

**RI/FS REPORT FOR
NEW YORK STATE SUPERFUND STANDBY CONTRACT
NAPANOCH PAPER MILL SITE
TOWN OF WAWARSING, ULSTER COUNTY
WORK ASSIGNMENT NO. D002478-15
SITE NO. 3-56-014**

VOLUME I - REPORT AND APPENDICES A & B

Prepared For:

**NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION**

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SECTION 1

INTRODUCTION

1.1 PROJECT BACKGROUND

The Napanoch Paper Mill Site (formerly the Rondout Paper Mill) is located on Route 55 in the Hamlet of Napanoch, Town of Wawarsing, Ulster County, New York (Figure 1.1). The site occupies an area of approximately 19 acres. It is bounded on the south by Rondout Creek and on the north by NY Route 55. See Figure 1.2 for features and locations described in this section unless otherwise referenced.

The property has undergone multiple changes of operation and ownership since 1883. The period of time associated with hazardous waste was from 1949 to 1977. During this time the mill produced packing, wrapping and recycled paper. After foreclosure proceedings and several changes of ownership, the mill was destroyed by a major fire in May of 1977. In August of 1986, a Phase I Investigation was completed by E.A. Science and Technology.

Table 1.1 summarizes the results of soil and sediment samples at the site taken by New York State Department of Environmental Conservation (NYSDEC) in 1990. The greatest concentrations of polychlorinated biphenyls (PCBs) were found in the area of process wastewater discharge lagoons with concentrations up to 350 milligrams per kilogram (mg/kg or parts per million) were detected. Volatile organic compounds (VOCs) and semivolatile organic compounds including polynuclear aromatic hydrocarbons (PAHs), were also detected. Samples taken from large paper rolls near the main plant foundation were found to contain up to 100 mg/kg PCBs.

In 1990, the Ulster County Department of Health sampled drinking water from four nearby residences located to the east-northeast of the site. Elevated levels of metals were detected in well water samples from two of the homes. However, no PCBs or volatiles were detected.

An Interim Remedial Measure (IRM) calling for the removal of approximately 6,750 tons of sludge and soil was completed at the site in September 1992. Sludge material removed from the lagoons and the underlying soil were dewatered and transported to a NYSDEC-approved incineration and landfill facility. Contaminated lagoon water was pretreated on-site and trucked to an industrial waste water treatment facility for disposal.

In a separate action, the NYSDEC Region 3 Emergency Spill Response Team, excavated and stockpiled approximately 3,000 cubic yards of petroleum-contaminated soil in September 1993. The removal action was concentrated around the former #6 above-ground storage tank (AST) and associated piping located east and south of the main plant ruins. After careful evaluation, NYSDEC proposed that the most environmentally sound and cost effective means to complete clean-up would be thermal treatment of the soil on the site, with disposal of the remediated soil either on or offsite. On December 16, 1993 a public meeting was held to present this remedial action.

The potentially responsible party(s) (PRPs) for the site have been identified and are unwilling to undertake remediation. Therefore, needed investigations were initiated and directed by the NYSDEC Division of Hazardous Waste under the State Superfund program. To accomplish these tasks, a work assignment to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Napanoch Paper Mill Site was issued to Engineering-Science, Inc. under a State Superfund Standby Contract (NYSDEC, 1991a). The investigation and study are a prerequisite for the clean-up and conclusion of activities at the site.

1.2 PROJECT OBJECTIVES

The objectives of the RI/FS for the Napanoch Paper Mill site are as follows:

- To define the extent, nature and source(s) of surface and subsurface contamination in soils, sediments, surface water and groundwater at the Napanoch Paper Mill site based on information collected previously and on information collected during this RI effort;
- To collect, from agencies and other sources, additional information needed to perform a risk assessment (e.g., human population characteristics, surrounding land uses, biota characteristics);
- To evaluate impacts of the site on public health and the environment in the form of a human health-based risk assessment and a habitat-based risk assessment;
- To identify New York State Standards and Guidance Values (SGVs) for the Napanoch Paper Mill site; and
- To develop and evaluate a range of site remediation alternatives including, but not limited to, containment, material recycling, in-place treatment and removal followed by treatment.

