.4	**23**	2.5[e]	**160**	35.8
Mercury	**0.13**	0.00051	0.16	ND	0.77[g]	**0.48**	0.18
Selenium	**1.3**	0.21	3	3.2	5.0[h]	5.9	NA
Zinc	**180**	8.5	**480**	ND	120[e]	107	121
PAHs							
Anthracene	ND	NA	ND	ND	NA	**0.075**	0.0572
Benz(a)anthracene	0.012	0.1[i]	ND	ND	NA	**0.12**	0.108
Benzo(a)pyrene	0.014	0.1[i]	ND	ND	NA	**0.17**	0.15
Benzo(b)fluoranthene	0.017	0.1[i]	ND	ND	NA	0.28	NA
Chrysene	0.018	NA	ND	ND	NA	**0.26**	0.166
2-Methylnaphthalene	ND	NA	10	ND	NA	0.063	NA
Phenanthrene	0.018	0.1[i]	17	ND	NA	0.18	0.204
Pyrene	0.025	0.1[i]	ND	ND	NA	**0.36**	0.195
VOCs							
Benzene	ND	0.05[i]	110	ND	5,300[j,k]	ND	NA
Ethylbenzene	ND	0.1[i]	700	ND	32,000[j,k]	ND	NA
Tetrachloroethylene	0.089	0.1[i]	**870**	ND	840[k]	ND	NA
Trichloroethylene	0.037	0.1[i]	940	ND	21900[k]	ND	NA
PESTICIDES							
4,4'-DDD	0.0027	NA	ND	ND	0.6[j,k]	**0.0058**	0.00488
4,4'-DDE	0.025	NA	ND	ND	1050[j,k]	**0.016**	0.00316
4,4'-DDT	0.019	0.7[i]	ND	ND	0.001[l]	**0.0083**	0.00416
Dieldrin	**0.0019**	0.000032[d]	ND	ND	0.056	ND	0.0019

a: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).
b: Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.
c: Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).
d: Ecological soil screening guidelines (USEPA 2005b).
e: Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L CaCO3.
f: Screening guidelines represent concentrations for Cr.+6
g: Derived from inorganic, but applied to total mercury.
h: Criterion expressed as total recoverable metal.
i: Canadian Council of Ministers of the Environment (CCME) environmental quality guidelines for agricultural land uses (CCME 2003)
j: Chronic criterion not available; acute criterion presented.
k: Lowest observable effects level (LOEL) (USEPA 1986).
l: Expressed as total DDT.
NA: Screening guidelines not available.
ND: Not detected.

The maximum concentration of arsenic, which slightly exceeded the TEC, was detected in a sample taken from the wetlands adjacent to the west corner of the Lightman Drum property (Figure 2).

Maximum concentrations of copper, lead, mercury, and selenium were detected in samples collected from Pump Branch approximately 1.4 km (0.85 mi) downgradient from the Lightman Drum property. Concentrations of copper and lead exceeded the TECs by a factor of approximately five, while mercury concentrations exceeded the TEC by a factor of three. No screening guideline is currently available for comparison to the concentration of selenium detected in the sediment samples.

Five PAHs were detected in sediment samples taken from the Lightman Drum site at concentrations that exceeded screening guidelines, and two PAHs were detected for which no screening guidelines are currently available.

Maximum concentrations of anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and pyrene were detected in samples taken from the wetlands adjacent to the west corner of the Lightman Drum property. Pyrene was also detected in a sample collected from Pump Branch approximately 1.4 km (0.85 mi) downgradient from the Lightman Drum property. The concentrations of anthracene, benz(a)anthracene, and benzo(a)pyrene slightly exceeded the TECs. Concentrations of chrysene and pyrene both exceeded the TECs by a factor of approximately two. No screening guideline is currently available for comparison to the concentration of benzo(b)fluoranthene detected in the sediment samples.

The maximum concentration of 2-methylnaphthalene was detected in a sample taken from the wetlands in the southwest corner of the Lightman Drum property. No screening guideline is currently available for comparison to the concentration of 2-methylnaphthalene detected in the sediment sample.

Three pesticides were detected in sediment samples taken from the Lightman Drum site at concentrations that exceeded screening guidelines.

Concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected in samples collected from the wetlands in the southwest corner of the Lightman Drum property. Concentrations of 4,4'-DDE and 4,4'-DDT exceeded the TECs by factors of five and two, respectively. The concentration of 4,4'-DDD slightly exceeded the TEC.

<u>Groundwater</u>

Four metals were detected in groundwater samples taken from the Lightman Drum site at concentrations that exceeded screening guidelines (Table 1).

The maximum concentration of cadmium was detected in a sample taken from a monitoring well in the unlined waste storage pit area, and exceeded the AWQC by two orders of magnitude.

The maximum concentrations of chromium and zinc were detected in samples taken from monitoring wells in the southern drum storage area. Concentrations of zinc exceeded the AWQC by a factor of four, while chromium concentrations exceeded the AWQC by a factor of 2.5.

The maximum concentration of copper, which exceeded the AWQC by a factor of seven, was detected in a sample taken from a water supply well near the trailer parking area.

Two PAHs were detected in groundwater samples taken from the Lightman Drum site. The maximum concentrations of 2-methylnaphthalene and phenanthrene were detected in samples collected from a monitoring well adjacent to the Conrail tracks approximately 1.1 km (0.68 mi) downgradient from the Lightman Drum property. No screening guidelines are currently available for comparison to the concentrations of 2-methylnaphthalene and phenanthrene detected in the groundwater samples.

One VOC was detected in groundwater samples taken from the Lightman Drum site at concentrations that equaled or exceeded screening guidelines (Table 1).

The maximum concentration tetrachloroethylene was detected in a sample collected from a monitoring well in the tank excavation area. The concentration of tetrachloroethylene slightly exceeded the AWQC.

Soil

Six metals were detected in soil samples taken from the Lightman Drum site at maximum concentrations that exceeded screening guidelines (Table 1).

The maximum concentrations of cadmium, mercury, and selenium were detected in samples taken from the unlined waste storage pit area (Figure 2). The mercury concentration exceeded the ORNL-PRG by two orders of magnitude, while the concentration of selenium exceeded the ORNL-PRG by a factor of six; the concentration of cadmium exceeded the USEPA soil screening guideline by a factor of four.

The maximum concentration of chromium was detected in a sample taken from the southern drum storage area and exceeded the ORNL-PRG by three orders of magnitude.

The maximum concentration of lead, which slightly exceeded the ORNL-PRG, was detected in the trailer parking area.

The maximum concentration of zinc, which exceeded the ORNL-PRG by one order of magnitude, was detected in a sample taken from the tank excavation area.

One pesticide was detected in soil samples taken from the Lightman Drum site at a maximum concentration that exceeded a screening guideline (Table 1). The maximum concentration of dieldrin, which exceeded the USEPA ecological soil screening guideline by one order of magnitude, was detected in a sample taken from the trailer parking area.

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St. Juliens Creek Annex (U.S. Navy)

Chesapeake, Virginia

EPA Facility ID: VA5170000181

Basin: Hampton Roads

HUC: 02080208

Executive Summary

From 1849 to 1970, the U. S. Navy operated the St. Juliens Creek Annex as an ordnance storage, assembly, and testing facility. Industrial operations such as metal plating, degreasing, painting, pest control, and lead battery maintenance occurred at the facility. The USEPA has identified four source areas at the site: Landfill B, Landfill C, Landfill D, and the Burning Grounds. The four source areas lie adjacent to or immediately upgradient of tidal creeks of the Southern Branch of the Elizabeth River, an estuary of Chesapeake Bay. The habitats of concern to NOAA are St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River. Many NOAA trust fish and invertebrate species inhabit these areas, and recreational and commercial fisheries occur in Hampton Roads Harbor, near the mouth of the Elizabeth River. The primary contaminants of concern to NOAA are metals, PAHs, pesticides, and PCBs. Surface water runoff is the primary pathway for the migration of contaminants from the site to NOAA trust resources.

Site Background

The St. Juliens Creek Annex (the Annex), a U.S. Naval facility, is in a mixed industrial and residential area of Chesapeake, Virginia (Figure 1). The site is approximately 198 ha (489 acres) in area and is bordered to the north by a railroad, to the east by the Southern Branch of the Elizabeth River, to the south by St. Juliens Creek, and to the west by a residential area (CDM 1998). Blows Creek runs through the northeastern portion of the site (Figure 2).

From 1849 to 1970, the Annex was operated as an ordnance storage, assembly, and testing facility. The Annex currently provides administrative offices, light industrial shops, a radar testing range, and storage facilities for the Navy. Former operations at the facility that generated potentially hazardous substances include metal plating, degreasing, painting, use of hydraulic equipment and vehicles, pest control, maintenance of lead batteries, and printing. Waste ordnance materials and garbage from the facility were disposed of in unlined landfills throughout the site (USEPA 2000).

The U.S. Environmental Protection Agency (USEPA) has identified four source areas at the site: Landfill B, Landfill C, Landfill D, and the Burning Grounds (Figure 2). Landfills B, C, and D and the Burning Grounds are all inactive, unlined disposal areas. Substances disposed of at the four source areas include solvents, waste oil, oil sludge, and polychlorinated biphenyls (PCBs) (CH2M Hill 1999). Ordnance disposal and burning of various materials occurred at the Burning Grounds (USEPA 2000).

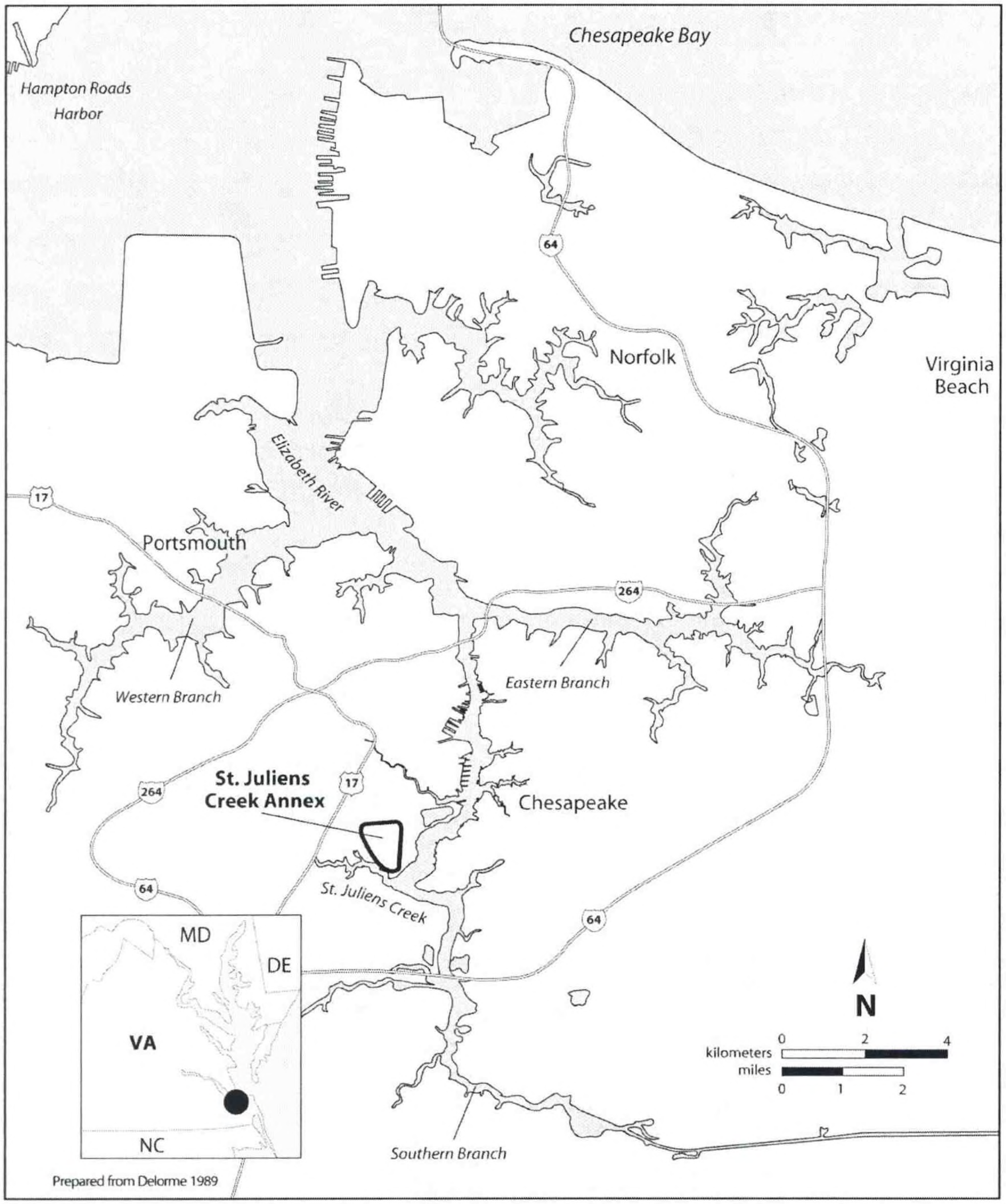

Figure 1. Location of the St. Juliens Creek Annex site, Chesapeake, Virginia.

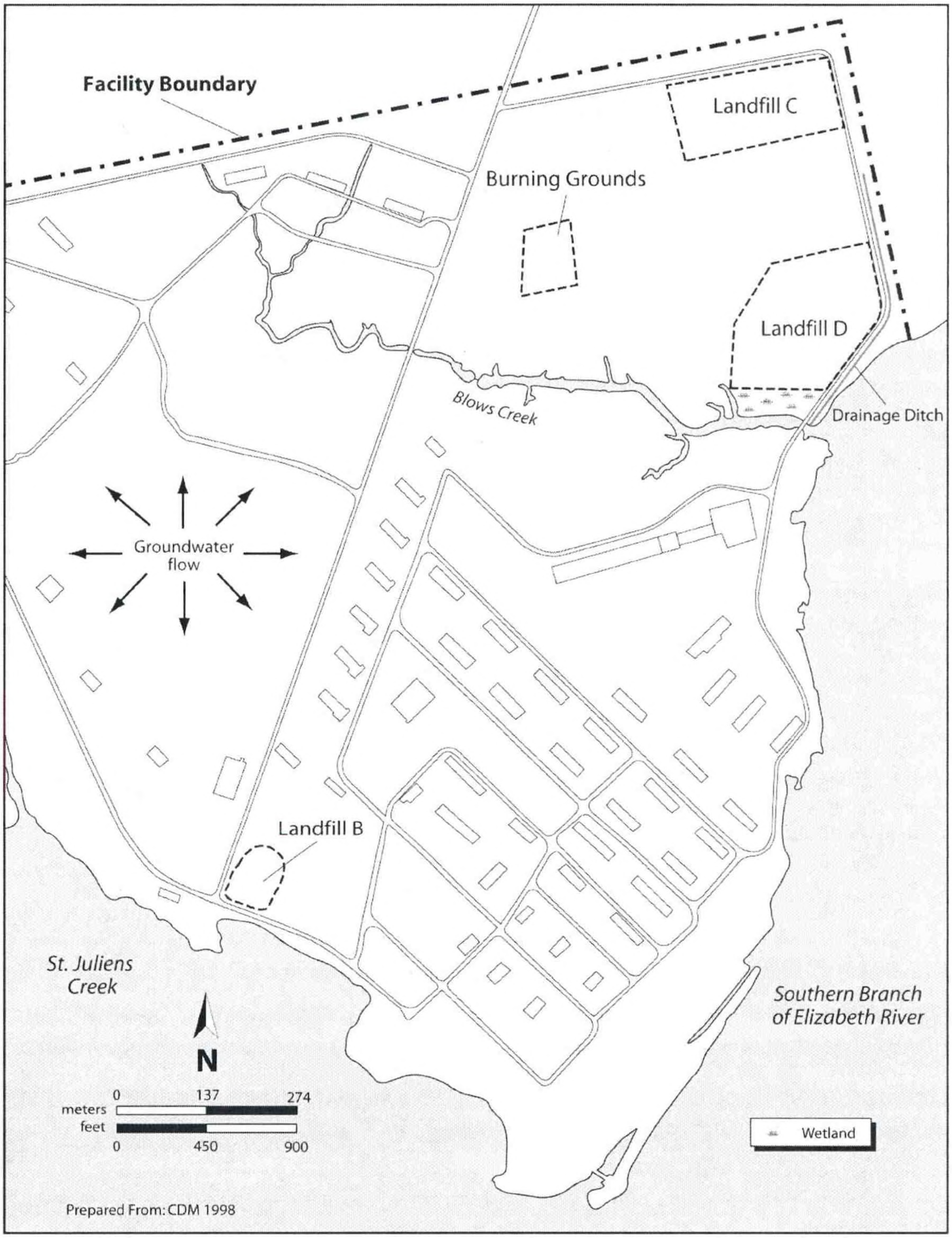

Figure 2. Detail of the St. Juliens Creek Annex property.

Numerous site investigations have been conducted by the Department of Defense and the USEPA at the St. Juliens Creek Annex. Remedial investigations and an ecological risk assessment were conducted at the identified source areas in 1998 (CH2M Hill 1999). A remedial investigation and ecological risk assessment were conducted at Landfill B in 2001 (CH2M Hill 2003a). A work plan for a remedial investigation and an ecological risk assessment for Landfill C, Landfill D, and the Burning Grounds was written in 2002; the results of these investigations were not available at the time this report was written. The St. Juliens Creek Annex was proposed for the National Priorities List (NPL) on February 4, 2000, and was placed on the NPL on July 27, 2000.

Surface water runoff is the primary pathway for the migration of contaminants from the site to NOAA trust resources; sediment and groundwater transport are secondary pathways. A ponded area in the center of Landfill B drains directly into St. Juliens Creek. Drainage ditches in the area of Landfill B also discharge into St. Juliens Creek (CH2M HILL 2003a). Landfill C was originally a mudflat of the Southern Branch of the Elizabeth River (CDM 1998). A drainage ditch that discharges to Blows Creek is adjacent to Landfill D. Wetland vegetation is present in Landfill D and an emergent salt marsh associated with Blows Creek is immediately south of Landfill D. The wetlands at the site are connected to the groundwater table (USEPA 2000). Surface water runoff from the Burning Grounds both discharges directly into Blows Creek and is directed into Blows Creek via drainage ditches (CH2M HILL 2003b).

Groundwater in the vicinity of the site is approximately 0.6 m to 2 m (2 to 6.5 ft) below ground surface. Groundwater flow beneath the site is generally radial, and groundwater discharges into nearby surface water bodies such as St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River (CH2M HILL 2003a).

NOAA Trust Resources

The habitats of concern to NOAA are St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River (Figure 1). St. Juliens Creek borders the Annex to the south and flows southeast approximately 1.2 km (0.75 mi) before entering the Southern Branch of the Elizabeth River, an estuary of Chesapeake Bay. Blows Creek flows to the southeast through the Annex property approximately 1.1 km (0.7 mi) before discharging into the Southern Branch of the Elizabeth River. An intermittent drainage ditch adjacent to Landfill D drains into Blows Creek. Salinities in the estuary range from 14 to 20 parts per thousand, and sediments range from silts to sands (Majumdar et al. 1987).

Trawl surveys conducted by the Virginia Institute of Marine Science (VIMS) indicate that many NOAA trust resources, including anadromous, catadromous, estuarine, and marine fish use the Southern Branch of the Elizabeth River and its tidally influenced tributaries for spawning, rearing, and adult habitat (Table 1). The tidally influenced tributaries include St. Juliens Creek and Blows Creek. Alewife, American shad, and blueback herring use the area near the site as a juvenile nursery, and as adults they migrate upstream of the site to spawn in freshwater streams (VIMS 1989). Striped bass, particularly juvenile stages, are common in the vicinity of the site (Stone et al. 1994). Juvenile and adult white perch are abundant in the estuary; the adults spawn in fresh water upstream of the site. The catadromous American eel is ubiquitous throughout the Chesapeake basin, and juvenile life stages are present near the site (Stone et al. 1994).

Table 1. NOAA trust resources present in the Elizabeth River estuary near the St. Juliens Creek Annex site (VIMS 1989; Stone et al. 1994; O'Reilly 2000).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Alewife	*Alosa pseudoharengus*		♦			
American shad	*Alosa sapidissima*		♦			
Blueback herring	*Alosa aestivalis*		♦			
Striped bass	*Morone saxatilis*		♦	♦	♦	
White perch	*Morone americana*		♦	♦		
CATADROMOUS FISH						
American eel	*Anguilla rostrata*		♦		♦	
MARINE/ESTUARINE FISH						
Atlantic croaker	*Micropogonias undulatus*		♦	♦		♦
Atlantic herring	*Clupea harengus harengus*		♦	♦		
Atlantic menhaden	*Brevoortia tyrannus*		♦	♦		
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Black drum	*Pogonias cromis*		♦	♦		
Black sea bass	*Centropristis striata*		♦	♦		
Bluefish	*Pomatomus saltatrix*		♦	♦		♦
Butterfish	*Peprilus triacanthus*		♦	♦		
Cownose ray	*Rhinoptera bonasus*		♦	♦		
Gobies	*Gobiosama* spp.	♦	♦	♦		
Hogchoker	*Trinectes maculatus*	♦	♦	♦		
Killifish	*Fundulus* spp.	♦	♦	♦		
Mullets	*Mugil* spp.		♦			
Northern pipefish	*Syngnathus fuscus*	♦	♦	♦		
Northern searobin	*Prionotus carolinus*		♦			
Oyster toadfish	*Opsanus tau*	♦	♦	♦		
Pinfish	*Lagodon rhomboides*		♦	♦		
Red drum	*Sciaenops ocellatus*		♦	♦		♦
Red hake	*Urophycis chuss*		♦			
Scup	*Stenotomus chrysops*		♦			
Sheepshead minnow	*Cyprinodon variegatus variegatus*	♦	♦	♦		
Silversides	*Menidia* spp	♦	♦	♦		
Skates	*Raja* spp.		♦	♦		
Spot	*Leiostomus xanthurus*		♦	♦		♦
Spotted seatrout	*Cynoscion nebulosus*		♦	♦		♦
Summer flounder	*Paralichthys dentatus*		♦	♦		♦
Tautog	*Tautoga onitis*		♦	♦		
Weakfish	*Cynoscion regalis*		♦	♦		♦
Windowpane flounder	*Scophthalmus aquosus*		♦	♦		
INVERTEBRATES						
Blue crab	*Callinectes sapidus*	♦	♦	♦	♦	♦
Blue mussel	*Mytilus edulis*	♦	♦	♦		
Daggerblade grass shrimp	*Palaemonetes pugio*	♦	♦	♦		
Eastern oyster	*Crassostrea virginica*	♦	♦	♦		♦
Northern quahog	*Mercenaria mercenaria*	♦	♦	♦		♦
Sevenspine bay shrimp	*Crangon septemspinosa*	♦	♦	♦		

Estuarine and marine resident species present near the site include bay anchovy, gobies, hogchoker, killifish, northern pipefish, oyster toadfish, sheepshead minnow, and silversides (VIMS 1989). All life stages of these species are spent within the estuary and several of the species are highly abundant. Species such as bluefish, butterfish, mullets, pinfish, and the sciaenids (croaker, drum, seatrout, spot, and weakfish) are coastal spawners; eggs and larval stages drift freely offshore and juvenile stages migrate to the estuary. Since many of these species are long-lived, juveniles may spend several years in the estuary. Adults of several of the species can also be found seasonally within the estuary. Species such as Atlantic croaker, bluefish, and spot are particularly abundant in the area (Stone et al. 1994).

Several invertebrates are present in the estuary, including blue crab, daggerblade grass shrimp, eastern oyster, and northern quahog. Juvenile and adult blue crab are abundant; mating and larval stages are also observed in the estuary, although females usually migrate to coastal waters to brood and release eggs. Daggerblade grass shrimp, eastern oyster, and northern quahog spend all life stages in the estuary (Stone et al. 1994).

Both commercial and recreational fishing occur in the Hampton Roads Harbor portion of Chesapeake Bay, near the mouth of the Elizabeth River. The bulk of the fish harvested commercially from this area include American eel, blue crab, and striped bass (O'Reilly 2000). Species targeted by recreational fishers include Atlantic croaker, blue crab, bluefish, eastern oyster, northern quahog, spot, summer flounder, and weakfish (Majumdar et al. 1987).

A fish consumption advisory is in effect for Chesapeake Bay and its small tributaries because of high levels of PCBs detected in fish tissue. The Virginia Department of Health recommends that people eat no more than two meals per month of anadromous striped bass (VDH 2004).

Site-Related Contamination

Surface water, sediment, groundwater, and soil samples have been collected for analysis from the St. Juliens Creek Annex site during numerous site investigations. Surface water data for Landfill C and the Burning Grounds were not available for review at the time of this report.

Samples were analyzed for metals, polycyclic aromatic hydrocarbons (PAHs), pesticides, and PCBs, which are also the primary contaminants of concern to NOAA. Surface water samples taken from Landfill D, and groundwater samples taken from Landfill C, Landfill D, and the Burning Grounds, were not analyzed for PAHs, pesticides, and PCBs.

Table 2 (groundwater and surface water) and Table 3 (soil and sediment) summarize maximum contaminant concentrations detected during the site investigations and compare them to appropriate screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of site-specific or regionally specific guidance, the screening guidelines for surface water and groundwater are the ambient water quality criteria (AWQC; USEPA 2002), and the screening guidelines for sediment are the effects range-low (ERL) values (Long et al. 1998). There are regional-specific guidelines available for soil, which are the USEPA Region III biological technical assistance group (BTAG) soil screening levels for fauna (USEPA 1995). Exceptions are noted on Table 3 where the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997) or the USEPA's ecological soil screening

Table 2. Maximum concentrations of contaminants of concern to NOAA in water, at the St. Juliens Creek Annex site (CDM 1998; CH2M HILL 2003a, 2003c). Contaminant values in bold exceed or are equal to screening guidelines.

	Groundwater (µg/L)			Surface Water (µg/L)		
Contaminant	Landfill B	Landfill C/D	Burning Grounds	Landfill B	Landfill D	AWQC[a]
METALS/INORGANICS						
Arsenic	6.2	ND	ND	4.4	27	36
Cadmium	ND	6.1	ND	2.5	ND	8.8
Chromiumb	**56**	6.1	ND	**170**	**67**	50
Copper	ND	**25**	**120**	**200**	**180**	3.1
Lead	**37**	2.3	**16**	**78**	**820**	8.1
Mercury	ND	ND	ND	ND	**1.2**	0.094[c]
Nickel	**17**	ND	**360**	**81**	**64**	8.2
Silver	**3**	ND	**2.8**	ND	ND	1.9d
Zinc	**640**	ND	**2000**	**1300**	**1200**	81
PESTICIDES/PCBs						
4,4'-DDD	ND	N/A	N/A	0.2	N/A	3.6[d,e]
4,4'-DDE	0.0051	N/A	N/A	ND	N/A	14[e]
4,4'-DDT	ND	N/A	N/A	ND	N/A	0.001[f]
Total PCBs	ND	N/A	N/A	ND	N/A	0.03

a: Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Marine chronic criteria presented.
b: Screening guidelines represent concentrations for Cr.+6
c: Derived from inorganic, but applied to total mercury.
d: Chronic criterion not available; acute criterion presented.
e: Lowest Observable Effect Level (LOEL) (USEPA 1986).
f: Expressed as Total DDT.
N/A: Not analyzed for.
ND: Not detected.

guidelines apply (USEPA 2005). Only maximum concentrations that exceeded relevant screening guidelines are discussed below.

