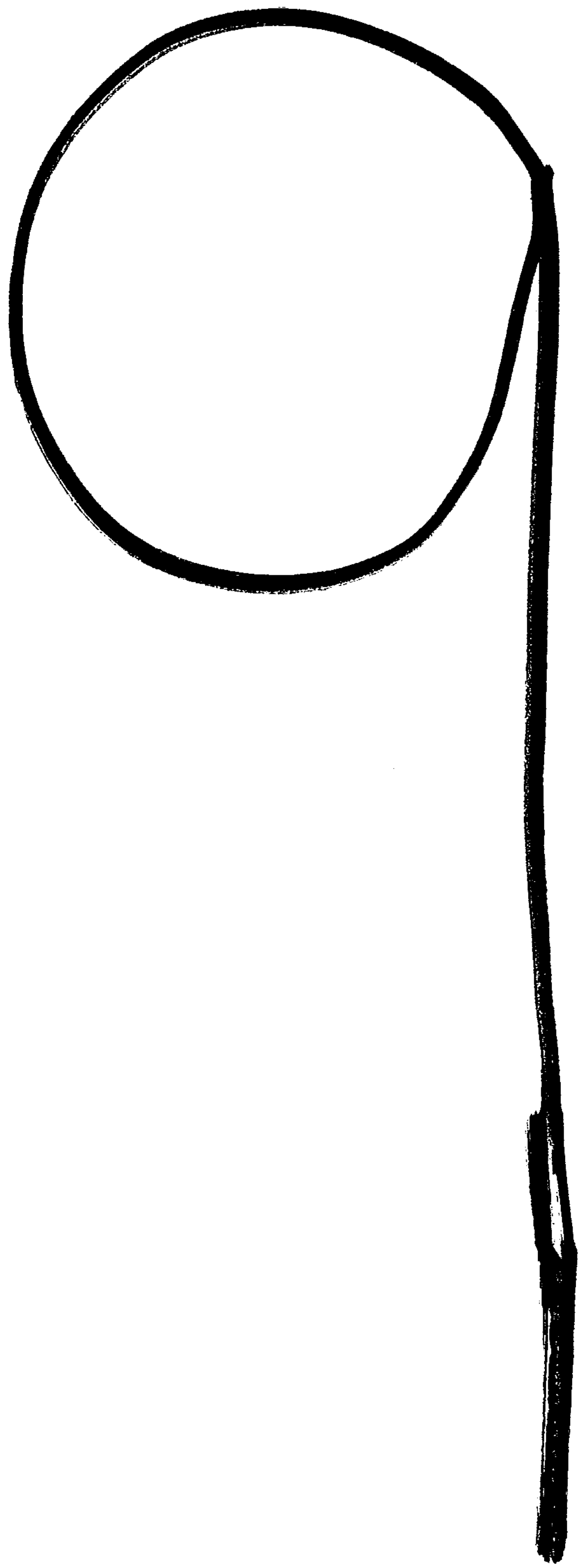

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E.C.JORDAN CO. ENGINEERS & SCIENTISTS

REMEDIAL INVESTIGATION FEASIBILITY STUDY NORTH LAWRENCE OIL DUMP SITE

ST. LAWRENCE COUNTY, N.Y.

SUBMITTED TO:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

FIRST PHASE FEASIBILITY STUDY

PREPARED BY:

E.C. JORDAN CO.

APRIL 1990

NORTH LAWRENCE OIL DUMP SITE
TOWNSHIP OF LAWRENCE
ST. LAWRENCE COUNTY, NEW YORK

FIRST PHASE FEASIBILITY STUDY

Prepared for:

DIVISION OF HAZARDOUS WASTE REMEDIATION
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK

Prepared by:

E.C. JORDAN CO.
PORTLAND, MAINE
Job No. 5809-30

APRIL 1990

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NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

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1.0 INTRODUCTION

E.C. Jordan Co. (Jordan), under contract to the New York State Department of Environmental Conservation (DEC), prepared this First Phase Feasibility Study (FS) of the North Lawrence Oil Dump Site (NLODS), located in the Township of Lawrence in St. Lawrence County, New York. This FS was prepared in accordance with DEC requirements, as identified in the Request for Proposal dated October 1987 and the site meeting on October 29, 1987. It identifies Applicable or Relevant and Appropriate Requirements (ARARs); describes the development of remedial response objectives and target clean-up levels; describes the identification and screening of technologies, and development and screening of remedial alternatives; and contains treatability study recommendations.

1.1 PURPOSE AND SCOPE OF THE FEASIBILITY STUDY

The purpose of the NLODS FS is to develop and screen potential remedial alternatives to allow DEC to select a remedial action that accomplishes the following criteria:

- protects human health and the environment
- attains federal and state public health and environmental requirements identified for the North Lawrence site, including ARARs
- uses permanent solutions and alternative treatment technologies to the maximum extent practicable, given feasible and available technologies
- uses treatment to permanently and significantly reduce the toxicity, mobility, or volume of wastes
- complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA)
- minimizes costs

This FS evaluates information obtained during the First Phase Remedial Investigation (RI), including site and waste characterization, and fate and transport of contaminants. This study also incorporates conclusions in the Risk Assessment (RA) regarding contaminants of concern, exposure pathways, and threats to public health and the environment from exposure to site contaminants.

The FS evaluates RI and RA conclusions and identifies chemical-, location-, and action-specific ARARs for the site. Then, based on identified ARARs and assessment of risk, general remedial response objectives are described, followed by target clean-up levels for each contaminant of concern and affected medium. These clean-up levels are set at concentrations that will reduce risk and meet ARARs.

As a preliminary step to developing alternatives, potential remedial technologies to clean up the site are identified and screened for effectiveness and implementability. These technologies and associated containment or disposal requirements are assembled into alternatives, which separately address remediation of site sludge, soil, sediments, and surface water. Based on the RI and RA conclusions, site groundwater is not considered a risk to public health and the environment; therefore, groundwater is not considered in this FS.

The National Contingency Plan (NCP) specifies that remedial alternatives be classified as either source control or management-of-migration remedial actions. Source control remedial actions primarily address situations in which hazardous substances remain at or near the areas where they originally were located; these hazardous substances are not adequately contained to prevent exposure to receptors or migration into the environment. The purpose of source control remedies is to prevent or minimize exposure to and migration of hazardous substances from source materials.

Management-of-migration remedial actions are formulated for cases in which hazardous substances, having migrated from the original contaminant source, pose a threat to public health, welfare, or the environment. Typically, management-of-migration alternatives involve groundwater response actions where contaminated groundwater has moved downgradient from the source or beyond site boundaries.

Management-of-migration remedial actions are not considered for the NLODS because (1) groundwater does not pose a risk to public health, and (2) wetland sediments are located next to the lagoon (i.e., near the original source area). Because sludge, soil, and sediment contain the same contaminants and are in the same general area, remedial alternatives developed for all three media are classified as source control alternatives.

For the NLODS, Jordan formulated a range of remedial alternatives, varying in the extent that they rely on long-term management of treatment residuals and untreated wastes. Remedial actions include alternatives involving waste treatment to reduce mobility, toxicity, or volume that still require long-term management or monitoring; an alternative using a permanent treatment or destruction technology that eliminates the need for long-term management; a containment/disposal alternative requiring little or no treatment; and a minimal, no-action alternative.

These alternatives are screened initially to eliminate those ineffective in protecting human health and the environment, not implementable, and not cost-effective. Cost is an important consideration when comparing alternatives providing similar results. However, costs are not used to discriminate between treatment and non-treatment alternatives. The list of alternatives was narrowed by eliminating those that (1) are not technically reliable, do not effectively and adequately protect public health and the environment, or do not attain ARARs; (2) are not technically feasible or available, or require significant institutional or administrative effort during implementation or operation; and (3) are significantly more costly than other alternatives, but fail to provide greater reliability, effectiveness, or environmental/public health benefits.

1.2 SUMMARY OF REMEDIAL INVESTIGATION

This section summarizes the information and conclusions in the RI to clearly present the scope of remediation developed in subsequent sections.

1.2.1 Site Description and History

NLODS is an inactive hazardous waste site in the Township of Lawrence in St. Lawrence County, New York. The site, located south of McAuslen Road and east of Cemetery Road, occupies an area approximately 600 feet long and 75 feet wide. A regulated wetland next to the southern portion of the site drains to Redwater Brook (Figure 1-1).

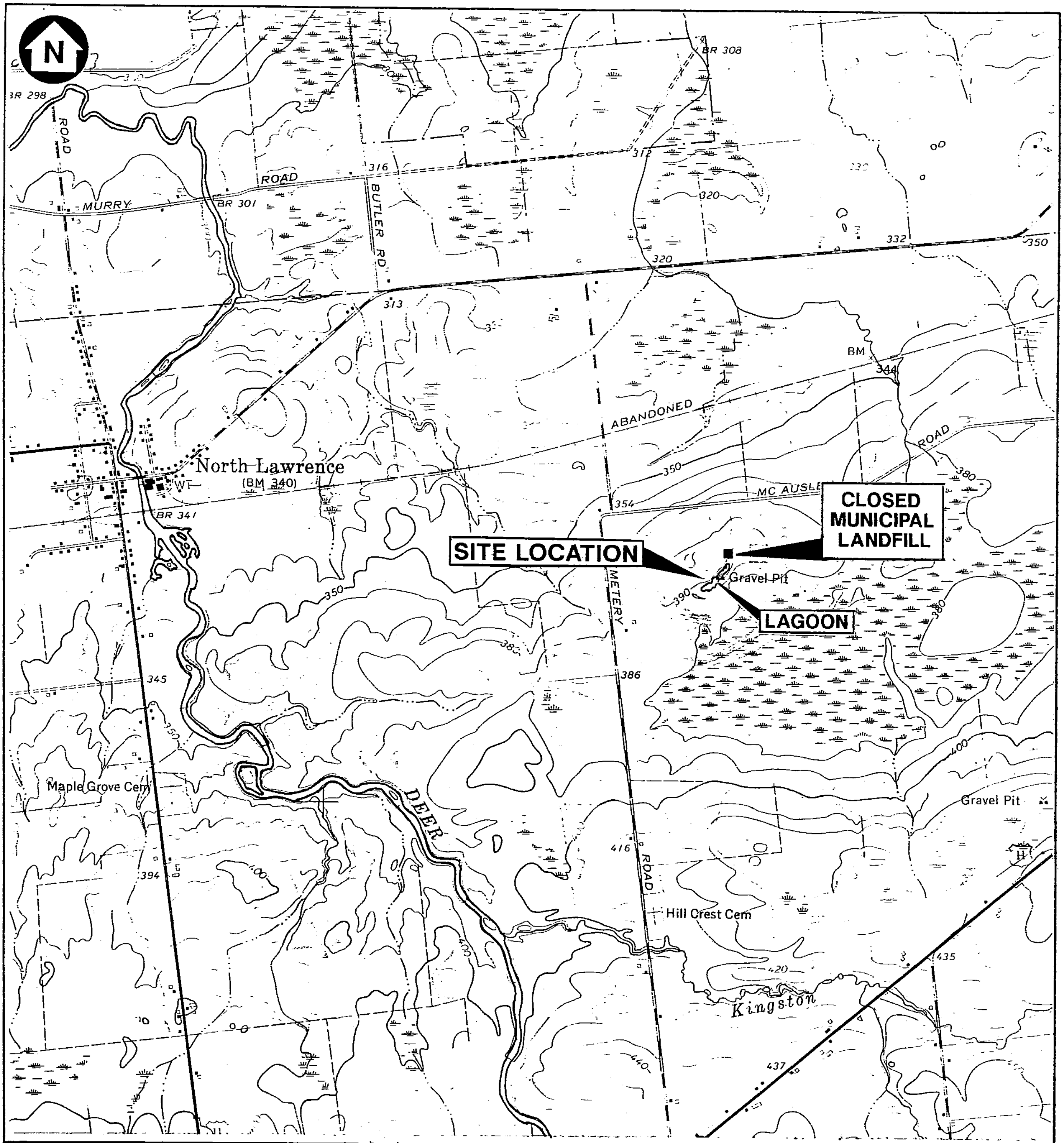
NLODS is approximately 390 feet above mean sea level, with higher terrain located south of the site. Topography in the immediate vicinity is generally flat, sloping downward to the north and northwest with an approximate 1 percent grade. Reportedly, the site area initially was operated as a gravel pit; currently, it appears as a slight depression surrounded by a soil berm.

Regional surface drainage is north and northwest via tributaries of Deer River and Redwater Brook. Wetlands occupy much of the local landscape. Drainage of the site area is directed southwest by surface topography and enters a wetland next to the site on the south. Drainage is then directed northward via tributaries of Redwater Brook.

The lagoon slopes down from a high elevation at the northeastern end to a low at the southwestern end. Surface runoff from meltwater in the spring and rainfall throughout the year drains to the southwest and is subsequently ponded, to a depth of approximately 3 to 4 feet in the southwestern end of the lagoon. Approximately 3 to 4 feet of oil sludge was encountered during the drilling program in the southwestern and northeastern ends of the lagoon. No oil sludge to sludge several inches thick was found in the center of the lagoon, which is bisected by an access road.

Surface water from the lagoon enters the regulated wetland, considered a sensitive environment, by flowing over the berm at the southwestern end. The wetland area drains into Redwater Brook, which discharges to Deer River approximately 5 miles downstream of the site. Deer River eventually discharges to the St. Lawrence River. According to the New York DEC, Deer River is not classified as suitable for a drinking water supply. Groundwater is the primary source of area drinking water.

NLODS, listed in the New York State Registry of Inactive Hazardous Waste Sites, occupies portions of two privately owned properties, and is adjacent to the closed North Lawrence Town Landfill (see Figure 1-1). The landfill apparently was a trench-and-fill operation that primarily accepted residential and bulky



SOURCE: USGS TOPOGRAPHIC 7.5 MINUTE SERIES, NORTH LAWRENCE, NY, 1964.

SCALE IN FEET

0 2000 4000

FIGURE 1-1
SITE LOCATION MAP
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

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waste and white goods. However, industrial and/or agricultural wastes might have been disposed of at the landfill.

NLODS was identified as a possible waste oil disposal site during an October 1980 investigation of the abandoned York Oil Company waste oil site in Moira in Franklin County, New York. Information obtained during interviews with Moira residents by U.S. Environmental Protection Agency (USEPA) personnel indicated the existence of a similar waste oil dump in North Lawrence.

NLODS reportedly was operated as a gravel pit prior to the disposal of waste oil. The excavation operation apparently shaped the site into a small depression with a mounded perimeter. During the middle to late 1960s, the NLODS apparently was used for disposal of waste oil and oil sludge. Evidence of oil deposits over the topographically low perimeter berm at the southwestern end and on vegetation in adjacent wetlands suggests the dump was operated as a lagoon. During periods of high water, free-floating oil escaped from the southwestern end of the lagoon. During an inspection of the area on October 7, 1980, DEC personnel observed stains on vegetation 18 inches above the ponded water.

Since its discovery in 1980, numerous inspections of the NLODS have been conducted by DEC, Regions 5 and 6, and the New York State Department of Health (DOH) Massena District Office. On November 27, 1984, a DEC engineer collected two sediment/soil samples from the lagoon for analyses of polychlorinated biphenyls (PCBs). One sample had a concentration of 100 milligrams per kilogram (mg/kg) of PCBs; the second sample yielded a concentration of 5 to 30 mg/kg of PCBs.

A New York State Superfund Phase I Study of the site was completed in August 1985 for DEC by RECRA Research, Inc. (RECRA), of Amherst, New York. The study reported a Hazard Ranking System (HRS) score of 31.6 and a direct contact score of 12.5 (RECRA Research, Inc., 1985). The HRS score provides a method by which uncontrolled hazardous waste sites may be systematically assessed for the potential risk a site might pose to public health and the environment. These HRS scores reflect conditions at the site that warrant further investigation.

Field investigations for the First Phase RI were conducted from March through May 1989 (E.C. Jordan Co., 1990a). A summary of the results and conclusions of the First Phase RI, submitted to the New York State DEC in February 1990, is presented in the following subsection.

1.2.2 Site Contamination and Risk Assessment

The NLODS field investigation included soil test borings, piezometer installations, and monitoring well installations. The location of each boring is shown in Figure 1-2.