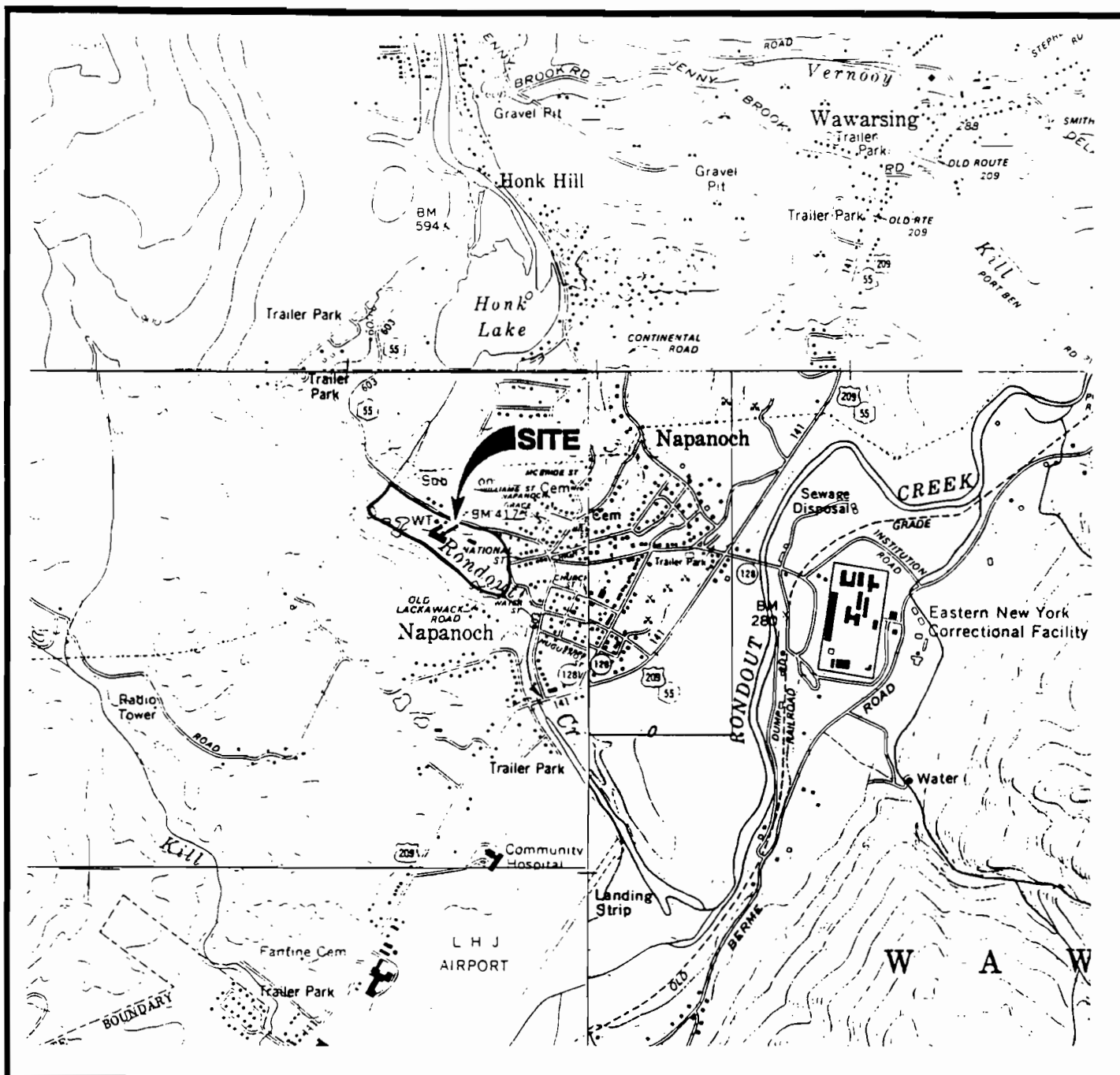
1.3 ORGANIZATION OF THIS REPORT

This draft RI/FS report documents the work performed, provides detailed results of the chemical analyses, and describes the nature and extent of detected chemicals in each environmental medium. It also presents potential remedial alternatives and the results of preliminary screening of these alternatives. The report is organized as follows:

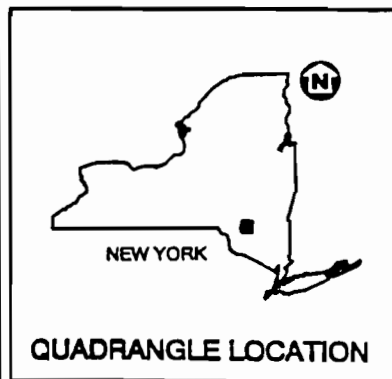
- Section 1 - Discussion of project background, objectives, and report organization.
- Section 2 - Discussion of the site history, features of the site, site geology, hydrogeology, climate and land use.
- Section 3 - Description of the field sampling and investigation methods for soil, sediment, surface water, paper, concrete, test pits, and groundwater.
- Section 4 - A summary of environmental sampling results in all media, including surface and subsurface soils, sediments, surface water, groundwater, paper, and concrete.

- Section 5 - An evaluation of impacts of the site on human health and the environment in the form of a baseline human health evaluation and ecological risk assessment, respectively.
- Section 6 - Remedial Investigation summary and conclusions.
- Section 7 - Establishment of remedial objectives, identification and screening of appropriate waste remediation technologies, and development of remedial alternatives potentially applicable at the Napanoch Paper Mill Site.
- Section 8 - Description and screening of remedial alternatives, their implementability and effectiveness, and comparisons between similar alternatives.

FIGURE 1.1



SOURCE: NYSDOT 7.5 MINUTE SERIES PLANIMETRIC MAPS; NAPANOCH (1973), KERHONKSON (1973), RONDOUT RESERVOIR (1973), AND ELLENVILLE (1976) QUADRANGLES.



LATITUDE: 41°44'55"
LONGITUDE: 74°22'35"



ENGINEERING-SCIENCE

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
RI/FS INVESTIGATION

**SITE LOCATION
MAP
NAPANOCH PAPER MILL
SITE**

TABLE 1.1
NAPANOCH PAPER MILL
RESULTS OF 1990 NYSDEC ENVIRONMENTAL SAMPLING

Location	Matrix	Parameter	Conc. (ppm)
Main Plant Ruins	Paper Rolls	PCB	100
Former Lagoons Areas (Areas 7,8)	Sludge	PCB	350
Southern Drainage Ditch (Area 9)	Sludge	PCB	350

SECTION 2

SITE HISTORY AND DESCRIPTION

2.1 SITE LOCATION AND SURFACE FEATURES

The Napanoch Paper Mill Site is located on NY Route 55 in the Hamlet of Napanoch, Ulster County, New York (see Figure 2.1). The site occupies an area of approximately 19 acres. It is bounded on the south by Rondout Creek and on the north by NY Route 55. The site lies on very uneven and wooded land on the northern flank of the Rondout Creek valley. It is situated in a mixed industrial and residential area; however, there are presently no industries located on or near the site. The nearest business is a furniture repair/stripping company located 400 feet south of the site on the opposite side of Rondout Creek. See Plate 2.1 for features and locations described in this section unless otherwise referenced.

Rondout Creek drains from the Rondout Reservoir approximately four miles to the northwest of the site through the Hamlet of Napanoch, New York. Topography in and adjacent to the site consists of alternating hills and steep-sided stream-filled ravines. These ravines empty into generally broad, flat-bottomed river valleys. Elevations in this region range from approximately 300 feet in the valleys to more than 2200 feet at High Point, located in the Shawangunk Mountains approximately two miles southeast of the site.

There exist several areas on the site and in the adjacent Rondout Creek which are relevant to discussions in this RI/FS. Some of these are referred to by numbers as designated by the NYSDEC during pre-RI/FS activities at the site. The locations and important features are shown on Plate 2.1. Each of these areas are described in the following paragraphs.