Surface Water

Metals were detected in surface water samples collected from the drainage ditches that drain Landfill B and Landfill D (Table 2; Figure 2). The maximum concentrations of lead and mercury were detected in the drainage ditches that drain Landfill D. Lead concentrations exceeded the AWQC by two orders of magnitude; mercury exceeded the AWQC by one order of magnitude.

The maximum concentrations of chromium, copper, nickel, and zinc were detected in surface water samples collected from the drainage ditch that drains Landfill B. Concentrations of copper and zinc exceeded the AWQC by one order of magnitude; nickel and chromium exceeded the AWQC by factors of nine and three, respectively.

Table 3. Maximum concentrations of contaminants of concern to NOAA in soil and sediment, at the St. Juliens Creek Annex site (CDM 1998; CH2M HILL 2003a, 2003c). Contaminant values in bold exceed or are equal to screening guidelines.

	Soil (mg/kg)					Sediment (mg/kg)				
Contaminant	Landfill B	Landfill C	Landfill D	Burning Grounds	BTAG[a] Screening Levels	Landfill B	Landfill C	Landfill D	Burning Grounds	ERL[b]
METALS/ INORGANICS										
Arsenic	**42**	**14**	**11**	**110**	9.9[c]	**19**	**9.1**	**33**	**13**	8.2
Cadmium	**11**	**0.47**	**0.88**	**6**	0.36[d]	**9.2**	**2.5**	0.84	ND	1.2
Chromium[e]	**250**	**42**	**680**	**75**	0.0075	**2300**	63	39	32	81
Copper	**4300**	**130**	**600**	**6500**	60[c]	**2600**	**130**	**390**	**40**	34
Lead	**8900**	**240**	**260**	**7200**	0.01	**550**	**730**	**440**	**300**	46.7
Mercury	**0.86**	**0.6**	**1.3**	**0.98**	0.058	**0.79**	**0.27**	**6.4**	**0.29**	0.15
Nickel	**250**	22	**550**	**92**	30[c]	**42**	15	**44**	7	20.9
Silver	**3.5**	ND	1.6	**3.5**	2[c]	0.87	0.37	**1**	**1.6**	1
Zinc	**9100**	**460**	**610**	**8500**	8.5[c]	**1400**	**580**	**620**	**150**	150
PAHs										
Anthracene	**0.59**	**0.12**	**0.2**	**0.054**	0.1	**0.17**	0.056	**0.2**	**0.099**	0.0853
Benz(a)anthracene	**2.3**	**0.35**	**1.3**	**0.48**	0.1	**1.3**	0.25	**1.3**	0.22	0.261
Benzo(a)pyrene	**1.4**	**0.39**	**1.4**	**0.81**	0.1	**0.91**	0.22	**1.2**	0.3	0.43
Chrysene	**2.7**	**0.73**	**1.8**	**1.1**	0.1	**1.4**	0.27	**1.2**	**0.45**	0.384
Fluoranthene	**5**	**0.64**	**3.3**	**0.79**	0.1	**2.2**	0.32	**2.8**	ND	0.6
Fluorene	**0.38**	0.048	0.047	ND	0.1	**0.53**	ND	ND	**0.063**	0.019
Phenanthrene	**4.4**	**0.42**	**2.2**	**0.33**	0.1	**1.1**	0.12	**0.4**	**0.52**	0.24
Pyrene	**7.2**	**0.56**	**3.1**	**1.2**	0.1	**3.1**	0.46	**2.8**	**0.68**	0.665
PESTICIDES /PCBs										
4,4'-DDD	**4.2**	0.043	0.015	**0.33**	0.1	**0.98**	**0.066**	**0.0057**	**0.11**	0.002
4,4'-DDE	**7.2**	0.043	0.037	**2.2**	0.1	**0.13**	**0.078**	**0.018**	**0.054**	0.0022
4,4'-DDT	**12**	**0.13**	0.04	**1.2**	0.1	**3.2**	**0.002**	**0.0082**	**0.038**	0.00158
Total PCBs	0.11	0.1	**6.3**	0.039	0.371[c]	**0.11**	**0.15**	**0.09**	ND	0.0227

a: Region III Biological Technical Assistance Group (BTAG) screening levels for fauna (USEPA 1995).

b: Effects range-low (ERL) represents the 10th percentile for the dataset in which effects were observed or predicted in studies compiled by Long et al. (1998).

c: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).

d: Ecological soil screening guidelines (USEPA 2005).

e: Screening guidelines represent concentrations for Cr.+6

ND: Not detected.

Sediment

Metals, PAHs, pesticides, and PCBs were detected in sediment samples taken from the drainage ditches that drain Landfill B, Landfill C, Landfill D, and the Burning Grounds (Table 3; Figure 2). The maximum concentrations of cadmium, chromium, copper, and zinc were detected in sediment samples taken from the drainage ditch that drains Landfill B. Concentrations of chromium and copper exceeded the ERL by one order of magnitude; zinc and cadmium exceeded the ERL by factors of nine and seven, respectively.

The maximum concentration of lead was detected in a sediment sample taken from the drainage ditch that drains Landfill C. Concentrations of lead exceeded the ERL by one order of magnitude.

The maximum concentrations of arsenic, mercury, and nickel were detected in sediment samples taken from the drainage ditches that drain Landfill D. Concentrations of mercury exceeded the ERL by one order of magnitude; arsenic and nickel exceeded the ERLs by factors of four and two, respectively.

The maximum concentration of silver was detected in a sediment sample taken from the drainage ditch that drains the Burning Grounds. Concentrations of silver just exceeded the ERL.

The maximum concentrations of PAHs were detected in sediment samples taken from the drainage ditches that drain Landfill B and Landfill D. Concentrations of fluorene, chrysene, phenanthrene, and pyrene were detected in the drainage ditch that drains Landfill B. Fluorene concentrations exceeded the ERL by one order of magnitude. Chrysene, phenanthrene, and pyrene concentrations exceeded the ERL by a factor of four.

The maximum concentrations of anthracene, benzo(a)pyrene, and fluoranthene were detected in sediment samples taken from the drainage ditch that drains Landfill D. Concentrations of fluoranthene exceeded the ERLs by a factor of four; anthracene and benzo(a)pyrene exceeded the ERLs by factors of two and three, respectively.

The maximum concentration of benz(a)anthracene was detected in both drainage ditches that drain Landfill B and Landfill D. Concentrations of benz(a)anthracene exceeded the ERLs by a factor of four.

The maximum concentrations of the pesticides 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE, which were detected in samples from the drainage ditch that drains Landfill B, exceeded the ERLs by three orders, two orders, and one order of magnitude, respectively.

The maximum concentration of PCBs, which was detected in sediment taken from the drainage ditch that drains Landfill C, exceeded the ERL by a factor of six.

Groundwater

Maximum concentrations of metals were detected in groundwater samples taken from monitoring wells in Landfill B and the Burning Grounds (Table 2; Figure 2). The maximum concentrations of copper, nickel, and zinc were detected in groundwater samples taken from monitoring wells in the Burning Grounds; all exceeded the AWQC by one order of magnitude.

The maximum concentrations of chromium, lead, and silver were detected in groundwater samples taken from monitoring wells in Landfill B. Concentrations of lead exceeded the AWQC by a factor of four; chromium and silver just exceeded the AWQC.

Soil

Metals, PAHs, pesticides, and PCBs were detected in soil samples taken from Landfill B, Landfill C, Landfill D, and the Burning Grounds (Table 3; Figure 2). The maximum concentrations of cadmium, lead, and zinc were detected in a soil sample taken from Landfill B. Concentrations of lead exceeded the BTAG screening level by five orders of magnitude. Concentrations of zinc exceeded the ORNL-PRG by three orders of magnitude, and concentrations of cadmium exceeded the ecological soil screening guideline by one order of magnitude.

The maximum concentrations of chromium, mercury, and nickel were detected in soil samples taken from Landfill D. Concentrations of chromium exceeded the BTAG screening level by four orders of magnitude; mercury and nickel exceeded the ORNL-PRGs by one order of magnitude.

The maximum concentrations of arsenic and copper were detected in soil samples taken from the Burning Grounds. Concentrations of copper and arsenic exceeded the ORNL-PRGs by two orders of magnitude and one order of magnitude, respectively.

The maximum concentration of silver was detected in soil samples taken from Landfill B and from the Burning Grounds. Concentrations of silver just exceeded the ORNL-PRG.

The maximum concentrations of all eight of the PAHs listed in Table 3 were detected in soil samples taken from Landfill B. Benzo(a)pyrene was also detected at a maximum concentration in a sample from Landfill D. Concentrations of benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene, and pyrene exceeded the BTAG screening levels by one order of magnitude; anthracene and fluorene exceeded the BTAG screening levels by factors of six and four, respectively.

The maximum concentrations of pesticides were detected in soil samples taken from Landfill B. Concentrations of the pesticide 4,4'-DDT exceeded the BTAG screening level by two orders of magnitude; 4,4'-DDD and 4,4'-DDE exceeded the BTAG screening levels by one order of magnitude.

The maximum concentration of PCBs was detected in Landfill D and exceeded the ORNL-PRG by one order of magnitude.

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Picayune Wood Treating Site

Picayune, Mississippi

EPA Facility ID: MSD065490930

Basin: Lower Pearl

HUC: 03180004

Executive Summary

The Picayune Wood Treating Site is in Picayune, Pearl River County, Mississippi. From 1946 to 1999, a wood treating facility operated at the site. Preserving solutions containing creosote, or creosote and PCP, were used to treat wood. Unlined surface impoundments were used to store and dispose of waste and cooling waters. Treated lumber was stored directly on the ground. The primary contaminants of concern to NOAA are PCP, PAHs, metals, dioxins, and furans. Mill Creek, the McCall River, and the East Pearl River, the latter of which provides freshwater adult habitat for NOAA trust resources, are the habitats of primary concern to NOAA. Groundwater and surface water runoff are the primary pathways for the migration of contaminants from the site to NOAA trust resources.

Site Background

The Picayune Wood Treating Site is in the city of Picayune, Pearl River County, Mississippi (Figure 1). The site is approximately 12 ha (30 acres) in area. It is bordered by residential, commercial, and industrial areas. A daycare, a public park with a playground, and the South Side Upper Elementary School are near the site (Tetra Tech 2001). Mill Creek is adjacent to the site.

The site has been used by several owners for wood treatment since 1946. Yellow southern pine wood was pressure-treated with preservation chemicals, including creosote and pentachlorophenol (PCP). When the Picayune Wood Treating Site was operational, the main process area, which was near the eastern portion of the site, included tanks of creosote, PCP, and diesel, as well as oil/water separator tanks (Figure 2). Wood processed at the site was placed in a pressure chamber and saturated with steam. After steaming, the chamber was vented to the atmosphere and the wood was exposed to a vacuum. The chamber was then filled with preservative, and the wood was impregnated with the preservative at high pressure. Between 1974 and 1982, the preserving chemicals in use were coal-tar creosote and PCP mixed with petroleum. Before 1974 and after 1982, only creosote was used (USEPA 2003). Waste from the wood treating process was stored and disposed of in five unlined trench impoundments, now closed and backfilled (Tetra Tech 2001). Treated lumber was stored directly on the ground.

In 1987, a groundwater quality assessment concluded that polycyclic aromatic hydrocarbons (PAHs), which are a constituent found in creosote, and other semivolatile organic compounds (SVOCs) had significantly impacted groundwater in the uppermost aquifer at the facility (Tetra Tech 2001).

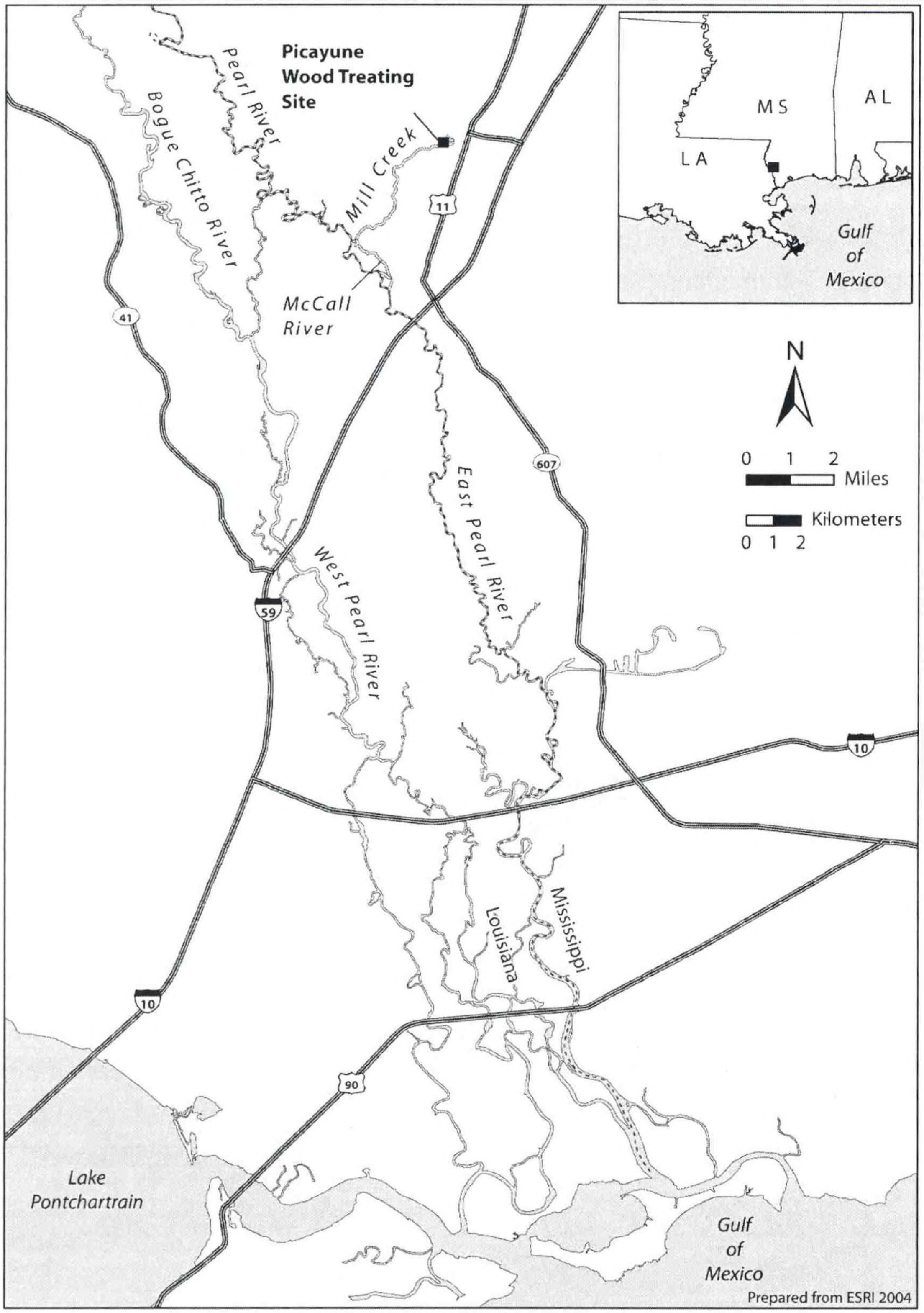

Figure 1. Location of the Picayune Wood Treating Site in Picayune, Mississippi.

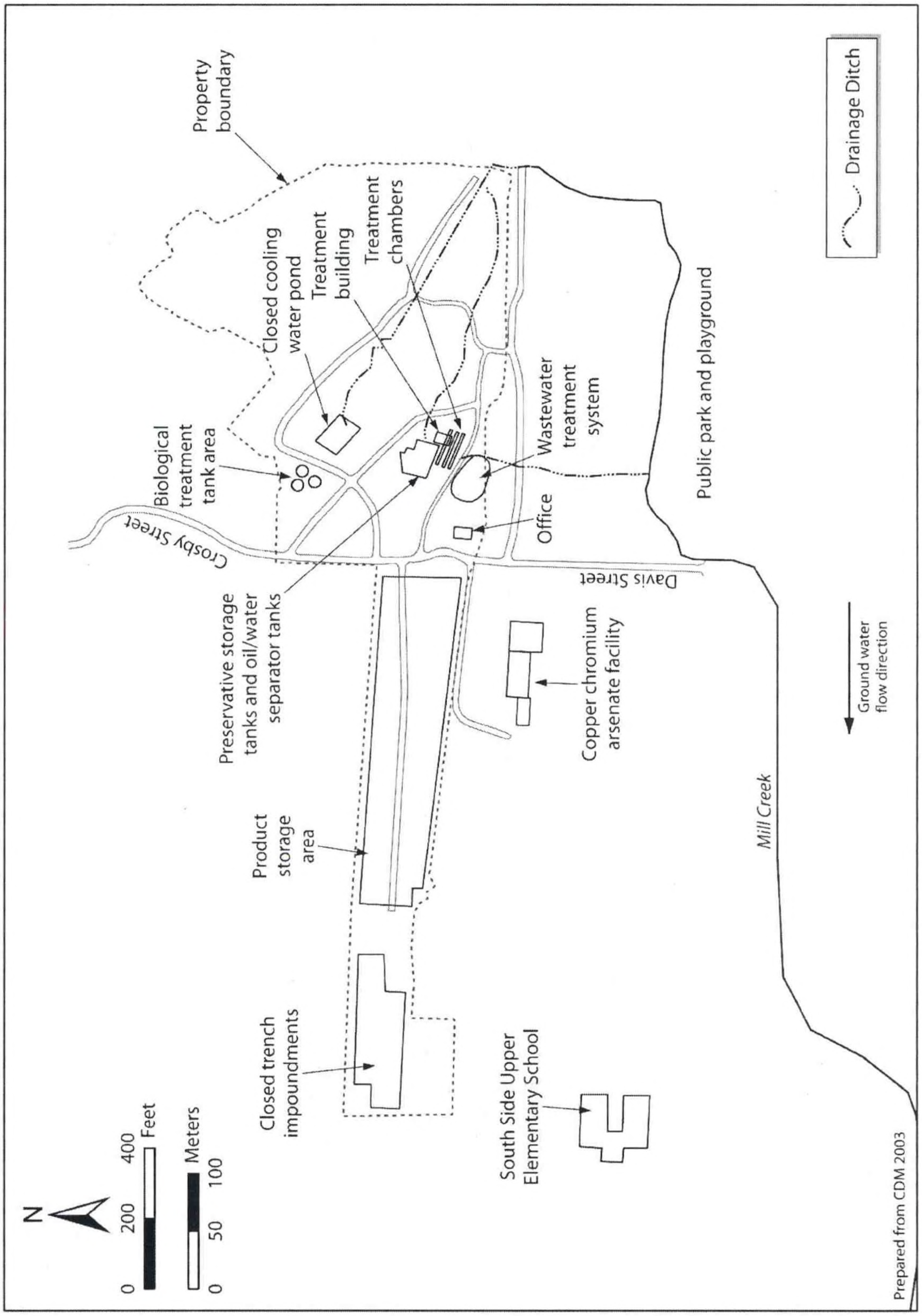

Figure 2. Detail of the Picayune Wood Treating property

In 1995, a facility investigation found that soils in the pressure tank area were contaminated with PAHs (Tetra Tech 2001). Groundwater was treated on the site from 1996 to 1999, when Wood Treating, Inc., the owner at that time, ceased operations (CDM 2003; USEPA 2004a). From October 1999 to February 2001, the U.S. Environmental Protection Agency (USEPA) removed creosote and waste; treated approximately 1.5 million L (400,000 gal) of wastewater on site; demolished and recycled 20 tanks and tanker cars; removed mercury, asbestos, and scrap metal; and solidified and stockpiled 1,150 m^3 (1,504 yd^3) of creosote sludge on site (USEPA 2004b; CDM 2003). The USEPA conducted a preliminary assessment/site inspection from 2000 to 2002 and detected elevated concentrations of metals, volatile organic compounds, PAHs, dioxins, and furans in soil, sediment, groundwater, and surface water samples. Dioxins and furans are impurities of PCP. The USEPA began a remedial investigation/feasibility study in September 2002 (CDM 2003). The Picayune Wood Treating Site was proposed to the National Priorities List (NPL) on March 8, 2004, and was placed on the NPL on July 22, 2004.

Groundwater and surface water runoff are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Groundwater was encountered at 6 to 20 m (20 to 66 ft) below ground surface (bgs) and also at approximately 51.5 to 114 m (169 to 374 ft) bgs. Groundwater flow direction is generally to the west (USEPA 2003). Surface water runoff from the facility enters various drainage ditches and culverts that empty into Mill Creek. Mill Creek runs adjacent to the site and ultimately connects to the Mississippi Sound, north of the Gulf of Mexico.

NOAA Trust Resources

The habitats of primary concern to NOAA are Mill Creek, the McCall River, and the East Pearl River (Figure 1). Mill Creek is a small stream bordered by forested wetlands. Mill Creek flows approximately 5 km (3 mi) beyond the site to the point where it intersects with the McCall River, which flows approximately 0.4 km (0.25 mi) before converging with the East Pearl River. The East Pearl River flows approximately 48 km (30 mi) before discharging into the Mississippi Sound, north of the Gulf of Mexico.

Information about fish species in Mill Creek and the McCall River was not available for review at the time of this report. The East Pearl River provides adult habitat for NOAA trust resources in the vicinity of the site, as well as spawning and nursery habitat upstream of the site. NOAA trust resources that use the East Pearl River in the vicinity of the site include the anadromous Alabama shad, Gulf sturgeon, and striped bass and the catadromous American eel (Table 1) (Riecke 2005; Slack 2005). No cross-channel obstructions that could block fish migration are known to exist between the site and the Gulf of Mexico (Whitehurst 2004).

Gulf sturgeon, a subspecies of Atlantic sturgeon, is considered a threatened species by the U.S. Fish and Wildlife Service (USFWS). In 2002, the USFWS proposed the Pearl River, which includes the East Pearl River, as critical habitat for Gulf sturgeon. The East Pearl River provides spawning habitat, summer resting holes, juvenile habitat, and a migration route to spawning grounds for Gulf sturgeon (USFWS 2002). In the vicinity of the site, Gulf sturgeon are present only as adults and may summer in that part of the East Pearl River after spawning (Slack 2005). Alabama shad is considered a species of concern by NOAA Fisheries (NOAA 2005). American eel are widespread in the Gulf of Mexico basin (Ross et al. 2001).

Table 1. NOAA trust resources present in the Pearl River near the Picayune Wood Treating Site (Riecke 2005; Slack 2005).

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Alabama shad	*Alosa alabamae*			♦		
Gulf sturgeon	*Acipenser oxyrinchus desotoi*			♦		
Striped bass	*Morone saxatilis*			♦		♦
CATADROMOUS FISH						
American eel	*Anguilla rostrata*			♦		

No commercial fishery occurs on the East Pearl River, the McCall River, or Mill Creek. Striped bass are fished recreationally on the East Pearl River (Riecke 2005). Recreational fishing also occurs along Mill Creek and could include NOAA trust resources (Tetra Tech 2001).

No fish consumption advisories are currently in effect for Mill Creek, the McCall River, or the East Pearl River. The most recent Mississippi fish-consumption advisory, which was updated in 2001, advises reduced consumption of largemouth bass and catfish when they are caught from a section of the Pearl River, upstream of the site near Jacksonville. This advisory is in effect because of mercury contamination (MDEQ 2001).

Site-Related Contamination

Surface water, sediment, groundwater, and soil samples were collected from the site and adjacent properties during multiple sampling events between 1985 and 2004. The samples were analyzed for metals, PAHs, phenols, pesticides, dioxins, and furans. Surface water and sediment samples were collected from drainage ditches on the property. Groundwater samples were collected from monitoring wells on and adjacent to the property. Soil samples were collected from throughout the site. Additional samples will be collected during the ongoing remedial investigation, which was initiated in 2002, but little data were available from that investigation at the time of this report.

The primary contaminants of concern to NOAA are PCP, PAHs, metals, dioxins, and furans. Table 2 summarizes maximum concentrations of contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such guidance, the screening guidelines for groundwater and surface water are the ambient water quality criteria (AWQC; USEPA 2006), and the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs; MacDonald et al. 2000). The regionally specific screening guidelines for soil are the ecological screening values for soil recommended by USEPA Region 4 (USEPA 2001). Exceptions to these screening guidelines, if any, are noted in Table 2. Only maximum concentrations that exceeded the screening guidelines are discussed below. When known, the general sampling location of a sample that exceeded the screening guidelines is also provided.

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Picayune Wood Treating Site (CDM 2003; Tetra Tech 2001). Contaminant values in bold exceed screening guidelines.

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	USEPA Region 4[a]	Ground-water	Surface Water	AWQC[b]	Sedi-ment	TEC[c]
METALS/INORGANICS							
Arsenic	**250**	10	27	18	150	**250**	9.79
Chromium	**13**	0.4	**54**	N/A	11[d]	13	43.4
Copper	**170**	40	**94**	N/A	9[e]	24	31.6
Lead	**13000**	50	**35**	**8.8**	2.5[e]	**130**	35.8
Mercury	**0.92**	0.1	**2.6**	0.43	0.77[f]	**3.4**	0.18
Nickel	6.1	30	**94**	0.82	52[e]	6.2	22.7
Selenium	**2.1**	0.81	N/A	N/A	5.0[g]	1.4	NA
Zinc	**150**	50	**590**	**130**	120[e]	**1100**	121
PAHs							
Acenaphthene	**110**	20	**560**	15	520[h]	**440**	0.290[i]
Acenaphthylene	78	NA	17	2	NA	**10**	0.160[i]
Anthracene	**74**	0.1	48	4	NA	**290**	0.0572
Benz(a)anthracene	170	NA	22	N/A	NA	**150**	0.108
Benzo(a)pyrene	**120**	0.1	7	N/A	NA	**47**	0.15
Benzo(b)fluoranthene	270	NA	9	N/A	NA	77	NA
Benzo(k)fluoranthene	130	NA	6	N/A	NA	**68**	13.4[i]
Chrysene	360	NA	7	N/A	NA	**150**	0.166
Dibenz(a,h)anthracene	24	NA	N/A	N/A	NA	**6.8**	0.033
Fluoranthene	**980**	0.1	170	4	NA	**620**	0.423
Fluorene	100	NA	240	3	NA	**440**	0.0774
Indeno(1,2,3-cd)pyrene	67	NA	2	N/A	NA	**13**	0.330[i]
2-Methylnaphthalene	54	NA	N/A	N/A	NA	330	NA
Naphthalene	**60**	0.1	**7000**	N/A	620[h]	**360**	0.176
Phenanthrene	**280**	0.1	510	1	NA	**960**	0.204
Pyrene	**860**	0.1	71	3	NA	**400**	0.195
PHENOLS							
Pentachlorophenol	**520**	0.002	**61**	**160**	15j	27	NA
PESTICIDES							
4,4'-DDE	0.0086	NA	N/A	N/A	1050[k,h]	**0.01**	0.00316
4,4'-DDT	ND	NA	N/A	N/A	0.001[i]	N/A	0.00416
Endosulfan (alpha + beta)	0.033	NA	N/A	N/A	0.056	ND	NA
Toxaphene	0.26	NA	N/A	N/A	0.0002	ND	NA
DIOXINS/FURANS							
2,3,7,8-Tetrachlorodibenzodioxin	2.1×10^{-5}	NA	N/A	N/A	1.0×10^{-8}[h]	N/A	8.8×10^{-6}[i]

Table 2 continued on next page.