Results of sampling during the RI indicated elevated levels of PCBs, total petroleum hydrocarbons (TPHs), trichloroethene (TCE), tetrachloroethene (PCE), lead, and several other inorganics in the oil sludge layer (from zero to 4 feet) and the soil/sludge transition zone (4 to 6 feet below ground surface [bgs]) in the lagoon. Contamination was particularly evident in the

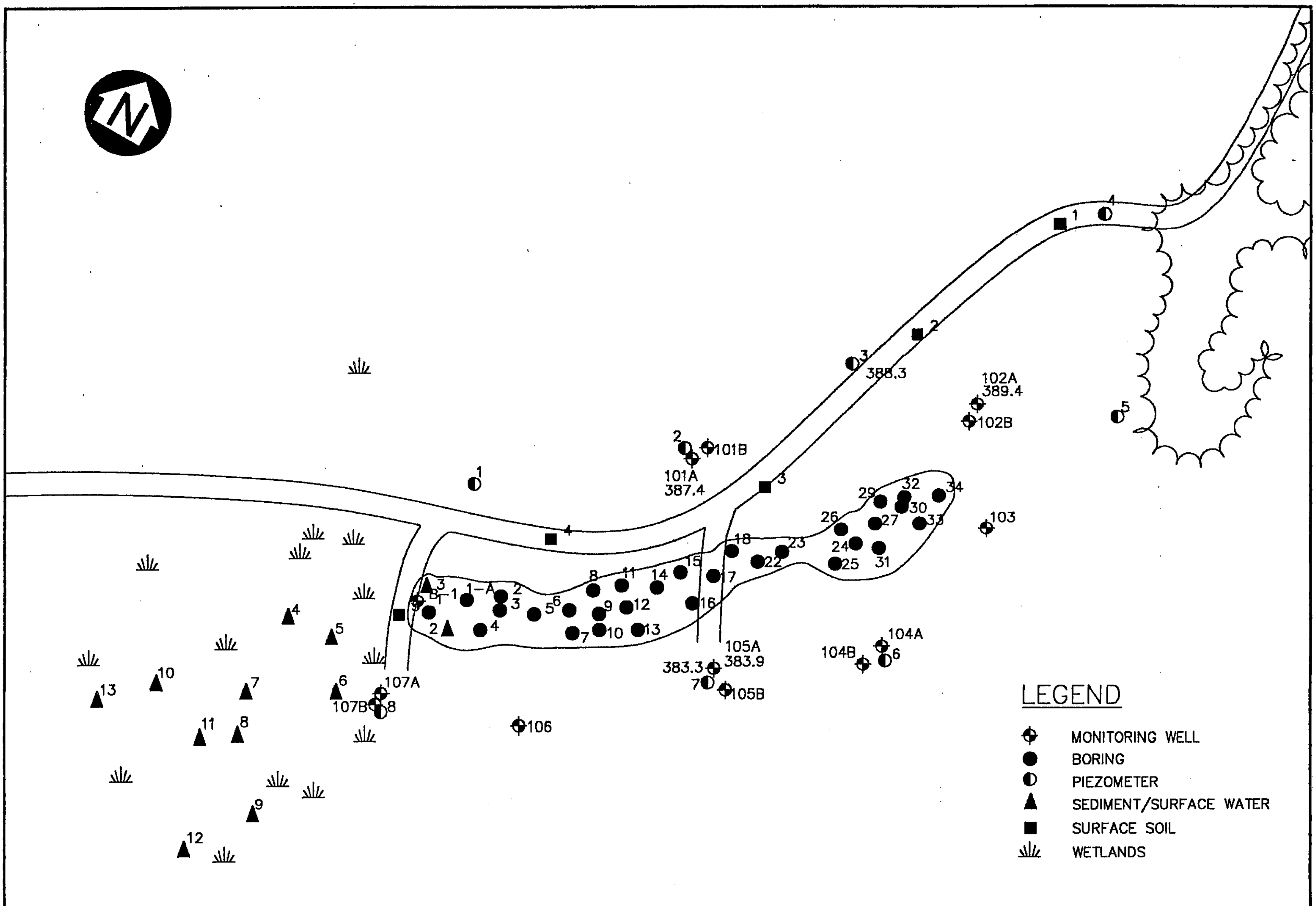


FIGURE 1–2
SAMPLE LOCATION MAP
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

E. C. JORDAN CO.

southwestern and northeastern ends of the lagoon. PCBs were detected in one surface soil sample and PCBs, lead, and various volatile organic compounds (VOCs) were detected in the sediments. Surface water samples primarily contained inorganics, particularly lead, and trace to non-detectable levels of VOCs and PCBs. Various inorganics were detected in the groundwater; however, detected compounds have only Secondary Maximum Contaminant Levels (MCLs) and were therefore not considered a risk to public health and the environment because Secondary MCLs are based on non-health-related criteria. TCE and PCE were detected in one groundwater monitoring well at concentrations exceeding New York State MCLs. Finally, PCBs and some elevated levels of inorganics were detected in biota samples collected at the site. No PCBs were detected in the air at the site.

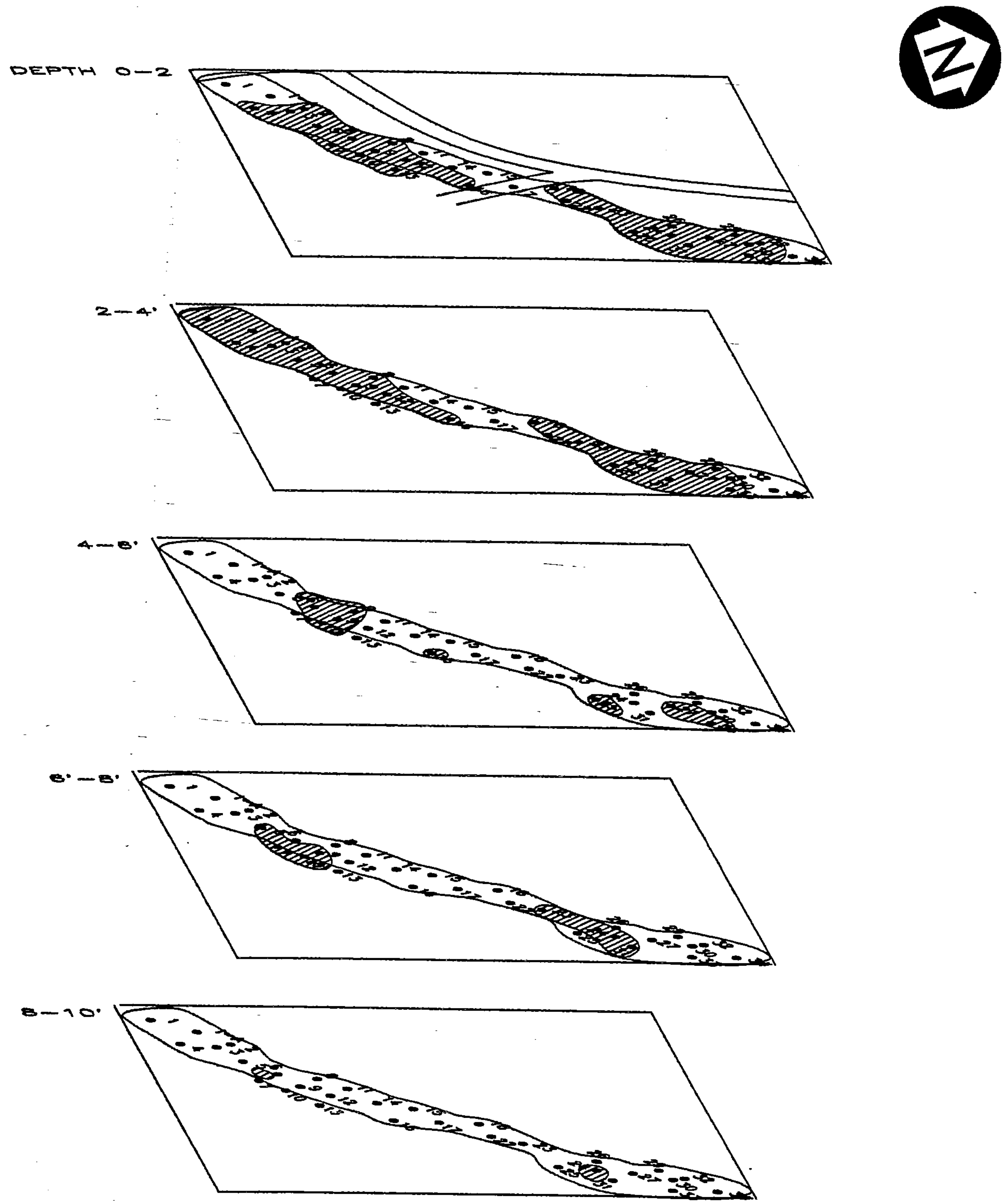
1.2.2.1 Soils. The RA indicated that no unacceptable risk to public health exists from exposure to soils in the lagoon. However, the environmental RA established that a clean-up level of 2 mg/kg for PCBs was necessary in the lagoon to protect the environment (E.C. Jordan Co., 1990b).

PCBs detected in the lagoon ranged in concentrations from less than 0.5 to 60 mg/kg. Most PCB data were obtained from the on-site field-screening program; data are presented in Figure 1-3. Sample locations not shaded in the figure represent samples with PCB concentrations below the method detection limit of 0.5 mg/kg.

PCB contamination in the lagoon is concentrated in two sections, the southwestern end and the northeastern end. Only sporadic detection of PCBs was encountered in the middle of the lagoon, where the access road crosses (see Figure 1-3). Concentrations greater than 10 mg/kg tend to be within 2 feet of ground surface; PCB concentrations greater than 5 mg/kg are generally located within 4 feet of ground surface, within the oil sludge layer. Concentrations of PCBs between 2 and 5 mg/kg tend to be beyond the oil sludge layer to depths of approximately 8 to 10 feet bgs.

Elevated levels of inorganic elements (i.e., barium, cobalt, lead, and zinc) were detected in the lagoon. Concentrations of all four inorganics were detected within 4 feet of ground surface and within the oil sludge layer. Lead was detected at the highest frequency and in the greatest concentrations. Figure 1-4 illustrates lead contamination distribution within the lagoon. Areas not shaded in Figure 1-4 represent sample locations that do not have associated analytical lead data. The areal distribution of lead concentrations is separated into two areas, the northeastern and the southwestern ends, similar to observations of other contaminants in the lagoon. Higher concentrations of lead (i.e., greater than 1,000 mg/kg, see Figure 1-4) are located in the upper 2 feet of the lagoon, except one sample that extends to at least 4 feet bgs. Below 2 feet, sample concentrations in the 100-to-1,000-mg/kg range are all in the lower end, ranging from 127 to 432 mg/kg. The other three elements follow the same distribution trends as lead.

1.2.2.2 Groundwater. Because groundwater was determined not to present a risk to public health or the environment, no remedial alternatives were developed in this FS, and a summary of the RI results is not included.



CONCENTRATION MG/KG > 10,000 1,000–10,000 100–1,000 1–100 BDL

LEGEND

•25 SOIL BORING AND NUMBER

FIGURE 1–3
DISTRIBUTION OF PCBs IN LAGOON
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

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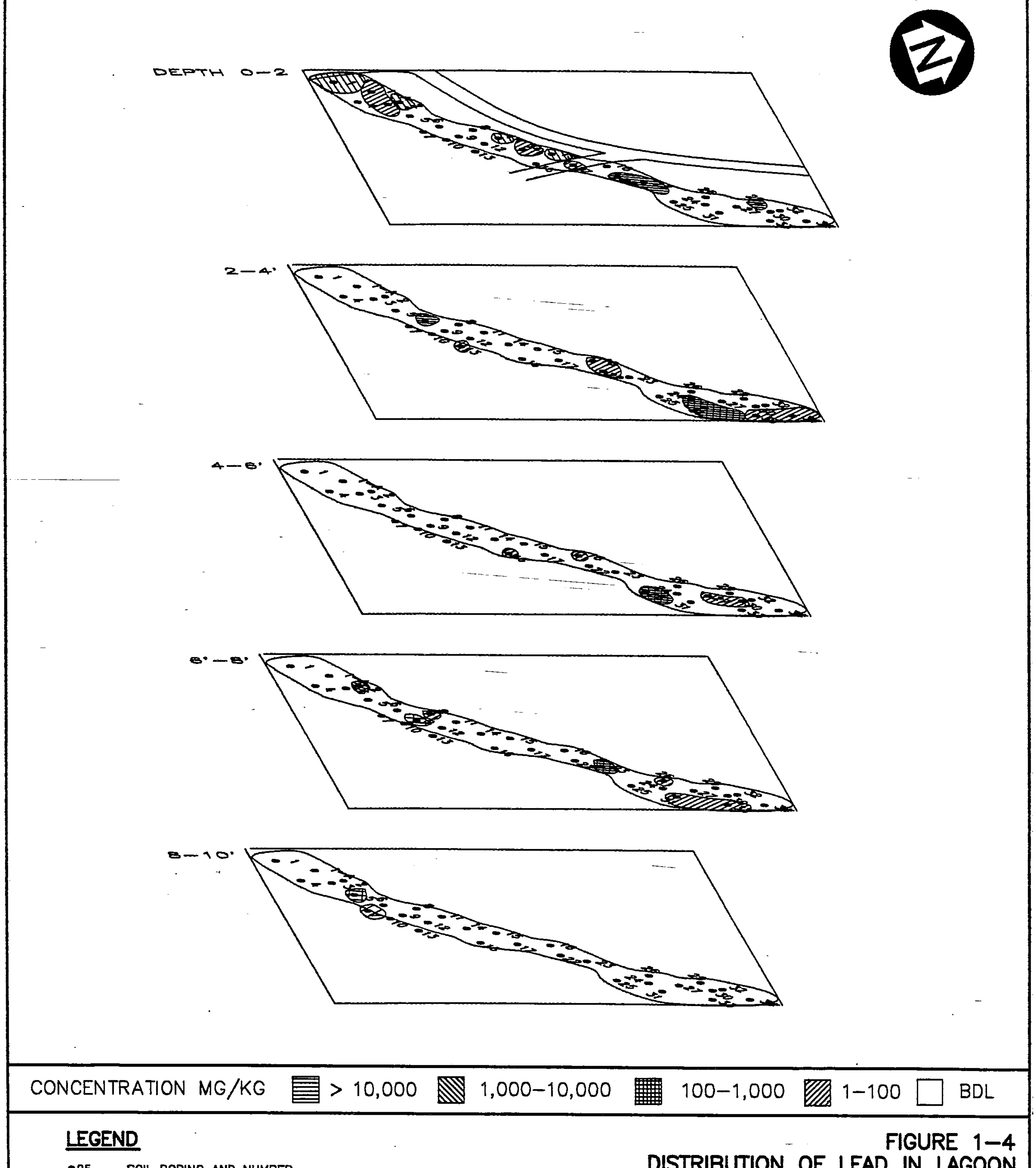

FIGURE 1–4
DISTRIBUTION OF LEAD IN LAGOON
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

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1.2.2.3 Surface Water and Sediments. The RA indicated that surface water and sediments present no risk to public health. However, to protect the environment, a clean-up level of 5 mg/kg PCBs was calculated for sediments in the wetlands. Due to lack of sediment criteria for inorganics, it was not possible to quantify environmental risks associated with inorganics in sediments. As a result, no clean-up levels were calculated for inorganic constituents in lagoon and wetland sediments. Lead, zinc, and copper may, however, pose an environmental risk given the high concentrations for samples collected in both areas.

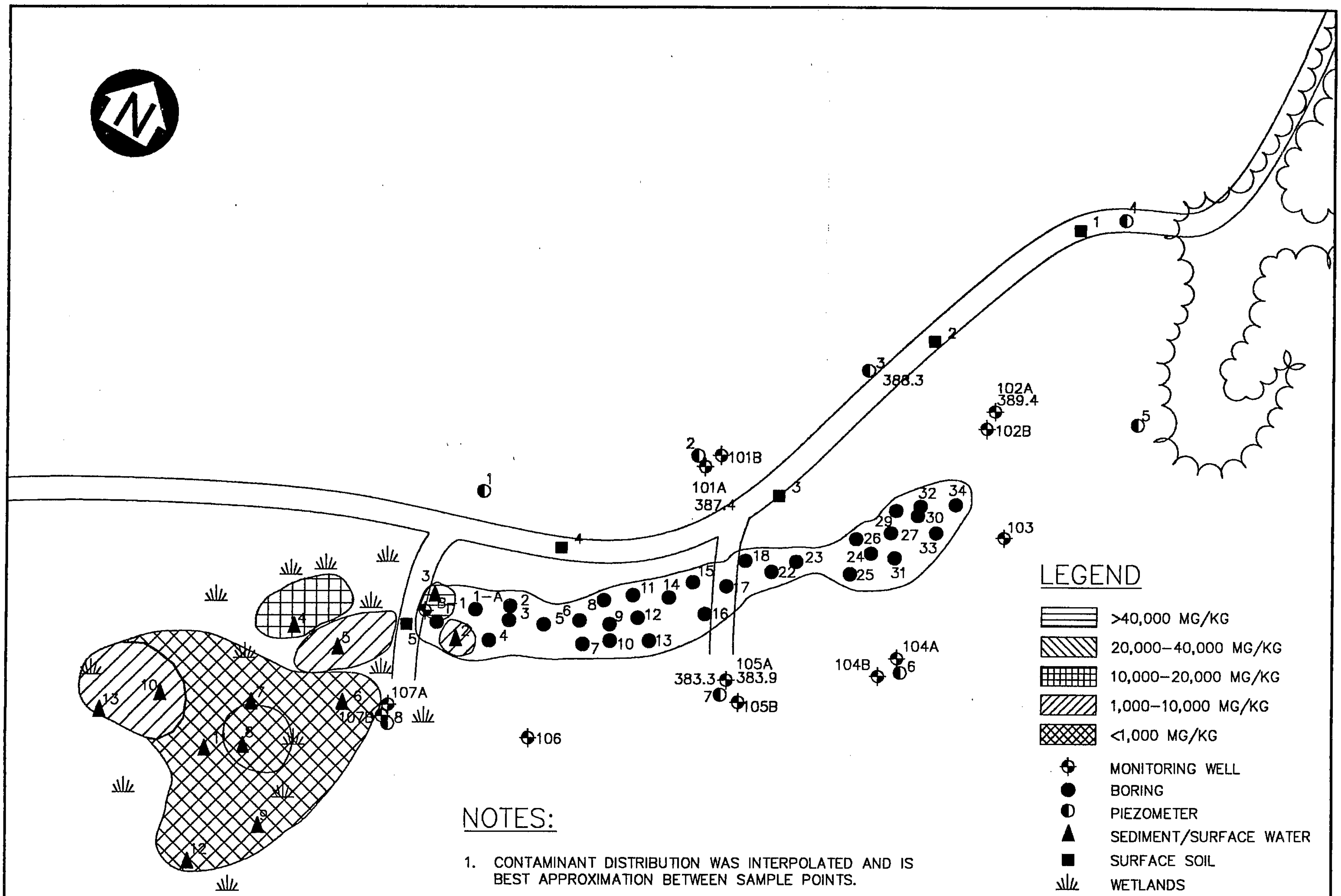
Surface water and sediment samples were collected from the southwestern end of the lagoon and the wetlands area south of the lagoon. Sampled sediments were primarily contaminated with inorganic constituents. Of the inorganics detected in wetlands sediment, lead, zinc, and copper may pose risks to the environment; lead appears to pose the greatest environmental risk.

The concentration of lead is highest near the lagoon area; 76,200 mg/kg of lead was detected at SD-3. Figure 1-5 shows distribution of lead in the sediments, which follow the flow of surface water through the wetlands. Lead concentrations decrease with distance from the lagoon. The sample point near SD-3 has elevated levels of lead (i.e., 10,900 mg/kg at SD-4 and 5,640 mg/kg at SD-5), but is lower in concentration compared to SD-3.