Table 2, *cont.*

a:	USEPA Region 4 recommended ecological screening values (USEPA 2001).
b:	Ambient water quality criteria for the protection of aquatic organisms (USEPA 2006). Freshwater chronic criteria presented.
c:	Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).
d:	Screening guidelines represent concentrations for Cr.+6
e:	Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L CaCO3.
f:	Derived from inorganic, but applied to total mercury.
g:	Criterion expressed as total recoverable metal.
h:	Lowest observable effects level (LOEL) (USEPA 1986).
i:	Freshwater upper effects threshold (UET) for bioassays (Buchman 1999). The UET represents the concentration above which adverse biological impacts would be expected.
j:	Chronic criterion is pH dependent; concentration shown above corresponds to pH of 7.8.
k:	Chronic criterion not available; acute criterion presented.
l:	Expressed as total DDT.
NA:	Screening guidelines not available.
N/A:	Not analyzed.
ND:	Not detected.

Surface Water

Metals and PCP were detected in surface water samples at maximum concentrations that exceeded screening guidelines.

Lead was detected in a sample taken from Mill Creek down-gradient of the site at a maximum concentration that exceeded the AWQC by a factor of 3.5. Zinc was detected in a sample taken from a drainage ditch in the western portion of the site at a maximum concentration that just exceeded the AWQC.

The maximum concentration of PCP, which was detected in a sample taken from the south end of the drainage ditch near the southern property line, exceeded the AWQC by one order of magnitude.

Sediment

Metals, PAHs, and the pesticide 4,4'-DDE were detected in sediment samples at maximum concentrations that exceeded screening guidelines.

Arsenic was detected in a sample taken from the drainage ditch northeast of the closed cooling pond at a maximum concentration that exceeded the TEC by one order of magnitude. Lead was detected in a sample taken from Mill Creek down-gradient of the site at a maximum concentration that exceeded the TEC by a factor of four. The maximum concentrations of mercury and zinc were detected in a sample taken from a drainage ditch on the site. The maximum concentrations of mercury and zinc exceeded the TECs by one order of magnitude and a factor of nine, respectively.

The maximum concentrations of 14 PAHs exceeded their respective TECs. The maximum concentrations of PAHs were detected in samples collected from the drainage ditch in the treated wood storage area, from Mill Creek down-gradient of the site, and from the confluence of a drainage ditch with Mill Creek on the north side of the park. Eight of the maximum concentrations of PAHs exceeded TECs by three orders of magnitude; three exceeded by two orders of magnitude; two exceeded by one order of magnitude; and one exceeded by a factor of five (Table 2).

The maximum concentrations of PCP and the pesticide 4,4'-DDE were detected in samples taken from the confluence of a drainage ditch and Mill Creek on the north side of the park. No TEC is available for comparison to the maximum concentration of PCP detected in the sediment samples. The maximum concentration of 4,4'-DDE exceeded the TEC by a factor of three.

Groundwater

Metals, PAHs, and PCP were detected in groundwater samples at maximum concentrations that exceeded screening guidelines.

The maximum concentrations of chromium, copper, lead, mercury, nickel, and zinc were detected in samples taken from a monitoring well adjacent to and south of the closed cooling water pond. The maximum concentrations of lead and copper exceeded the AWQC by one order of magnitude; chromium and zinc exceeded the AWQC by a factor of five. The maximum concentrations of mercury and nickel exceeded the AWQC by factors of three and two, respectively.

The maximum concentrations of PAHs were detected in samples taken from a monitoring well adjacent to and south of the closed cooling water pond. The maximum concentration of naphthalene exceeded the AWQC by one order of magnitude, while the maximum concentration of acenaphthene just exceeded the AWQC. The maximum concentration of PCP, which exceeded the AWQC by a factor of four, was detected in a sample taken from a monitoring well near the closed trench impoundments on the western portion of the site.

Soil

Metals, PAHs, and PCP were detected in soil samples at maximum concentrations that exceeded screening guidelines.

The maximum concentration of arsenic was detected in a sample collected from the drainage ditch northeast of the closed cooling water pond and exceeded the USEPA Region 4 screening guideline by one order of magnitude. The maximum concentrations of chromium, lead, selenium, and zinc were detected in samples from the closed trench impoundments area in the western portion of the site. The maximum concentration of lead exceeded the screening guideline by two orders of magnitude; chromium exceeded the screening guideline by one order of magnitude. The maximum concentrations of zinc and selenium exceeded the screening guidelines by factors of three and 2.5, respectively. The maximum concentration of copper was detected in a sample taken from the western portion of the site just north of the school and exceeded the screening guideline by a factor of four. The maximum concentration of mercury was detected in a sample collected near the office at the center of the site and exceeded the screening guideline by a factor of nine.

PAHs were detected in samples collected from throughout the site. The maximum concentration of phenanthrene was detected in a sample taken from the city park and exceeded the screening guideline by three orders of magnitude. The maximum concentrations of anthracene, benzo(a)pyrene, fluoranthene, naphthalene, and pyrene were detected in samples taken from the area of the preservative storage tanks and oil/water separator tanks. The maximum concentrations of benzo(a)pyrene, fluoranthene, and pyrene exceeded the screening guidelines by three orders of magnitude. The maximum concentrations of naphthalene and anthracene exceeded the screening guidelines by two orders of magnitude. The maximum concentration of acenaphthene was detected in a sample taken from the area northeast of the office and exceeded the screening guideline by a factor of 5.5.

PCP was detected in a sample taken from the area of the wastewater treatment system at a maximum concentration that exceeded the screening guideline by five orders of magnitude.

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Ashland/Northern States Power Lakefront

Ashland, Wisconsin

EPA Facility ID: WISFN0507952

Basin: Beartrap-Nemadji

HUC: 04010301

Executive Summary

The Ashland/Northern States Power Lakefront site is located in Ashland, Wisconsin, adjacent to and including a portion of Chequamegon Bay and Lake Superior. Industrial activities including lumber operations, gas manufacturing, and wastewater treatment, have taken place at the site since the 1880s. The primary contaminants of concern to NOAA are PAHs, which were detected in soil, groundwater, surface water, and sediments at the site. The habitat of primary concern to NOAA is Chequamegon Bay, which provides habitat for a variety of NOAA trust resources.

Site Background

The Ashland/Northern States Power Lakefront site is located in Ashland, Wisconsin, adjacent to and including a portion of Chequamegon Bay and Lake Superior (Figure 1). The site is approximately 12 ha (30 acres) in size and encompasses the Northern States Power (NSP) property, the former Ashland property that is now referred to as Kreher Park, and a portion of Chequamegon Bay (Figure 2). Kreher Park extends east, beyond the site boundary. In 2000, when NSP and New Centuries Energy merged to form Xcel energy, the NSP property was acquired by Xcel Energy (Xcel Energy 2000). The site includes a former manufactured gas plant located on the NSP property and a former wastewater treatment plant located adjacent to Kreher Park.

The gas plant operated on the NSP property from 1885 to 1947. Combustible gas was manufactured from coal, which produced residual coal tars and oils as byproducts. These byproducts were then discharged along with the wastewater from the gas plant. The gas plant was located on a bluff that varies in height from 195 m (640 ft) at the top, to approximately 183 to 186 m (600 to 610 ft) above mean sea level at the bottom. Railroad tracks for the Wisconsin Central Railroad run along the bluff (Figure 2). Adjacent to the bluff, is the historical location of a north-south trending ravine that formerly drained toward Chequamegon Bay. Flood insurance maps indicate that this ravine was filled sometime between 1909 and 1923 (Dames & Moore 1995). Fill soils contaminated with coal tar have been identified at the base of the former ravine, in addition to dense non-aqueous phase liquid (DNAPL). Fill material in the ravine also contains cinder ash, boiler slag, and demolition debris (USEPA 2000).

The Kreher Park area was created in the late 1800s and early 1900s by placing a variety of fill materials into Chequamegon Bay, extending the shoreline approximately 122 m (400 ft) north of its original location at the base of the bluff. The fill materials consisted mostly of wood chips, wood pieces, and sawdust mixed with soil. Various lumber companies owned and operated at the site from the late 1800s until 1939 (SEH 1996). The City and County of Ashland also used the site as a general disposal area during the 1900s (Dames & Moore

1995). Solid wastes including concrete, bricks, and bottles, were reportedly dumped at the site by the City of Ashland (SEH 1996).

In 1951, the City of Ashland constructed a wastewater treatment plant on the northern portion of the site. In the 1980s, the City investigated the possible expansion of the wastewater treatment plant (SEH 1996) at the site. However, the City abandoned the project when the presence of contamination, believed to be creosote wastes, was found in the subsoil and groundwater at the site (USEPA 2000). A new wastewater treatment plant was constructed by the City of Ashland at a different location in 1989 (SEH 1996).

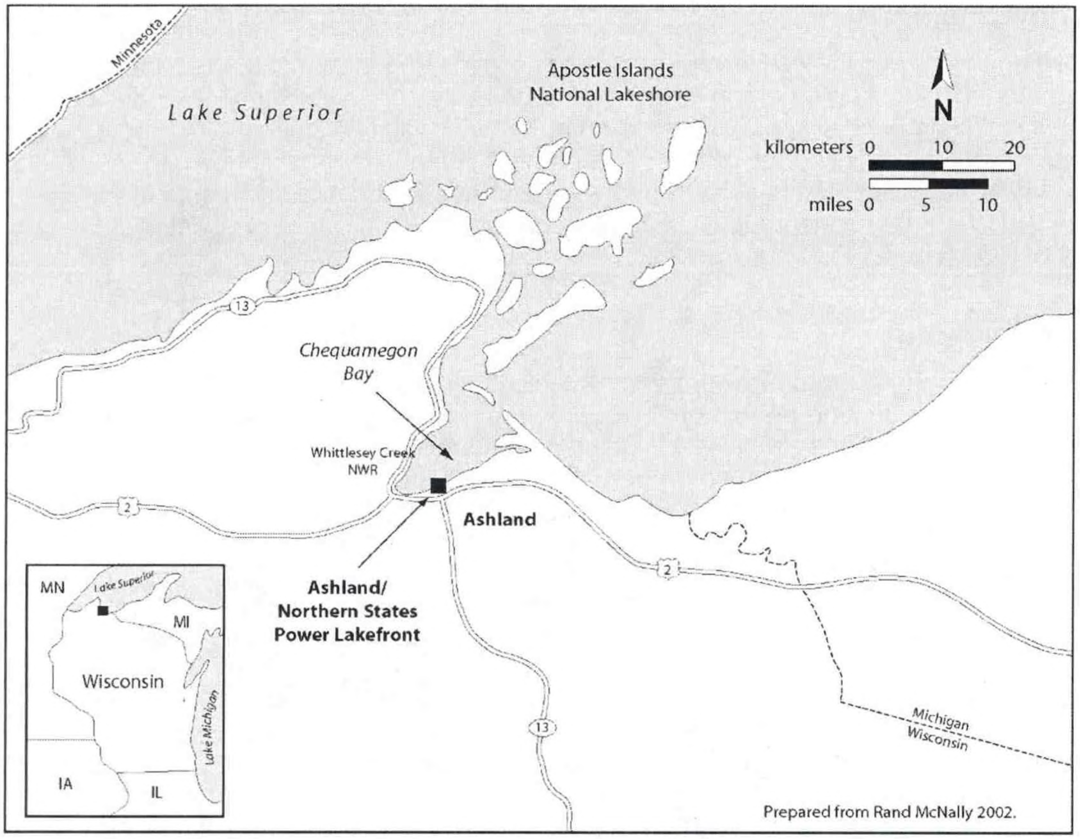

Figure 1. Location of the Ashland/Northern States Power Lakefront site, Ashland, Wisconsin.

In 1989, an environmental assessment of the site was conducted by the City of Ashland. Based on their findings, the City notified the Wisconsin Department of Natural Resources (WDNR) of the contamination at the site. In 1994, the WDNR conducted a remedial investigation at the site. Preliminary findings indicated that a number of contaminants had impacted groundwater at the site however, the extent and source of the contamination were not identified (SEH 1996).

Additional investigations since 1994 have included the excavation of test pits, the installation of monitoring wells, and the collection and analysis of groundwater samples. These investigations indicated contamination of the soil and groundwater by polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) (SEH 1996).

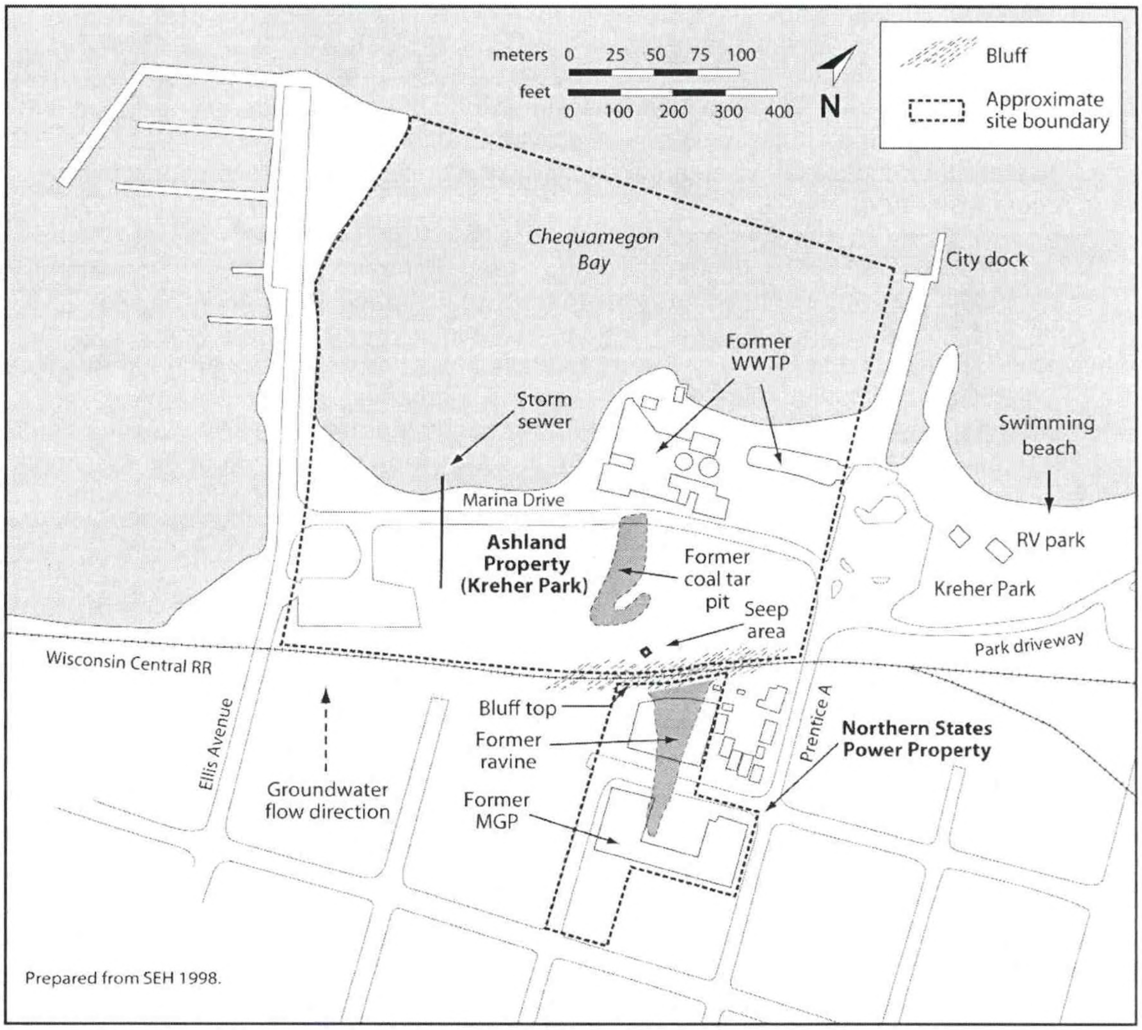

Figure 2. Detail of Ashland/Northern States Power Lakefront property.

In 1995, offshore sediment samples were collected to determine whether contaminants had migrated into Chequamegon Bay. A black, staining, oily liquid with a sheen and strong odor was observed in sediments collected from the nearshore area (SEH 1996). The spatial extent of non-visible contamination in Chequamegon Bay is currently being evaluated. During a 1998 investigation by WDNR, Chequamegon Bay sediments directly offshore of Kreher Park contained elevated concentrations of VOCs, PAHs, and DNAPL oils and tars. Due to a petition from a private citizen, the site was placed on the final National Priorities List in September 2002 (USEPA 2000). In 2002, USEPA Contaminated Sediment Technical Advisory Group reviewed the site and submitted a series of recommendations. The USEPA signed an administrative order on consent with Xcel Energy in 2003 to begin work on the Remedial Investigation/Feasibility Study at the site.

In 2001, investigations revealed a DNAPL pool located at the mouth of a 30-centimeter (12-inch) clay tile pipe in Kreher Park. The clay tile pipe was traced up the ravine to the former manufactured gas plant on the NSP property. It is believed that the clay tile served as a conduit for the migration of DNAPL rather than a direct release through the pipe. An interim remedial response was conducted in 2002 to destroy the clay tile pipe, remove the contaminated soil, and cap the seep area.

Investigations of the soil and groundwater in and around the NSP property concluded that there was a large plume of dissolved phase coal tar and pools of DNAPL in the groundwater. NSP installed a coal tar recovery system in 2000 to extract, separate, and treat groundwater from the site.

Surface water runoff and groundwater discharge are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Surface water from the site generally flows north to Chequamegon Bay. Groundwater is encountered at approximately 0.6 to 3 m (2 to 10 ft) beneath the site and generally flows north to Chequamegon Bay (SEH 1995). In 2003, additional monitoring wells were installed along the shoreline of Chequamegon Bay to determine if contaminated groundwater from the site is discharging into the bay (USEPA 2006). Groundwater samples are being collected from the monitoring wells quarterly (Jaffess 2004). Analytical results from these sampling events were not available for review at the time this report was prepared.

NOAA Trust Resources

NOAA's primary focus is on fisheries resources and their supporting habitat. Each of the Great lakes can be divided into two zones: a nearshore zone, which provides important spawning and nursery habitat for NOAA trust resources, and an offshore pelagic zone, generally a less diverse habitat than the nearshore zone. Chequamegon Bay includes the Apostle Islands, which are considered a National Lakeshore by the National Park Service. Nearby Whittlesey Creek, located within the Whittlesey Creek National Wildlife Refuge, produces 35 percent of the coho salmon in Lake Superior (WDNR 2004a).

NOAA trust resources include all aquatic species within the Great Lakes basin however, the primary focus is on anadromous and catadromous resources. NOAA trust species present in Lake Superior and Chequamegon Bay are presented in Table 1. These species use the habitat for adult foraging, spawning, and as a nursery area.

Commercial fishing does not occur in Chequamegon Bay. There is recreational fishing for several trust species, including lake trout, lake whitefish, smallmouth bass, northern pike, walleye, (WDNR 2004b) brown trout, Chinook and coho salmon, lake herring, rainbow smelt, steelhead trout, and yellow perch (Schram 2002).

A fish-consumption advisory is currently in effect for Lake Superior, including all tributaries of the lake up to the first impassable barrier, because of elevated concentrations of polychlorinated biphenyls (PCBs) and mercury in fish tissue. The WDNR advises reduced consumption of lake trout, siscowet, Chinook salmon, coho salmon, rainbow trout, brown trout, lake whitefish, and lake sturgeon. They also advise against the consumption of any siscowet larger than 64 cm (25 in) in length (WDNR 2004c).

There are ongoing efforts in the area to restore brook trout (locally referred to as coaster brook trout) and lake sturgeon. Restoration efforts for brook trout are focused on habitat restoration, development of more restrictive fishing regulations, and stocking (USFWS 2004a). Lake sturgeon restoration projects are currently focused on determining the habitat required for a healthy population and migration patterns of lake sturgeon (USFWS 2004b).

Table 1. NOAA trust resources present in Chequamegon Bay and Lake Superior (Schram 2002; SEH 2002).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
MIGRATORY FISH						
Alewife	*Alosa pseudoharengus*			♦		
American eel	*Anguilla rostrata*			♦		
Brook trout	*Salvelinus fontinalis*			♦		
Brown trout	*Salmo trutta*		♦	♦		♦
Chinook salmon	*Oncorhynchus tshawytscha*			♦		♦
Coho salmon	*Oncorhynchus kisutch*			♦		♦
Lake herring	*Coregonus artedi*		♦	♦		♦
Lake sturgeon	*Acipenser fulvescens*			♦		
Ninespine stickleback	*Pungitius pungitius*			♦		
Rainbow smelt	*Osmerus mordax mordax*	♦	♦	♦		♦
Steelhead	*Oncorhynchus mykiss*			♦		♦
White perch	*Morone americana*			♦		
Yellow perch	*Perca flavescens*	♦	♦	♦		♦
RESIDENT FISH						
Black bullhead	*Ameiurus melas*	♦	♦			
Black crappie	*Pomoxis nigromaculatus*	♦	♦			
Blacknose shiner	*Notropis heterolepis*			♦		
Bluntnose minnow	*Pimephales notatus*			♦		
Brook stickleback	*Culaea inconstans*	♦	♦	♦		
Brown bullhead	*Ameiurus nebulosus*	♦	♦	♦		
Burbot	*Lota lota*		♦	♦		
Central mudminnow	*Umbra limi*	♦	♦	♦		
Creek chub	*Semotilus atromaculatus*			♦		
Emerald shiner	*Notropis atherinoides*	♦	♦	♦		
Goldfish	*Carassius auratus auratus*	♦	♦			
Johnny darter	*Etheostoma nigrum*	♦	♦	♦		
Lake trout	*Salvelinus namaycush*			♦		♦
Lake whitefish	*Coregonus clupeaformis*			♦		♦
Logperch	*Percina caprodes*	♦	♦	♦		
Longnose sucker	*Catostomus catostomus catostomus*		♦	♦		
Mimic shiner	*Notropis volucellus*	♦	♦	♦		
Mottled sculpin	*Cottus bairdii*		♦	♦		
Muskellunge	*Esox masquinongy*			♦		
Northern pike	*Esox lucius*		♦	♦		♦
Pumpkinseed	*Lepomis gibbosus*	♦	♦	♦		
Rainbow trout	*Oncorhynchus mykiss*	♦	♦	♦		
Rock bass	*Ambloplites rupestris*	♦	♦	♦		
Round whitefish	*Prosopium cylindraceum*			♦		
Ruffe	*Gymnocephalus cernuus*			♦		
Shorthead redhorse	*Moxostoma macrolepidotum*		♦	♦		
Silver redhorse	*Moxostoma anisurum*		♦	♦		
Slimy sculpin	*Cottus cognatus*	♦	♦	♦		
Smallmouth bass	*Micropterus dolomieu*	♦	♦	♦		♦
Spoonhead sculpin	*Cottus ricei*			♦		
Spottail shiner	*Notropis hudsonius*	♦	♦	♦		
Trout-perch	*Percopsis omiscomaycus*	♦	♦	♦		
Walleye	*Sander vitreus*	♦	♦	♦		♦
White sucker	*Catostomus commersonii*		♦	♦		

Site-Related Contamination

Groundwater, surface water, sediment, and soil samples have been collected during numerous sampling events conducted from 1989 to 2004. The samples were analyzed for metals, semi-volatile organic compounds (SVOCs) including PAHs and VOCs. Soil samples were collected from locations throughout the site. Groundwater was sampled from monitoring wells and an artesian well. The artesian well has since been closed even though no contaminants of concern were ever detected (Jaffess 2004). Surface water and sediment samples were collected from Chequamegon Bay.

The primary contaminants of concern to NOAA are PAHs. Table 2 summarizes the maximum contaminant concentrations detected during the site investigations and compares them to appropriate screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such guidance, the screening guidelines for groundwater and surface water are the ambient water quality criteria (AWQC; USEPA 2002). The screening guidelines for sediment are the threshold effects concentrations (TECs; MacDonald et al. 2000). The screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997). Any exceptions to these screening guidelines are noted in Table 2. Only maximum concentrations that exceeded the screening guidelines are discussed below.

Groundwater

Several metals and PAHs were detected in groundwater samples collected from locations throughout the site. The maximum concentrations of zinc and cadmium were detected in a sample taken from a monitoring well in the southeast portion of the site; the maximum copper concentration was detected in a sample taken from a monitoring well near the seep area (Table 2; Figure 2). The maximum concentrations of zinc, copper, and cadmium exceeded the AWQC by a factor of seven, three, and two, respectively.

Table 2. Maximum concentrations of contaminants of concern to NOAA detected in soil, groundwater, surface water, and sediment samples collected from the Ashland/Northern States Power Lakefront site (SEH 1995; SEH 1996; SEH 1998; Dames & Moore 1999; URS 2001).

	Soil (mg/kg)		**Water (µg/L)**			**Sediment (mg/kg)**	
Contaminant	Soils	ORNL-PRG[a]	Ground-water	Surface Water	AWQC[b]	Sediment	TEC[c]
INORGANIC COMPOUNDS							
Arsenic	N/A	9.9	25	N/A	150	1.3	9.79
Cadmium	**25**	0.38[d]	**0.69**	N/A	0.25[e]	0.1	0.99
Chromium	N/A	0.4	**15**	N/A	11[f]	7.3	43.4
Copper	N/A	60	**30**	N/A	9[e]	3.9	31.6
Lead	**1300**	40.5	**4.7**	N/A	2.5[e]	3.3	35.8
Nickel	N/A	30	8.6	N/A	52[e]	5.5	22.7
Selenium	**17**	0.21	<1.5	N/A	5.0[g]	N/A	NA
Zinc	N/A	8.5	**840**	N/A	120[e]	12	121

Table 2 continued on next page.