Table 1-1 outlines the typical range of inorganic concentrations that naturally occur in soils of the eastern U.S. The range of concentrations helps interpret where contaminant levels exceed background concentrations. In addition, four sediment samples were taken near McAuslen Road, which is approximately two miles southwest of the lagoon area. Low levels of lead were detected in all four samples; concentrations ranged from 27 mg/kg to 102 mg/kg. Due to the distance from the site, and since the sample concentrations fall within the published concentration ranges, the concentrations of compounds in samples collected in this area can be considered site background values. Lead concentrations in samples SD-12 (131 mg/kg) and SD-9 (32 mg/kg), collected in the southeastern portion of the wetland, are close to or within the range of lead concentrations found in eastern U.S. soils and in the background samples collected near McAuslen Road. Concentrations of lead in these samples suggest these areas are near the edge of the lead contamination.

PCB contamination of sediments was detected in sample locations near the lagoon (Figure 1-6). Highest concentrations of PCBs were detected at sample locations SD-3, SD-4, and SD-5. This is consistent with the high levels of inorganics found in these samples. PCBs were also detected at SD-8; however, there was no detection of PCBs in surrounding samples. This isolated spot of PCBs is not consistent with the contaminant distribution pattern seen with the inorganics. This isolated area of contamination could be part of a distribution of PCBs undetected by the pattern of collected sediment samples.

Inorganic contamination of surface water can be affected by the presence and distribution of inorganics in sediment. Contouring of the lead concentration in surface water is shown in Figure 1-7. As seen with the distribution of lead in sediment, the concentration of lead in surface water decreases with distance from the lagoon. Highest concentrations of lead in surface water were detected in samples nearest the lagoon.



NOTES:

1. CONTAMINANT DISTRIBUTION WAS INTERPOLATED AND IS BEST APPROXIMATION BETWEEN SAMPLE POINTS.
2. SITE CONDITIONS WILL VARY WITH TIME AND MAY BE DIFFERENT THAN SHOWN.

0 100 200 FEET

SCALE 1"=100'

FIGURE 1–5
DISTRIBUTION OF LEAD IN SEDIMENTS
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

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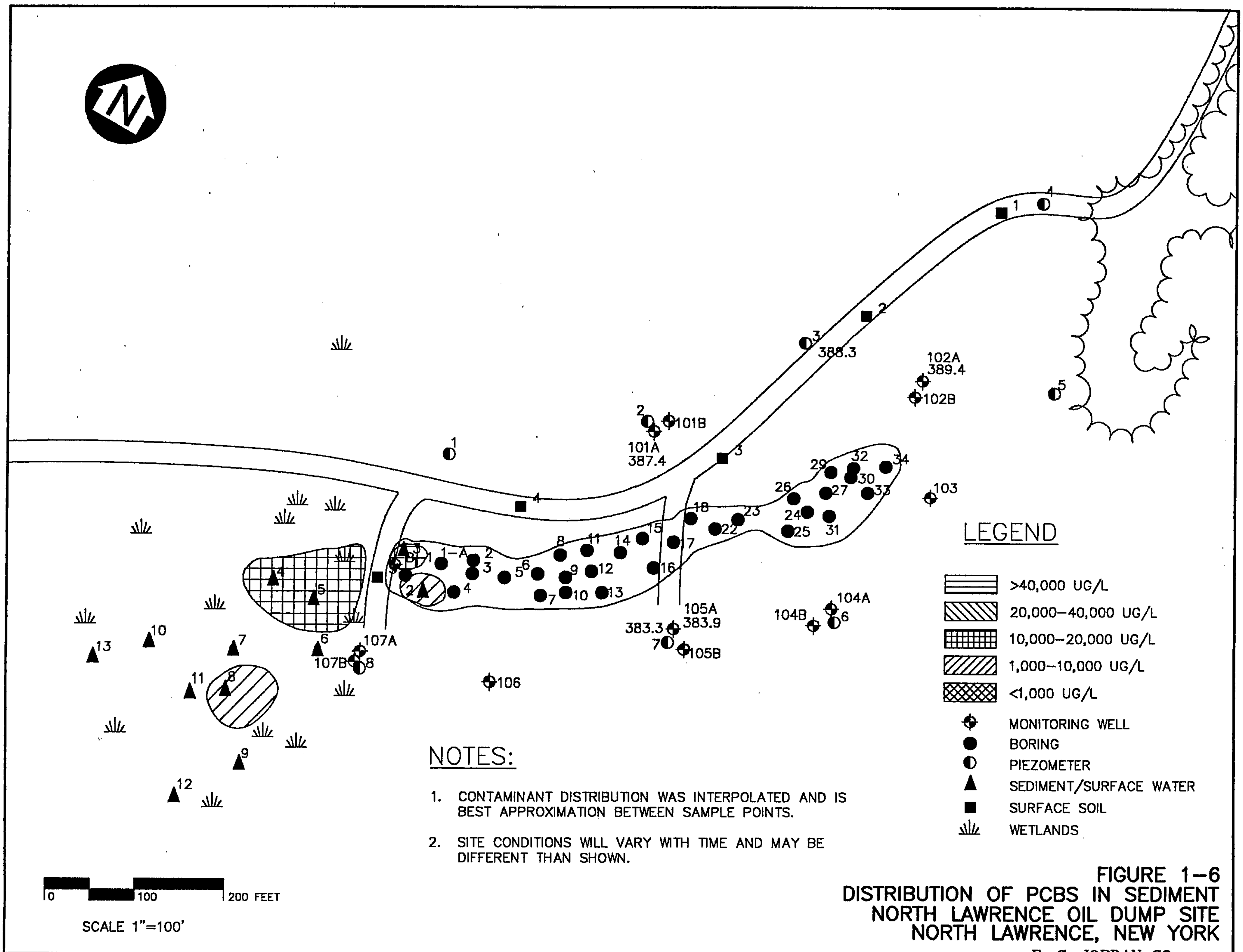
TABLE 1-1
COMMON CONCENTRATION RANGES
OF INORGANICS IN SOILS OF
THE EASTERN U.S.

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

METAL	COMMON RANGE OF CONCENTRATIONS (mg/kg)	AVERAGE CONCENTRATIONS* (mg/kg)
Arsenic	1 - 50	5
Barium	100 - 3,000	430
Chromium	1 - 1,000	100
Copper	2 - 200	30
Lead	2 - 100	10
Manganese	20 - 3,000	600

NOTES:

*Source: Lindsay, 1979.



NOTES:

1. CONTAMINANT DISTRIBUTION WAS INTERPOLATED AND IS BEST APPROXIMATION BETWEEN SAMPLE POINTS.
2. SITE CONDITIONS WILL VARY WITH TIME AND MAY BE DIFFERENT THAN SHOWN.

FIGURE 1–6
DISTRIBUTION OF PCBS IN SEDIMENT
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

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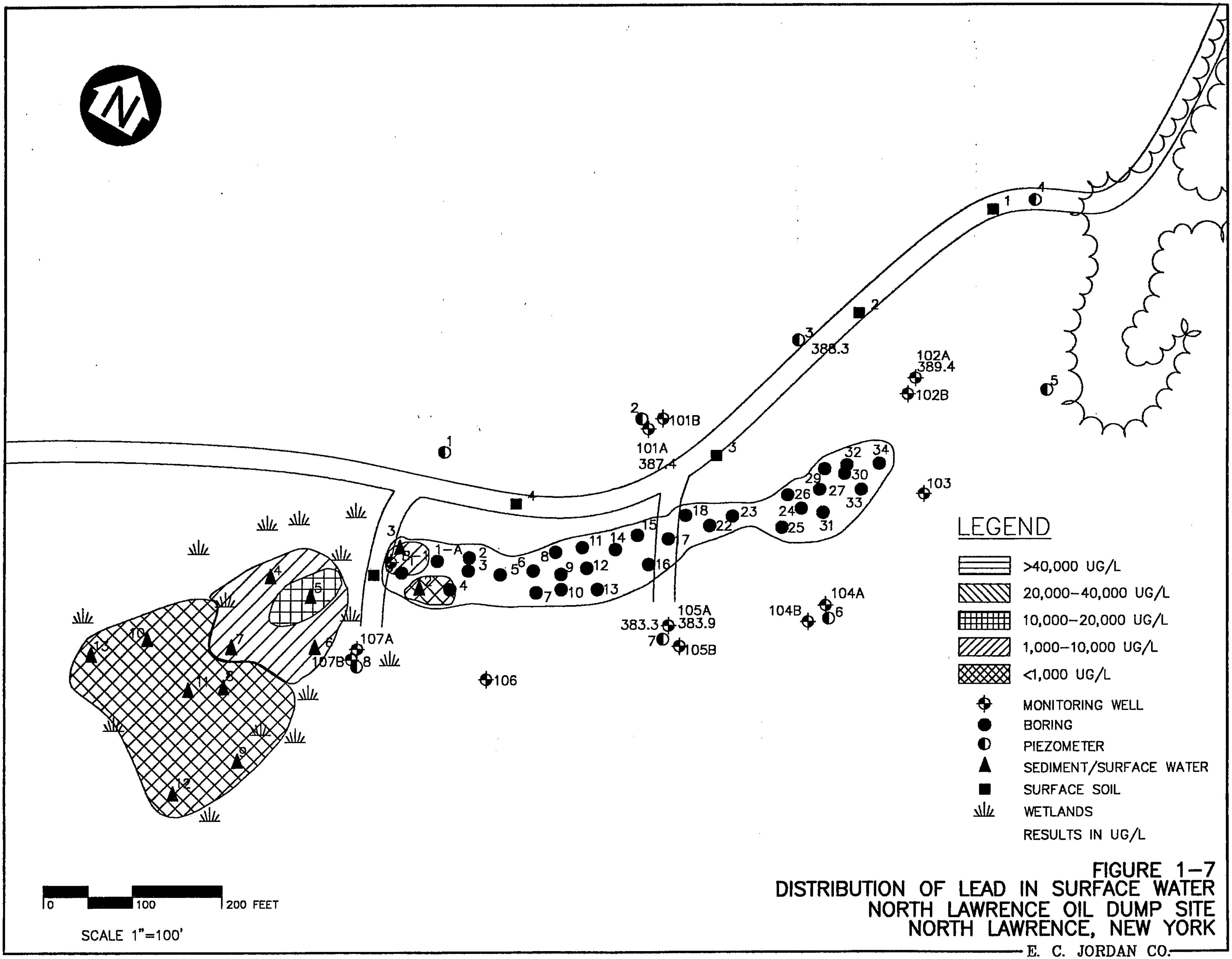

FIGURE 1–7
DISTRIBUTION OF LEAD IN SURFACE WATER
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

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1.2.2.4 Air. Although technical problems during the air monitoring program resulted in sample pump failure prior to the recommended 8-hour duration, the time period the pumps did operate was sufficient to collect samples for laboratory analysis. Results of laboratory analyses of the collected air samples indicate that during April, PCBs were not present in the air at the site in concentrations greater than the detection limit of 0.2 micrograms per cubic meter ($\mu g/m^3$). This detection limit is below the New York State toxic emissions program interim level of 1.67 $\mu g/m^3$, the Occupational Safety and Health Administration (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) limits of 1.0 $\mu g/m^3$, and the National Institute of Occupational Safety and Health (NIOSH)-recommended exposure limit of 1.0 $\mu g/m^3$. New York State DOH reportedly plans to publish an ambient guidance concentration (AGC) for PCBs of 0.5 nanograms per cubic meter (ng/m^3) which, according to the DOH, would require a detection limit of 0.05 ng/m^3 to avoid uncertainty at levels at or near the AGC. Currently, the detection limit of air quality data is not sufficiently low to compare to the AGC.

1.2.2.5 Biota. Locations of the biological sampling stations are shown in Figure 1-8. Results of the biological tissue sampling and analysis program indicate that some food chain contamination is occurring, as would be expected based on the levels of chemicals present at the NLODS. Results generally indicate the highest levels of chemicals in biota from the lagoon. Lower levels were detected in biota in the wetland next to the lagoon, and no contaminants were detected in biota at the McAuslen Road sampling sites.

Earthworm, tadpole, mouse, turtle, and cattail samples collected from the lagoon all had detectable levels of PCBs, with a maximum concentration of 9.8 mg/kg total PCBs (in tadpoles). These samples also contained lead and zinc. Although lead appears elevated in tadpole, earthworm, and cattail samples, zinc appears high only in the earthworm sample. These high levels would be expected based on the reported presence of PCBs, lead, and zinc at elevated concentrations in lagoon sediment.

Attempts to collect animals in the wetland next to the lagoon were unsuccessful. However, two collected cattail samples provide some information about the extent of potential food chain contamination in the wetland. Sample BI-10 was collected near sediment sampling station SD-4; the sediment contained 15.4 mg/kg of total PCBs. The cattail sample contained 2.4 mg/kg of total PCBs, indicating that organisms ingesting cattails near the lagoon ingest PCBs. No PCBs were detected in sediments at SD-7, nor were they detected in cattail sample BI-11 collected nearby.

The fish, tadpole, and cattail samples collected at the wetland outlet all appear uncontaminated. No PCBs were detected in these samples, and no inorganics were reported at levels that appear elevated relative to other samples.

1.3 SITE CHARACTERISTICS

NLODS is a remote site accessible by a gravel road. Topography in the site vicinity is generally flat and slopes to the north and northwest, with an

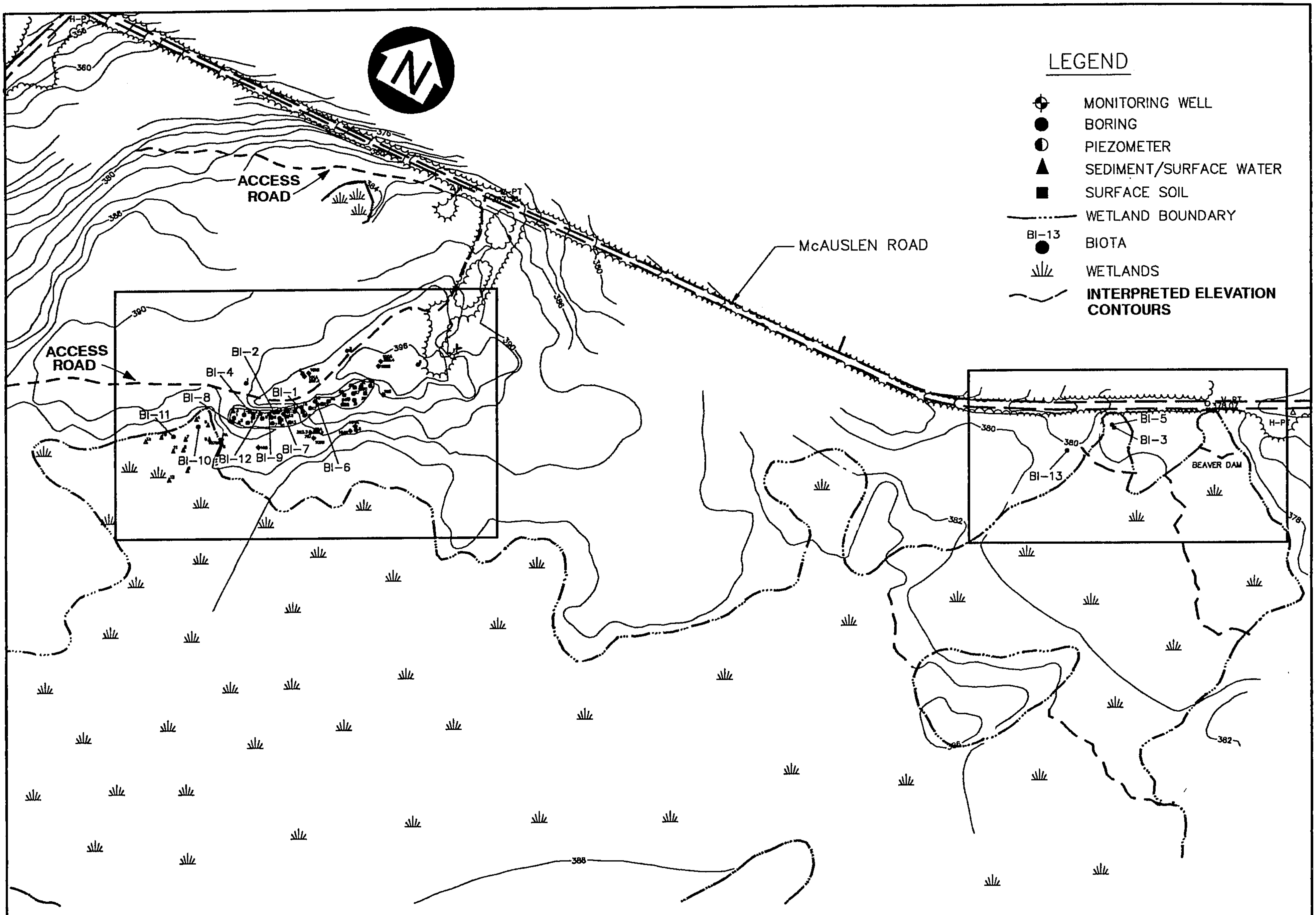

FIGURE 1-8
BIOTA SAMPLING MAP
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

E. C. JORDAN CO.

approximate one percent grade. The area surrounding the lagoon and next to the wetland is heavily wooded. There are no utilities at the site.

The lagoon contains approximately 4 feet of oil sludge with some miscellaneous debris. Underlying the sludge is a transition zone, approximately 2 feet thick, primarily consisting of silty sand with frequent cobbles and boulders. Natural soils underlying the transition zone consist of glacial till of varying grain sizes from clay to gravel, with cobbles and boulders. Grain size analyses conducted on site soils indicate 28 to 71 percent passing the standard U.S. No. 200 sieve. Moisture content on the soil samples ranged from 7 to 13 percent.