Table 2, *cont.*

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soils	ORNL-PRG[a]	Ground-water	Surface Water	AWQC[b]	Sediment	TEC[c]
PAHs							
Acenaphthene	**840**	20	**26000**	N/A	520[h]	**10000**	0.290[i]
Acenaphthylene	1900	NA	3800	N/A	NA	**130**	0.160[i]
Anthracene	640	NA	8800	0.1	NA	**360**	0.0572
Benz(a)anthracene	320	NA	6800	0.29	NA	**150**	0.108
Chrysene	310	NA	7300	0.27	NA	**130**	0.166
Dibenz(a,h)anthracene	11	NA	620	0.17	NA	**6.4**	0.033
Fluoranthene	610	NA	16000	0.46	NA	**330**	0.423
Fluorene	1000	NA	11000	N/A	NA	**500**	0.0774
2-Methylnaphthalene	8700	NA	38000	N/A	NA	2400	NA
Naphthalene	10000	NA	53000	N/A	NA	**2700**	0.176
Phenanthrene	2700	NA	62000	0.66	NA	**1200**	0.204
Pyrene	950	NA	40000	0.7	NA	**440**	0.195

a: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).

b: Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.

c: Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).

d: Ecological soil screening guidelines (USEPA 2005).

e: Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L.

f: Screening guidelines represent concentrations for Cr.+6

g: Criterion expressed as total recoverable metal.

h: Lowest Observable Effects Level (LOEL) (USEPA 1986).

i: Freshwater upper effects threshold (UET) for bioassays (Buchman 1999). The UET represents the concentration above which adverse biological impacts would be expected.

NA: Screening guidelines not available.

N/A: Contaminant not analyzed for.

The maximum concentrations of chromium and lead were detected in samples collected from the eastern portion of the site at concentrations that just exceeded the AWQC.

The maximum concentrations of PAHs ranged from 620 - 62,000 µg/L. All but one of the maximum PAH concentrations were detected in a sample collected from the seep area. The maximum concentration of acenaphthene, which exceeded the AWQC by a factor of five, was detected in a sample taken from the seep area. There are no screening guidelines available for comparison to the concentrations of the other eleven PAHs that were detected in groundwater at the site.

Surface water

Several PAHs were detected in surface water samples collected from Chequamegon Bay. Maximum concentrations of PAHs ranged from 0.1 - 0.7 µg/L. There are no screening guidelines available for comparison to the concentrations of PAHs that were detected in the surface water samples. Surface water samples were not analyzed for the presence of metals.

Sediment

Several metals and PAHs were detected in offshore sediment samples collected from Chequamegon Bay. The maximum concentrations of PAHs ranged from 6.4 -10,000 mg/kg. The maximum concentration of naphthalene exceeded the TEC by four orders of magnitude. The maximum concentrations of six PAHs exceeded the TECs by three orders of magnitude, and four PAHs exceeded the TECs by two orders of magnitude (Table 2). There are no screening guidelines available for comparison to the concentrations of 2-Methylnaphthalene detected in the sediment samples.

Soil

Twelve soil samples were collected from locations throughout the site. The maximum concentration of cadmium exceeded the USEPA soil screening guidelines by one order of magnitude in a sample collected northwest of the wastewater treatment plant (USEPA 2005). The maximum concentration of selenium was detected in a soil sample taken from the northwest corner of the site. Selenium concentrations exceeded the ORNL-PRGs by one order of magnitude.

Several PAHs were detected in the soil samples at concentrations ranging from 11 -10,000 mg/kg. The majority of the maximum PAH concentrations were detected in the soil boring collected from the former coal tar pit. The maximum concentration of acenaphthene exceeded the ORNL-PRGs by one order of magnitude. There are no screening guidelines available for comparison to the maximum concentrations of the other 11 PAHs detected in soil samples.

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Devil's Swamp Lake

Scotlandville, Louisiana

EPA Facility ID: LAD981155872

Basin: Bayou Sara-Thompson

HUC: 08070201

Executive Summary

The Devil's Swamp Lake (Devil's Swamp) site is in a rural/industrial area of Scotlandville, Louisiana. The Devil's Swamp site consists of a freshwater lake and wetlands that have received drainage from industrial facilities, including the nearby Rollins Environmental Services property. Since 1971, the Rollins property has been operated as a commercial hazardous waste disposal facility, where hazardous wastes are incinerated, stabilized, and landfilled. From the 1970s to the early 1990s, the facility discharged treated wastewater and stormwater runoff to the Rollins drainage ditch, which discharges to Devil's Swamp Lake. Metals, PAHs, pesticides, and PCBs have been detected in sediment and surface water at the Devil's Swamp site. Elevated concentrations of PCBs have also been detected in fish and crawfish tissue samples collected from Devil's Swamp and Devil's Swamp Lake. The primary contaminants of concern to NOAA are PCBs. The habitats of concern to NOAA are Devil's Swamp, Devil's Swamp Lake, the southern portions of Bayou Baton Rouge, and the Mississippi River. NOAA trust resources present in the vicinity of the site include the anadromous Alabama shad and striped bass and the catadromous American eel. Surface water runoff and sediment transport are the primary pathways for the migration of contaminants from the site to NOAA trust resources.

Site Background

The Devil's Swamp Lake (Devil's Swamp) site is in a rural/industrial area of Scotlandville, Louisiana, approximately 16 km (10 mi) north of Baton Rouge (Figure 1). Devil's Swamp is bordered to the north by a farm and the former Rollins Environmental Services (Rollins) property, to the east by the Baton Rouge barge harbor, and to the south and west by the Mississippi River. Devil's Swamp is a freshwater wetland encompassing approximately 31 km^2 (12 mi^2) in the floodplain of the Mississippi River. Devil's Swamp Lake is a man-made 26-ha (64-acre) lake in the central portion of Devil's Swamp. Bayou Baton Rouge bisects the site and drains Devil's Swamp to the south to the Mississippi River (Figure 2).

Historically, the area surrounding Devil's Swamp supported farming, grazing, and some forestry. From the 1960s to the 1970s, the area bordering Devil's Swamp was heavily industrialized, including manufacturers of inorganic and organic chemicals, a lead battery recycling facility, metals manufacturers, and a facility for repairing railroad cars. Since the 1960s, many of the industrial facilities in the area have discharged effluents and surface water runoff directly to Devil's Swamp and Devil's Swamp Lake. As a result of this industrialization, numerous waste storage facilities were also developed in the vicinity of Devil's Swamp. Wastes were stored in unlined waste storage pits throughout the nearby area. Wastewater and stormwater runoff from many of the waste storage facilities discharged directly to Devil's Swamp and Devil's Swamp Lake.

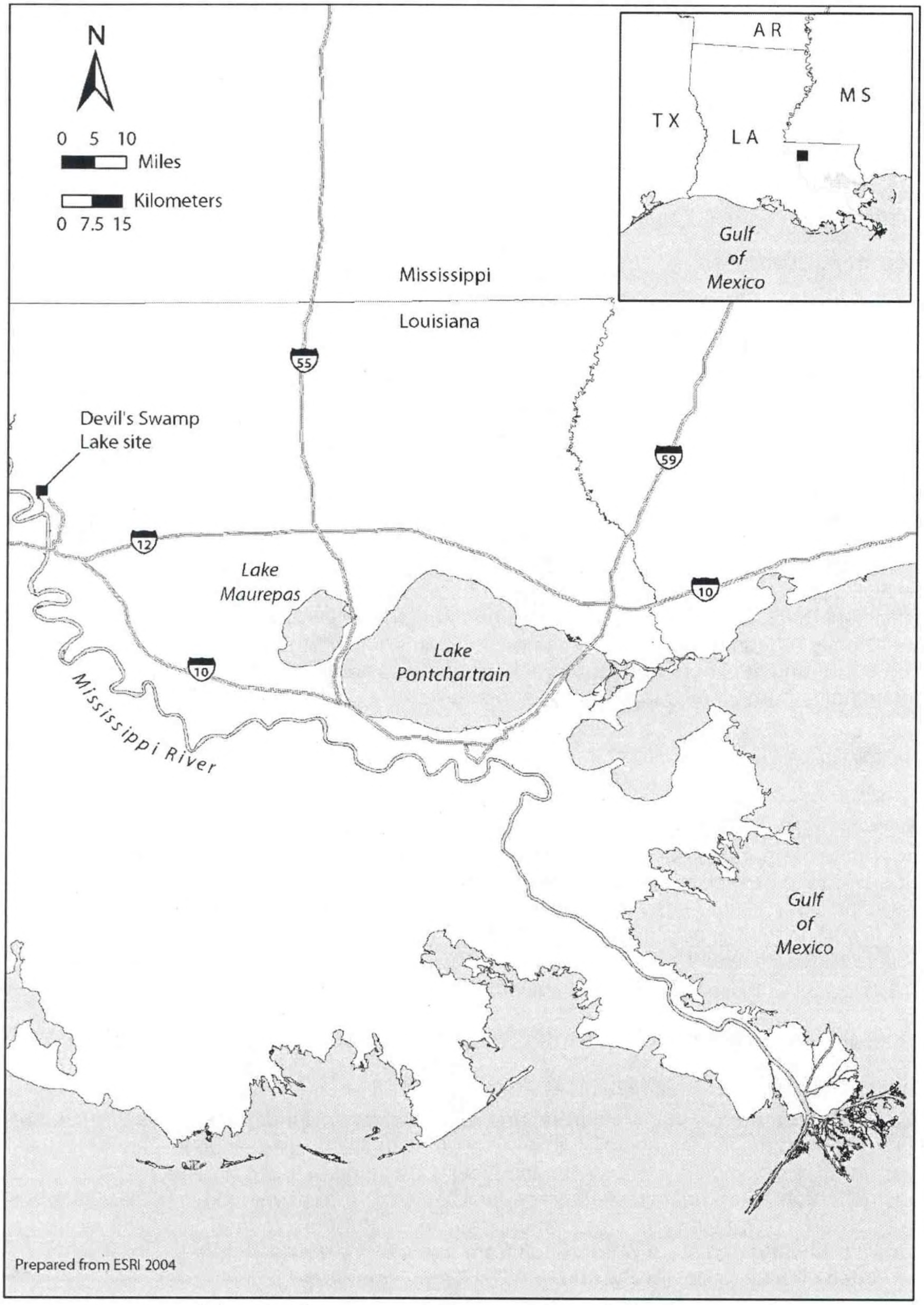

Figure 1. Location of the Devil's Swamp Lake site in Scotlandville, Louisiana.

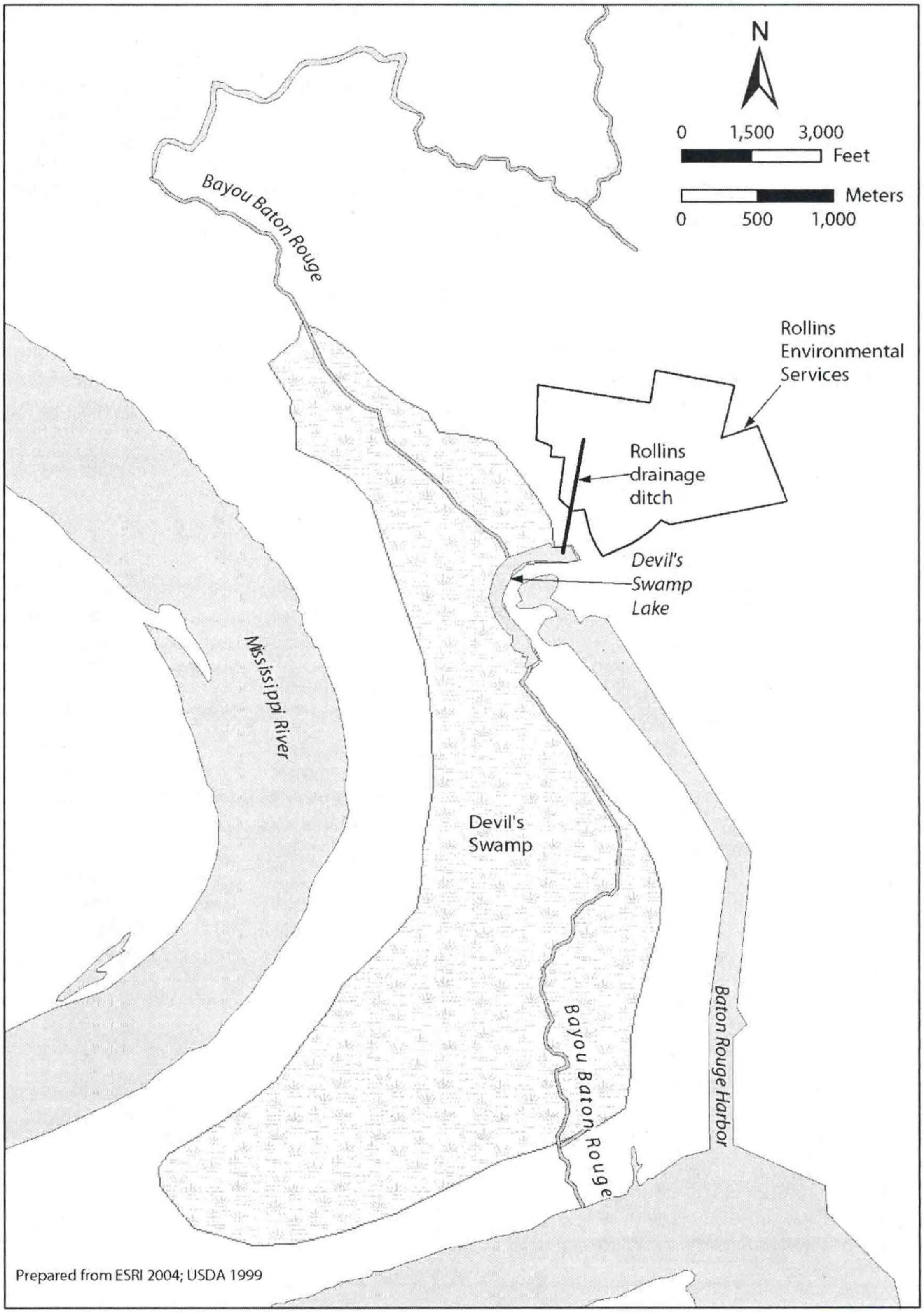

Figure 2. Detail of the Devil's Swamp Lake site.

Since 1971, the Rollins property, which encompasses approximately 82 ha (200 acres) of land adjacent to Devil's Swamp Lake, has been operated as a commercial hazardous waste disposal facility, where hazardous wastes are incinerated, stabilized, and landfilled. The facility, which is now owned and operated by Clean Harbors Baton Rouge LLC, is permitted as a hazardous waste disposal facility under the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendments. From the 1970s to the early 1990s, Rollins discharged treated wastewater and stormwater runoff through two outfalls to the Rollins drainage ditch under the National Pollutant Discharge Elimination System (NPDES). The Rollins drainage ditch discharges to the north end of Devil's Swamp Lake. Under an NPDES permit, the facility currently discharges treated wastewater to the Mississippi River via a pipeline and discharges uncontaminated stormwater runoff to Devil's Swamp Lake via the Rollins drainage ditch (Figure 2) (DPRA 1996; TechLaw 1998).

Metals, polycyclic aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs) have been detected in sediment and surface water collected from the Devil's Swamp site during investigations conducted by the Louisiana Department of Environmental Quality (LDEQ) and the U.S. Environmental Protection Agency (USEPA). Elevated concentrations of PCBs have also been detected in fish and crawfish tissue samples collected from Devil's Swamp and Devil's Swamp Lake (DPRA 1996; TechLaw 1998).

From the 1980s to the mid-1990s, the LDEQ conducted sediment and surface water investigations at the Devil's Swamp site, which included the analysis of fish and crawfish tissue samples (TechLaw 1998). In the 1990s, the USEPA conducted numerous preliminary assessments and site inspections. In 1995, the USEPA conducted a screening-level risk assessment, which resulted in the initiation of a comprehensive risk assessment at the site. The comprehensive risk assessment was completed in 1998. In 1999, the USEPA completed a human health risk assessment and an ecological risk assessment. The Devil's Swamp Lake site was proposed to the National Priorities List on March 8, 2004 (USEPA 2005).

Surface water runoff and sediment transport are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Surface water runoff in Devil's Swamp generally flows to the south toward the Mississippi River. Seasonal high-water events in the Mississippi River may cause flooding in the southern portion of Devil's Swamp. Effluent and surface water runoff from the former Rollins facility are directed into the Rollins drainage ditch, which flows to the west and south approximately 1,100 m (3,600 ft) before discharging into the north end of Devil's Swamp Lake (USEPA 2004). No information on groundwater flow at the site was available at the time this report was written.

NOAA Trust Resources

The habitats of concern to NOAA are Devil's Swamp, Devil's Swamp Lake, southern portions of Bayou Baton Rouge, and the Mississippi River. The stretch of the Mississippi River adjacent to Devil's Swamp is known as the lower Mississippi River. As shown on Figure 2, Devil's Swamp and Devil's Swamp Lake drain to Bayou Baton Rouge, which runs through the center of the southern portion of Devil's Swamp. Bayou Baton Rouge flows to the south approximately 5.6 km (3.5 mi) before discharging to the lower Mississippi River. The lower Mississippi River flows approximately 370 km (230 mi) before discharging into the Gulf of Mexico.

Devil's Swamp is characterized by small ponds and channels with bald cypress and water tupelo trees. Bayou Baton Rouge provides drainage for the entire swamp and Devil's Swamp Lake. The lake is approximately 6 m (20 ft) in depth and holds water during seasonal dry periods (TechLaw 1998).

NOAA trust resources present in the vicinity of the site (Table 1) include the anadromous Alabama shad and striped bass and the catadromous American eel, which is ubiquitous in the lower Mississippi River drainage system. The Mississippi River provides spawning, nursery, and adult habitat for Alabama shad and striped bass in the vicinity of the site, as well as adult habitat for American eel (Forester 2005). Information regarding anadromous and catadromous species present in Devil's Swamp, Devil's Swamp Lake, and Bayou Baton Rouge was not available for this report, but no blockages exist to impede their migration into these water bodies. American eel enter rivers as juveniles and reside in freshwater habitats throughout their adult lives, migrating widely in most river systems (Forester 2005).

Alabama shad spawn in freshwater reaches of coastal rivers and streams from January to April. Alabama shad spend the majority of their lives in coastal rivers seeking cool water, especially during hot summer months. Alabama shad enter fresh water to spawn from

January to April when water temperatures reach 19°C to 22°C. Spawning occurs over sand, gravel, and rock substrates in a moderate current (NMFS 2004).

Table 1. NOAA trust resources present in Devil's Swamp, Devil's Swamp Lake, Bayou Baton Rouge, and the Mississippi River near the Devil's Swamp Lake site (Forester 2005; Morrison 2005).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Alabama shad	*Alosa alabamae*	♦	♦	♦		
Striped bass	*Morone saxatilis*	♦	♦	♦		♦
CATADROMOUS FISH						
American eel	*Anguilla rostrata*			♦		

Striped bass migrate extensively throughout river systems, spending most of their life cycle in fresh water. Striped bass enter coastal rivers and streams to spawn in mid-February when saltwater temperatures begin to rise. Striped bass deposit eggs and sperm directly into the water column. Under normal conditions, eggs hatch after 36 to 42 hours. This is a critical time for striped bass; strong water currents and adequate river distances are required to ensure that eggs and newly hatched young will not settle to the river bottom (USFWS 2003).

There is no commercial fishery for anadromous or catadromous species in the vicinity of the site (Forester 2005). Recreational fishing for striped bass occurs throughout the Mississippi River drainage (Morrison 2005).

The Louisiana Department of Health and Hospitals and the LDEQ have issued fish consumption and swimming advisories because of the concentrations of hexachlorobenzene, hexachloro-1,3-butadiene, PCBs, arsenic, lead, and mercury in Devil's Swamp, Devil's Swamp Lake, and Bayou Baton Rouge. The advisories recommend that the public limit fish consumption to two meals per month and avoid swimming in these waters (LDEQ 2005).

Site-Related Contamination

Sediment and surface water samples were collected from the site and surrounding areas by the LDEQ and the USEPA between 1985 and 1997. Sediment samples were analyzed for metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), pesticides, and PCBs. Surface water samples were analyzed for metals, SVOCs, VOCs, and pesticides, but not for PCBs. Metals, PAHs, pesticides, and PCBs were detected in sediment samples and metals and pesticides were detected in surface water samples taken from Devil's Swamp, the Rollins drainage ditch, Devil's Swamp Lake, and surrounding areas (ENCOTEC 1992, as cited in USEPA 2004; DPRA 1996; TechLaw 1998). The primary contaminants of concern to NOAA are PCBs. Secondary contaminants of concern to NOAA are metals, PAHs, and pesticides.

Table 2 summarizes the maximum concentrations of contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such guidance, the screening guidelines for surface water are the ambient water quality criteria (AWQC) (USEPA 2002) and the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs) (MacDonald et al. 2000). Exceptions to these screening guidelines, if any, are noted on Table 2. Only maximum concentrations that exceeded relevant screening guidelines or for which there are no screening guidelines are discussed below. When known, the general sampling locations are also provided for maximum concentrations that exceeded screening guidelines or do not have screening guidelines.

Surface Water

Lead was the only contaminant detected in surface water samples at a maximum concentration that exceeded the AWQC. The maximum concentration of lead, which was detected in a sample collected from Devil's Swamp Lake, exceeded the AWQC by a factor of five.

Sediment

Nine metals were detected in sediment samples at maximum concentrations that exceeded the TECs, and one metal for which no screening guideline is available was also detected. The maximum concentrations of arsenic, chromium, copper, and silver were detected in samples taken from the southern portion of Devil's Swamp. The maximum concentrations of arsenic and copper exceeded the TECs by a factor of approximately four. The maximum concentrations of silver and chromium exceeded the TECs by factors of three and two, respectively. The maximum concentrations of cadmium, lead, mercury, nickel, selenium, and zinc were detected in samples taken from Devil's Swamp Lake. The maximum concentration of cadmium exceeded the TEC by one order of magnitude. The maximum concentrations of nickel, lead, and mercury exceeded the TECs by factors of approximately six, five, and four, respectively. The maximum concentration of zinc exceeded the TEC by a factor of two. No screening guideline is available for comparison to the maximum concentration of selenium.

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Devil's Lake Swamp site. Contaminant values in bold exceed or are equal to screening guidelines (ENCOTEC 1992 as cited in USEPA 2004; DPRA 1996; TechLaw 1998).

	Water (µg/L)		Sediment (mg/kg)	
Contaminant	Surface Water	AWQC[a]	Sediment	TEC[b]
METALS/INORGANICS				
Arsenic	2.7	150	**36**	9.79
Cadmium	ND	0.25[c]	**26**	0.99
Chromiumd	ND	11	**95**	43.4
Copper	5	9[c]	**140**	31.6
Lead	**12**	2.5[c]	**180**	35.8
Mercury	ND	0.77[e]	**0.65**	0.18
Nickel	ND	52[c]	**140**	22.7
Selenium	ND	5.0[f]	0.65	NA
Silver	ND	3.2[c,g]	**12**	4.5[h]
Zinc	16	120[c]	**240**	121
PAHs				
Acenaphthene	ND	520[i]	**1.4**	0.290[h]
Acenaphthylene	ND	NA	**1.1**	0.160[h]
Anthracene	ND	NA	**2.3**	0.0572
Benz(a)anthracene	ND	NA	**3**	0.108
Benzo(a)pyrene	ND	NA	**0.56**	0.15
Benzo(b)fluoranthene	ND	NA	0.74	NA
Chrysene	ND	NA	**3.9**	0.166
Fluoranthene	ND	NA	**2.7**	0.423
Fluorene	ND	NA	**4.3**	0.0774
2-Methylnaphthalene	ND	NA	4.8	NA
Naphthalene	ND	620[i]	**1.6**	0.176
Phenanthrene	ND	NA	**17**	0.204
Pyrene	ND	NA	**7.4**	0.195
PESTICIDES				
Chlordane	ND	0.0043	**0.011**	0.00324
4,4'-DDD	ND	0.6[g,l]	**0.028**	0.00488
4,4'-DDE	ND	1050[g,l]	**0.019**	0.00316
Endrin	0.0044	0.036	**0.0022**	0.00222
Gamma-BHC (Lindane)	ND	0.95[g]	**0.0065**	0.00237
Heptachlor Epoxide	0.0019	0.0038	**0.014**	0.00247
Hexachlorobenzene	ND	NA	**4.9**	0.1[h]
Hexachlorobutadiene	ND	NA	3.3	NA
PCBs				
Aroclor 1248	N/A	0.014[j]	**27**	0.0598[j]
Aroclor 1254	N/A	0.014[j]	**78**	0.0598[j]
Aroclor 1260	N/A	0.014[j]	**6.1**	0.0598[j]

Table 2 continued on next page.

Table 2, *cont.*

a:	Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.
b:	Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).
c:	Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L CaCO3.
d:	Screening guidelines represent concentrations for Cr.+6
e:	Derived from inorganic, but applied to total mercury.
f:	Criterion expressed as total recoverable metal.
g:	Chronic criterion not available; acute criterion presented.
h:	Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.
i:	Lowest observable effects level (LOEL) (USEPA 1986).
j:	Expressed as Total PCBs.
NA:	Screening guidelines not available.
ND:	Not detected.
N/A:	Not analyzed for.

Eleven PAHs were detected in sediment samples at maximum concentrations that exceeded the TECs, and two PAHs for which no screening guidelines are available were also detected. All of the maximum concentrations occurred in samples taken from Devil's Swamp Lake. The maximum concentrations of anthracene, benz(a)anthracene, chrysene, fluorene, phenanthrene, and pyrene exceeded the TECs by one order of magnitude. The maximum concentrations of naphthalene, acenaphthylene, fluoranthene, acenaphthene, and benzo(a)pyrene exceeded the TECs by factors of nine, seven, six, five, and four, respectively. No screening guidelines are available for comparison to the maximum concentrations of benzo(b)fluoranthene and 2-methylnaphthalene.

Seven pesticides were detected in sediment samples at maximum concentrations that equaled or exceeded the TECs, and one pesticide for which no screening guideline is available was also detected. All of the maximum concentrations occurred in samples taken from Devil's Swamp Lake. The maximum concentration of hexachlorobenzene exceeded the TEC by one order of magnitude. The maximum concentrations of 4,4'-DDD, 4,4'-DDE, and heptachlor epoxide exceeded the TECs by a factor of six. The maximum concentrations of chlordane and gamma-BHC (lindane) exceeded the TECs by a factor of three. The maximum concentration of endrin was equal to the TEC. No screening guideline is available for comparison to the maximum concentration of hexachlorobutadiene.

Three PCB Aroclors were detected in sediment samples taken from the Rollins drainage ditch at maximum concentrations that exceeded the TECs. The maximum concentration of Aroclor 1254 exceeded the TEC by three orders of magnitude. The maximum concentrations of Aroclor 1248 and Aroclor 1260 exceeded the TECs by two orders of magnitude.