Groundwater observations (during the spring of 1989) in piezometers and monitoring wells around the lagoon indicate the water table varies between 1.5 and 5 feet bgs. Based on the shallow monitoring wells, the geometric mean hydraulic conductivity for the silty sands is $9x10^{-5}$ centimeters per second (cm/sec). The underlying glacial till has a mean hydraulic conductivity of $4x10^{-5}$ cm/sec.

Ultimate, proximate analyses were conducted on seven composited samples representative of lagoon sludge. The parameters included percent moisture, ash, volatile matter, fixed carbon, carbon, hydrogen, sulfur, nitrogen, and oxygen. Each sample was also analyzed for Toxicity Characteristic Leaching Procedure (TCLP) for VOCs, semivolatile organic compounds (SVOCs), and inorganics; heat of combustion, pH, and sulfide. Table 1-2 summarizes sample results. Of the TCLP compounds analyzed, lead was detected with the highest frequency and in the greatest concentration. Therefore, lead is the only compound in the summary table.

1.4 WASTESTREAM CHARACTERISTICS

The selection of applicable technologies depends on wastestream characteristics and the chemical and physical properties of the PCBs and metals. Physical, chemical, and biological properties indirectly influence the behavior of PCBs and metals in the environment and the effectiveness of various treatment technologies.

1.4.1 Properties of PCBs

PCBs are nonpolar aromatic compounds exhibiting low volatility and very low solubilities in water or other polar solvents. PCBs have a strong tendency to adsorb onto soil and sediment particles, especially those with high organic content. Finer grained soils (e.g., clays and silts) show an increase in the adsorptivity of PCBs because of increased surface area.

The tendency of PCBs to adsorb onto sediments directly affects treatment technologies, as follows:

- o Extraction of PCBs from sediments may require the use of a nonpolar solvent.

TABLE 1-2
PHYSICAL/CHEMICAL PROPERTIES OF LAGOON SLUDGE

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SAMPLE IDENTIFICATION	JRH 101	JRH 102	JRH 103	JRH 104	JRH 105	JRH 106	JRH 107
PARAMETER							
% Moisture	58.97	58.50	57.90	13.51	11.42	18.78	48.50
% Ash	60.04	62.12	59.49	90.67	87.00	85.90	62.48
% Volatile Matter	40.65	38.47	40.82	8.44	13.54	14.67	38.40
% Fixed Carbon	<0.01	<0.01	<0.01	0.89	<0.01	<0.01	<0.01
% Carbon	29.85	28.22	29.87	3.39	4.74	8.61	27.43
% Hydrogen	4.67	4.56	4.54	0.63	0.68	1.15	4.21
% Sulfur	0.63	0.71	0.72	0.04	0.21	0.15	0.62
% Nitrogen	0.14	0.12	0.14	0.02	0.02	0.11	0.19
% Oxygen	4.67	4.27	5.24	5.25	7.35	4.08	5.07
TCLP-Lead (mg/L)	420	490	300	4.6	37	33	350
Heat of Combustion (BTU/LB)	1,240	1,470	2,420	1,230	<1,000	<1,000	2,420
pH	7.56	7.33	6.93	9.02	8.87	7.28	7.22
Sulfide (µg/g)	2,000	1,500	1,300	300	680	750	960

- Flushing soil or sediment with water will not be effective for PCB removal.

High boiling points and low vapor pressures make PCBs difficult to remove through vaporization. This directly affects the efficiencies of several treatment technologies, as follows:

- Stripping technologies that preferentially remove volatile organics of higher vapor pressure from water are not effective for PCB removal because the water is stripped before the PCBs (i.e., water vapor pressure is higher than that for PCBs).

- Air stripping of PCBs from organic soils is a slow process due to the slow vaporization rate.

PCBs were used in many applications because of high resistance to chemical transformations including oxidation, reduction, addition, elimination, and electrophilic substitution. Under conditions where PCBs do react, there is potential for the formation of various chlorinated aromatic compounds. The chemical stability and by-product formation potential of PCBs affects the effectiveness of some treatment technologies, as follows:

- Substantial energy is required to destroy the PCB structure. This is reflected by the high temperatures and long residence times needed to achieve PCB destruction with incineration and other thermal processes. These processes accomplish destruction at great fuel expense.

PCBs resist biological degradation. Acclimated microbes have been used to biodegrade PCBs in some instances, but in general, these applications are in the development stage. The effectiveness of biological techniques is highly site- and PCB mixture-specific. Therefore, the process would require extensive pilot testing on the sludge, soil, and sediments if biological degradation is to be considered.

1.4.2 Properties of Metals

In addition to the treatment of PCBs in sediments, elevated levels of certain metals may require remedial action at the site. The metal of primary concern is lead. PCB removal technologies generally will not reduce the potential toxicity of metals; in several cases, treatment for PCBs could increase mobility of the metals through oxidation (e.g., thermal treatment technologies). Two treatment strategies are available for metals: removal of metals from the solids; or chemical immobilization/solidification to reduce mobility of the metals.

In general, metals tend to be more mobile under acidic conditions than basic conditions. Metals can be removed from sediments, ash, or soils through soil washing. Metals also can be converted to a less mobile form and left in treated sediments or ash by chemical immobilization. This is accomplished by treating the sediments or ash with a basic solution that will form metal sulfides or carbonates exhibiting lower solubility and, therefore, lower mobility.

Solidification techniques immobilize metals in a relatively impermeable matrix. Addition of solidifying agents such as Portland cement or vitrification of sediments into a solid mass bind the metals in a form that is less accessible to the environment (i.e., reduces leachability of metals).

2.0 DEVELOPMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section provides general information on ARARs including the types of ARARs available, and the approach used to develop an inventory of suitable ARARs. Also included is a discussion of the site-specific development of ARARs for the NLODS. The ARARs described in this section are used in Section 3.0 to support formulation of remedial response objectives and target clean-up levels.

2.1 DEFINITION AND APPROACH TO DEVELOPMENT OF ARARS

As originally defined in the NCP (40 CFR Part 300; November 20, 1985), "applicable or relevant and appropriate requirements" are federal regulatory requirements with which remedial actions must comply. The definition was further expanded by SARA Section 121(d)(2)(c) to include state laws and state and federal nonregulatory criteria, advisories, and guidance documents. State requirements must be attained if legally enforceable and consistently enforced statewide. The purpose of ARARs development is to ensure consistency among other pertinent state and federal site characterizations and environmental clean-up efforts. Throughout the RI/FS process, ARARs are used as a guide to (1) evaluate the appropriate extent of site cleanup, (2) scope and formulate remedial action alternatives, and (3) govern the implementation and operation of the selected remedial action.

SARA Section 121(d)(4) specifies the following six circumstances under which ARARs may be waived:

- The selected remedial action is an interim measure, and part of a total remedial action that will attain ARARs.
- Compliance with a particular ARAR will cause greater risk to human health and the environment than other options.
- Compliance with a particular ARAR is technically impracticable from an engineering perspective.
- The selected remedial action will attain an equivalent standard of performance to the ARAR through the use of another method or approach.
- The ARAR is a state requirement that the state has not applied consistently (or demonstrated the intent to apply consistently) in similar circumstances.
- For remedial actions that are solely Superfund-financed, compliance with the ARAR will not provide a balance between protecting human health and the environment and the availability of Superfund money for response at other sites.

2.1.1 Definition of ARARs

The NCP and SARA further define three categories of potential requirements: (1) applicable requirements, (2) relevant and appropriate requirements, and (3) additional nonregulatory requirements to be considered. These categories are discussed in the following paragraphs.

Applicable Requirements. Applicable requirements are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address and have jurisdiction over a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Superfund site. These requirements include regulatory requirements that would be legally applicable to the remedial action if that action were not taken pursuant to Section 104 or 106 of CERCLA.

Relevant and Appropriate Requirements. Although not legally applicable to the site-specific circumstances, these requirements include clean-up standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal and state law that address problems or situations sufficiently similar to those encountered at the Superfund site that application of them is "appropriate" and makes good sense. The term "relevant" was included so that requirements initially screened as nonapplicable because of jurisdictional restrictions would be reconsidered and, if relevant, would be included as ARARs. The determination that a requirement is relevant and appropriate is generally more subjective than establishing its applicability, and often requires the decision-maker's "best professional judgment." Relevant and appropriate requirements are intended to have the same weight and consideration as applicable requirements.

Other Requirements To Be Considered. A third category of requirements to be considered includes federal and state nonregulatory criteria, advisories, and guidance. These requirements do not have the status of potential ARARs; however, they are considered in the absence of federal or state ARARs, or when such ARARs are not sufficiently protective. These requirements include, but are not limited to, Ambient Water Quality Criteria (AWQC), Maximum Contaminant Level Goals (MCLGs), and state guidance criteria.

2.1.2 Phased Approach to ARARs Development

According to the NCP and SARA, development of ARARs involves a continuing process of identification, evaluation, and refinement throughout the RI/FS process. Typically, the following three categories of ARARs should be evaluated during three phases of the process:

- Location-specific ARARs. These place restrictions on activities or contaminant concentrations because of the site location or a special site feature (e.g., wetlands, floodplains, sensitive ecosystems, areas of historical or archeological significance, landfill or disposal areas). These ARARs are the first to be identified prior to RI field activities, and can be used in scoping the RI and during the FS to assess potential remedial actions.

- Chemical-specific ARARS. These are numerical values based on risk to public health or the environment. They limit the concentration of a chemical that can be present in or discharged to the environment (e.g., MCLs and AWQC). These ARARs can be identified at the start of the RI to guide field activities, and are refined at the completion of the RI. They can govern the extent of site remediation by providing either actual clean-up levels or the basis for calculating such levels. They are used during the FS to develop remedial response objectives and remedial alternatives.

- Action-specific ARARs. These place restrictions on remedial technologies and site activities, and govern implementation of the selected remedial alternative (i.e., requirements for discharge of treated water). These ARARs are identified during the detailed analysis of alternatives in the FS, and are used in the screening, selection, and design of the remedial action.

2.2 SITE-SPECIFIC ARARS DEVELOPMENT

Regulations identified as location- and chemical-specific ARARs for existing site conditions are in the First Phase RI report, Section 2.0. These ARARs are used during the identification of remedial action objectives, screening of technologies, and development and screening of remedial alternatives. An inventory of potential ARARs for each category was prepared to consider all ARARs. Jordan narrowed the list of potential ARARs based on whether the requirement (1) has legal jurisdiction over contaminants detected at the site or over site conditions (i.e., applicable), or (2) could be applied to similar situations covered under its jurisdiction (i.e., relevant and appropriate). Checklists used to identify the location- and chemical-specific ARARs are in Appendix A of the First Phase RI report (E.C. Jordan Co., 1990a). To be consistent with the NCP definition of ARARs, each checklist was subdivided as follows:

- federal requirements (applicable, appropriate, and relevant)
- New York State requirements
- federal criteria, advisories, and guidance documents
- New York State criteria, advisories, and guidance

Action-specific ARARs control implementation and/or operation of remedial actions identified for the site; feasibility and effectiveness of the remedy can be assessed against these regulations. The potential action-specific ARARs are identified in Subsection 2.2.2 and used in Section 5.0 to perform initial screening of remedial alternatives. The Second Phase FS will discuss action-specific ARARs in more detail in relation to specific alternatives, and will use ARARs as an integral part of the detailed analysis of remedial alternatives.

2.2.1 Identification of Chemical- and Location-Specific ARARs

Requirements identified as chemical- and location-specific ARARs are listed in Tables 2-1 and 2-2, respectively.

2.2.1.1 Chemical-Specific ARARs. Chemical-specific ARARs for the NLODS are identified in Table 2-1. In the following discussion, these ARARs are described by media requiring remediation (i.e., soil and sediments) or media that may receive discharges as a result of remedial action (i.e., surface water and air).

Groundwater. Groundwater was determined in the RA not to present unacceptable risk to public health and the environment. Because the groundwater monitoring wells at the NLODS will be resampled and additional wells installed during the Second Phase Field Investigation, ARARs associated with groundwater have been identified. Risks due to groundwater contamination will then be reassessed based on the results of the field investigation and therefore, the ARARs presented may be applicable.

Several federal and New York State regulations govern the quality, use, and discharge of groundwater (see Table 2-1). Because groundwater at the NLODS is classified as IIB under federal standards and GA under New York State state standards (classifications stipulating that groundwater is a potential potable water source), drinking water standards are relevant and appropriate. Groundwater must therefore be cleaned to these standards unless the ARAR is waived under a condition set forth in SARA.

MCLGs, nonenforceable health goals for drinking water established by USEPA, are set at levels at which no adverse health effects may arise. MCLs are legally enforceable federal drinking water standards set as close to the respective health-based goal as possible. MCLs are commonly identified as ARARs for existing or potential future drinking water sources. MCLGs are used in cases where multiple contaminants or pathways of exposure present extraordinary risks. In such cases, a site-specific determination of more stringent standards would be made.

The DEC promulgated a groundwater classification system and groundwater quality standards for each class of groundwater (in 6 NYCRR Part 703). As stated, groundwater at the NLODS is classified as GA, which is defined as suitable as a source of potable water. New York State DOH regulates public water supplies in the state of New York and has set maximum allowable concentrations for 87 substances to protect groundwater quality. In some cases, the New York State DOH MCLs are more stringent than the federal MCLs (i.e., arsenic and lead) and are often used as clean-up levels for water that may be used as an existing or potential future water supply.

In addition to federal and state regulatory standards, federal and state nonregulatory criteria must be considered. As stated in the RA, USEPA Risk Reference Doses (RfDs) and USEPA Carcinogen Assessment Group (CAG) Potency Factors were used to characterize risks. AWQC, adjusted for drinking water, can be used to help establish clean-up goals in the absence of federal and New York State MCLs.

TABLE 2-1
CHEMICAL-SPECIFIC ARARS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY FEASIBILITY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN RI/FS
FEDERAL REGULATORY REQUIREMENTS		
Safe Drinking Water Act Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16)	Under this regulation, standards are set for the maximum permissible level of a contaminant in drinking water.	MCLs (mg/L) for inorganics detected at the NLODS are arsenic 0.05, barium 1.0, chromium 0.05, lead 0.05, and silver 0.05.
Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50-141.51)	MCLGs are standards at which there are no known or anticipated public health effects. These are guidance values.	Proposed MCLGs include (μg/L) arsenic 30 and calcium 100.
Federal Ambient Water Quality Criteria (AWQC)	AWQC are health-based estimates of the ambient surface water concentration that will not result in health effects.	AWQC will be considered during the RA.
RCRA - Subpart F, Groundwater Protection Standards (40 CFR 264.94)	Under RCRA, standards have been set to prevent adverse effects on groundwater quality.	Groundwater maximum concentrations (mg/L) of constituents found at NLODS include arsenic 0.05, barium 1.0, chromium 0.01, lead 0.05, and silver 0.5.
Clean Air Act (40 CFR 50)	National primary and secondary ambient air quality standards that define levels of air quality to protect public health are set forth in this regulation.	Particulate standards for 24-hour ambient air quality is 150 $\mu g/m^3$.
STATE REGULATORY REQUIREMENTS		
New York Water Classifications and Quality Standards (6 NYCRR Parts 701-703)	New York State has classified surface water bodies and groundwater based on use. Water Quality Standards have been set to protect the designated uses of water.	Groundwater at NLODS is classified as Class GA. Class GA standard includes (mg/L): arsenic 0.025, barium 1.0, chromium 0.05, iron 0.3, lead 0.025, manganese 0.3, and zinc 5. Red-water Brook is classified as Class B; water standards include (μg/L) arsenic 190, iron 300, PCB 0.001, silver 0.1, and zinc 30.
New York Ambient Air Quality Standards (6 NYCRR 257)	State standards promulgated for the protection of public health.	The 24-hour standard is 250 $\mu g/m^3$.
FEDERAL ADVISORIES, GUIDANCE, AND TO BE CONSIDERED		
USEPA Reference Doses (RfDs)	Route-specific RfDs are the preferred criteria to evaluate noncarcinogenic effects. The RfD is considered the level unlikely to cause adverse health effects in humans exposed for a lifetime.	RfDs that exist for contaminants of concern detected at NLODS will be used during the RA.

TABLE 2-1
(continued)
CHEMICAL-SPECIFIC ARARS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN RI/FS
AICs (Acceptable Intake-Chronic) and AISs (Acceptable Intake-Subchronic) USEPA Health Assessment Document.	AICs and AISs are similiar to RfDs, but are derived using less vigorous methodology.	These values will be considered during the RA.
TSCA - PCB Spill Cleanup Policy	TSCA outlines appropriate response actions for PCB-contaminated sites. TSCA regulations only apply to PCB concentrations greater than 50 ppm.	PCBs were disposed of at NLODS prior to February 1978; therefore, TSCA regulations do not apply. However, TSCA Spill Policy disposal options will be considered in the FS.

TABLE 2-2
LOCATION-SPECIFIC ARARS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SITE FEATURE	REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN RI/FS
WETLANDS			
Federal Regulatory Requirements	Clean Water Act Section 404	Regulates the discharge of dredged or fill material into U.S. waters, including wetlands. The purpose of Section 404 is to ensure that proposed discharges are evaluated with respect to impact on the aquatic ecosystem.	During identification, screening, and evaluation of alternatives, the effects on wetlands will be evaluated.
	Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230)	Maintains that no dredged or fill material discharge will be permitted if there is a practicable alternative with less impact to the aquatic ecosystem. Discharge will also not be permitted unless steps are taken to minimize potential adverse impacts, or if it will cause or contribute to significant degradation of U.S. waters.	Impacts from remedial actions requiring dredging will be evaluated during development and screening of alternatives.
	National Environmental Policy Act	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of Protection of Wetlands Executive Order (EO 11990). Appendix A requires that no remedial alternative adversely affects a wetland if another practicable alternative is available.	During the Feasibility Study process, the identification and evaluation of alternatives for the site will include an evaluation of each alternative's impact on the wetlands.
	Fish and Wildlife Coordination Act	The Fish and Wildlife Coordination Act Requires that the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and other related state agencies be consulted before a body of water is modified.	This requirement will be addressed under Clean Water Act Section 404.
State Regulatory Requirement	New York Freshwater Regulations, 6 NYCRR Parts 662 through 665	The regulations require permit applications to be filed with the regulating authority (i.e., New York State Department of Environmental Conservation, local government) for activities that may impinge upon or substantially affect the wetland or the adjacent area. The regulations apply to wetlands encompassing an area of 12.4 acres or more, or wetlands with unusual local importance regardless of size.	Anyone proposing to alter a wetland must first obtain a permit/application.
Federal Non-regulatory Requirement to Be Considered	Wetlands Executive Order (EO 11990)	Under this regulation, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	Many of the requirements of this Executive Order will be addressed under Clean Water Act Section 404. Any remaining requirements will also be considered during the identification, screening, and evaluation of alternatives.