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Gulfco Marine Maintenance

Freeport, Texas

EPA Facility ID: TXD055144539

Basin: 12070104

HUC: Lower Brazos

Executive Summary

The Gulfco Marine Maintenance site in Freeport, Brazoria County, Texas, lies along the Gulf Intracoastal Waterway and is approximately 1 km (0.62 mi) from Oyster Creek. From 1971 to 1998, the site was used by multiple owners for barge cleaning, servicing, and refurbishing and for the construction of offshore oil rigs. Barges that were cleaned and repaired at the facility contained crude oil, chlorinated solvents, alcohol, ketones, hydrochloric acids, calcium chloride, or fertilizers. Barges were also repainted at the site, which involved the use of abrasive sandblasting grit, zinc primer, and urethane and epoxy coatings. Waste and residual products from these processes were stored in aboveground storage tanks and surface impoundments. PAHs, pesticides, and metals are the primary contaminants of concern to NOAA. Many NOAA trust resources, including anadromous, marine/estuarine, and invertebrate species, are found in the Gulf Intracoastal Waterway and Oyster Creek. Sediment from barge slips at the site, surface water runoff, and groundwater transport are the primary pathways for the migration of contaminants from the site to NOAA trust resources. The habitats of primary concern to NOAA are the surface waters and sediments of the Gulf Intracoastal Waterway and Oyster Creek.

Site Background

The Gulfco Marine Maintenance (Gulfco) site in Freeport, Brazoria County, Texas, lies along the north bank of the Gulf Intracoastal Waterway (Figure 1). From 1971 to 1998, the site, which is approximately 16 ha (40 acres) in area, was used by multiple owners for barge cleaning, servicing, and refurbishing and for the construction of offshore oil rigs.

Barges that were cleaned and repaired at the facility contained crude oil, chlorinated solvents, alcohol, ketones, hydrochloric acids, calcium chloride, or fertilizers. Barges were also repainted at the site, which involved the use of abrasive sandblasting grit, zinc primer, and urethane and epoxy coatings (LT Environmental 1999). Chemical-containing barges were drained and pumped to remove the residual products, which were stored in aboveground storage tanks (ASTs). The barges were then washed with water or detergent. The used wash water was stored in surface impoundments, a floating barge, and ASTs (Figure 2). The surface impoundments, which were lined with a natural clay layer, have since been closed, including removal of the liquids and some but not all of the sludges, and capped (USEPA 2002a).

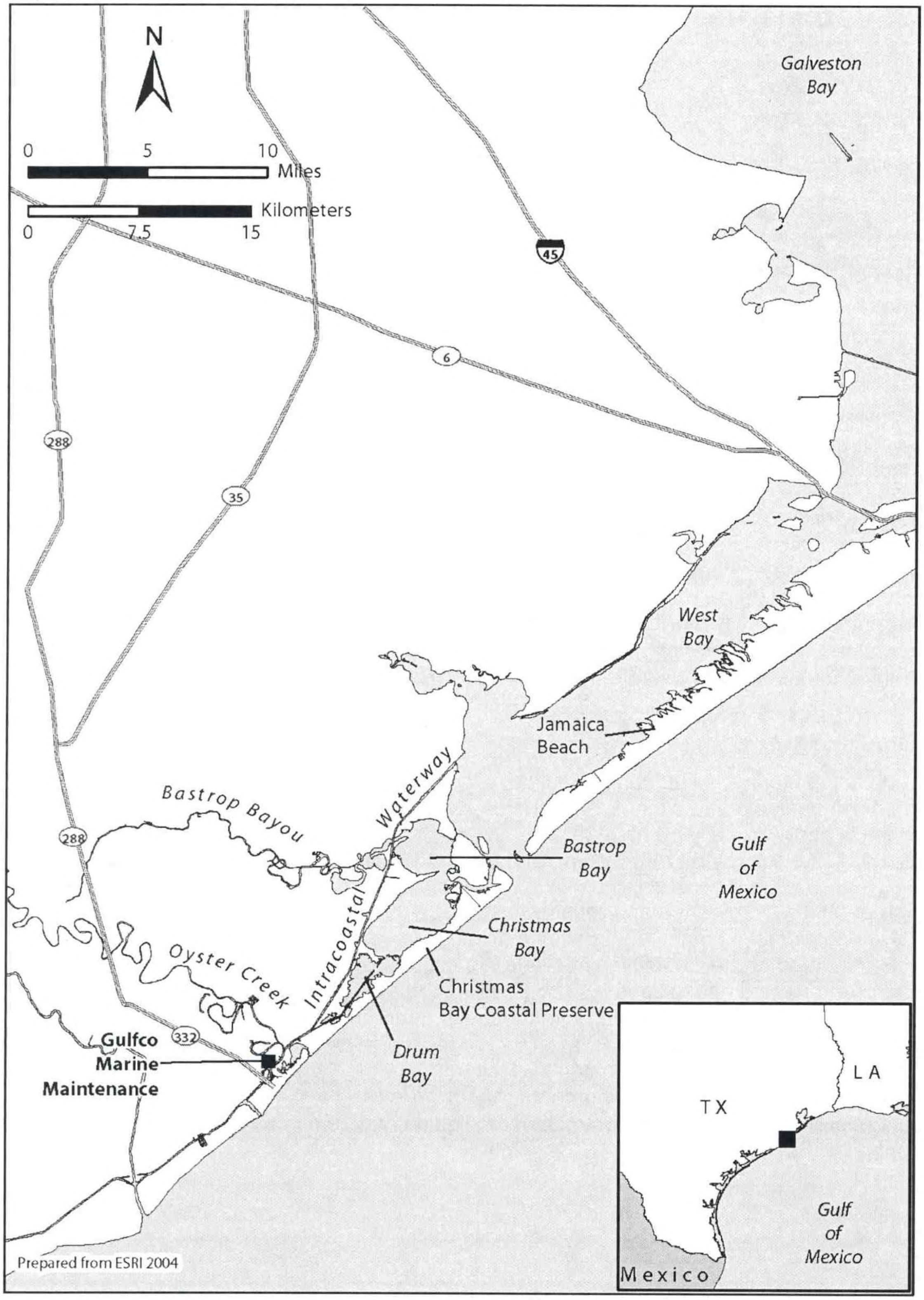

Figure 1. Location of the Gulfco Marine Maintenance site in Freeport, Texas.

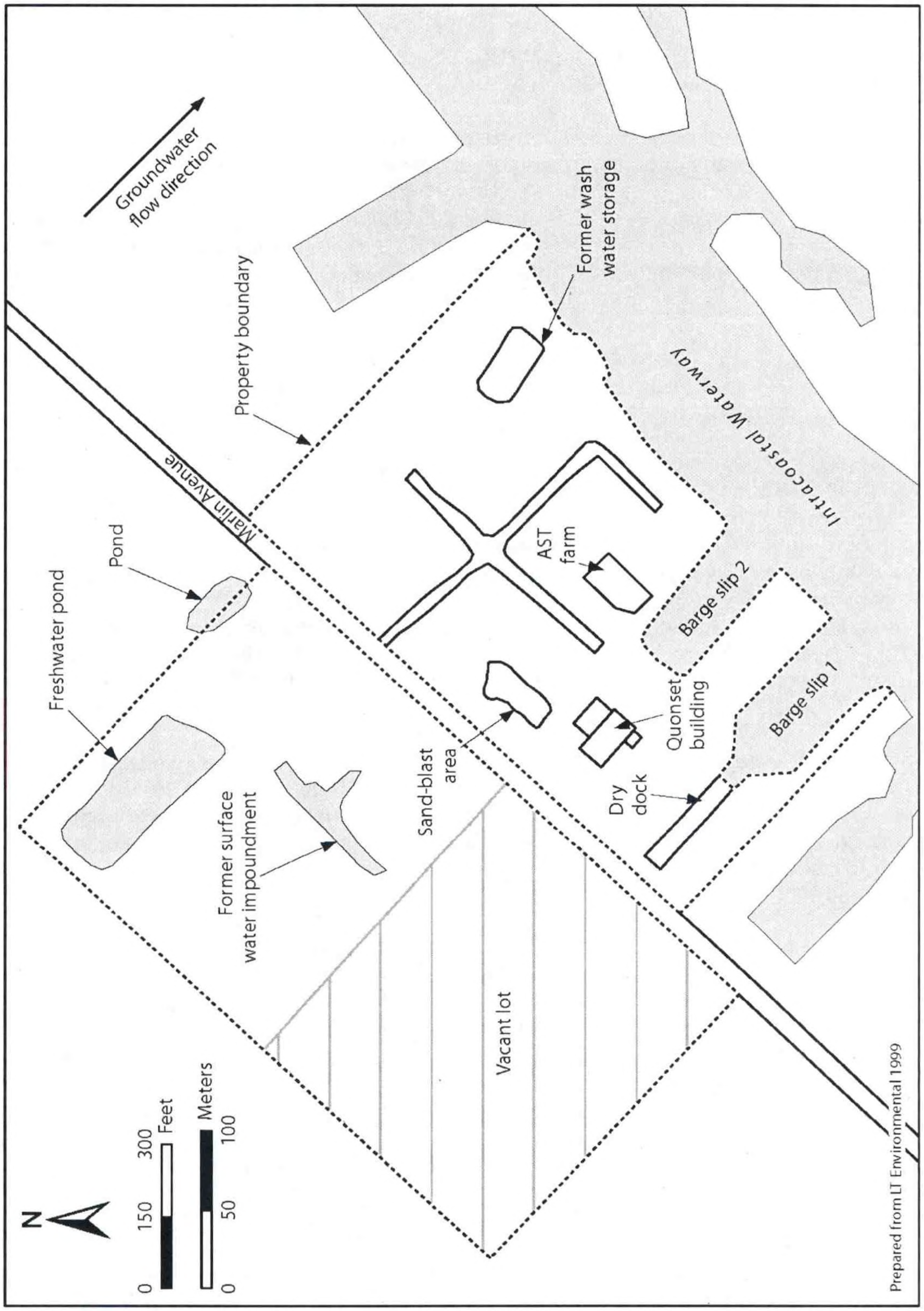

Figure 2. Detail of the Gulfco Marine Maintenance property.

A number of environmental investigations have been conducted at the site, most recently an expanded site investigation and remedial investigation in September 2001. The site was proposed to the National Priorities List (NPL) on September 5, 2002 and was placed on the NPL on April 30, 2003 (USEPA 2004).

Sediment in the barge slips, surface water runoff, and groundwater transport are the possible pathways for the migration of contaminants from the site to NOAA trust resources. Groundwater in the vicinity flows to the southeast and has been encountered in site monitoring wells at depths of 6 m (20 ft) or less (LT Environmental 1999; USEPA 2002a). Surface water flows southward from the site into the Gulf Intracoastal Waterway, and there is evidence of contaminant migration from spills that flowed over land (LT Environmental 1999). Soil at the site ranges from silty clay to clayey sand.

NOAA Trust Resources

The habitats of primary concern to NOAA are the Gulf Intracoastal Waterway and Oyster Creek, which is approximately 1 km (0.62 mi) northeast of the site. The southern portion of the site drains to the Gulf Intracoastal Waterway, which is hydrologically connected to the Gulf of Mexico. From the site, the Gulf Intracoastal Waterway flows east into Drum Bay and from there into Christmas Bay, Bastrop Bay, and Galveston Bay (Figure 1). The surface water migration pathway extends in all directions within these contiguous water bodies because they are tidally influenced.

Galveston Bay is designated as a National Estuary. Christmas Bay is part of the Texas Coastal Preserve Program. The Brazoria National Wildlife Refuge is south of Bastrop Bayou, and a wetland area is approximately 152 m (500 ft) south of the Gulfco site, across the Gulf Intracoastal Waterway.

Table 1 lists the anadromous and marine/estuarine fish species and the invertebrate species most commonly found or fished in the Gulf Intracoastal Waterway and Oyster Creek. The Gulf Intracoastal Waterway and Oyster Creek provide spawning, nursery, and/or adult habitat for numerous marine and estuarine fish species, including Atlantic croaker, bay anchovy, black drum, gafftopsail catfish, hardhead catfish, red drum, southern flounder, and spotted seatrout.

The anadromous gizzard shad, which use the Gulf Intracoastal Waterway and Oyster Creek for adult habitat, inhabit fresh and brackish waters. Most gizzard shad complete their entire life cycle in fresh water, but some along the Gulf Coast enter brackish bays and estuaries and occasionally enter marine waters. Adult gizzard shad commonly eat phytoplankton and aquatic insects. Spawning occurs in fresh water when temperatures are approximately 16° C in spring and early summer, principally in shallow areas. Gizzard shad are sensitive to sudden or extreme changes in temperature (Williamson and Nelson 1985).

Macroinvertebrates, including blue crab, brown shrimp, grass shrimp, and white shrimp, are present in Galveston Bay and other connected bays (Nelson et al. 1992; Hensley 2005). The green sea turtle, which is listed by NOAA as a threatened species (NOAA 2005), is found in the Christmas Bay Coastal Preserve (USEPA 2004). The Kemp's ridley sea turtle, also listed by NOAA as an endangered species (NOAA 2005), has been found on Jamaica Beach near Galveston Bay (Texas A&M 2005).

Table 1. NOAA trust resources present in the Gulf Intracoastal Waterway and Oyster Creek near the Gulfco Marine Maintenance site (Linam and Kleinsasser 1987; Hensley 2005).

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Gizzard shad	*Dorosoma cepedianum*			♦		
MARINE/ESTUARINE FISH						
Atlantic croaker	*Micropogonias undulatus*		♦	♦	♦	♦
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Black drum	*Pogonias cromis*		♦	♦	♦	♦
Gafftopsail catfish	*Bagre marinus*		♦	♦	♦	♦
Gulf killifish	*Fundulus grandis*	♦	♦	♦		
Gulf menhaden	*Brevoortia patronus*		♦			
Hardhead catfish	*Ariopsis felis*	♦	♦	♦	♦	♦
Pinfish	*Lagodon rhomboides*		♦			
Red drum	*Sciaenops ocellatus*		♦	♦		♦
Sand seatrout	*Cynoscion arenarius*		♦	♦		
Sheepshead	*Archosargus probatocephalus*		♦	♦		
Sheepshead minnow	*Cyprinodon variegatus*	♦	♦	♦		
Silversides	*Menidia* spp.	♦	♦	♦		
Southern flounder	*Paralichthys lethostigma*		♦	♦		♦
Southern kingfish	*Menticirrhus americanus*		♦	♦		♦
Spanish mackerel	*Scomberomorus maculatus*		♦		♦	♦
Spot	*Leiostomus xanthurus*		♦	♦		
Spotted seatrout	*Cynoscion nebulosus*	♦	♦	♦		♦
Striped mullet	*Mugil cephalus*		♦	♦		
INVERTEBRATES						
Atlantic rangia	*Rangia cuneata*	♦	♦	♦		♦
Blue crab	*Callinectes sapidus*	♦	♦	♦	♦	
Brown shrimp	*Farfante penaeus aztecus*		♦		♦	
Eastern oyster	*Crassostrea virginica*	♦	♦	♦	♦	♦
Grass shrimp	*Palaemonetes* spp.	♦	♦	♦	♦	
Gulf stone crab	*Menippe adina*		♦	♦	♦	♦
White shrimp	*Litopenaeus setiferus*		♦	♦	♦	

Commercial fisheries in the vicinity include Atlantic croaker, black drum, crab, hardhead catfish, oyster, and shrimp. Many species are fished recreationally, including Atlantic croaker, black drum, red drum, southern flounder, southern kingfish, and spotted seatrout.

A fish consumption advisory is in effect for king mackerel in all Texas coastal waters because of mercury contamination. Recommendations regarding consumption depend on the size of the fish. No closures or bans are in effect for the area around the Gulfco site. In upper Galveston Bay, approximately 75 km (47 mi) northeast of the site, limited consumption advisories are in effect for all species of fish and blue crabs because of contamination with polychlorinated biphenyls (PCBs), dioxin, and organochlorine pesticides (TPWD 2005).

Site-Related Contamination

Sediment, groundwater, and soil samples were collected from the Gulfco Marine Maintenance site during a 1999 site characterization (LT Environmental 1999), a 2000 screening site inspection (USEPA 2000), and a 2001 expanded site investigation (USEPA 2002a). The sediment samples were collected from barge slips in the Gulf Intracoastal Waterway and a constructed freshwater pond. The groundwater samples were collected from the north, east, west, and south sides of the former surface water impoundments. The soil samples were collected from throughout the site, including the dry dock, the sandblast area, the AST farm, the former wash water storage area, the Quonset building, near Barge Slip 2, former surface impoundments, and the vacant lot north of Marlin Avenue, which bisects the Gulfco facility (Figure 2). The primary contaminants of concern to NOAA are polycyclic aromatic hydrocarbons (PAHs), pesticides, and metals.

Table 2 summarizes the maximum concentrations of contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. The Texas Commission on Environmental Quality ecological benchmarks for sediment (EBS) are used when available (TCEQ 2005). The screening guidelines for groundwater are the ambient water quality criteria (AWQC) (USEPA 2002b); and the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs) (Efroymson et al. 1997) and the U.S. Environmental Protection Agency's (USEPA) ecological soil screening guidelines (USEPA 2005). Exceptions to these screening guidelines, if any, are noted in Table 2. Only maximum concentrations that exceeded relevant screening guidelines or for which there are no screening guidelines are discussed below. When known, the general sampling locations are also provided for maximum concentrations that exceeded screening guidelines or do not have screening guidelines.

Sediment

Three metals were detected in sediment samples taken from the Gulfco site at maximum concentrations that exceeded the EBSs (Table 2). The maximum concentrations of zinc and lead were detected in a sample collected from Barge Slip 1 (Figure 2). The maximum concentration of zinc exceeded the EBS by a factor of two, while the maximum concentration of lead slightly exceeded the EBS. The maximum concentration of arsenic, which was detected in a sample collected from the freshwater pond, slightly exceeded the EBS.

Three PAHs were detected in sediment samples taken from the Gulfco site at maximum concentrations that exceeded EBSs. The maximum concentrations of fluoranthene, phenanthrene, and pyrene, which were all detected in a sample collected from Barge Slip 1, exceeded the EBSs by three orders of magnitude.

The maximum concentration of PCB Aroclor 1254, which slightly exceeded the ERL, was detected in a sample collected from Barge Slip 1. The maximum concentration of the pesticide heptachlor epoxide was detected in a sample collected from Barge Slip 2. No screening guideline is available for comparison to the maximum concentration of heptachlor epoxide.

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Gulfco Marine Maintenance site (LT Environmental 1999; USEPA 2000; USEPA 2002a). Contaminant values in bold exceed or are equal to screening guidelines.

	Soil (mg/kg)		Water (µg/L)		Sediment (mg/kg)	
Contaminant	Soil	ORNL-PRG[a]	Groundwater	AWQC[b]	Sediment	TCEQ EBS[c]
METALS/INORGANICS						
Arsenic	6.3	9.9	**77**	36	**9.8**	8.2
Chromiume	**34**	0.4	14	50	7.1	81
Copper	47	60	**270**	3.1	N/A	34
Lead	**220**	40.5	**95**	8.1	**47**	46.7
Mercury	**0.16**	0.00051	N/A	0.094[f]	ND	0.15
Nickel	26	30	**220**	8.2	N/A	20.9
Zinc	**1100**	8.5	N/A	81	**310**	150
PAHs						
Acenaphthene	0.21	20	N/A	710[i]	N/A	0.016
Anthracene	0.5	NA	N/A	300[h,i,j]	N/A	0.0853
Benz(a)anthracene	2.4	NA	N/A	300[h,i,j]	N/A	0.261
Benzo(a)pyrene	2.6	NA	N/A	300[h,i,j]	N/A	0.43
Benzo(b)fluoranthene	2.7	NA	N/A	300[h,i,j]	N/A	1.8[g]
Benzo(k)fluoranthene	2.5	NA	N/A	300[h,i,j]	N/A	1.8[g]
Chrysene	2.8	NA	N/A	300[h,i,j]	N/A	0.384
Fluoranthene	5.1	NA	N/A	16[i]	**2,000**	0.6
Fluorene	0.2	NA	N/A	300[h,i,j]	N/A	0.019
Indeno(1,2,3-cd)pyrene	2.2	NA	N/A	300[h,i,j]	N/A	0.6[g]
Naphthalene	0.06	NA	230	2350[h,i]	N/A	0.16
Phenanthrene	2.5	NA	N/A	NA	**1,200**	0.24
Pyrene	4.4	NA	N/A	300[h,i,j]	**2,000**	0.665
PESTICIDES/PCBs						
Aroclor 1254k	0.15	0.371	N/A	0.03	**0.027**	0.0227
4,4'-DDD	0.01	NA	N/A	3.6[h,i]	N/A	0.002[l]
4,4'-DDE	0.01	NA	N/A	14[i]	N/A	0.0022[l]
4,4'-DDT	0.01	NA	**1.4**	0.001[m]	N/A	0.00158
Dieldrin	**0.01**	0.000032[d]	**0.2**	0.0019	N/A	0.000715[n]
Endrin	0.004	NA	**0.3**	0.0023	N/A	NA
Gamma-BHC (Lindane)	N/A	NA	**0.6**	0.16[h]	N/A	0.00032[n]
Heptachlor	N/A	NA	**0.2**	0.0036	N/A	0.0003[g]
Heptachlor Epoxide	N/A	NA	**1.5**	0.0036	3.8	NA

Table 2 continued on next page.

Table 2, *cont.*

a:	Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).
b:	Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002b). Marine chronic criteria presented.
c:	The Texas Commission on Environmental Quality (TCEQ) Ecological Benchmarks for Sediment (EBS) (TCEQ 2005) are the effects range-low (ERL) which represents the 10th percentile for the dataset in which effects were observed or predicted in studies compiled by Long et al (1995). Marine value is presented.
d:	Ecological soil screening guidelines (USEPA 2005).
e:	Screening guidelines represent concentrations for Cr.+6
f:	Derived from inorganic, but applied to total mercury.
g:	Marine apparent effects threshold (AET) for bioassays. The AET represents the concentration above which adverse biological impacts would be expected.
h:	Chronic criterion not available; acute criterion presented.
i:	Lowest Observable Effect Level (LOEL) (USEPA 1986).
j:	Value for chemical class.
k:	Value for Total PCBs.
l:	Effects range-low (ERL) (Long et al. 1998)
m:	Expressed as Total DDT.
n:	Threshold Effects Level (TEL) (Smith et al. 1996)
N/A:	Not analyzed.
NA:	Screening guidelines not available.
ND:	Not detected.

Groundwater

Four metals were detected in groundwater samples taken from the Gulfco site at maximum concentrations that exceeded the AWQC (Table 2). The maximum concentrations of arsenic, copper, lead, and nickel were detected in samples collected from the north side of the former surface impoundments at the toe of the surface impoundment cap (Figure 2). Maximum concentrations of copper, lead, and nickel exceeded the AWQC by one order of magnitude. The maximum concentration of arsenic exceeded the AWQC by a factor of two.

Six pesticides were detected in groundwater samples taken from the Gulfco site at maximum concentrations that exceeded the AWQC. The maximum concentrations of 4,4'-DDT, dieldrin, and lindane were all detected in a sample collected from the south side of the former surface impoundments at the toe of the surface impoundment cap. The maximum concentration of 4,4'-DDT exceeded the AWQC by three orders of magnitude. The maximum concentration of dieldrin exceeded the AWQC by two orders of magnitude. The maximum concentration of lindane exceeded the AWQC by a factor of approximately 3.5. The maximum concentrations of endrin, heptachlor epoxide, and heptachlor were detected in samples collected from the north side of the former surface impoundment. The maximum concentrations of endrin and heptachlor epoxide exceeded the AWQC by two orders of magnitude. The maximum concentration of heptachlor exceeded the AWQC by one order of magnitude.

Soil

Four metals were detected in soil samples collected from the Gulfco site at maximum concentrations that exceeded the ORNL-PRGs (Table 2). The maximum concentrations of chromium and mercury, which were detected in a sample collected from the dry dock area

(Figure 2), exceeded the ORNL-PRGs by one order of magnitude and two orders of magnitude, respectively. The maximum concentration of zinc, which was detected in a sample collected from the sandblast area, exceeded the ORNL-PRG by two orders of magnitude. The maximum concentration of lead, which was detected in a sample collected from a vacant lot north of Marlin Avenue, exceeded the ORNL-PRG by a factor of approximately five.

Twelve PAHs for which no screening guidelines are available were detected in soil samples collected from the Gulfco site. The maximum concentrations of anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were detected in samples collected from a vacant lot north of Marlin Avenue. The maximum concentration of naphthalene was detected in a sample collected from the AST farm area.

The pesticide dieldrin was detected in soil samples collected at the Gulfco site at a maximum concentration that exceeded the USEPA's ecological soil screening guideline, and four pesticides for which no screening guidelines are available were also detected in soil samples. The maximum concentrations of dieldrin, 4,4'-DDE, and 4,4'-DDT were detected in samples taken from the former wash water storage area. The maximum concentration of dieldrin exceeded the USEPA ecological soil screening guideline by two orders of magnitude. The maximum concentration of 4,4'-DDD was detected in a sample taken from a vacant lot north of Marlin Avenue, and the maximum concentration of endrin was detected in a sample taken from the AST farm area. Screening guidelines are not available for comparison to the maximum concentrations of 4,4'-DDE, 4,4'-DDT, 4,4'-DDD, and endrin.

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Star Lake Canal

Star Lake Canal

Port Neches, Texas

EPA Facility ID: TX0001414341

Basin: Lower Neches

HUC: 12020003

Executive Summary

The Star Lake Canal site consists of contaminated sediment in the Star Lake Canal, Jefferson Canal, and Molasses Bayou in Port Neches, Texas. The two canals and the bayou join and flow in to the Neches River approximately 5.6 km (3.5 mi) upstream of Sabine Lake. Sediments at the Star Lake Canal site have been contaminated with metals, PAHs, pesticides, and PCBs by outfall from chemical and other manufacturing facilities in the vicinity. Polycyclic aromatic hydrocarbons (PAHs), metals, polychlorinated biphenyls (PCBs), and pesticides are contaminants of concern to NOAA at the Star Lake Canal site. Molasses Bayou, the lower Neches River, and Sabine Lake, which are the habitats of primary concern to NOAA, provide adult foraging, juvenile nursery, migratory, and spawning habitat to numerous NOAA trust resources.

Site Background

The Star Lake Canal site comprises contaminated portions of the Star Lake and Jefferson industrial canals and wetlands bordering Molasses Bayou. The Star Lake Canal meets the Jefferson Canal approximately 2.9 km (1.8 mi) east of its origin and then flows approximately 1.9 km (1.2 mi) before joining the tidally influenced Neches River (Figure 1). A dam is located in the Star Lake Canal upstream of its intersection with the Jefferson Canal (Figure 2). From its confluence with the Star Lake Canal, the Neches River flows approximately 5.6 km (3.5 mi) to Sabine Lake, which is connected to the Gulf of Mexico through the Sabine Pass Ship Channel (TechLaw Inc. 1999) (Figure 1).