Surface Water. If a treatment system is installed at NLODS that discharges to the wetlands on-site, the Clean Water Act (CWA), which governs discharges of priority pollutants into surface waters and establishes AWQC, becomes an ARAR. Such discharges must comply with the federal CWA National Pollutant Discharge Elimination System (NPDES) and the New York State Pollution Discharge Elimination System (SPDES) (see Table 1-1).

DEC has promulgated a surface water classification system and surface water quality standards. Surface waters at NLODS drain into Redwater Brook, which is classified as a Class B water. Class B surface waters are suitable for contact recreation. Each class has specified standards for pH, coliform, and dissolved oxygen.

Soils/Sediments. The Toxic Substances Control Act (TSCA) (40 CFR 761, Subpart G - PCB Spill Clean-up Policy) establishes clean-up standards for spills of PCBs greater than 50 ppm that occur after the effective date of this policy (i.e., May 4, 1987). Because NLODS operations ceased in the mid to late 1960s, these requirements are not applicable. As stated in a USEPA memorandum, "Evaluation of TSCA Requirements as ARARs for the Re-Solve, Inc., Superfund Site" (July 24, 1987), "spills that occurred before the effective date of this policy are to be decontaminated to requirements established at the discretion of USEPA...."; therefore, these requirements are not relevant and appropriate as chemical-specific ARARs.

In addition to the PCB Spill Clean-up Policy, USEPA promulgated other requirements under TSCA (40 CFR 761) regulating the storage and disposal (Subpart D), and the marking (Subpart C) of materials containing PCBs greater than 50 ppm. Because NLODS operations ceased in the mid to late 1960s, these PCB regulations are not applicable to past disposal practices at the site. However, as the USEPA memorandum (dated July 24, 1987) states, "50 ppm... is not a public health-based standard nor is it designed to attain complete protection of the environment. The establishment of this regulatory limit was based on economic and administrative considerations, as well as human health and the environment... [The 50-ppm standard] does not necessarily achieve the objective of Section 121 of CERCLA." The memorandum identifies health-based, site-specific standards as the appropriate clean-up levels; therefore, these requirements, as they pertain to clean-up levels at NLODS, are not relevant and appropriate as chemical-specific ARARs. However, the requirements for marking, storage, and disposal of PCB materials (once soil with PCBs greater than 50 ppm is excavated) will be applicable as action-specific ARARs for implementation of remedial alternatives. Under 40 CFR 761.60, any non-liquid PCBs (including PCB-contaminated soil or debris) with concentrations greater than 50 ppm shall be disposed of in an incinerator, which complies with 761.70, or in a chemical waste landfill, which complies with 761.75.

No federal or New York regulations specify soil concentration limits for contaminants observed in site soils.

Air. New York State DEC adopted federal ambient air quality standards for criteria pollutants and added standards for hydrogen sulfide and fluoride (in 6 NYCRR Part 257). The standard most applicable to NLODS remedial activities is the PM_{10} standard for particulates (i.e., particulate matter less than

10 microns in size). PM_{10} standards for particulates are 60 $\mu g/m^3$ (annual geometric mean) and 150 $\mu g/m^3$ (24-hour maximum, not to be exceeded more than once a year). To apply an ambient air quality value, the maximum ambient air quality impact from the source must be determined via the emission rate and a dispersion model.

2.2.1.2 Location-Specific ARARs. Location-specific ARARs for the NLODS site are identified in Table 2-2. These ARARs pertain to physical features at the site, including wetlands and floodplains. Several potential ARARs regulate wetlands in the NLODS. Under federal law, the CWA (in Section 404) and the Fish and Wildlife Coordination Act regulate activity potentially affecting wetlands. The CWA requires that effects on wetlands be evaluated and no activity adversely impacting a wetland be permitted if a practicable alternative with less effect is available. The Fish and Wildlife Coordination Act requires that both the Fish and Wildlife Service and the DEC Division of Fish and Wildlife be consulted before a body of water is modified.

An additional applicable requirement for the NLODS is the Executive Order (EO 11990) related to wetlands. At the state level, wetlands are protected under the New York Freshwater Wetlands Act and Regulations (in 6 NYCRR Parts 662-665). These laws are intended to protect and conserve wetlands.

2.2.2 Identification of Potential Action-Specific ARARs

Regulations identified as potential ARARs for possible remedial alternatives are listed in Table 2-3. Major requirements that must be attained are discussed in the following paragraphs. Action-specific ARARs for each remedial alternative that passes initial screening will be discussed in more detail in the analyses of remedial alternatives in the Second Phase FS.

Resource Conservation and Recovery Act, Subtitle C. Resource Conservation and Recovery Act (RCRA) Subtitle C regulates the treatment, storage, and disposal of hazardous waste. In general, RCRA Subtitle C requirements are applicable if a combination of the following conditions is met:

- the waste is a listed or characteristic waste under RCRA
- the waste was treated, stored, or disposed of (as defined in 40 CFR 260.10) after the effective date of the RCRA requirements under consideration
- the activity at the NLODS constitutes treatment, storage, or disposal as defined by RCRA

Several proposed technologies for the NLODS generally constitute treatment, storage, or disposal. RCRA Part 264 requirements that must be instituted for remedial alternatives involving construction of on-site treatment, storage, or disposal facilities include (1) standards for owners and operators of permitted hazardous waste facilities, (2) preparedness and prevention, (3) contingency plan and emergency procedures, (4) recordkeeping and reporting, and (5) groundwater monitoring. In addition, all remedial alternatives must meet RCRA

TABLE 2-3
ACTION-SPECIFIC ARARs

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
FEDERAL REGULATORY REQUIREMENTS		
RCRA - General Facility Standards (40 CFR 264.10 - 264.18)	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	Any facilities will be constructed, fenced, posted, and operated in accordance with this requirement. All workers will be properly trained.
RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.37)	This regulation outlines requirements for safety equipment and spill-control requirements for hazardous waste facilities. Part of the regulation includes a requirement that facilities be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment.	Safety and communication equipment will be installed at the site; local authorities will be familiarized with site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Plans will be developed and implemented during site work including installation of monitoring wells, and implementation of site remedies. Copies of the plans will be kept on-site.
RCRA - Releases From Solid Waste Management Units (40 CFR 264.90 - 264.109)	This regulation details requirements for a groundwater monitoring program to be installed at the site.	During preparation of the post-closure plan, the location and depth of monitoring wells must be evaluated for use in this monitoring program. A corrective action program must be undertaken to address groundwater contamination above drinking water standards.
RCRA - Closure and Post-closure (40 CFR 264.110 - 264.120)	This regulation details the general requirements for closure and post-closure of hazardous waste facilities, including the installation of a groundwater monitoring program.	Those parts of the regulation concerned with long-term monitoring and maintenance of the site will be considered during remedial design.

TABLE 2-3
(continued)
ACTION-SPECIFIC ARARs

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
RCRA - Surface Impoundments (40 CFR 264.220 - 264.249)	This regulation establishes the design, construction, operation, monitoring, inspection, and contingency plans for a RCRA surface impoundment, as well as closure and post-closure options. If all hazardous wastes cannot be removed or decontaminated, the surface impoundment must be capped and receive post-closure care. The regulation provides three closure options: clean closure, containment closure, and alternate closure.	To comply with clean closure, the owner must remove or decontaminate all waste. To comply with containment closure, the owner must eliminate free liquid, stabilize remaining waste, and cover impoundment with a cover that complies with the regulation. Cover integrity must be maintained, the groundwater system monitored, and runoff controlled. To comply with alternate closure, all pathways of exposure to contaminants must be eliminated and long-term monitoring provided.
RCRA - Waste Piles (40 CFR 264.250 - 264.269)	Details procedures, operating requirements, and closure and post-closure options for waste piles. If removal or decontamination of all contaminated subsoils is not possible, closure and post-closure requirements for landfills must be attained.	According to RCRA, waste piles used for treatment or storage of non-containerized accumulation of solid, non-flowing hazardous waste may comply with either the waste pile or landfill requirements. The temporary storage of solid waste on-site, therefore, must comply with one or the other subpart.
RCRA - Land Treatment (40 CFR 264.20 - 264.299)	These rules require DEC approval of laboratory or field testing of treatment programs prior to implementation of an alternative. A monitoring program must be in place during remedial activities and steps should be taken during closure to prevent mobilization of hazardous constituents.	Treatability tests will be conducted prior to implementation of a bio-remediation alternative. All other operation, closure, and post-closure requirements will be followed during remedial activities.
RCRA - Landfills (40 CFR 264.300 - 264.339)	This regulation details the design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for a RCRA landfill. Two liners must be installed to prevent groundwater contamination. A leachate collection system must be placed above and between the liner systems.	Disposal of contaminated materials must be at a facility that complies with all relevant and appropriate RCRA landfill regulations, including closure and post-closure.
RCRA - Incinerators (40 CFR 264.340 - 264.599)	This regulation specifies the performance standards, operating requirements, monitoring, inspection, and closure guidelines of any incinerator burning hazardous waste.	On-site thermal treatment must comply with the appropriate requirements specified in this subpart.

TABLE 2-3
(continued)
ACTION-SPECIFIC ARARs

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
RCRA - Miscellaneous Units (40 CFR 264.600 - 264.999)	These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations for treatment, storage, and disposal units.	Units not previously defined under RCRA must comply with these requirements.
RCRA - Land Disposal Restrictions (40 CFR 268)	Land Disposal Restrictions (Land Ban) prohibits land disposal of hazardous wastes, not meeting specified treatment standards, beyond specified dates. Treatment standards may be either a concentration level or a specified technology.	Hazardous wastes subject to Land Disposal Restrictions will be treated to levels specified in the finalized restrictions.
RCRA - Standards Applicable to Generators of Hazardous Waste (40 CFR 262)	These regulations will apply if hazardous wastes are removed off-site. Removal to a treatment, storage, disposal facility (TSDF) will require acquisition of a USEPA identification number and compliance with pre-transport and recordkeeping and reporting requirements.	Implementation of an off-site disposal alternative would be performed in accordance with the requirements set forth in these regulations.
RCRA - Standards Applicable to Transporters of Hazardous Waste (40 CFR 263)	These regulations outline the standards for transportation of hazardous waste off-site. Transporters of hazardous waste must comply with manifest, recordkeeping, and reporting requirements set forth in these rules.	This ARAR will be attained through compliance with DOT Rules for Transportation of Hazardous Waste.
TSCA - Markings of PCBs and PCB Items (40 CFR 761.60 - 761.90)	PCB storage areas, disposal items, vehicles, or equipment must be marked with M_L that is placed in an easily readable position.	During remedial activities, items associated with the storage, transportation, and disposal of PCBs will be appropriately marked.
TSCA - Storage and Disposal (40 CFR 761.60 - 761.69)	PCBs at concentrations greater than or equal to 50 ppm must be disposed of in a TSCA-compliant incinerator, a TSCA-compliant chemical waste landfill or another approved method.	
TSCA - Records and Reports (40 CFR 761.180 - 761.185)	Owners of incineration facilities must maintain records, for at least 5 years, concerning the date, rate, emissions, and solid residues generated when PCBs are incinerated. Owners of chemical waste landfill facilities must maintain records concerning receipt and burial of PCB materials, and results of facility monitoring, for at least 20 years after receipt of PCB wastes.	Incineration or landfilling of PCB materials will be contracted to facilities in compliance with these regulations.

TABLE 2-3
(continued)
ACTION-SPECIFIC ARARs

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
OSHA - General Industry Standards (29 CFR Part 1910)	These regulations specify the 8-hour time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the required concentrations. Workers performing remedial activities will be required to complete specified training requirements prior to site work.
OSHA - Safety and Health Standards (29 CFR Part 1926)	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	All appropriate safety equipment will be on-site. In addition, safety procedures will be followed during on-site activities.
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)	This regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	These requirements apply to all site contractors and subcontractors and must be followed during all site work.
CWA - National Pollutant Discharge Elimination System Regulations (40 CFR Parts 122, 125)	This requirement implements the NPDES program that specifies the applicable effluent standards, monitoring requirements, and standard and special conditions for direct discharge.	Both on- and off-site discharges to surface waters are required to meet the substantive CWA NPDES requirements, including discharge limitations, monitoring requirements, and best management practices.
CWA - Permits for Dredged and Fill Material (Section 404)	This regulation outlines requirements for discharges of dredged or fill material. Under this requirement, no activity that impacts a wetland shall be permitted if a practicable alternative with less impact on the wetland is available. If there is no other practicable alternative, impacts must be mitigated.	During the identification, screening, and evaluation of alternatives, the effects on wetlands must be evaluated.
CAA - NAAQS for Particulate Matter Less Than 10 Microns in Diameter (40 CFR Part 60, Appendix J).	This regulation specifies maximum annual arithmetic mean and maximum 24-hour concentrations for particulate matter.	Fugitive dust emissions from site excavation activities will be maintained below the 24-hour maximum of 150 ug/m^3 and the annual arithmetic mean of 50 ug/m^3 by dust suppressants, if necessary.
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-172.558)	This regulation outlines procedures for the packaging, labeling, manifesting, and transporting of hazardous materials.	Contaminated materials will be packaged, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations.

TABLE 2-3
(continued)
ACTION-SPECIFIC ARARs

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
National Environmental Policy Act (40 CFR 6)	This act sets the policy for carrying out the provisions of the Protection of Wetlands Executive Orders.	Requirements under NEPA will be met through attainment of other ARARs.
CWA - Regulations on Disposal Site Determinations Under the Water Act (40 CFR 231)	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill material into U.S. waters, which include wetlands.	The dredged or fill material should not be discharged unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact on the wetlands.
U.S. Fish and Wildlife Coordination Act (16 U.S.C. 661)	This act requires that, before undertaking any federal action that causes the impoundment, diversion, or other modification of any body of water, the appropriate state agency exercising jurisdiction over Wildlife Resources and the U.S. Fish and Wildlife Service be consulted.	Before discharging treated groundwater to surface water or before the wetlands are altered, the appropriate agencies will be consulted.
Army Corps of Engineers Permit Program Regulations (33 CFR 320-330)	These regulations prescribe the statutory authorities, and general and special policies and procedures applicable to the review of applications for Department of the Army (DA) permits for controlling certain activities in U.S. waters; this includes discharge of dredged or fill material.	Dredging and filling of the wetlands must be shown to cause minimal adverse impacts, a less environmentally damaging alternative does not exist, and the project is in the overall public interest in order to obtain a DA permit.
STATE REGULATORY REQUIREMENTS		
New York Rules for Inactive Hazardous Waste Disposal Sites (6 NYCRR Part 375)	These rules apply to the development and implementation or remedial programs at inactive hazardous waste sites.	Under these rules, NLODS is a Class II site, which defines it as posing a threat and requires remediation. New York State DEC generally conforms to all federal requirements concerning site clean-up. Remedial activities will follow these policies.
New York Hazardous Management and Facility Regulations (6 NYCRR Parts 370-372, 373-1 and 373-2)	These regulations govern hazardous waste identification, generation, transportation and operation of TSDFs. Treatment facilities must be operated in accordance to these rules.	On-site treatment facilities will be designed, constructed, and operated as set forth in these regulations.
New York Rules for Siting Industrial Waste Facilities (6 NYCRR Part 361)	This regulation establishes the criteria that must be considered before construction of new hazardous waste TSDFs.	Design of a treatment facility will consider siting criteria. New York State DEC will be consulted prior to any construction activity.

TABLE 2-3
(continued)
ACTION-SPECIFIC ARARs

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
New York Rules on Collection and Transport of Industrial Wastes (6 NYCRR Part 364)	These rules govern the collection, transportation, and delivery of hazardous and regulated waste in the State of New York.	Off-site transport of contaminated waste or treatment process residuals will be performed by a state-permitted transporter.
New York Air Pollution Control Regulations (6 NYCRR Parts 200-202)	These regulations prohibit the emission of air contaminants that exceed air quality standards. Emission testing, sampling, and analysis may be required to determine compliance.	Design and operation of incinerators, and any other treatment alternative that generates air emissions, will need to comply with these regulations.
New York Air Pollution Control Act - Burning of Hazardous Waste (NY ECL Sec. 19-304)	A trial burn plan must be submitted to New York State DEC for approval. Plans should include characteristics of waste type, operating specifications of the incinerator, and sampling and analysis plan to quantify results of incineration.	Treatability studies will be conducted prior to implementation of any alternative that includes incineration.
New York Regulations on State Pollutant Discharge Elimination System (6 NYCRR Parts 750-758)	Compliance with the New York SPDES is required for discharge of treatment process waters. Under these regulations, New York DEC may impose treatment standards for discharge and monitoring, reporting and recordkeeping requirements.	These ARARs maybe obtained through compliance with NPDES program under the CWA.

closure and post-closure requirements relevant and appropriate to on-site remedial actions.

RCRA Part 264 provides three basic closure options that are relevant and appropriate for CERCLA remedial actions. The clean closure option requires removal or decontamination of all hazardous constituents, and includes stringent groundwater standards. If all hazardous constituents will not be removed or decontaminated, the landfill closure option may be used. Landfill closure, a containment option, requires a final cover or cap and a post-closure plan that protects human health and the environment. The third closure option, alternate closure, is a hybrid between clean closure and landfill closure requirements. Alternate closure allows wastes to remain at the site and does not require a full-closure program or an impermeable cap. Requirements are site-specific and based on potential pathways of concern. However, the threat of direct contact and the potential for leachate to contaminate groundwater must be eliminated.

For remedial alternatives involving transportation, treatment, storage, and/or disposal of hazardous wastes, RCRA Subtitle C disposal requirements will be potential ARARs.

RCRA Part 268 - Regulations on Land Disposal Restrictions (i.e., Land Ban) will be invoked for remedial actions involving transport, treatment, storage, and/or disposal of RCRA hazardous wastes. These regulations, required by the 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA, prohibit continued land disposal of hazardous wastes beyond specified dates unless USEPA determines, based on a case-specific petition, that there will be "no migration" of hazardous constituents from the disposal unit for as long as the wastes remain hazardous. Wastes treated in accordance with treatment standards set by USEPA pursuant to RCRA Section 3004(m) are not subject to Land Ban prohibitions and may be land-disposed.

Land Ban restrictions set forth a series of land disposal deadlines for three categories of wastes: (1) solvents and dioxins, (2) California List wastes, and (3) scheduled wastes ("First Third," "Second Third," and "Third Third"). Wastes at the NLODS affected by the Land Ban may fall into the category for third scheduled wastes.

RCRA land disposal restrictions for third scheduled wastes have been proposed and are required to be finalized by May 8, 1990 (Federal Register, 1989). The final rule will propose treatment standards or treatment technologies for hazardous wastes exhibiting one or more characteristics defined in Subpart C of 40 CFR Part 261 (i.e., ignitability, corrosivity, reactivity, or Extraction Procedure [EP] toxicity). For certain wastes, USEPA is proposing treatment below the level at which the wastes no longer exhibit the specific characteristic.

Samples collected from the lagoon at NLODS were analyzed using the TCLP. The extract from many of these samples exceed the USEPA maximum level for lead of 5 ppm; therefore, it is considered a characteristic waste that may require treatment according to Land Disposal Restrictions for third schedule wastes.

Clean Water Act. Several regulations promulgated under the CWA apply when considering remedial alternatives involving dredging, groundwater treatment, and discharges to surface water. NPDES permit requirements for point-source discharges must be met, including the NPDES Best Management Practice Program. These regulations include, but are not limited to, requirements for compliance with water quality standards, a discharge monitoring system, and records maintenance. Section 404 of the CWA, which regulates discharges of dredged fill material into U.S. waters, also applies to alternatives involving dredging. Under Section 404, activities that negatively affect a wetland will not be permitted if a practicable alternative with less impact on the wetland is available. Specifically, the Guidelines for Specification of Disposal Sites for Dredged or Fill Materials for Wetlands (i.e., 40 CFR 230) will be relevant and appropriate when screening or implementing remedial actions that affect wetlands.

Advance Identification under Section 230.80 of the CWA 404(b)(1) guidelines allows state and local officials and the U.S. Army Corps of Engineers (USACE), in cooperation, to identify water bodies and wetlands as generally unsuitable for use as disposal sites in advance of receiving applications to fill them. This designation does not prohibit or restrict work in a given area; rather, it indicates in advance whether a proposed project is likely to comply with 404(b)(1) guidelines and (therefore) whether a permit application is likely to be approved or denied.

Clean Air Act. Requirements concerning alternatives involving excavation and air emissions from treatment facilities include the National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (CAA).

Occupational Safety and Health Administration. Federal OSHA requirements regulating worker safety and employee records must be followed during all site work. These regulations include safety and health standards for federal service contracts, and recordkeeping, reporting, and related regulations.

Fish and Wildlife Coordination Act. For proposed discharges to surface water, the Fish and Wildlife Coordination Act applies, requiring USEPA to notify various federal agencies of the proposed action.

Department of Transportation Rules for Transport of Hazardous Materials. If materials that contain hazardous wastes are to be transported off-site, U.S. Department of Transportation (DOT) general and manifest requirements apply.

New York State Regulatory Requirements. In addition to federal ARARs, several New York State regulations apply to potential remedial alternatives. New York State requirements apply to dredging and impacts to the wetlands, ambient air quality, air pollution, and waterways regulations. Specific requirements are listed in Table 2-3.

3.0 DEVELOPMENT OF REMEDIAL RESPONSE OBJECTIVES AND TARGET CLEAN-UP LEVELS

This section describes response objectives that serve as the basis for formulating target clean-up levels and for developing and evaluating site remediation alternatives.

3.1 GENERAL REMEDIAL RESPONSE OBJECTIVES

Remedial response objectives are statements of proposed clean-up goals associated with site-specific chemical contamination. These objectives, developed with the consideration of ARARs, address identified public health or environmental concerns. Response objectives are used to guide the identification and screening of remedial technologies and the development and evaluation of remedial alternatives. Response objectives and target clean-up levels for NLODS were developed based on site contamination identified in the RI, and the potential exposure pathways and assessments of risks evaluated in the RA submitted to DEC in February 1990.

Before evaluating the potential risk to public health and the environment, chemicals of concern were selected for each medium at the site based on a combination of toxicity, frequency of detection, detected concentrations, mobility, and persistence. Public health and potential environmental chemicals of concern by medium are listed in Tables 3-1 and 3-2, respectively. The rationale for inclusion or exclusion of chemicals detected at the site is in the RA.

Potential routes of exposure to these chemicals of concern and potentially exposed populations were determined based on USEPA guidelines, population information, and land use. The following exposure scenarios were used in the RA to evaluate risk to human health or the environment:

- dermal absorption and incidental ingestion of lagoon sediments by children
- dermal absorption and incidental ingestion of surface soils along the lagoon access road
- direct contact with surface water and sediments by aquatic biota
- ingestion of prey and soil by terrestrial organisms

Due to the relatively low potential for exposure, no unacceptable risk to public health exists from exposure to soils or sediments in the lagoon and wetlands. In addition, based on the First Phase Field Investigation, no significant public health risk is presently anticipated for the surface waters or groundwater at this site.

TABLE 3-1
PUBLIC HEALTH CHEMICALS OF CONCERN BY MEDIUM

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

MEDIUM	CHEMICAL	RANGE OF DETECTABLE CONCENTRATIONS
SURFACE SOIL	Aroclor-1260	*5,300 µg/kg
SEDIMENT (includes 0-2 foot depth lagoon soil borings)		
	Acetone	310-2,900 µg/kg
	Trichloroethene	2,000-16,000 µg/kg
	Tetrachloroethane	5-33,000 µg/kg
	Toluene	8-7,100 µg/kg
	Ethylbenzene	120-11,000 µg/kg
	Xylene	14-67,000 µg/kg
	Naphthalene	3,200-8,600 µg/kg
	Aroclor 1242	1,500-12,000 µg/kg
	Aroclor 1260	1,100-14,000 µg/kg
	Aroclor 1016	2,000-3,200 µg/kg
	Barium	47.1-11,900 mg/kg
	Copper	39-587 mg/kg
	Lead	21-76,200 mg/kg
	Zinc	28-67,400 mg/kg
GROUNDWATER	No chemicals of concern (may be reassessed following the Second Phase Field Investigation)	
SURFACE WATER	No chemicals of concern (may be reassessed following the Second Phase Field Investigation)	
AIR	No chemicals of concern	

* Aroclor - 1260 was detected in only one surface soil sample

TABLE 3-2
ENVIRONMENTAL CHEMICALS OF CONCERN BY MEDIUM

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

MEDIUM	CHEMICAL	RANGE OF DETECTABLE CONCENTRATIONS
Lagoon Surface Water	Lead	99.6 - 1,730 µg/L
	Zinc	72 - 246 µg/L
	Aroclor - 1254	*3.6 µg/L
Wetland Surface Water	Aluminum	3,340 - 7,100 µg/L
	Lead	8.1 - 15,600 µg/L
	Zinc	122 - 769 µg/L
Lagoon Sediments	Copper	86 - 308 mg/kg
	Lead	1,060 - 76,200 mg/kg
	Zinc	1,040 - 6,990 mg/kg
	Aroclor - 1242	1,500 - 9,000 µg/kg
	Aroclor - 1260	1,100 - 5,300 µg/kg
Wetland Sediments	Copper	70 - 587 mg/kg
	Lead	98 - 10,900 mg/kg
	Zinc	28 - 563 mg/kg
	Aroclor - 1242	8,900 - 12,000 µg/kg
	Aroclor - 1260	6,500 - 14,000 µg/kg

*Aroclor - 1254 was detected in only one lagoon surface water sample

Ecological risk due to exposure to sediments, soils, and surface water containing PCBs and various inorganics (i.e., lead, copper, zinc, and aluminum) are predicted in both the wetland and lagoon.

Based on the ecological RA, remediation of the lagoon and possibly wetland sediments is warranted to mitigate threats to the environment. Preliminary target clean-up levels were developed, where possible, for contaminated surface water and soils and sediments in the lagoon and wetlands at NLODS. These are discussed in subsequent subsections.

3.2 SITE-SPECIFIC TARGET CLEAN-UP LEVELS

Because the public health RA suggests that no unacceptable health hazard exists at NLODS, development of target clean-up levels for protection of public health was not warranted. The environmental RA indicated potential risk to aquatic and terrestrial receptors. Preliminary target clean-up levels will therefore be developed for surface water, soil, and sediments in the lagoon and wetlands.

3.2.1 Surface Water

Exposure to lead, zinc, and PCBs in lagoon surface water could result in acute and chronic effects to aquatic biota. In the wetlands, aluminum, lead, and PCBs are expected to result in acute and chronic toxicity. Although environmental risks may require reevaluation pending results of the Second Phase Field Investigation, target clean-up levels for on-site surface water that will remain on-site (i.e., the lagoon and wetlands) will be developed based on "to be considered" ARARs and achievable detection limits. There are no enforceable regulations promulgated for these contaminants in surface water; however, AWQC are available for PCBs, lead, zinc, and aluminum for protection of freshwater aquatic life. These criteria do not have regulatory impact; rather, they present scientific data and guidance on the environmental effects of pollutants. Target clean-up levels for PCBs, lead, zinc, and aluminum for the protection of freshwater aquatic life will be based on these ARARs. However, when the best achievable detection limit is higher than the ARAR limit, as it is for PCBs, the detection limit will be used as the clean-up level.

3.2.2 Soils and Sediments

There are no regulations or criteria available for contaminants in soil or sediment that are protective of biota or wildlife. Preliminary sediment target clean-up levels were calculated for PCBs based on exposure of aquatic and terrestrial receptors. Preliminary clean-up levels of 2 mg/kg in the lagoon and 5 mg/kg in the wetlands were developed assuming Total Organic Carbon (TOC) concentrations of 10 and 25 percent, respectively. The procedures and calculations used to develop these preliminary clean-up levels are described in the RA.

Only limited test data exist to evaluate the significance of exposure to biota via direct contact/ingestion with contaminated sediments or soil for inorganic contaminants. As a result, it was not possible to quantify risks and target clean-up levels associated with exposure to copper, lead, and zinc in lagoon and wetland sediments. However, based on high concentrations detected in sediments at the site, inorganics, particularly lead, could cause acute and chronic effects to aquatic and terrestrial receptors. Results of the Second Phase Field Investigation will be assessed and, if appropriate, target clean-up levels will be developed for lead and other compounds of concern.

Based on First Phase RI Data and preliminary target clean-up levels, it is estimated that 7,100 cubic yards of soil, sludge, and sediments and 20,000 gallons of surface water from the lagoon and wetlands will require treatment and/or disposal. This volume estimate may change based on the Second Phase Field Investigation.

4.0 TECHNOLOGY IDENTIFICATION AND SCREENING

An inventory of technologies applicable to the site were identified based on an understanding of site contaminants, remedial response objectives, and target clean-up levels. Identified technologies were screened for effectiveness and implementability at the site. This section describes a range of technologies that can be assembled into feasible remedial action alternatives (see Section 5.0).

4.1 TECHNOLOGY IDENTIFICATION

Remedial technologies are identified and listed in Table 4-1 for each medium (i.e., sludge, soil, sediments, and surface water). The technologies are separated by function into response categories (i.e., no-action, containment, treatment, disposal, and ancillary).

The no-action alternative includes technologies restricting access to contaminated areas with physical barriers or by establishing institutional controls through legal means to prohibit public use of the site. Environmental monitoring is also included because continued monitoring is necessary to evaluate the long-term migration and distribution of contaminants at the site. These technologies will reduce exposure to contamination, but will not reduce the mobility, toxicity, or volume of the contaminants.

Containment actions include technologies involving little or no treatment, which do provide protection to human health and the environment by reducing the mobility of, or accessibility to, contaminants. Through isolation, containment technologies attempt to reduce potential routes of exposure. Containment actions typically consist of covering contaminated areas or controlling groundwater movement by using low permeability barriers or containment wells.

Treatment actions include technologies that reduce the mobility, toxicity, and/or volume of contaminants by biological, physical, or chemical processes. CERCLA, as amended by SARA, favors treatment processes over containment or disposal options, unless site conditions limit the feasibility of treatment technologies.

Disposal actions are intended to consolidate material, prevent exposure to waste material, or manage residuals from treatment and/or materials handling processes. Disposal actions may be combined with treatment actions when developing closure alternatives. For example, sludge may be treated by solvent extraction techniques (treatment action) and the residuals placed in an on-site disposal area (disposal action).

Ancillary treatment actions include technologies to pretreat waste or treat process residuals from various technologies. Examples are screening of sludge to remove debris, sludge dewatering to increase efficiency of the thermal treatment process, or solidifying process ash from on-site incineration.

TABLE 4-1
TECHNOLOGY IDENTIFICATION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SOIL, SLUDGE, AND SEDIMENTS

TECHNOLOGY	DESCRIPTION OF TECHNOLOGY
<u>No Action</u>	
Site Access Restrictions	Restrict site access with chain link fencing; post warning signs.
Institutional Controls	Initiate zoning or deed restrictions to prohibit residential or public use of the site. Conduct public awareness programs to keep public informed of site status and to help implement land use controls.
Environmental Monitoring	Evaluate migration of site contaminants over time.
<u>Containment</u>	
Cover System	Reduce potential exposure routes by covering contaminated area with a low permeability cap to reduce direct contact with on-site soil and sediments and reduce infiltration.
Slurry Wall	Helps prevent horizontal migration of contaminants in permeable soils. Must be tied into existing material of low permeability.
<u>Treatment</u>	
Alkali Metal Dechlorination (APEG)	Excavate sludge and mix with alkali polyethylene glycol (APEG) at elevated temperatures (150°C). This process dechlorinates the PCB molecules, thereby converting them to less toxic compounds. The process is not effective for VOCs or metals treatment.
Off-site Incineration	Excavate and transport sludge to an off-site incinerator to destroy organic constituents. Incineration does not treat metals.
On-site Incineration	Excavate contaminated sludge and incinerate in on-site mobile/transportable incinerator to destroy organic constituents. Will not treat metals.
Stabilization	Improve material handling properties of sludge through addition of binding agents.
Solidification (For Inorganics)	Add solidifying agents (e.g., cement, lime, fly ash, silicate, or kiln dust) to excavated sludge; mix; replace on site; and cure to form a solid low permeability matrix.
Solvent Extraction	Excavate sludge and separate oil, water, and solid using solvents and a controlled separation process. Waste solvent, oil, and solid require appropriate handling (i.e., treatment, disposal, or recycling).
Thermal Extraction	Excavate soil and sediments and place in a reaction vessel with a heated surface. Contaminants are volatilized from the excavated material through contact with the heated surface and recovered with activated carbon or condensers, or passed through an afterburner.

TABLE 4-1
(continued)
TECHNOLOGY IDENTIFICATION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SOIL, SLUDGE, AND SEDIMENTS

TECHNOLOGY	DESCRIPTION OF TECHNOLOGY
Treatment (continued)	
On-site Vitrification	Excavate contaminated soil and sediments and treat by raising the temperature of the medium above its melting point (±3000°F) to create a chemically inert, vitrified, glass-like residual. The material can be treated by placement in a mobile reactor or in-situ (see below).
Product Inclusion (Sludge in Asphalt Concrete Off-site)	Excavate and recycle sludge in asphalt concrete manufacturing process off-site.
Product Inclusion (Sludge in Portland cement Off-site)	Excavate and mix sludge with Portland cement for incorporation into concrete building materials.
In Situ Treatment	
Deep Soil Mixing/Solidification	Contaminated soil is solidified in place using a backhoe or a large, multi-auger rig to mix solidification agents with soil. Contaminated soil and sediments from remote locations would be relocated onto the central part of the site prior to applying the process.
Vitrification	Contaminated soil is vitrified in place by inserting electrodes into the ground and electronically heating the soil until it melts. The high temperatures generated during meltdown pyrolyze and eventually combust organic constituents. Vapors produced during the process are collected in a mobile hood and treated. Contaminated soil and sediments from remote locations would be relocated onto the central part of the site prior to applying the process.
Biological	Nutrients and oxygen are circulated through contaminated zones to achieve microbial degradation of organic constituents.
Soil Flushing	Water is flushed through the vadose zone and leachate collected using extraction wells.
Vacuum Extraction	Air is mechanically drawn through contaminated zones to remove VOCs.
Steam Stripping	Steam is forced through the soil and extracted by a vacuum collection system to remove VOCs and SVOCs.
Disposal	
Off-site Permitted Landfill	Excavate, transport, and dispose of sludge or treatment residuals at a permitted off-site facility.
On-site Permitted Landfill	Construct an on-site landfill to dispose of sludge, treated material, or waste residuals.
On-site Disposal Area	Consolidate treatment residuals in a single area at the site.