Chemical and other manufacturing facilities have discharged industrial wastewater and stormwater into the Star Lake and Jefferson canals for over 20 years (TNRCC 1999). Seventeen current and former facilities have been investigated as possible contributors to the contamination at the Star Lake Canal site, although the exact sources have not yet been fully identified (TechLaw Inc. 1999).

A screening site inspection (SSI) and an expanded site inspection (ESI) were conducted at the Star Lake Canal site in October 1996 and March 1998, respectively (TNRCC 1997; TNRCC 1999). The U. S. Environmental Protection Agency (USEPA) placed the Star Lake Canal site on the National Priorities List in July 2000 (USEPA 2005). A remedial investigation and feasibility study are planned for the site, but work had not yet begun at the time this report was prepared (USEPA 2005).

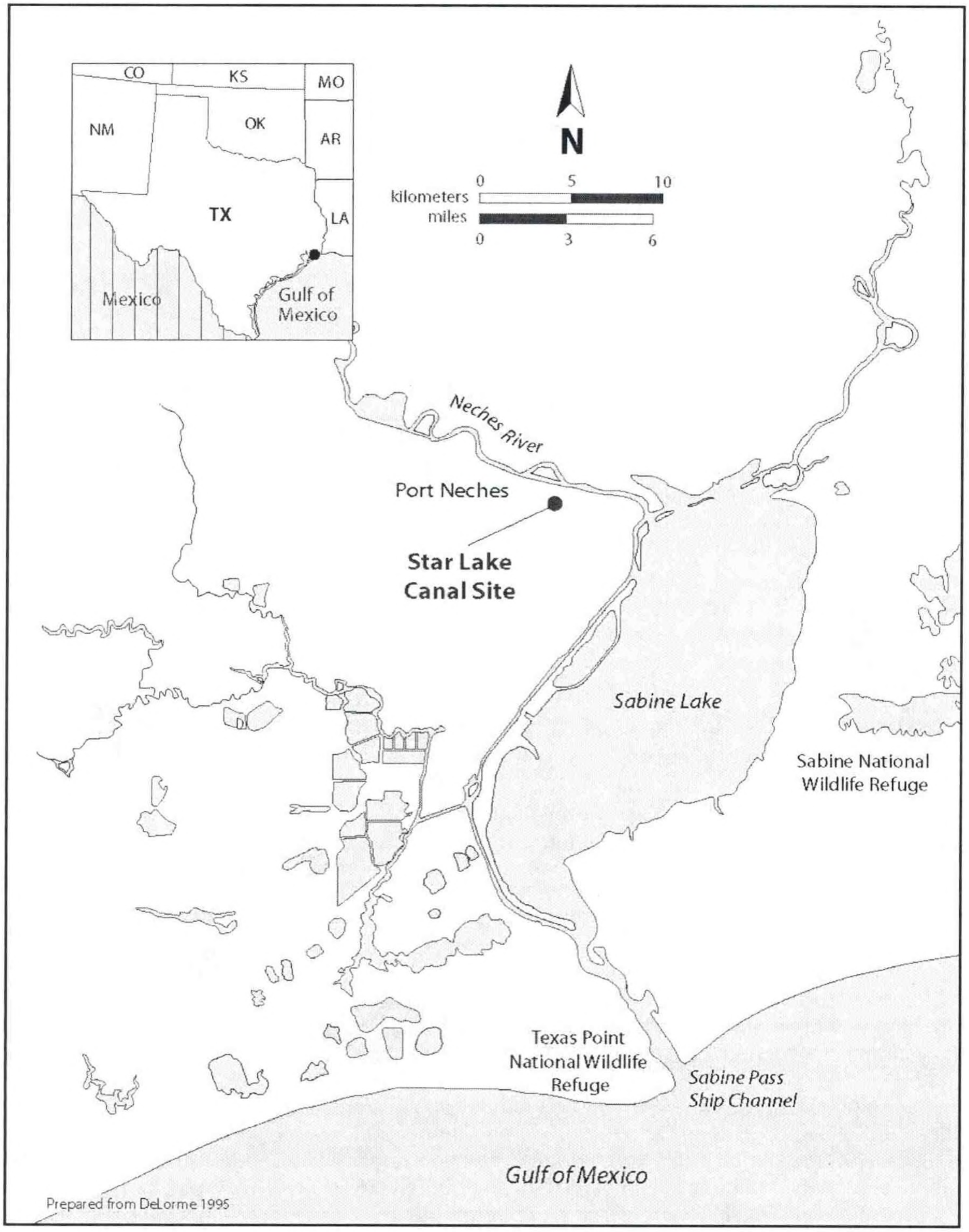

Figure 1. Location of the Star Lake Canal site in Port Neches, Texas.

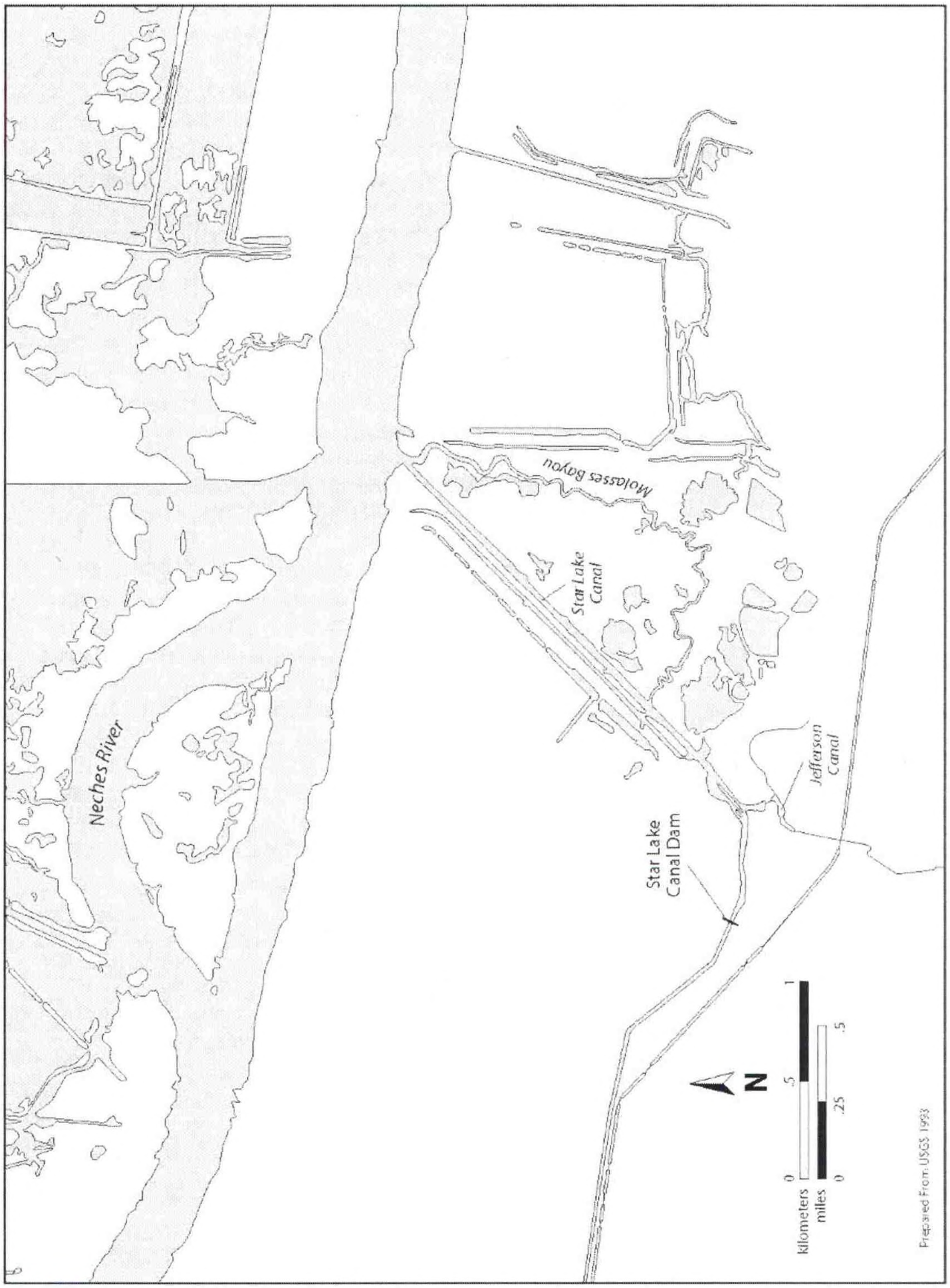

Figure 2. Detail of the Star Lake Canal site.

NOAA Trust Resources

Habitats of potential concern to NOAA are Molasses Bayou, the lower Neches River, Sabine Lake, and the Star Lake and Jefferson canals. Numerous NOAA trust fish and invertebrate species use the estuary for spawning, rearing, and foraging (Nelson et al. 1991). Of the major estuaries in Texas, Sabine Lake has the largest freshwater inflow, including inflow from the Neches River, which results in a low average salinity of 2.3 parts per thousand (Stelly 2000). The segment of the Neches River nearest the Star Lake Canal varies in salinity from 0 to 5 parts per thousand. A 12-m (40-ft)-deep navigation channel is maintained through the lower reaches of the Neches River to the Sabine Pass Ship Channel (Orlando et al. 1993).

Nearly 14,000 ha (35,000 acres) of vegetated wetlands, which are dominated by saltgrass (*Distichlis spicata*) and cordgrass (*Spartina* spp.), border the estuary. Texas Point National Wildlife Refuge, the largest salt marsh bordering the estuary, is west of the Sabine Pass Ship Channel (Stelly 2000). Smaller marshes are located along the Neches River at the head of the estuary (Armstrong 1987). Most of the salt marsh to the east of the estuary has been designated as the Sabine National Wildlife Refuge (USFWS 1998).

Fish have access to the Star Lake Canal, Jefferson Canal, and Molasses Bayou, but information about fish presence in these areas was not available (Stelly 2000). Sabine Lake and the lower Neches River provide adult foraging, juvenile nursery, migratory, and spawning habitat to numerous fish species; the species most commonly found in Sabine Lake and the lower Neches River are listed in Table 1. The anadromous gizzard shad uses Sabine Lake as a migratory corridor to the Neches River during spring spawning runs. Small estuarine fish such as bay anchovy, gulf killifish, hardhead catfish, and sheepshead minnow spend their entire lives within the estuary. Adult Atlantic croaker, black drum, pinfish, sheepshead, silver perch, southern flounder, spot, spotted seatrout, and striped mullet are present in the estuary seasonally. Many other species, including gulf menhaden and red drum, spawn in more saline waters, but use the estuary as a juvenile nursery (Pattillo et al. 1997).

Blue crab are abundant in Sabine Lake and the lower Neches River as both adults and juveniles. Adult males remain in the estuary after mating, while females usually return to more saline water to brood eggs. Larvae are released offshore and are subsequently transported back into estuaries, where they settle to the bottom. Daggerblade grass shrimp, which also are common in Sabine Lake, typically spend their entire lives in the estuary, where they prefer saltmarsh and oyster reef habitats. Brown and white shrimp also are abundant in Sabine Lake and the lower Neches River, although spawning occurs offshore. The most abundant bivalve species is the Atlantic rangia, followed by eastern oyster. All oyster and rangia lifestages are present within the estuary (Nelson et al. 1992; Pattillo et al. 1997).

Recreational fishing and commercial fisheries occur in Sabine Lake and the lower Neches River. Common recreational catch includes black drum, blue crab, red drum, southern flounder, and spotted seatrout. Commercial fisheries in Sabine Lake and the lower Neches River include blue crab and white shrimp. Commercial crabbing also takes place in the Neches River across from the Star Lake Canal. No health advisories or restrictions on fishing or fish consumption have been issued for the portion of the Neches River downstream of the Star Lake Canal or Sabine Lake (Stelly 2000).

Table 1. NOAA trust resources present in surface water near the Star Lake Canal site (Nelson et al. 1991; Nelson et al. 1992; Pattillo et al. 1997; Stelly 2000).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Gizzard shad	*Dorosoma cepedianum*			♦		
MARINE/ESTUARINE FISH						
Atlantic croaker	*Micropogonias undulatus*		♦	♦		
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Black drum	*Pogonias cromis*		♦	♦		♦
Gulf killifish	*Fundulus grandis*	♦	♦	♦		
Gulf menhaden	*Brevoortia patronus*		♦			
Hardhead catfish	*Ariopsis felis*	♦	♦	♦		
Pinfish	*Lagodon rhomboides*		♦	♦		
Red drum	*Sciaenops ocellatus*		♦			♦
Sheepshead	*Archosargus probatocephalus*		♦	♦		
Sheepshead minnow	*Cyprinodon variegatus*	♦	♦	♦		
Silver perch	*Bairdiella chrysoura*		♦	♦		
Southern flounder	*Paralichthys lethostigma*		♦	♦		♦
Spot	*Leiostomus xanthurus*		♦	♦		
Spotted seatrout	*Cynoscion nebulosus*		♦	♦		♦
Striped mullet	*Mugil cephalus*		♦	♦		
INVERTEBRATES						
Atlantic rangia	*Rangia cuneata*	♦	♦	♦		
Blue crab	*Callinectes sapidus*		♦	♦	♦	♦
Brown shrimp	*Farfante penaeus aztecus*		♦	♦		
Daggerblade grass shrimp	*Palaemonetes pugio*	♦	♦	♦		
Eastern oyster	*Crassostrea virginica*	♦	♦	♦		
White shrimp	*Litopenaeus setiferus*		♦	♦	♦	

Site-Related Contamination

During the SSI and ESI, 25 sediment samples were collected from the Jefferson Canal, Star Lake Canal, and Molasses Bayou (TNRCC 1999). Soil, surface water, and groundwater were not sampled. Based on this initial screening of the site, polycyclic aromatic hydrocarbons (PAHs), metals, polychlorinated biphenyls (PCBs), and pesticides are contaminants of concern to NOAA at the Star Lake Canal site. Subsequent investigations of the site may identify a broader list of contaminants.

Table 2 summarizes the maximum concentrations of contaminants of concern to NOAA detected in sediment collected from the Star Lake and Jefferson canals and Molasses Bayou and compares them to relevant screening guidelines. The Texas Commission on Environmental Quality ecological benchmarks for sediment (EBS) are used when available

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Star Lake Canal site (TNRCC 1997; TNRCC 1999). Contaminant values in bold exceed or are equal to screening guidelines.

Contaminant	Sediment (mg/kg) Jefferson Canal	Star Lake Canal	Molasses Bayou	TCEQ EBS[a]
METALS/INORGANICS				
Arsenic	1.9	**21**	ND	8.2
Chromiumb	**130**	51	70	81
Copper	**390**	**110**	**140**	34
Mercury	**0.76**	0.1	**1.0**	0.15
Selenium	1.8	ND	ND	NA
PAHs				
Acenaphthene	**200**	**14**	**100**	0.016
Acenaphthylene	**720**	**12**	**25**	0.044
Anthracene	**180**	**11**	**34**	0.0853
Benz(a)anthracene	**32**	**5.6**	**14**	0.261
Benzo(a)pyrene	**46**	**3.6**	**9.9**	0.43
Benzo(b)fluoranthene	19	2.7	6	NA
Benzo(k)fluoranthene	22	3	6.8	NA
Benzo(g,h,i)perylene	12	0.87	2.1	NA
Chrysene	**87**	**5.3**	**14**	0.384
Fluoranthene	**160**	**12**	**36**	0.6
Fluorene	**520**	**18**	**76**	0.019
Indeno(1,2,3-cd)pyrene	10	0.72	2.2	NA
2-Methylnaphthalene	**930**	**7.2**	**100**	0.07
Naphthalene	**4,300**	**4.6**	**240**	0.16
Phenanthrene	**1,200**	**55**	**190**	0.24
Pyrene	**320**	**22**	**63**	0.665
PESTICIDES/PCBs				
Aldrin	**0.035**	ND	**0.008**	0.002[c]
4,4'-DDD	**0.19**	ND	ND	0.00122
Heptachlor Epoxide	**0.049**	0.00091	ND	0.00247[d]
Aroclor 1254e	**1.5**	**0.13**	**0.33**	0.06[c]

a: The Texas Commission on Environmental Quality (TCEQ) Ecological Benchmarks for Sediment (EBS) (TCEQ 2005) are the effects range-low (ERL) which represents the 10th percentile for the dataset in which effects were observed or predicted in studies compiled by Long et al (1995). Marine value is presented.
b: Screening guidelines represent concentrations for Cr.+6
c: The lowest effect level (LEL) represents the level of contamination in sediments at which biological effects among sensitive organisms would first become apparent (Persaud et al. 1993). Freshwater value is presented.
d Marine value not available; freshwater value is presented.
NA: Screening guidelines not available.
ND: Not detected.

(TCEQ 2005). Exceptions to the EBSs are noted in Table 2. Only maximum concentrations that exceeded the screening guidelines are discussed below.

Sediment

Twelve PAHs were detected in sediment samples from the Star Lake Canal site at maximum concentrations that exceeded the EBSs. The maximum concentrations of PAHs were all detected in samples collected from Jefferson Canal. The maximum concentration of acenaphthene, acenaphthylene, fluorene, 2-methylnaphthalene, and naphthalene exceeded the EBSs by four orders of magnitude. The maximum concentrations of anthracene and phenanthrene exceeded the EBSs by three orders of magnitude. The maximum concentrations of benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, and pyrene exceeded the EBSs by two orders of magnitude. Screening guidelines are not available for comparison to the maximum concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene.

Four metals were detected in sediment samples at maximum concentrations that exceeded the EBSs. The maximum concentration of copper exceeded the EBS by one order of magnitude in a sediment sample collected from the Jefferson Canal. The maximum concentration of mercury exceeded the EBS by a factor of six in a sample collected from Molasses Bayou. The maximum concentration of chromium just exceeded the EBS in a sample collected from the Jefferson Canal. The maximum concentration of arsenic exceeded the EBS by a factor of two in a sample collected near the dam on the Star Lake Canal. No screening guideline is available for comparison to the maximum concentration of selenium.

Three pesticides and the PCB Aroclor 1254 were detected in sediment samples from the Jefferson Canal at maximum concentrations that exceeded the EBSs. The maximum concentrations of aldrin, 4,4'-DDD, heptachlor epoxide, and PCB Aroclor 1254 exceeded the EBSs by one order of magnitude.

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Quendall Terminal

Renton, Washington

EPA Facility ID: WAD980639125

Basin: Lake Washington

HUC: 17110012

Executive Summary

The Quendall Terminal site is a former creosote manufacturing facility in Renton, King County, Washington. The site, which is in a mixed-use industrial, residential, and recreational area, is situated on the southeastern shore of Lake Washington. From 1917 to 1969, the facility was used to refine and process coal tar and oil-gas tar residues into creosote and other coal tar products. In the late 1930s, approximately 151,400 L (40,000 gal) of creosote and coal tar were released directly to Lake Washington. Surface water and stormwater runoff at the Quendall Terminal property flows to three stormwater collection ponds, to wetlands, and directly to Lake Washington. Elevated concentrations of metals, PAHs and VOCs have been detected during numerous soil, surface water, groundwater, and sediment investigations conducted at the site from 1971 to 2004. Surface water runoff and sediment transport are the primary pathways for the migration of contaminants from the site to NOAA trust resources; groundwater transport is a secondary pathway. The habitat of primary concern to NOAA is Lake Washington. NOAA trust resources present in the vicinity of the site include anadromous Chinook, coho, and sockeye salmon.

Site Background

The Quendall Terminal site is a former creosote manufacturing facility in Renton, King County, Washington. The site encompasses approximately 10 ha (25 acres) in a mixed-use industrial, residential, and recreational area on the southeastern shore of Lake Washington (Figure 1). The property was developed on the alluvial delta of May Creek after Lake Washington was lowered in 1916. May Creek bisected the property until it was rerouted to the south between 1926 and 1936. The Cedar River is approximately 3 km (2 mi) southwest of the site. Wetlands are present on the property (Figure 2).

From 1917 to 1969, the facility was used to refine and process coal tar and oil-gas tar residues into creosote and other coal tar products. Tar residues were shipped or barged to the facility, then pumped into two approximately 7.6 million-L (2 million-gal) aboveground storage tanks (ASTs) via a pipeline that ran along a former T-pier (Hart Crowser 1997) (Figure 2). After refining, the creosote and coal tar products were stored on the property in numerous ASTs before being shipped by rail, tanker truck, or vessel. In the course of the facility's operations, raw materials and finished products were spilled on the ground; sludges and wastes from the distillation process were dumped in various locations on the property; and overflows occurred at the former T-pier during transfers. In the late 1930s, approximately 151,400 L (40,000 gal) of creosote and coal tar were released from the end of the former T-pier directly to Lake Washington (USEPA 2005a). From 1969 to 1978, the property was used for fuel storage. The property is currently being used as a log storage and sorting yard.

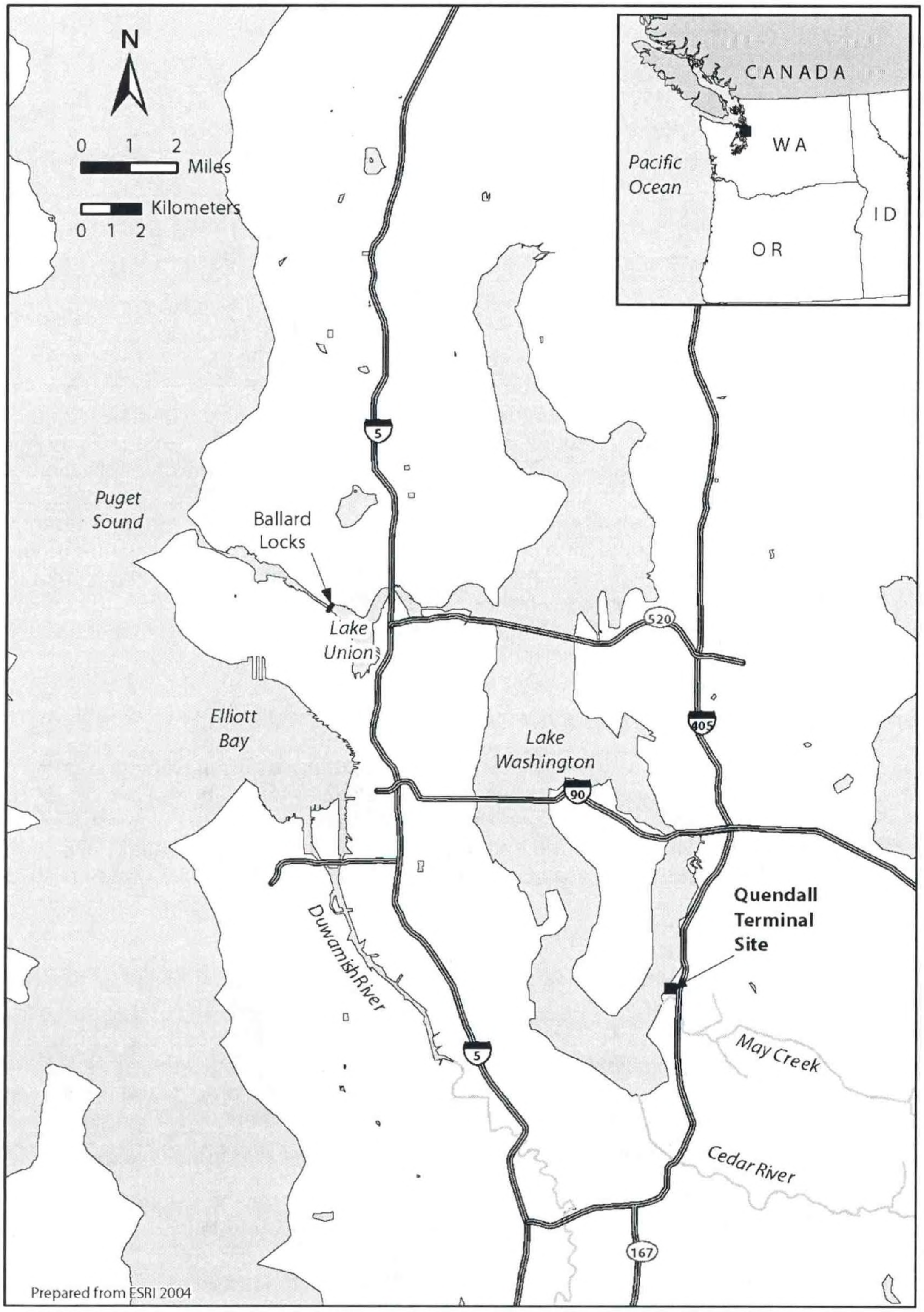

Figure 1. Location of the Quendall Terminal site in Renton, Washington.

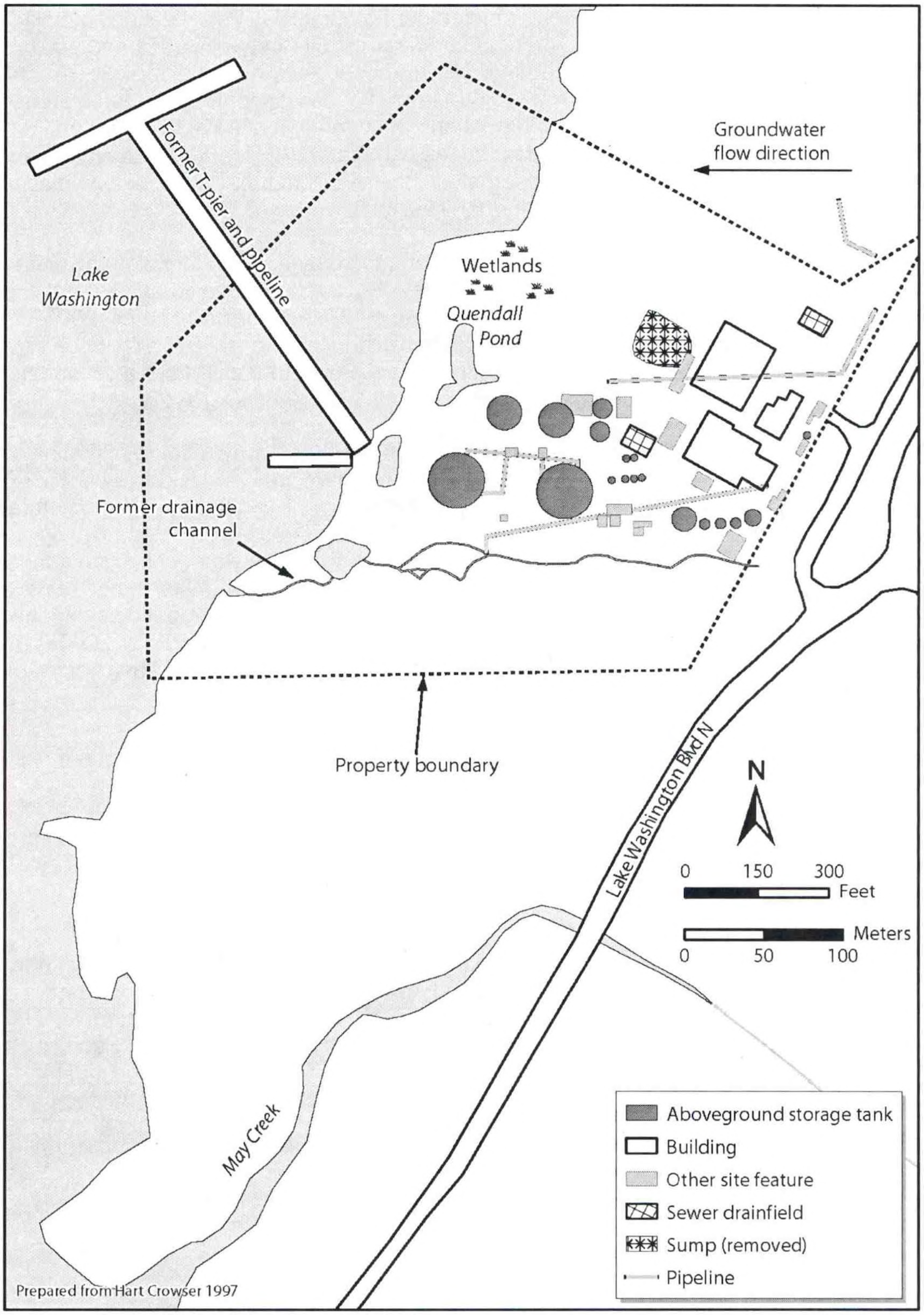

Figure 2. Detail of the Quendall Terminal property.