TABLE 4-1
(continued)
TECHNOLOGY IDENTIFICATION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SOIL, SLUDGE, AND SEDIMENTS

TECHNOLOGY	DESCRIPTION OF TECHNOLOGY
Ancillary	
Screening	Remove debris (e.g., cobbles, boulders) from excavated sludge using meshed or mechanical screens.
Dewatering	Dewater sludge prior to processing or disposal using a centrifuge or filter press, or by thermally dewatering.
Solidification (For Inorganics)	Mix process residuals (e.g., ash from on-site incinerator or solids from solvent extraction) with a setting agent to form a solid matrix in which inorganics are encapsulated.
Off-site Disposal/Treatment	Transport process water to appropriate off-site facility for treatment and/or disposal.
Soil Washing	Extract contaminants from excavated soil or ash using a liquid medium as a washing solution. Chelating agents enhance metal mobility and may be used in washing solutions to treat metals in the sludge.
Carbon Adsorption	Remove gas-phase VOCs using activated carbon.
Treatment	Treat process water using mobile process units. Treatment could involve metals precipitation and/or activated carbon adsorption of organics. Requires appropriate disposal of metal precipitate and spent carbon.

TABLE 4-1
(continued)
TECHNOLOGY IDENTIFICATION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SURFACE WATER	
TECHNOLOGY	DESCRIPTION OF TECHNOLOGY
No Action	
Site Access Restrictions	Install fence and warning signs to restrict site access.
Institutional Controls	Implement land-use or other controls to restrict future site use. Conduct public awareness programs to keep public informed of site status and to help implement land use controls.
Environmental Monitoring	Monitor on-site surface water and sediment contaminants and off-site migration of contaminants over time, through sampling and analysis of sediments and surface water in the southwestern portion of the lagoon and the wetlands.
Disposal	
Disposal/Treatment at Off-site Facility	Pump on-site surface water into tank trucks and transport to off-site POTW or other appropriate disposal facility for treatment and/or disposal.
Treatment	
Treatment with On-site Mobile Treatment Units	Pump and treat on-site surface water in mobile process units. Treatment involves precipitation of metals and requires appropriate disposal of metal precipitate.

A primary consideration in evaluating treatment and disposal methods is the degree to which the methods rely on long-term management of residuals or untreated waste. Therefore, a key factor in analysis of technologies is the amount of waste and residuals that a technology may produce, and the environmental, engineering, and regulatory concerns associated with those residuals.

4.2 TECHNOLOGY SCREENING

Identified technologies were screened on the basis of effectiveness and implementability, as well as applicability to site contaminants and environmental media (i.e., the screening considered both waste and site characteristics).

Effectiveness screening was used to evaluate how well the technology protects public health and the environment through reduction of contaminant mobility, toxicity, threat of exposure, and volume. In evaluating long-term effectiveness, a review was conducted of long-term management requirements for residual contamination and/or untreated waste produced by a technology and the threats posed by those materials. (Long-term management requirements reduce the effectiveness of a technology.)

Implementability screening was used to evaluate the engineering feasibility of implementing a technology. This criterion considers a technology's complexity and past performance at achieving reduction of contaminant mobility, toxicity, and volume. If a technology is technically effective at mitigating site problems, but is difficult to implement due to engineering complexities, it may be screened out.

Waste characteristics screening includes physical properties such as volatility, solubility, specific chemical constituents, and properties affecting performance of a technology. Site characteristics were reviewed to identify conditions that may limit or favor the use of certain remedial technologies. Technologies whose use was precluded by waste or site characteristics were eliminated from further consideration.

Table 4-2 describes technology screening evaluations for each medium of concern. Technologies that cannot be implemented at the site for the previous reasons were eliminated from further consideration. The technologies remaining after screening were used to develop potential remedial action alternatives. Table 4-3 summarizes the conclusions (i.e., retained or eliminated technologies) of the screening process.

TABLE 4-2
SCREENING OF TECHNOLOGIES
SOIL, SLUDGE, AND SEDIMENT

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
No Action			
Site Access Restrictions	Fence and warning signs reduce public health exposure risks if periodically inspected and maintained. Public awareness programs can reduce risks by discouraging trespassing. These actions restrict, but do not totally eliminate, site access, and are not effective in preventing volatilization or off-site runoff of contaminated surface water, or in protecting the environment.	Requires installation of fence, followed by routine inspection and maintenance. Public awareness can be developed through information dissemination via public meetings and local news media.	Retained
Institutional Controls	Reduces public health exposure risks by controlling future site use. Does not address environmental impacts.	Would be implemented by state and/or local political subdivisions.	Retained
Environmental Monitoring	Useful for evaluating if contaminant reduction is occurring naturally through attenuation, dilution, volatilization, and biodegradation, and thereby, reducing toxicity. Effectively monitors contaminant migration through erosion and water transport of sludge, soil, and sediments, and can be used to evaluate if off-site environmental impacts are increasing or decreasing.	No Problems anticipated.	Retained
Contaminant			
Cover System	Reduces on-site public health and environmental exposure risks and hazards associated with inhalation and direct contact, and off-site contaminant migration via erosion and water transport of sludge, soil, and sediments. Reduces mobility, but does not eliminate potential for continued contamination migration to groundwater. Does not reduce toxicity or volume of waste. Potential long-term liability associated with landfilled waste.	Cap must meet TSCA design requirements. Uses conventional construction techniques. Would include relocation of some material to consolidate contaminated material in one area on-site. Requires monitoring, maintenance, and land use controls to ensure long-term performance.	Retained

TABLE 4-2
(continued)
SCREENING OF TECHNOLOGIES
SOIL, SLUDGE, AND SEDIMENT

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
Contaminant (continued)			
Slurry Wall	Reduces mobility of contaminants in permeable soils. Does not reduce toxicity or volume of contaminants. Effective only when tied into an existing low permeability layer.	Requires excavation. Layer of low permeability material to tie into is difficult to access.	Eliminated; Not technically feasible
Treatment			
Alkali Metal Dechlorination (APEG)	Reduces public health and environmental exposure risks posed by PCBs by chemically converting them to less toxic compounds. Not effective for other organics or metals. Does not reduce mobility or volume. Toxicity of residuals unknown.	Full-scale process has not yet been demonstrated. Few vendors exist. Requires excavation. Requires additional technology for treatment of other organic and inorganic compounds.	Eliminated; Not Proven.
Off-site Incineration	Reduces public health and environmental exposure risks posed by contaminated sludge, soil, or sediment. Eliminates continued future contaminant migration to groundwater. Permanently destroys organics, thereby reducing their mobility, toxicity, and volume. Not effective for treating metals, but removes metals from the site, because ash residue would be handled by the incineration facility.	Currently, the operating TSCA incinerator facilities are running at capacity. Requires waste characteristic analysis and/or test burn prior to incineration. Requires excavation, appropriate packaging, and transportation. Sludge may require dewatering.	Eliminated; Too costly
On-site Incineration	Reduces public health and environmental exposure risks posed by organic contaminants in the soil, sludge, or sediments. Eliminates continued future contaminant migration to groundwater. Permanently destroys organics, thereby reducing their mobility, toxicity, and volume. Not effective for metals.	Requires test burns to demonstrate performance with specific waste. Requires excavation. Sludge may require dewatering. Potential for negative community reaction. Treated residue may require special handling (i.e., off-site disposal) or further treatment due to levels of metals.	Retained
Stabilization	Does not reduce toxicity or volume of contaminated material. Provides increased strength to materials for handling/disposal purposes.	Uses coventional mixing equipment. Mix ratios may be high for sludges.	Retained

TABLE 4-2
(continued)
SCREENING OF TECHNOLOGIES
SOIL, SLUDGE, AND SEDIMENTS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
Treatment (continued)			
Solidification (For Inorganics)	Reduces public health and environmental exposure risks posed by contaminants in the soil, sludge, or sediments by reducing their mobility. Does not reduce toxicity. May increase volume by 20% or more. Long-term effectiveness is not well-demonstrated for PCBs and other organics.	Requires excavation. Uses conventional mixing equipment. May require use of proprietary additives. Requires bench-scale tests to determine optimum additives and dosages. Requires monitoring to ensure long-term performance.	Retained
Solvent Extraction	Reduces public health and environmental exposure risks posed by organics in contaminated soil, sludge, and sediments. The treatment units currently under development are not effective in removing metals from soil. Potentially eliminates continued future contaminant migration to groundwater.	Requires excavation. Produces contaminated extract, which requires subsequent treatment/handling.	Retained
Thermal Extraction	Reduces public health and environmental exposure risks posed by organics in contaminated soil, sludge, and sediments. Not effective for treating metals.	Requires excavation. Off-gases may require additional treatment. Sludge may require dewatering.	Retained
On-site Vitrification	Reduces public health and environmental exposure risks by destroying the organics and incorporating the inorganics into non-leachable, glass-like solid. Reduces mobility, toxicity, and volume of organics, and mobility of inorganics. Fate of PCBs during vitrification is currently under investigation.	Requires excavation. Few vendors exist. Large power requirement necessary for operation. Requires a pilot test.	Eliminated; due to site location and power requirements
Product Inclusion (Sludge in Asphalt Concrete Off-site)	Reduces the mobility of organics and metals in contaminated soil, sludge, and sediments.	Requires excavation. May require dewatering. Must add material to product at very small mix ratios.	Eliminated; Not technically feasible
Product Inclusion (Sludge in Portland cement Off-site)	Reduces the mobility of organics and metals in contaminated soil, sludge and sediments.	Requires excavation. May require dewatering. Must add material to product at very small mix ratios.	Eliminated; Not technically feasible.

TABLE 4-2
(continued)
SCREENING OF TECHNOLOGIES
SOIL, SLUDGE, AND SEDIMENTS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE REASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
In Situ Treatment			
Deep Soil Mixing/ Solidification	Reduces public health and environmental exposure risks posed by soil and sediment contaminants by reducing their mobility. Does not reduce toxicity or volume. Long-term effectiveness is not well-demonstrated for PCBs or other organics.	Excavation not required. Few vendors have required equipment. Rocky soil or buried debris may cause engineering difficulty. May require use of proprietary additives. Requires bench-scale tests to determine optimum additives and dosages; pilot tests prior to final design; and monitoring to ensure long-term performance.	Eliminated; due to soil type, debris, and lack of available equipment.
Vitrification	Reduces public health and environmental exposure risks by destroying the organics and incorporating the inorganics into non-leachable, glass-like solid. Reduces mobility, toxicity, and volume of organics, and mobility of inorganics. Fate of PCBs during vitrification is currently under investigation. Buried debris may limit effectiveness.	Excavation not required. Requires lowering the water table. Rocky soil or buried debris may cause engineering difficulty. Demonstrated in full-scale pilot tests. Requires site preparation (e.g., clearing and regrading); a crane to move equipment on-site; and pilot test prior to final design. Large power requirement necessary for operation.	Eliminated; due to site location and power requirements
Biological	Reduces public health and environmental exposure risks posed by some organic compounds by biological degradation, however, not effective for PCBs or metal treatment. Metals in soil, sludge, or sediment may be toxic to micro-organisms.	Would require treatability study to determine effectiveness. Long treatment period may be required.	Eliminated; high metal concentrations may inhibit micro-organisms.
Soil Flushing	Reduces the toxicity of soil contaminants. Reduced public health and environmental risks associated with soil and sediments by leaching out contaminants.	Installation of extraction wells is required. Soil permeability may restrict influx of sufficient quantities of water to effectively flush soils. Surfactants or other additives may be required to successfully remove the contaminants.	Eliminated; Due to site characteristics (i.e., low permeable soils)
Vacuum Extraction	Reduces public health and environmental risks posed by VOCs in contaminated soil and sediments. Not effective for treating metals or PCBs.	Permeability of soil may not be high enough to allow sufficient air flow through contaminated zones. Requires off-gas treatment.	Eliminated; Not effective treatment for PCBs or inorganics
Steam Stripping	Reduces public health and environmental risks posed by VOCs and SVOCs in contaminated soil and sediments. Not effective for treating metals or PCBs.	Permeability of soil may not be high enough to allow sufficient steam flow through contaminated zones. Requires vapor-phase treatment.	Eliminated; Not effective treatment for PCBs or inorganics

TABLE 4-2
(continued)
SCREENING OF TECHNOLOGIES
SOIL, SLUDGE, AND SEDIMENTS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
<u>Disposal</u>			
Off-site Permitted Landfill	Reduces public health and environmental exposure risks posed by contaminated soil, sludge, and sediments. Eliminates continued future contaminant migration to groundwater. Does not reduce toxicity or volume of waste. Potential long-term liability associated with landfilled waste.	Requires excavation and transport. Capacity of TSCA landfills is limited. Requires waste-characteristic analysis prior to disposal.	Retained
On-site Permitted Landfill	Reduces public health and environmental exposure risks posed by contaminated soil, sludge, and sediments. Eliminates continued future contaminant migration to groundwater. Does not reduce toxicity or volume of waste. Potential long-term liability associated with landfilled waste.	Landfill must meet TSCA design requirements. Available space and site terrain may limit siting of on-site facility. Requires excavation of contaminated soil, sludge, and sediments. May require temporary on-site storage of excavated material while disposal cell is under construction. Requires monitoring, maintenance, and land use controls to ensure long-term performance.	Eliminated; due to site constraints (e.g., limited space)
On-site Disposal Area	Does not reduce toxicity or volume of contamination. Reduces potential contaminant migration. Effective in containing wastes.	Requires excavation of at least some of the soil/sediments. Require maintenance and land use controls to ensure long-term performance.	Retained
<u>Ancillary</u>			
Screening	Does not reduce toxicity, mobility or volume of contamination. Would be used in conjunction with other treatment technologies.	Easily implemented.	Retained
Dewatering	Would reduce the volume of the contaminated soil, sludge, and sediments to be treated. This technology would be used in conjunction with other treatment technologies.	Several types of dewatering systems are available for use.	Retained

TABLE 4-2
(continued)
SCREENING OF TECHNOLOGIES
SOIL, SLUDGE, AND SEDIMENTS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
<u>Ancillary</u> (continued)			
Solidification (For Inorganics)	Reduces public health and environmental exposure risks of residuals by reducing mobility. Does not reduce toxicity. May increase volume by 20% or more. Long-term effectiveness is not well demonstrated.	Uses conventional mixing equipment. May require use of proprietary additives. Requires bench-scale tests to determine optimum additives and dosages. Requires monitoring to ensure long-term performance.	Retained
Disposal/Treatment at Off-site Facility	Reduces toxicity of process water by additional treatment.	Appropriate facility must be identified. Requires pumping system and transportation off-site. Requires testing prior to acceptance at the off-site facility.	Retained
Soil Washing	Reduces public health and environmental exposure risks posed by contaminants in soil, sludge or sediments by extracting them into a washing solution.	Requires excavation. Would require treatability test to determine effectiveness. Sludge may require dewatering. Concentrated wastestream would require further treatment.	Retained
Carbon Adsorption	Effective for removing VOCs from off-gas treatment processes.	Easily implemented.	Retained
Treatment	Reduces toxicity of process water by additional treatment.	Several types of mobile treatment units are available from vendors.	Retained

TABLE 4-2
SCREENING OF TECHNOLOGIES
SURFACE WATER

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSIONS
No Action			
Site Access Restrictions	Fence and warning signs reduce public health exposure risks if periodically inspected and maintained. Public awareness programs can reduce risks by discouraging trespassing. These actions restrict, but do not totally eliminate, site access, and are not effective in preventing volatilization or off-site runoff of contaminated sludge, soil, or sediments, or in protecting the environment.	Requires installation of fence, followed by routine inspection and maintenance. Public awareness can be developed through information dissemination via public meetings and local news media.	Retained
Institutional Controls	Reduces public health exposure risks by controlling future site use. Does not address environmental impacts.	Would be implemented by state and/or local political subdivisions.	Retained
Environmental Monitoring	Useful for evaluating if contaminant reduction is occurring naturally through attenuation, dilution, volatilization, and biodegradation, and thereby, a reduction in toxicity. Effectively monitors contaminant migration through erosion and water transport of sludge, soil, and sediments, and can be used to evaluate if off-site environmental impacts are increasing or decreasing.	No Problems anticipated.	Retained
Disposal			
Disposal/Treatment at Off-site Facility	Reduces toxicity of surface water by treating at an off-site POTW or other appropriate facility.	Appropriate facility must be identified. Requires pumping system and transportation off-site. Requires testing to demonstrate that the accepting facility's system and discharge will not be adversely affected.	Retained
Treatment			
Treatment with On-site Mobile Treatment Units	Process would effectively remove metals by precipitation.	Pumping system would be required. Appropriate disposal of metal precipitate is required.	Retained

TABLE 4-3
SUMMARY OF TECHNOLOGY SCREENING

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	RETAINED	ELIMINATED
SOIL, SLUDGE, AND SEDIMENTS		
No Action		
Site Access Restrictions	X	
Institutional Controls	X	
Environmental Monitoring	X	
Containment		
Cover System	X	
Slurry Wall		X
Treatment		
Alkali Metal Dechlorination (APEG)		X
Off-Site Incineration		X
On-Site Incineration	X	
Stabilization	X	
Solidification (For Inorganics)	X	
Solvent Extraction	X	
Thermal Extraction	X	
On-Site Vitrification		X
Product Inclusion (Sludge in Asphalt Concrete Off-Site)		X
Product Inclusion (Sludge in Portland Cement Off-Site)		X
In-Situ Treatment		
Deep Soil Mixing/Solidification		X
Vitrification		X
Biological		X
Soil Flushing		X
Vacuum Extraction		X
Stream Stripping		X
Disposal		
Off-Site Permitted Landfill	X	
On-Site Permitted Landfill		X
On-Site Disposal Area	X	

TABLE 4-3
(continued)
SUMMARY OF TECHNOLOGY SCREENING

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

TECHNOLOGY	RETAINED	ELIMINATED
SOIL, SLUDGE, AND SEDIMENTS		
Ancillary		
Screening	X	
Dewatering	X	
Solidification (For Inorganics)	X	
Off-Site Disposal/Treatment	X	
Soil Washing	X	
Carbon Absorption	X	
Treatment	X	
SURFACE WATER		
No Action		
Site Access Restrictions	X	
Institutional Controls	X	
Environmental Monitoring	X	
Disposal		
Disposal/Treatment at Off-Site Facility	X	
Treatment		
Treatment with On-Site Mobile Treatment Units	X	

5.0 DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

5.1 APPROACH TO ALTERNATIVES DEVELOPMENT

The retained technologies, listed in Table 4-3, are considered technically feasible and applicable to the waste types and site conditions at NLODS. These technologies were assembled into potential remedial alternatives capable of mitigating site contamination and achieving response objectives. SARA emphasizes the following statutory preferences when evaluating remedial alternatives:

- Remedial actions involving treatment technologies that permanently and significantly reduce the mobility, toxicity, or volume of contaminants or waste are preferred rather than those that focus on reducing or preventing exposure (i.e., containment or disposal).

- Remedial actions that use permanent solutions, alternative or innovative treatment technologies, or resource recovery technologies will be assessed.

- Remedial actions that involve off-site transport and disposal of untreated wastes are considered least favorable.

In developing the alternatives, consideration was given to attaining the response objectives, as well as statutory preferences in SARA. Therefore, alternatives were developed that cover a range of possible remedial approaches, varying in the degree to which they require long-term site management. The limits of this range extend from (1) alternatives providing treatment to reduce mobility, toxicity, or volume, but still require continued long-term management of treatment residuals or low-concentration wastes, to (2) alternatives providing permanent remediation, thereby eliminating the need for long-term management.

In addition to evaluating alternatives involving treatment technologies, a no-action alternative, as well as containment and disposal alternatives (involving little or no treatment) were developed. Consequently, the set of developed alternatives includes the following categories:

- No-Action alternatives

- Containment and Disposal alternatives

- Range of Treatment alternatives

5.2 DEVELOPMENT OF ALTERNATIVES

As stated, the NCP specifies that remedial alternatives be classified as either source control or management-of-migration remedial actions. Management-of-migration remedial actions were not considered because (1) groundwater does not pose an unacceptable risk to public health, and

(2) wetland sediments are located next to the lagoon (i.e., near the original source area). Because sludge, soil, and sediment contain the same contaminants and are in the same general area, the alternatives developed for all three media were classified as source control alternatives.

Six potential source control alternatives developed for the site are described in Table 5-1. Alternatives include a no-action alternative (i.e., SC-1), a containment alternative (i.e., SC-2), an off-site disposal alternative (i.e., SC-6), and three treatment alternatives (i.e., SC-3: on-site incineration and solidification; SC-4: on-site solvent extraction and solidification; and SC-5: on-site thermal extraction and soil washing). With the exception of SC-1 (minimal no-action), all alternatives require excavation of contaminated sediments in the wetland with the assumption that the excavated area will be allowed to re-vegetate naturally.

5.3 INITIAL SCREENING OF ALTERNATIVES

The purpose of the initial screening of alternatives was to evaluate potential remedial alternatives developed for the site, and appropriately narrow the number of alternatives retained for subsequent detailed analysis, while preserving a range of options. Three criteria (i.e., effectiveness, implementability, and cost) were used to evaluate each potential alternative. These screening criteria are consistent with the remedy selection requirements set forth in SARA and the NCP. Table 5-2 lists the advantages and disadvantages of each alternative with respect to effectiveness, implementability, and cost. This evaluation of alternatives presents a clear, concise procedure for screening potential corrective actions.

The identified alternatives provide a range of treatment technologies as well as containment, disposal, and no-action alternatives. At this time, treatment alternatives all appear to be technically reliable, feasible, and capable of effectively and adequately protecting public health and the environment. The conclusion of the screening process is to retain all the identified alternatives for detailed analysis. Table 5-3 summarizes the remedial alternatives retained for detailed analysis.

TABLE 5-1
IDENTIFICATION OF POTENTIAL REMEDIAL ALTERNATIVES

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

ALTERNATIVE NO.	DESCRIPTION OF KEY COMPONENTS
SC-1	Minimal No-Action
	o Site Access Restrictions. Install fence and warning signs and conduct community awareness programs.
	o Institutional Controls. Restrict future land use and discourage fishing and recreational use of the site.
	o Environmental Monitoring. Sample and analyze surface soil, sediment, surface water, and groundwater to monitor contaminant migration from the source area and evaluate natural site restoration.
SC-2	Stabilization and Site Capping
	o Drain and treat/dispose on-site surface water.
	o Excavate sludge, stabilize, and replace in area to be capped.
	o Excavate contaminated soil and sediments from wetlands area and other remote locations and relocate to area to be capped.
	o Construct low-permeability cap over contaminated area.
	o Conduct long-term monitoring and maintenance.
SC-3	On-Site Incineration and Solidification
	o Drain and treat/dispose on-site surface water.
	o Excavate contaminated sludge, soil, and sediments and temporarily stockpile.
	o Treat contaminated sludge, soil, and sediments in on-site incinerator.
	o Solidify process residuals.
	o Replace treated material on-site and regrade excavated areas.
	o Conduct limited long-term monitoring and minimal long-term maintenance.

TABLE 5-1
(continued)
IDENTIFICATION OF POTENTIAL REMEDIAL ALTERNATIVES

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

ALTERNATIVE NO.	DESCRIPTION OF KEY COMPONENTS
SC-4	On-Site Solvent Extraction and Solidification
	o Drain and treat/dispose on-site surface water.
	o Excavate contaminated sludge, soil, and sediments and temporarily stockpile.
	o Treat contaminated sludge, soil, and sediments in on-site solvent extraction unit.
	o Solidify residuals into low-permeable mass.
	o Replace treated material on-site and regrade excavated areas.
	o Conduct long-term monitoring and maintenance.
SC-5	On-Site Thermal Extraction and Soil Washing
	o Drain and treat/dispose on-site surface water.
	o Excavate contaminated sludge, soil, and sediments and treat by thermal extraction on-site.
	o Treat residuals by soil washing techniques.
	o Replace treated material on-site and regrade excavated areas.
	o Conduct long-term monitoring and maintenance.
SC-6	Off-Site Disposal at TSCA Landfill
	o Drain and treat/dispose on-site surface water.
	o Excavate and transport contaminated sludge, soil, and sediments to a permitted TSCA landfill.
	o Backfill and regrade excavated areas with clean fill.

TABLE 5-2
(continued)
SCREENING OF REMEDIAL ALTERNATIVES

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

ALTERNATIVE SC-2
STABILIZATION AND SITE CAPPING

This alternative involves stabilizing the sludge, placing the contaminated soil, sediments, and stabilized sludge in a common area on-site, and covering with a low-permeability cap.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages	Advantages	Advantages
o Stabilization would provide increased strength to sludge.	o Stabilization is a demonstrated technology.	o Minimal long-term monitoring costs.
o Cap would reduce mobility of contaminants entering groundwater.	o Installation of cap is easily implementable.	o Stabilization is relatively inexpensive.
o Cap would be effective in short-term.	o Limited long-term monitoring and maintenance required.	o Capping is relatively inexpensive.
o Monitoring of groundwater wells would assess cap's long-term effectiveness.		
Disadvantages	Disadvantages	Disadvantages
o Would not reduce toxicity of contaminants.	o Requires excavation.	o Excavation costs incurred.
o Stabilization would increase the volume of the sludge.	o Land Ban restrictions may apply once material is excavated.	
o Treatability tests would need to be performed to determine the correct admixture.	o May require future source control and/or groundwater treatment.	

Conclusions. This alternative will reduce the mobility of the contaminants, and reduce the potential for direct human contact; it is retained for detailed analysis.

TABLE 5-2
(continued)
SCREENING OF REMEDIAL ALTERNATIVES

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

ALTERNATIVE SC-3
ON-SITE INCINERATION AND SOLIDIFICATION

This alternative consists of incinerating the contaminated sludge, soil, and sediments, solidifying the process residuals, and replacing the solidified mass on-site.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages	**Advantages**	**Advantages**
o Permanently and significantly reduces mobility, toxicity, and volume of contamination. o Reduces risk to public health and the environment. o Incineration would permanently reduce toxicity of soil contaminants (VOC destruction removal efficiency is greater than 99 percent). o Off-gases would be collected and treated to comply with air quality standards. o Chemical-specific ARARs would be attained. o Solidification would reduce mobility, leaching potential, and potential for direct human contact with residuals.	o Meets SARA's preference for treatment. o Vendors are available to mobilize and operate on-site incinerator. o Solidification is a proven technology with several vendors available.	o Capital costs well-defined. o Long-term monitoring and five-year reviews not necessary.
Disadvantages	**Disadvantages**	**Disadvantages**
o High potential for worker exposure during source removal. o Test burn required for on-site incineration. o Potential Air Emissions of metals. o Solidification may increase volume of treated solids by up to 20%.	o Requires excavation. o Land ban restrictions may apply once material is excavated. o Mobile incinerators require approximately two acres for set-up.	o High cost associated with incineration. o Excavation costs incurred.

Conclusion. This alternative permanently reduces the mobility, toxicity, and volume of contamination; it is retained for detailed analysis.

TABLE 5-2
(continued)
SCREENING OF REMEDIAL ALTERNATIVES

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

ALTERNATIVE SC-5
THERMAL EXTRACTION AND SOIL WASHING

This alternative consists of excavating the sludge, soil, and sediments and treating with thermal extraction, followed by treatment of residuals with soil washing, and finally replacement on-site.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages	**Advantages**	**Advantages**
o Reduces toxicity, mobility, and volume of contaminants in soil, sludge, and sediments.	o Thermal extraction equipment readily available and requires minimal monitoring.	o Thermal extraction costs are relatively inexpensive. ($110 - 150/cy)
o Reduces long-term health risks associated with direct contact of soils, sludge, and sediments.	o Mobile soil washers are available for on-site use.	o Soil washing costs are relatively inexpensive. ($125/cy)
o Short-term direct contact or inhalation risks to workers would be reduced by use of personal protective equipment and air monitoring.		
Disadvantages	**Disadvantages**	**Disadvantages**
o Treatability studies would be required to assess overall effectiveness of thermal extraction and soil washing.	o Treatability tests required for both technologies.	o Excavation costs incurred.
o Concentrated wastes from soil washing provide potential for short-term risk.	o Concentrated waste from soil washing will require treatment/disposal.	
o Off-gases from thermal extraction provide potential for short-term risk.	o Off-gases from thermal extraction may require additional treatment.	
	o Land ban restrictions may apply once material is excavated.	

Conclusion. This alternative would reduce the toxicity, mobility, and volume of contaminants in the sludge, soil, and sediments; it is retained for detailed analysis.

TABLE 5-2
(continued)
SCREENING OF REMEDIAL ALTERNATIVES

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

ALTERNATIVE SC-6
OFF-SITE DISPOSAL AT TSCA LANDFILL

This alternative consists of excavating the contaminated sludge, soil, and sediments and transporting to a TSCA landfill for disposal.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages	Advantages	Advantages
o Off-site disposal of soil, sediments, and sludge would remove the source of contamination. o Off-site disposal would reduce long-term human health risks due to direct soil contact. o Short-term human health risks to workers during excavation activities would be reduced through use of personal protective equipment and air monitoring.	o Would not require installation of a treatment system. o Very easy to implement this alternative.	o Costs include only excavation, transport and disposal of material.
Disadvantages	Disadvantages	Disadvantages
o Excavation and disposal would not reduce the toxicity, mobility, or volume of chemicals in the sludge, soil, and sediments. o Disposal without treatment is the least-preferred alternative under SARA because the mobility, toxicity, or volume of waste is not being reduced. o Long term liability may still be present because the generated wastes are still present.	o Land disposal regulations would have to be considered. o Excavation would be required. o There is a potential hazard in hauling the wastes to the approved landfill.	o Although significant cost is associated with this alternative, no reduction of toxicity, mobility, or volume is achieved.

Conclusions. Though this alternative does not reduce the volume, toxicity, or mobility of the contamination, it does remediate the site. It is retained for detailed analysis.

TABLE 5-3
SUMMARY OF REMEDIAL ALTERNATIVES RETAINED FOR DETAILED ANALYSIS

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

SC-1	Minimal No-Action
SC-2	Stabilization and Site Capping
SC-3	On-Site Incineration and Solidification
SC-4	On-Site Solvent Extraction and Solidification
SC-5	On-Site Thermal Extraction and Soil Washing
SC-6	Off-Site Disposal at TSCA Landfill

6.0 TREATABILITY STUDY RECOMMENDATIONS

Six treatment technologies passed through technology screening into alternatives development: stabilization, incineration, solidification, solvent extraction, thermal extraction, and soil washing. Each technology was assessed for treatability testing requirements based on waste- and site-specific characteristics, proven performance, reliability, and availability. In assessing this need, vendors were contacted and literature sources were reviewed to determine whether the site and waste characteristics were significantly different from other applications of the specific technology.

Incineration was considered to be an established technology with proven destruction and removal efficiency. Therefore, a treatability study would be unnecessary. If incineration is the selected treatment technology, a test burn will be required in accordance with state and federal regulations. Solidification is also an established technology with substantial documentation about the effectiveness of the process for inorganic wastes. Several companies have claimed success in applying a solidification process to a wide range of inorganic wastes of varying matrices, including solids, sludge, and incinerator ash. Therefore, a treatability study was considered unnecessary.

To complete a detailed evaluation of the Remedial Alternatives (Second Phase FS), it is recommended that treatability tests be conducted for the following technologies:

- Stabilization, to determine the quantity and type of binding agents required to improve sludge stability

- Solvent Extraction, to determine the effectiveness and cost of the process

- Thermal Extraction, to determine the effectiveness of the process, the degree of sludge dewatering required, and a cost comparison with solvent extraction

- Soil Washing, to determine the effectiveness of treating inorganics in solid residuals from the extraction processes

Tables 6-1 through 6-4 describe each treatability study, a vendor contact, and advantages and disadvantages for each of the recommended studies.

The Second Phase FS will evaluate the remedial alternatives identified in this report. This evaluation will be conducted following the Second Phase Field Investigation. Data gathered from the recommended treatability studies for various technologies will be used to evaluate each alternative's effectiveness in meeting clean-up goals. In addition, the treatability studies will provide a better estimate of costs involved in the full-scale operation. The studies may also identify any problems associated with technology implementation at the site.

TABLE 6-1
TREATABILITY STUDY ASSESSMENT - STABILIZATION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

Vendor Contact: Harmon Environmental - Plymouth Meeting, Pennsylvania
Frank Friday (215) 825-8877

Description: A treatability study would involve sending approximately 5 gallons of sludge to Envirite for bench-scale testing. The bench-scale system would determine the type of binding agent required to sufficiently strengthen and stabilize the sludge.

Advantages	Disadvantages
o Characterize binding agents necessary to strengthen and stabilize sludge.	o None.
o Characterize stability of metals in sludge.	
o 3-4 weeks to perform bench-scale tests.	
o Relatively inexpensive, approximately $3,000.	

TABLE 6-2
TREATABILITY STUDY ASSESSMENT - SOLVENT EXTRACTION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

Vendor Contact: Resources Conservation Company (RCC)
Lanny Weimer (301) 596-6066

CF Systems, Inc.
Tom Cody (617) 890-1200

Description: A treatability study would involve sending approximately 5 gallons of sludge to vendor for bench-scale testing. The bench-scale system would determine effectiveness of the extraction technique on the contaminated material.

Advantages	Disadvantages
o Characterize the processability of site-specific soils and sludges.	o 1-2 months to perform bench-scale tests.
o Vendors are available.	
o Cost - Approximately $6,000 per sample.	

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TABLE 6-3
TREATABILITY STUDY ASSESSMENT - THERMAL EXTRACTION

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

Vendor Contact: Weston Services, Inc. - West Chester, Pennsylvania
Roger Nielson (215) 692-3030

Description: A treatability study would involve sending approximately 15 gallons of material to Weston for bench-scale testing. The bench-scale system would estimate VOC and SVOC removal and characterize off-gases. The treated material would be tested for residual contamination.

Advantages	Disadvantages
o Characterizes the processability of site-specific soils and sludges.	o Two-month time frame to perform bench-scale test.
o Characterize the effectiveness of volatilizing VOCs and SVOCs.	o Cost - Approximately \$15,000 - \$20,000
o Vendors are available.	

TABLE 6-4
TREATABILITY STUDY ASSESSMENT - SOIL WASHING

NORTH LAWRENCE OIL DUMP SITE
FIRST PHASE FEASIBILITY STUDY

Vendor Contact: ECOVA Corporation - Redmond, Washington
Jim Morrison (206) 883-1900

Description: A treatability study would involve sending approximately 5 gallons of extraction process residuals to ECOVA for bench-scale testing. The bench-scale system would determine the type of organic solvent required and other parameters necessary to wash metals from the soil residuals.

Advantages	Disadvantages
o Characterize the processability of extraction residuals.	o 1-2 months to perform bench-scale tests.
o Characterizes the effectiveness of removing metals.	o Cost - Approximately $30,000.
o Vendors are available.	

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AGC	Ambient Guidance Concentration
AIC	Acceptable Intake-Chronic
AIS	Acceptable Intake-Subchronic
APEG	Alkali Polyethylene Glycol
ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CAA	Clean Air Act
CAG	Carcinogen Assessment Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cm/sec	centimeters per second
CWA	Clean Water Act
DA	Department of the Army
DEC	Department of Environmental Conservation (New York State)
DOH	Department of Health (New York State)
DOT	Department of Transportation
EP	Extraction Procedure (Toxicity)
FS	Feasibility Study
HRS	Hazard Ranking System
HSWA	Hazardous and Solid Waste Amendments
MCLGs	maximum contaminant level goals
MCLs	maximum contaminant level
mg/kg	milligrams per kilogram
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
ng/m^3	nanograms per cubic meter
NIOSH	National Institute of Occupational Safety and Health
NLODS	North Lawrence Oil Dump Site
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PAHs	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
POTW	publicly owned treatment works

RA	Risk Assessment
RCRA	Resource Conservation and Recovery Act
RECRA	RECRA Research, Inc.
RfDs	Risk Reference Doses
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act of 1986
SPDES	State Pollution Discharge Elimination System
SVOC	semivolatile organic compound
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, Disposal Facility
$\mu g/m^3$	micrograms per cubic meter
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

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