Elevated concentrations of metals, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs) have been detected during numerous investigations of soil, surface water, groundwater, and sediment at and near the site between 1971 and 2004 (Norton 1991; Hart Crowser 1997; Exponent 1999; Anchor and Aspect 2003; USEPA 2005a). Creosote measuring 1 to 2 m (3 to 6 ft) in thickness was found to underlie areas of the site, and oily seeps have been observed along the shoreline of Lake Washington adjacent to the property. Elevated concentrations of metals, PAHs, and VOCs have been detected in surface water and sediment samples collected from Lake Washington adjacent to the property and from the area of the former T-pier.

In 2004, a risk assessment/feasibility study was conducted by a consultant working under contract to the property owner. A hazard ranking system package was completed by Region 10 of the U.S. Environmental Protection Agency (USEPA) on August 24, 2005. The Quendall Terminal site was proposed to the National Priorities List (NPL) on October 15, 1984, but was not placed on the NPL. The site was proposed to the NPL for a second time on September 14, 2005 and added to the NPL on April 19, 2006 (USEPA 2005b).

Surface water runoff and sediment transport are the primary pathways for the migration of contaminants from the site to NOAA trust resources; groundwater transport is a secondary pathway. Surface water and stormwater runoff at the Quendall Terminal site flows to three stormwater collection ponds, to the wetlands, and directly to Lake Washington. Runoff collected in the ponds is not treated or managed. One of the stormwater collection ponds, known as the Quendall Pond, has been observed overflowing to Lake Washington during heavy rains. A direct drainage route from one of the unnamed collection ponds along the former drainage channel to Lake Washington has also been observed (USEPA 2005a). Groundwater underlying the site flows to the west and discharges to Lake Washington (Anchor and Aspect 2003).

NOAA Trust Resources

The habitat of primary concern to NOAA is Lake Washington. Lake Washington empties to Lake Union, which is connected to Puget Sound via the Hiram M. Chittenden Locks, referred to locally as the Ballard Locks (Figure 1). A fish ladder at the locks provides fish passage for anadromous salmonids (WDFW 2005a).

NOAA trust resources present in the vicinity of the site include anadromous Chinook, coho, and sockeye salmon (Table 1). Near the site, the shoreline of Lake Washington provides critical migratory and rearing habitat for adult and juvenile Chinook, coho, and sockeye salmon, which spawn in May Creek and the Cedar River, south of the site (Figure 1). The Cedar River supports the largest sockeye run in the contiguous United States (Pauley, 1989). Sockeye also use the shoreline of Lake Washington in the vicinity of the site for spawning (King County 2005). NOAA Fisheries lists Chinook salmon as a threatened species and designates coho salmon as a species of concern (NOAA 2006). Bull trout, which are listed by the U.S. Fish and Wildlife Service (USFWS) as threatened, have been observed in the southern portion of Lake Washington. Bald eagles, which are also listed by the USFWS as threatened, have been observed feeding on salmon carcasses in the vicinity of the site (USFWS 2006).

Recreational fishing is common throughout Lake Washington and likely occurs adjacent to the Quendall Terminal site, where fishing boats are regularly observed (USEPA 2005a). NOAA trust resources targeted by recreational fishers include coho and sockeye salmon

(WDFW 2005b). A tribal commercial fishery exists in Lake Washington for sockeye salmon. Recreational fishing and the tribal commercial fishery are closely regulated, and fishing for coho and sockeye is allowed only after sufficient numbers of fish have passed through the Ballard Locks (WDFW 2005a). All wild Chinook are required to be released.

The Washington Department of Health (WDOH) has issued a fish consumption advisory for all of Lake Washington because of concentrations of mercury and polychlorinated biphenyls (PCBs). The advisory recommends no consumption of Northern pikeminnow by anyone. The advisory also recommends that the public limit consumption of yellow perch to no more than one meal per month if the fish is more than about 27 cm (10.5 in) in length and to no more than four meals per month if the fish are smaller. In addition, the advisory recommends that the public limit consumption of cutthroat trout to no more than one meal per month if the fish is more than about 30 cm (12 in) in length and to no more than three meals per month if the fish are smaller. The advisory further recommends that the public limit consumption of large- and smallmouth bass to no more than two meals per month (WDOH 2005).

Table 1. NOAA trust resources present in Lake Washington near the Quendall Terminal site (King County 2005; USEPA 2005a; WDFW 2005a, 2005b, 2005c).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Migratory Route	Comm.	Rec.
ANADROMOUS FISH						
Chinook salmon	*Oncorhynchus tshawytscha*		♦	♦		♦
Coho salmon	*Oncorhynchus kisutch*		♦	♦		♦
Sockeye salmon	*Oncorhynchus nerka*	♦	♦	♦	♦	♦

Site-Related Contamination

Large numbers of surface water, sediment, groundwater, and soil samples have been collected over the years during numerous environmental investigations conducted at the Quendall Terminal site. These samples have been analyzed for a wide range of environmental contaminants, including metals, semivolatile organic compounds (including PAHs), VOCs, and pesticides. Metals, PAHs, and VOCs have been detected in surface water, sediment, groundwater, and soil samples taken from the Quendall Terminal site and in surface water and sediment samples taken from Lake Washington adjacent to the property. Pesticides have also been detected in soil samples taken from the Quendall Terminal site. The primary contaminants of concern to NOAA are metals and PAHs. VOCs are secondary contaminants of concern to NOAA.

Table 2 summarizes the maximum concentrations of contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such guidance, the screening guidelines for groundwater and surface water are the ambient water quality criteria (AWQC) (USEPA 2002); the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs) (MacDonald et al. 2000); and the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs) (Efroymson et al. 1997) and the USEPA's ecological soil screening guidelines (USEPA 2005c). Exceptions to these screening guidelines, if any, are noted on Table 2. Only maximum concentrations that exceeded relevant screening guidelines or for which there are no screening guidelines are discussed below. When known, the general sampling locations (refer to Figure 2) are also provided for maximum concentrations that exceeded screening guidelines or do not have screening guidelines.

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Quendall Terminal site. Contaminant values in bold exceed or are equal to screening guidelines (Norton 1991; Hart Crowser 1997; Exponent 1999; Anchor and Aspect 2003; USEPA 2005a).

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	ORNL-PRG[a]	Ground-water	Surface Water	AWQC[b]	Sediment	TEC[c]
METALS/INORGANICS							
Arsenic	**31**	9.9	**150**	1	150	**18**	9.79
Cadmium	**1.9**	0.36[d]	ND	ND	0.25[e]	0.8	0.99
Chromium[f]	**65**	0.4	8	ND	11	N/A	43.4
Copper	30	60	**15**	ND	9[e]	**41**	31.6
Lead	**77**	40.5	**3**	ND	2.5[e]	**89**	35.8
Mercury	**0.11**	0.00051	ND	ND	0.77[g]	**0.27**	0.18
Nickel	**53**	30	30	ND	52[e]	N/A	22.7
Zinc	**109**	8.5	69	ND	120[e]	N/A	121
PAHs							
Acenaphthene	**3,200**	20	**1,900**	4.4	520[h]	**570**	0.290[i]
Acenaphthylene	200	NA	2,300	4.5	NA	**3**	0.160[i]
Anthracene	1,300	NA	1,300	ND	NA	**350**	0.0572
Benz(a)anthracene	1,900	NA	1,100	0.064	NA	**280**	0.108
Benzo(a)pyrene	2,100	NA	1,700	0.17	NA	**140**	0.15
Benzo(b)fluoranthene	1,700	NA	50	0.25	NA	280	NA
Benzo(k)fluoranthene	2,200	NA	17	0.089	NA	13	13.4[i]
Chrysene	2,500	NA	1,700	0.12	NA	**290**	0.166
Dibenz(a,h)anthracene	180	NA	420	0.092	NA	**39**	0.033
Fluoranthene	4,400	NA	2,800	0.3	NA	**1,400**	0.423
Fluorene	2,500	NA	2,200	0.2	NA	**510**	0.0774
Indeno(1,2,3-cd)pyrene	1,500	NA	830	0.15	NA	**84**	0.330[i]
2-Methylnaphthalene	5,200	NA	12,000	ND	NA	150	NA
Naphthalene	11,000	NA	**43,000**	2.2	620[h]	**160**	0.176
Phenanthrene	7,800	NA	6,200	ND	NA	**2,100**	0.204
Pyrene	5,200	NA	2,400	0.14	NA	**1,200**	0.195
Total PAHs	41,820	NA	81,050	11.2	NA	**7,300**	1.61
PESTICIDES							
Aldrin	0.13	NA	ND	N/A	3.0[j]	N/A	0.040[i]
Gamma-BHC (Lindane)	0.18	NA	ND	N/A	0.95[j]	N/A	0.00237
Heptachlor Epoxide	0.05	NA	ND	N/A	0.0038	N/A	0.00247
VOCs							
Benzene	4.4	NA	**30,000**	68	5,300[h,j]	260	NA
Ethylbenzene	92	NA	4,000	13	32,000[h,j]	N/A	NA
Toluene	28	200	3,400	16	17,500[h,j]	N/A	NA
Xylene	187	NA	7,800	4	NA	N/A	NA

Table 2 continued on next page.

Table 2, *cont.*

a:	Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).
b:	Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.
c:	Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).
d:	Ecological soil screening guidelines (USEPA 2005c).
e:	Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L CaCO3.
f:	Screening guidelines represent concentrations for Cr.+6
g:	Derived from inorganic, but applied to total mercury.
h:	Lowest observable effects level (LOEL) (USEPA 1986).
i:	Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.
j:	Chronic criterion not available; acute criterion presented.
N/A:	Not analyzed for.
NA:	Screening guidelines not available.
ND:	Not detected.

Surface Water

Eleven PAHs for which no screening guidelines are available were detected in surface water samples collected from the Quendall Terminal site. The maximum concentrations of all detected PAHs occurred in samples taken from Lake Washington adjacent to the site's northwestern shoreline. Detected PAHs for which no screening guidelines are available were acenaphthylene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, and pyrene. No screening guidelines are available for comparison to the maximum concentration of total PAHs.

The maximum concentration of the VOC, xylene, was detected in a sample taken from Lake Washington adjacent to the site's northwestern shoreline. No screening guideline is available for comparison to the maximum concentration of xylene.

Sediment

Four metals were detected in sediment samples collected from the Quendall Terminal site at maximum concentrations that exceeded TECs. The maximum concentrations of arsenic, copper, lead, and mercury were detected in samples collected from Lake Washington in the vicinity of the former T-pier. The maximum concentration of lead exceeded the TEC by a factor of 2.5. The maximum concentration of arsenic exceeded the TEC by a factor of 2. The maximum concentration of mercury exceeded the TEC by a factor of 1.5. The maximum concentration of copper slightly exceeded the TEC.

Thirteen PAHs were detected in sediment samples taken from the Quendall Terminal site at maximum concentrations that exceeded screening guidelines, and two PAHs for which no screening guidelines are available were also detected. The maximum concentrations of all 15 PAHs occurred in samples collected from Lake Washington in the vicinity of the former T-pier. The maximum concentration of phenanthrene exceeded the TEC by four orders of magnitude. The maximum concentrations of acenaphthene, anthracene, benz(a)anthracene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, and pyrene exceeded the TECs by three orders of magnitude. The maximum concentrations of benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and naphthalene exceeded the TECs by two orders of magnitude, and the maximum concentration of acenaphthylene exceeded the TEC by one order of magnitude. The maximum concentration of total PAHs exceeded the TEC by three orders of magnitude. No screening guidelines are available for comparison to the maximum concentrations of benzo(b)fluoranthene and 2-methylnaphthalene.

One VOC was detected in a sediment sample taken from the Quendall Terminal site. The maximum concentration of benzene occurred in a sample taken from Lake Washington in the vicinity of the former T-pier. No screening guideline is available for comparison to the maximum concentration of benzene. The presence of benzene may cause mobilization of PAHs.

Groundwater

Three metals were detected in groundwater samples collected from the Quendall Terminal site at maximum concentrations that exceeded screening guidelines. The maximum concentration of arsenic, which was detected in a sample taken from a monitoring well in the northwestern portion of the property, was equal to the AWQC. The maximum concentrations of copper and lead were detected in samples collected from monitoring wells in the southwestern portion of the property; the maximum concentration of copper was also detected in a sample collected from a monitoring well in the southeastern portion of the property. The maximum concentration of copper exceeded the AWQC by a factor of two, and the maximum concentration of lead slightly exceeded the AWQC.

Two PAHs were detected in groundwater samples taken from the Quendall Terminal site at maximum concentrations that exceeded screening guidelines, and 14 PAHs for which no screening guidelines are available were also detected. The maximum concentrations of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, pyrene, and total PAHs were detected in samples taken from a monitoring well in the central portion of the property. The maximum concentration of acenaphthene was also detected in a sample collected from a monitoring well in the southwestern portion of the Quendall Terminal property. The maximum concentration of naphthalene exceeded the AWQC by one order of magnitude, and the maximum concentration of acenaphthene exceeded the AWQC by a factor of four. No screening guidelines are available for comparison to the maximum concentrations of acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, and pyrene. No screening guidelines are available for comparison to the maximum concentration of total PAHs.

The maximum concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene, and phenanthrene were detected in groundwater samples collected from a monitoring well in the southwestern portion of the Quendall Terminal property. No screening guidelines are available for comparison to the maximum concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene, and phenanthrene.

One VOC was detected in groundwater samples taken from the Quendall Terminal site at a maximum concentration that exceeded the screening guideline, and one VOC for which no screening guideline is available was also detected. The maximum concentrations of benzene and xylene occurred in samples taken from monitoring wells along the northwestern shoreline and the central portion of the Quendall Terminal property. The maximum concentration of benzene exceeded the AWQC by a factor of six. No screening guideline is available for comparison to the maximum concentration of xylene.

Soil

Seven metals were detected in soil samples taken from the Quendall Terminal site at maximum concentrations that exceeded screening guidelines. The maximum concentration of arsenic, which exceeded the ORNL-PRG by a factor of three, was detected in a soil sample taken from the southeastern portion of the property.

The maximum concentrations of cadmium, lead, mercury, nickel, and zinc were detected in soil samples taken from the northwestern portion of the Quendall Terminal property. The maximum concentration of mercury exceeded the ORNL-PRG by two orders of magnitude. The maximum concentration of zinc exceeded the ORNL-PRG by one order of magnitude. The maximum concentration of cadmium exceeded the USEPA ecological soil screening guideline by a factor of five. The maximum concentrations of lead and nickel exceeded the ORNL-PRGs by a factor of two.

The maximum concentration of chromium, which was detected in a soil sample taken from the southwestern portion of the Quendall Terminal property, exceeded the ORNL-PRG by two orders of magnitude.

One PAH was detected in a soil sample taken from the Quendall Terminal site at a maximum concentration that exceeded screening guidelines, and 15 PAHs for which no screening guidelines are available were also detected. The maximum concentrations of acenaphthene, anthracene, dibenz(a,h)anthracene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and total PAHs were detected in soil samples taken from the southwestern portion of the Quendall Terminal property. The maximum concentration of acenaphthene exceeded the ORNL-PRG by two orders of magnitude. No screening guidelines are available for comparison to the maximum concentrations of anthracene, dibenz(a,h)anthracene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene. No screening guidelines are available for comparison to the maximum concentration of total PAHs.

The maximum concentrations of acenaphthylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene were detected in soil samples taken from the central portion of the Quendall Terminal property. No screening guidelines are available for comparison to these maximum concentrations.

The maximum concentrations of benz(a)anthracene and benzo(k)fluoranthene were detected in soil samples collected from the northeastern portion of the Quendall Terminal property. No screening guidelines are available for comparison to these maximum concentrations.

Three pesticides for which no screening guidelines are available were detected in soil samples taken from the Quendall Terminal site. The maximum concentrations of all three pesticides occurred in samples collected from the southeastern portion of the property. No screening guidelines are available for comparison to the maximum concentrations of aldrin, gamma-BHC (lindane), and heptachlor epoxide.

Three VOCs for which no screening guidelines are available were detected in soil samples taken from the Quendall Terminal site. The maximum concentrations of all three VOCs occurred in samples collected from the southwestern portion of the property. No screening guidelines are available for comparison to the maximum concentrations of benzene, ethylbenzene, and xylene.

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Glossary of terms

Adit Horizontal entrance to a mine.

Adult habitat The environment where an aquatic resource lives after reaching physical and sexual maturity.

Aestivation The dormant or sluggish state that some animals enter to cope with periods of hot and dry conditions.

Ambient water quality criteria (AWQC) The U.S. Environmental Protection Agency's (USEPA) compilation of nationally recommended water quality criteria, based on data and scientific judgments on pollutant concentrations and how they affect the environment or human health.[1]

Amphidromous refers to predominately freshwater species that require estuarine or marine waters for completion of larval phases.

Anadromous Migrating from marine waters to breed in freshwater. Examples of anadromous fish include salmon, river herring (alewife), and striped bass.

Aquifer An underground geological formation, or group of formations, containing water. Are sources of groundwater for wells and springs.

Aroclor A trade name for a group of polychlorinated biphenyls (PCBs).

Artesian aquifer An aquifer in which groundwater is confined under pressure by impermeable rock layers.

Baghouse dust Particles collected from the air by an air pollution system.

Bioavailable The fraction of the total chemical in the surrounding environment that is available for uptake by organisms. The environment may include water, sediment, suspended particles, and food items.

Biotransformation Chemical alteration of a substance within the body.

Body burden The amount of a chemical stored in the body at a given time, especially a potential toxin in the body as the result of exposure.

Boiler slag Molten inorganic material that drains to the bottom of the furnace when coal is being converted so that it can be used to create power.

Borehole A hole made with drilling equipment.

Brood To hatch eggs.

Capacitor An electric circuit element used to store charge temporarily.

Catadromous Living in fresh water but migrating to marine waters to breed. An example is the American eel.

Chemical affinity An attraction or force between particles that causes them to combine.

Coal tar A material obtained from the destructive distillation of coal in the production of coal gas. The crude tar contains a large number of organic compounds (e.g., benzene, naphthalene, methylbenzene, etc.), and is used as roofing, waterfproofing, and insulating compounds. It is also used as a raw material for dyes, drugs, and paints.

Confined aquifer An aquifer that is bounded above and below by impermeable rock layers.

Confluence The point where two or more streams meet or flow together.

Contaminants of concern Chemicals at a hazardous waste site that are likely to have an adverse effect on NOAA trust resources.

Contaminant partitioning In general, it is the tendency of a contaminant to be in the air, water, soil, or sediment based on the relative chemical affinities of that contaminant.

Decant To pour off without disturbing the sediment.

Demersal Dwelling at or near, sinking to, or deposited near the bottom of a body of water.

Depurate Elimination of a chemical from an organism by desorption, diffusion, excretion, egestion, biotransformation, or another route.

Desorption To remove an absorbed substance from.

Diadromous Fishes that migrate between fresh and salt water (e.g., salmon and American eel).

Effects range–low (ERL) NOAA sediment quality guidelines derived from the examination of a large number of individual contamination studies, all in salt water. The ERLs are indicative of contaminant concentrations below which adverse effects rarely occur.[2]

Egestion To discharge or excrete from the body.

Emergency Removal Action Steps taken to remove contaminated materials that pose imminent threats to local residents (e.g., removal of leaking drums or the excavation of explosive waste).[3]

Emergent plants/vegetation Rooted aquatic plants with some herbaceous vegetative parts that project above the water surface. Also referred to as emersed vegetation.

Emergent wetlands Class of wetland habitat characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens, that are present for most of the growing season.

Emergent wetland, subclass: non-persistent No obvious signs of emergent vegetation at certain seasons.

Emergent wetland, subclass: persistent Erect, rooted, herbaceous aquatic plants. Species that normally remain standing until the beginning of the next growing season.

Endangered species Animals, birds, fish, plants, or other living organisms threatened with extinction by anthropogenic (human-caused) or other natural changes in their environment.[3]

Endangered Species Act A 1973 act of Congress mandating that endangered and threatened species of fish, wildlife, and plants be protected and restored.

Environmental medium/media External conditions affecting the life, development, and survival of an organism, including air, water, and soil, which are the subject of regulatory concern and activities.

Ephemeral Short-lived or transitory.

Estuary, estuarine Region of interaction between rivers and nearshore marine waters, where tidal action and river flow mix fresh and salt water. Such areas include bays, mouths of rivers, salt marshes, and lagoons. These brackish water ecosystems shelter and feed marine life, birds, and wildlife. *See wetlands.*

Fish passage Features of a dam that enable fish to move around, through, or over without harm. Generally an upstream fish ladder or a downstream bypass system.

Flue A tunnel or conduit that connects a furnace to a chimney stack.

Forage To search for food.

Groundwater The supply of fresh water found beneath the earth's surface, which supplies wells and springs.[3]

Groundwater monitoring well See monitoring well.

Groundwater plume A visible or measurable discharge of a contaminant from a given point of origin into groundwater.

Habitat The place where a plant or animal species naturally lives and grows or characteristics of the soil, water, and biologic community (other plants and animals) that make this possible.

Habitat of concern The habitat that will be or is being affected by contaminants of concern from a hazardous waste site.

Hazardous ranking system/hazard ranking system package The principal screening tool used by the USEPA to evaluate risks to public health and the environment associated with abandoned or uncontrolled hazardous waste sites.[3]

Heavy metals Metallic elements with high atomic weights (e.g., mercury, chromium, cadmium, arsenic, and lead).

Hectare 2.471 acres or 10,000 square meters (m^2).

Heterogeneous Consisting of dissimilar parts or elements.

Hydrologic Unit Code (HUC) The United States is divided into hydrologic units for water resource planning and data management. Hydrologic units represent natural and human-imposed areas. Each HUC is a unique eight-digit number. The first two digits indicate the major geographic area or region, the second two digits indicate the sub-region, the third two digits indicate the accounting units, and the fourth two digits indicate the cataloging units. Cataloging units are also called "watersheds."

Hydrophyte (1) Plants that grow in water or saturated soils. (2) Any macrophyte that grows in wetlands or aquatic habitats on a substrate that is at least periodically deficient in oxygen because of excessive water content.

Ingot A mass of metal that is cast in a standard shape for convenient storage or transportation.

Inorganic compounds Chemical substances of mineral origin, not of basically carbon structure.

Intertidal That area of the shore between the high and low water marks; the intertidal zone of oceans and estuaries is regularly covered and exposed by the tides.

Invertebrate An animal without a spinal column or backbone.

Isomers Different substances that have the same formula.

Iteroparous Animals that do not die after spawning.

Juvenile habitat The environment in which an organism lives from one year of age until sexual maturity.

Karst A type of topography that results from dissolution and collapse of carbonate rocks such as limestone and dolomite and characterized by closed depressions or sinkholes, caves, and underground drainage.[4]

Leachate Water that collects contaminants as it trickles through wastes, pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, ground water, or soil.[3]

Lowhead dam Dams that range from a six-inch drop off to a 25- foot drop off.

Macrophyte A plant that can be seen without the aid of optics.

Mainstem The principal channel of a drainage system into which other smaller streams or rivers flow.

Marine Of or relating to the sea.

Marsh A type of wetland that does not accumulate appreciable peat deposits (partially decomposed plants and other organic materials that can build up in poorly drained wetland habitats) and is dominated by plants with little or no woody tissue. *See wetland.*

Materiel The equipment, apparatus, and supplies of a military force.

Mean U.S. soil screening guidelines Average concentrations of inorganic compounds found in natural soils of the United States.

Metals Chemical elements with particular properties that include being good conductors of electricity and heat; in these reports, generally synonymous with inorganic compounds.

Migratory corridor, migratory route A body of water that adult fish travel through but do not remain in for any significant time.

Monitoring well (1) A well used to obtain water quality samples or measure groundwater levels. (2) A well drilled to collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the amounts, types, and distribution of contaminants beneath a site.

National Priorities List A list of hazardous waste sites, compiled by the USEPA, where hazardous wastes have been found and the initial evaluation shows a significant risk to human health or the environment. NPL sites are often called "Superfund sites" because Superfund money can be used by the USEPA to investigate and clean up these sites.

Neutralization Decreasing the acidity or alkalinity of a substance by adding alkaline or acidic materials, respectively.

NOAA trust resources Natural resources in coastal and marine areas, including the anadromous and catadromous fish that migrate between freshwater and coastal and marine areas.

Nursery habitat The habitat where larvae or juveniles settle, seek shelter, feed, and mature.

Oligohaline A low salinity region of an estuary, typically 0.5 to 5.0 parts per thousand salinity.

Order of magnitude A change in the value of a quantity or unit by a factor of 10.

Ordnance Military materiel, such as weapons, ammunition, artillery, combat vehicles, and equipment.

Organic compounds / chemicals / substances / materials Naturally occurring (animal- or plant-produced) or synthetic substances containing mainly carbon, hydrogen, nitrogen, and oxygen.[3]

Outfall The point where wastewater or drainage discharges from a sewer pipe, ditch, or other conveyance to a receiving body of water.[5]

Palustrine wetland a wetland beyond the influence of tidal brackish waters and typically dominated by persistent vegetation that remain standing into the next growing season; most inland wetlands fall into this classification; located in upland areas.

Pathway (for migration of contaminants) The physical course a chemical or pollutant takes from its source to the exposed organism.[3]

Pelagic Living or occurring in the open sea.

Pentachlorophenol (PCP) A manufactured chemical that is not found naturally in the environment. It was used as a biocide and wood preservative, and was one of the most heavily used pesticides in the United States. Now, only certified applicators can purchase and use this chemical. It is still used in industry as a wood preservative for power line poles, railroad ties, cross arms, and fence posts.[6]

Pesticides Substances or mixtures thereof intended for preventing, destroying, repelling, or mitigating any pest.[3]

Polychlorinated biphenyls (PCBs) A group of synthetic organic compounds that can cause a number of different harmful effects. There are no known natural sources of PCBs in the environment. PCBs are either oily liquids or solids and are colorless to light yellow.[6]

Polycyclic aromatic hydrocarbons (PAHs) A group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. Also referred to as polycyclic aromatic hydrocarbons (PAHs).[6]

Rearing habitat *See nursery habitat.*

Remediation Cleanup or other methods used to remove or contain a toxic spill or hazardous materials from a Superfund site.[3]

Rinsate The solution remaining after something is rinsed.

Rock flour Very finely powdered rock, produced when rocks are ground together.

Runoff That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface-water. It can carry pollutants from the air and land into receiving waters.

Salinity A measurement of the amount (usually in parts per thousand) of salt in water.

Salmonid Fish of the family Salmonidae, which includes salmon and steelhead.

Sediment The organic material that is transported and deposited by wind and water.

Semivolatile organic compounds (SVOCs) Organic compounds that volatilize slowly at standard temperature (20°C and 1 atm pressure).

Slag The glassy waste product created during the smelting of metal ores.

Spawning habitat The habitat where fish reproduce.

Steam (or boiler) blowdown To control solids in the boiler water

Stormwater Precipitation that accumulates in natural and/or constructed storage and stormwater systems during and immediately following a storm event.

Storm sewer A system of pipes (separate from sanitary sewers) that carries water runoff from buildings and land surfaces.[3]

Substrate The composition of a streambed, including either mineral or organic materials.[7]

Sump A low-lying place such as a pit, that receives drainage.

Superfund Money collected from a special tax on chemicals and raw petroleum that is appropriated by Congress. These funds are used to investigate, evaluate, and clean up the worst hazardous waste sites in the U.S. These sites are listed on the NPL.

Supratidal The area of the shore above the normal high-tide line.

Surface water All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Surface water runoff Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions.[3]

Tailings Residue of raw material or waste separated out during the processing of crops or mineral ores.[3]

Threatened species Plants and animals whose numbers are very low or decreasing rapidly. Threatened species are not endangered species yet, but are likely to become endangered in the future.[8]

Threshold Effects Concentration (TEC) Concentration below which harmful effects are unlikely to be observed.

Threshold effect level (TEL) The concentration of a contaminant below which negative biological effects are expected to occur only rarely.

Trace elements In these reports, generally synonymous with inorganic compounds.

Trust resources *See NOAA trust resources.*

Trustee (for natural resources) The party responsible for maintaining the original characteristics of our land, water, and the plants and animals that live there. NOAA is a federal trustee for natural resources that spend any portion of their life cycle in a marine or estuarine environment; and their habitats.

Unconfined aquifer An aquifer that is not confined under pressure and is bounded by permeable layers.

Uptake The transfer of a chemical into or onto an aquatic organism.

Volatile organic compounds (VOCs) Organic compounds that evaporate readily.[6]

Wastewater The spent or used water from a home, community, farm, or industry, which contains dissolved or suspended matter.

Water Quality Criteria Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water table The level of groundwater.

Watershed The region draining into a river, river system, or other body of water.

Wetland An area that is saturated by surface or groundwater with vegetation adapted for life under those soil conditions including marshes, estuaries, swamps, bogs, and fens.

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[1] http://www.epa.gov/waterscience/ criteria/ (accessed August 2005).

[2] http://response.restoration.noaa.gov/cpr/sediment/SPQ.pdf (accessed August 2005).

[3] http://www.epa.gov/OCEPAterms/ (accessed August 2005).

[4] http://water.usgs.gov/pubs/circ/circ1166/nawqa91.e.html (accessed August 2005).

[5] http://www.forester.net/sw_glossary.html (accessed August 2005).

[6] http://www.atsdr.cdc.gov/toxprofiles/ (accessed August 2005).

[7] http://www.streamnet.org/pub-ed/ff/Glossary/ (accessed August 2005).

[8] http://www.epa.gov/espp/coloring/especies.htm (accessed August 2005).

Appendix

Table 1. List of the 377 hazardous Waste Site Reports published by NOAA to date. Sites in bold italics are included in this volume.

Region 1

Connecticut	Date	EPA Facility ID
Barkhamsted-New Hartford Landfill	1989	CTD980732333
Beacon Heights Inc. Landfill	1984	CTD07212206
Broad Brook Mill	2003	CT0002055887
Gallups Quarry	1989	CTD108960972
Kellogg-Deering Well Field	1987	CTD98067081
New London Naval Submarine Base	1990	CTD980906515
O'Sullivans Island	1984	CTD98066799
Raymark Industries, Inc.	1996	CTD001186618
Yaworski Waste Lagoon	1985	CTD00977496

Maine		
Brunswick Naval Air Station	1987	ME8170022018
Callahan Mining Corp	2004	MED980524128
Eastland Woolen Mill	2002	MED980915474
McKin Company	1984	MED980524078
O'Connor Company	1984	MED980731475
Portsmouth Naval Shipyard	1995	ME7170022019
Saco Municipal Landfill	1989	MED980504393

Massachusetts		
Atlas Tack Corporation	1989	MAD001026319
Blackburn & Union Privileges	1993	MAD982191363
Cannon Engineering	1984	MAD980525232

Region 1 *cont.*

Massachusetts *cont.*	**Date**	**EPA Facility ID**
Charles George Land Reclamation	1987	MAD003809266
General Electric - Housatonic River	1999	MAD002084093
Groveland Wells 1 & 2	1987	MAD980732317
Hanscom Air Force Base	1995	MA8570024424
Haverhill Municipal Landfill	1985	MAD980523336
Industri-Plex 128	1987	MAD076580950
Natick Research, Development, and Engineering Center	1995	MA1210020631
Naval Weapons Industrial Reserve Plant	1995	MA6170023570
New Bedford Harbor	1984	MAD980731335
Nyanza Chemical Waste Dump	1987	MAD990685422
South Weymouth Naval Air Station	1995	MA2170022022
Sullivan's Ledge	1987	MAD980731343
U.S. Army Materials Technology Laboratory	1995	MA0213820939

New Hampshire		
Beede Waste Oil	1997	NHD018958140
Coakley Landfill	1985	NHD06442415
Dover Municipal Landfill	1987	NHD98052019
Fletcher's Paint Works and Storage	1989	NHD001079649
Grugnale Waste Disposal Site	1985	NHD06991103
Mohawk Tannery	2005	NHD981889629
New Hampshire Plating Co., Inc.	1992	NHD001091453
Pease Air Force Base	1990	NH7570024847
Savage Municipal Water Supply	1985	NHD98067100
Sylvester's	1985	NHD09936354

Rhode Island		
Centredale Manor Restoration Project	2005	RID981203755
Davis Liquid Waste	1987	RID980523070
Kingston Dump/URI Disposal Area	1992	RID981063993
Naval Construction Battalion Center	1990	RI6170022036

Region 1 *cont.*

Rhode Island *cont.*	**Date**	**EPA Facility ID**
Naval Education Training Center	1990	RI6170085470
Peterson-Puritan, Inc.	1987	RID055176283
Picillo Farm	1987	RID980579056
Rose Hill Regional Landfill	1989	RID980521025
Stamina Mills Inc.	1987	RID980731442
Western Sand and Gravel	1987	RID009764929

Vermont		
BFI Sanitary Landfill	1989	VTD980520092
Elizabeth Mine	2003	VTD988366621
Ely Copper Mine	2003	VTD988366571
Old Springfield Landfill	1987	VTD00086023

Region 2

New Jersey		
Albert Steel Drum	1984	NJD00052515
American Cyanamid	1985	NJD00217327
Atlantic Resources	2004	NJD981558430
Bog Creek Farm	1984	NJD06315715
Brick Township Landfill	1984	NJD98050517
Brook Industrial Park	1989	NJD078251675
Chemical Control	1984	NJD00060748
Chemical Insecticide Corporation	1990	NJD980484653
Chipman Chemical (Reagent Chemical Company)	1985	NJD98052889
Cornell Dubilier Electronics, Inc.	1999	NJ981557879
Cosden Chemical Coatings Corp.	1987	NJD00056553
Curcio Scrap Metal Inc.	1987	NJD01171758
De Rewal Chemical Company	1985	NJD98076137
Denzer and Schafer X-Ray	1984	NJD04664440

Region 2 *cont.*

New Jersey *cont.*	Date	EPA Facility ID
Diamond Alkali/Diamond Shamrock Corporation	1984	NJD98052899
Diamond Head Oil Refinery Div.	2004	NJD092226000
Emmell's Septic Landfill	2002	NJD980772727
FAA Technical Center Atlantic City Airport	1990	NJ9690510020
Federal Creosote	***2007***	***NJ0001900281***
Garden State Cleaners	1989	NJD053280160
Global Sanitary Landfill	1989	NJD063160667
Hercules, Inc.	1984	NJD00234905
Higgins Disposal Service	1989	NJD053102232
Higgins Farm	1989	NJD981490261
Horseshoe Road Dump	1984	NJD9806636
Horseshoe Road Industrial Complex	1995	NJD980663678
Ideal Cooperage	1984	NJD98053290
Industrial Latex	1989	NJD981178411
Jackson Township Landfill	1984	NJD98050528
Kauffman & Minteer	1989	NJD002493054
Kin-Buc Landfill	1984	NJD04986083
Koppers Company	1984	NJD00244511
Krysowaty Farm	1985	NJD98052983
LCP Chemicals, Inc.	1999	NJD079303020
Lightman Drum Company	***2007***	***NJD014743678***
Martin Aaron, Inc.	2003	NJD014623854
Middlesex Sampling Plant	2002	NJ0890090012
Mobil Chemical Company	1984	NJD00060675
NL Industries	1984	NJD06184324
Perth Amboy's PCBs	1984	NJD98065390
PJP Landfill	1984	NJD98050564
Puchack Well Field	1999	NJD981084767
Quanta Resources	2004	NJD000606442
Roebling Steel Company	1984	NJD07373225
Roosevelt Drive-In	1984	NJD03025048

Region 2 *cont.*

New Jersey *cont.*	**Date**	**EPA Facility ID**
Route 561 Dump	2002	NJ0000453514
Sayreville Landfill	1984	NJD98050575
Sayreville Pesticide	1984	NA
Scientific Chemical Processing, Inc.	1984	NJD07056540
South Jersey Clothing Company	1989	NJD980766828
Syncon Resins	1984	NJD06426381
T. Fiore Demolition, Inc. Site	1984	NA
Toms River Chemical Company	1984	NA
United States Avenue Burn	2002	NJ0001120799
Universal Oil Products, Inc.	1984	NJD00200510
Ventron/Velsicol	1984	NJD98052987
White Chemical Company	1984	NJD00123918
Williams Property	1984	NJD98052994
Woodbrook Road Dump	2005	NJSFN0204260
Zschiegner Refining Company	1999	NJD986643153

New York		
Action Anodizing	1989	NYD072366453
Applied Environmental Services	1985	NYD98053565
Brookhaven National Laboratory	1990	NY7890008975
C & J Disposal Site	1989	NYD981561954
Carroll and Dubias Sewage Disposal	1989	NYD010968014
Computer Circuits	2002	NYD125499673
Consolidated Iron and Metal	2004	NY0002455756
Ellenville Scrap Iron and Metal	2003	NYSFN0204190
Jones Sanitation	1987	NYD98053455
Li Tungsten	1992	NYD986882660
Liberty Industrial Finishing	1985	NYD00033729
MacKenzie Chemical Works	2004	NYD980753420
Marathon Battery	1984	NYD01095975
Mattiace Petrochemical Company, Inc.	1989	NYD000512459

Region 2 *cont.*

New York *cont.*	**Date**	**EPA Facility ID**
North Sea Municipal Landfill	1985	NYD98076252
Old Roosevelt Field Contaminated Groundwater Area	2003	NYSFN0204234
Peter Cooper	1999	NYD980530265
Port Washington Landfill	1984	NYD98065420
Rowe Industries Groundwater Contamination	1987	NYD98148695
Sidney Landfill	1989	NYD980507677
Smithtown Groundwater Contamination	2003	NY0002318889
Stanton Cleaners Area Ground Water Contamination	2002	NYD047650197

Puerto Rico		
Clear Ambient Service	1984	PRD09041613
Frontera Creek	1984	PRD98064096
Naval Security Group Activity (NSGA)	1989	PR4170027383
Pesticide Warehouse III	2004	PRD987367299
Scorpio Recycling, Inc.	2005	PRD987376662
V&M/Albaladejo Farms	1997	PRD987366101
Vega Baja Solid Waste Disposal	2002	PRD980512669

Virgin Islands		
Island Chemical Company	1996	VID980651095
Tutu Wellfield	1993	VID982272569

Region 3

Delaware		
Army Creek Landfill	1984	DED98049449
Cokers Sanitation Services Landfills	1986	DED98070486
Delaware City PVC	1984	DED98055166
Delaware Sand & Gravel Landfill	1984	DED00060597
Dover Air Force Base	1987	DE857002401
Dover Gas and Light Company	1987	DED98069355
E.I. DuPont Newport Landfill	1987	DED98055512

Region 3 *cont.*

Delaware *cont.*	**Date**	**EPA Facility ID**
Halby Chemical Company	1986	DED98083095
Kent County Landfill	1989	DED980705727
Koppers Company Facilities	1990	DED980552244
National Cash Register Corporation	1986	DED04395838
New Castle Spill Site	1984	DED05898044
New Castle Steel	1984	DED98070525
Old Brine Sludge	1984	DED98070489
Pigeon Point Landfill	1987	DED98049460
Sealand Limited	1989	DED981035520
Standard Chlorine of Delaware, Inc.	1986	DED04121247
Sussex County Landfill	1989	DED980494637
Tybouts Corner Landfill	1984	DED00060607
Wildcat Landfill	1984	DED98070495

Maryland		
68th Street Dump/Industrial Enterprises	2002	MDD980918387
Aberdeen, Michaelsville Landfill	1986	MD3210021355
Aberdeen Proving Ground – Edgewood Area	1986	MD2210020036
Andrews Air Force Base	2003	MD0570024000
Anne Arundel County Landfill	1989	MDD980705057
Beltsville Agricultural Research Center	1995	MD0120508940
Brandywine DRMO	2003	MD9570024803
Bush Valley Landfill	1989	MDD980504195
Central Chemical Corporation	1999	MDD003061447
Fort George G. Meade	1997	MD9210020567
Joy Reclamation Co.	1984	MDD030321178
Naval Air Station Patuxent River	1996	MD7170024536
Ordnance Products, Inc.	1995	MDD982364341
Sand, Gravel and Stone	1984	MDD980705164
Southern Maryland Wood Treating	1987	MDD980704852
Woodlawn County Landfill	1987	MDD980504344

Region 3 *cont.*

Pennsylvania	Date	EPA Facility ID
Austin Avenue Radiation Site	1993	PAD987341716
Boarhead Farms	1989	PAD047726161
Bridesburg Dump	1984	PAD98050840
Butler Tunnel	1987	PAD98050845
Crater Resources, Inc.	1993	PAD980419097
Croydon TCE	1986	PAD98103500
Douglassville Disposal Site	1987	PAD00238486
Elizabethtown Landfill	1989	PAD980539712
Enterprise Avenue	1984	PAD98055291
FMC Marcus Hook, aka East Tenth St. Industrial Area	1996	PAD980714505
Foote Mineral Company	1993	PAD077087989
Hellertown Manufacturing Company	1987	PAD00239074
Jacks Creek/Sitkin Smelting & Refining.	1989	PAD980829493
Keyser Avenue Borehole	1989	PAD981036049
Lower Darby Creek Area	2003	PASFN0305521
Metal Bank of America	1984	PAD04655709
Occidental Chemical/Firestone	1989	PAD980229298
Paoli Railyard	1987	PAD98069259
Publicker Industries	1990	PAD981939200
Recticon/Allied Steel Corporation	1989	PAD002353969
Revere Chemical Company	1986	PAD05139549
Rohm and Haas Landfill	1986	PAD09163797
Salford Quarry	1997	PAD980693204
Tinicum National Environmental Center	1986	PA614351544
Tysons Dump	1985	PAD98069202
UGI Columbia Gas Plant	1995	PAD980539126
U.S. Navy Ships Parts Control Center	1996	PA3170022104
Wade (ABM) Site	1984	PAD98053940

Virginia		
Abex Corporation	1989	VA980551683

Region 3 *cont.*

Virginia *cont.*	**Date**	**EPA Facility ID**
Arrowhead Associates Inc./Scovill Corporation	1989	VAD042916361
Atlantic Wood Industries, Inc.	1987	VAD99071041
C and R Battery Co., Inc.	1987	VAD04995791
Chisman Creek	1984	VAD98071291
Former Nansemond Ordnance Depot	2002	VAD123933426
Fort Eustis	1996	VA6210020321
Kim-Stan Landfill	2002	VAD077923449
Langley Air Force Base	1995	VA2800005033
Marine Corps Combat Development Command Quantico	1995	VA1170024722
Naval Amphibious Base Little Creek	2002	VA5170022482
Naval Surface Weapons Center, Dahlgren Laboratory	1993	VA7170024684
Naval Weapons Station Yorktown	1993	VA8170024170
Norfolk Naval Base	1997	VA6170061463
NWS Yorktown - Cheatham Annex	2004	VA3170024605
Saunders Supply Company	1987	VAD00311738
St. Juliens Creek Annex (U.S. Navy)	***2007***	***VA5170000181***
USN Norfolk Naval Shipyard	1999	VA1170024813

Washington D.C.		
Washington Naval Yard	1999	DC91700243100

Region 4

Alabama		
American Brass, Inc.	2002	ALD98186846
Ciba-Geigy Corporation	1990	ALD001221902
Olin Chemical Corporation	1990	ALD008188708
Redwing Carriers, Inc.	1989	ALD980844385

Region 4 *cont.*

Florida	Date	EPA Facility ID
62nd Street Dump	1984	FLD98072887
Agrico Chemical Company	1989	FLD980221857
American Creosote Works	1984	FLD00816199
Broward County/21st Manor Dump	1992	FLD9819300506
Chem-Form, Inc.	1990	FLD080174402
Harris Corporation/General Development Utilities	1986	FLD00060233
Helena Chemical Company	1993	FLD053502696
Kassouf-Kimerling	1984	FLD00060233
MRI Corporation	1997	FLD088787585
Munisport Landfill	1984	FLD08453544
Naval Air Station Cecil Field	1990	FL5170022474
Naval Air Station Jacksonville	1990	FL6170024412
Naval Air Station Whiting Field	1996	FL2170023244
Pensacola Naval Air Station	1990	FL9170024567
Picketville Landfill	1984	FLD98055635
Solitron Microwave	2002	FLD045459526
Standard Auto Bumper Corporation	1989	FLD004126520
Stauffer Chemical Company	1993	FLD004092534
Stauffer Chemical Company	1993	FL010596013
Tyndall Air Force Base	1997	FL1570024124
United Metals, Inc.	2004	FLD098924038
Woodbury Chemical Company	1989	FLD004146346

Georgia		
Brunswick Wood Preserving	1997	GAD981024466
Camilla Wood Preserving	1999	GAD008212409
Terry Creek Dredge Spoil/Hercules Outfall	1997	GAD982112658

Mississippi		
Chemfax, Inc.	1995	MSD008154486
Davis Timber Company	2004	MSD046497012

Region 4 *cont.*

Mississippi *cont.*	**Date**	**EPA Facility ID**
Gautier Oil Company, Inc.	1989	MSD098596489
Picayune Wood Treating Site	***2007***	***MSD065490930***

North Carolina		
ABC One Hour Cleaners	1989	NCD024644494
Camp Lejeune Marine Corps Base: Site 21 Lot 40	1989	NC6170022580
FCX, Incorporated	1989	NCD981475932
New Hanover County Airport Burn Pit	1989	NCD981021157
Potter's Septic Tank Services Pits	1989	NCD981023260
Reasor Chemical Company	2004	NCD986187094

South Carolina		
Geiger (C&M Oil)	1984	SCD98071127
Helena Chemical Company	1989	SCD058753971
Koppers Company, Inc., Charleston Plant	1993	SCD980310239
Macalloy Corporation	2004	SCD003360476
Savannah River Plant	1990	SC1890008989
Wam Chem, Inc.	1984	SCD03740536

Region 5

Wisconsin		
Ashland/Northern States Power Lakefront	***2007***	***WISFN0507952***
Fox River NRDA/PCB Releases	2003	WI0001954841

Region 6

Louisiana		
Bayou Sorrell	1984	LAD98074554

Region 6 *cont.*

Louisiana *cont.*	Date	EPA Facility ID
Delatte Metals	2002	LAD052510344
Devil's Swamp Lake	***2007***	***LAD981155872***
Madisonville Creosote Works	1997	LAD981522998
Mallard Bay Landing Bulk Plant	2004	LA0000187518

Texas		
ALCOA (Point Comfort/Lavaca Bay)	1995	TXD008123168
Bailey Waste Disposal	1985	TXD98086464
Brine Service Company	2004	TX0000605264
Brio Refining, Inc.	1989	TXD980625453
Crystal Chemical Company	1989	TXD990707010
Dixie Oil Processors	1989	TXD089793046
French Limited	1989	TXD980514814
Gulfco Marine Maintenance	***2007***	***TXD055144539***
Highlands Acid Pits	1989	TXD980514996
Malone Service Company, Inc.	2003	TXD980854789
Motco Corp.	1984	TXD98062985
Palmer Barge Line	2005	TXD068104561
Patrick Bayou	2003	TX000605329
Sikes Disposal Pits	1989	TXD980513956
Star Lake Canal	***2007***	***TX0001414341***
State Marine	1999	TXD099801102
Tex-Tin Corporation	1989	TXD062113329

Region 9

American Samoa		
Taputimu Farm	1984	ASD98063765

Region 9 *cont.*

California	Date	EPA Facility ID
Alviso Dumping Areas	1985	NA
Camp Pendleton Marine Corps Base	1990	CA2170023533
Coast Wood Preserving	1984	CAD06301588
Cooper Drum Company	1993	CAD055753370
CTS Printex, Inc.	1989	CAD009212838
Del Amo	1992; 2004	CAD029544731
Del Norte County Pesticide Storage Area	1984	CAD00062617
El Toro Marine Corps Air Station	1989	CA6170023208
Fort Ord Army Base	1990	CA7210020676
GBF, Inc. Dump	1989	CAD980498562
GBF/Pittsburg Landfill	1993	CAD980498562
Hewlett-Packard	1989	CAD980884209
Intersil, Inc., and Siemens Components	1989	CAD041472341
Iron Mountain Mine	1989	CAD980498612
Jasco Chemical Corporation	1989	CAD009103318
Liquid Gold Oil Corporation	1984	CAT00064620
McCormick & Baxter Creosoting Company	1993	CAD009106527
MGM Brakes	1984	CAD00007412
Moffett Field Naval Air Station	1986	CA217009007
Montrose Chemical Corportion	1985	CAD00824271
Naval Air Station Alameda	1989	CA2170023236
Naval Weapons Station	1989	CA7170024528
Naval Weapons Station Concord	1993	CA7170024528
Naval Station Treasure Island – Hunters Point Annex	1989	CA1170090087
Pacific Coast Pipelines	1989	CAD980636781
Riverbank Army Ammunition Depot	1989	CA7210020759
Sola Optical USA, Inc.	1989	CAD981171523
Travis Air Force Base	1990	CA5570024575
Zoecon Corporation/ Rhone-Poulenc, Incorporated	1985	CAT00061135

Region 9 *cont.*

Guam	Date	EPA Facility ID
Andersen Air Force Base	1993	GU6571999519

Hawaii		
Del Monte Corporation (Oahu Plantation)	1995	HID980637631
Pearl City Landfill	1984	HID980585178
Pearl Harbor Naval Complex	1992	HI4170090076

Region 10

Alaska		
Elmendorf Air Force Base	1990	AK8570028649
Fort Richardson	1995	AK6214522157
Klag Bay Site	2002	AK0002364768
Naval Air Station Adak	1993	AK7170090099
Standard Steel	1990	AK980978787

Idaho		
Blackbird Mine	1995	IDD980725832
Stibnite/Yellow Pine Mining Area	2003	ID9122307607

Oregon		
Allied Plating, Inc.	1987	ORD009051442
Gould, Inc.	1984	ORD095003687
Harbor Oil	2004	ORD071803985
Martin-Marietta Aluminum Co.	1987	ORD052221025
McCormick & Baxter Creosoting Company	1995	ORD009020603
Northwest Pipe and Casing Company	1993	ORD980988307
Portland Harbor	2003	ORSFN1002155
Stauffer Chemical Company	1984	NA
Taylor Lumber and Treating	2005	ORD009042532

Region 10 *cont.*

Oregon *cont.*	**Date**	**EPA Facility ID**
Teledyne Wah Chang	1985	ORD050955848
Union Pacific Tie Treating Facility	1990	ORD009049412

Washington		
Aluminum Company of America (ALCOA)	1989	WAD009045279
American Crossarm and Conduit Company	1989	WAD057311094
Bonneville Power Administration, Ross Complex	1990	WA1891406349
Centralia Landfill	1989	WAD980836662
Commencement Bay, Nearshore Sites	1984	WAD980726368
Commencement Bay, South Tacoma	1984	WAD980726301
Hamilton Island Landfill	1992	WA5210890096
Hanford – Areas 100, 200, 300, 1100	1989	WA3890090075
Harbor Island	1984	WAD980722839
Jackson Park Housing Complex	1995	WA3170090044
Kent Highlands Landfill	1989	WAD980639462
Lower Duwamish Waterway	2003	WA0002329803
Naval Air Station Whidbey Island Ault Field	1986	WA5170090059
Naval Air Station Whidbey Island Seaplane Base	1986	WA6170090058
Northwest Transformer	1989	WAD027315621
Oeser Company	1997	WAD008957243
Old Navy Dump	1996	WA8680030931
Pacific Sound Resources	1995	WAD009248287
Puget Sound Naval Shipyard	1995	WA2170023418
Quendall Terminal	***1985; 2007***	***WAD980639215***
Tulalip Landfill	1992	WAD980369256
U.S. Naval Submarine Base, Bangor	1990	WA5170027291
Western Processing	1984	WAD009487513
Wyckoff Company Eagle Harbor	1986	WAD009248295

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August 2007

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