2.1.1 Features On and Near Rondout Creek

The Route 55 bridge, which crosses Rondout Creek, is located in the northernmost portion of the site. A dam across Rondout Creek referred to in this report as the Upper Dam is located downstream and approximately 900 feet to the south of the bridge. A shallow fill area approximately 250 feet in length is located on the site, west of the main plant building and slightly northeast of the dam.

2.1.2 Main Plant Ruins

In the center of the site lies the main plant ruins encompassing an area of approximately 250 by 300 feet (75,000 sq. ft.). Within this area are the remains of three building foundations. The largest constitutes the main plant ruins, and there are two others which are smaller in area. In addition to these three foundations, there are two small concrete structures of unknown use, and an office building, which is still intact, located adjacent to Route 55. The majority of the scorched ruins of the former paper mill lie within the immediate area of the three building foundations. Within these ruins are various mixtures of concrete, steel, tin, wood, and large paper rolls. In addition, these ruins contain drums, tanks, mixing vats, machinery, and PVC piping.

2.1.3 Area No. 10

At the southeast corner of the main plant ruins is Area #10. This is a small, water-filled depressional feature partially carved into bedrock. The original purpose of this feature is not known. It has a concrete wall at one end and lower levels of the main plant at the other.

2.1.4 Former Fuel Storage Tanks

Immediately south of Area #10 is the former location of above and below ground fuel storage tanks. A removal action was performed in this area in September 1993 as described in Section 1.

2.1.5 Former Lagoons

South and east of the main plant ruins is a permanent decontamination pad constructed for the IRM and used during this RI/FS. The IRM, which was completed in 1992, encompassed six areas or former lagoons (Areas 1 through 6) from the decontamination pad southward a distance of approximately 700 feet. These areas ranged from approximately 150 to 250 feet in width.

2.1.6 Other Buildings

Adjacent to the northernmost portion of the IRM is a partially burned building that seems to have been used for storage of recyclable paper. Near the southeastern corner of the IRM Area is an existing wooden building (wheel house) formerly used for power generation at the plant.

2.1.7 Areas 7, 8 and 9

In the northeast corner of the site, adjacent to the IRM, are Areas 7, 8 and the north end of Area 9. These areas lie in an extensively wooded part of the site where a former axe/knife manufacturing plant existed. Area 7 is a bermed circular feature at the edge of the IRM which was apparently used to hold process water from the plant. Area 8 is positioned immediately north of Area 7 and is also a suspected lagoon for process water. Area 9 is an existing stoned-lined drainage ditch extending from Area 8. This ditch runs northeast 100 feet, turns southeast approximately 140 feet to the site fence where it turns southward and runs a distance of about 400 feet, discharging to Rondout Creek.

2.1.8 Ponded Area of Rondout Creek

At the southernmost part of the site is the Ponded Area in Rondout Creek. The Ponded Area extends from just northeast of the location of the wheel house southward approximately 450 feet to the lower dam. It ranges from approximately 50 feet to 180 feet in width. The Ponded Area is downstream from the entire site and is considered a primary location where sediment runoff, sludge, and process material could have accumulated during and following operation of the paper mill.

On the plant side of the Ponded Area is a slough way extending downstream from the lower dam. The purpose of this slough way seems to have been to divert water from Rondout Creek to a pulp mill, 180 feet downstream. This feature is

approximately 10 feet wide and 6 to 8 feet deep with an unknown amount of sediment in its bed.

2.1.9 Residential Areas

Residential areas exist to the north across Route 55 and at the eastern side of the site. Residences border the site along Route 55 and southward along the southeasternmost fence line. National Street parallels this fence line to the lower dam. The Hamlet of Napanoch lies to the northeast, east, and southeast of the site. Residential areas also exist across from (southwest of) the Poned Area of Rondout Creek.

2.2 SITE HISTORY

The Napanoch Paper Mill (originally the Rondout Paper Mill) was built in 1883-84. The mill had multiple owners and company names over the years; Napanoch Mills, Frost and Sons, Ulster Tissue Mills and Rondout Paper Mill. The mill primarily made wrapping paper through approximately 1914. However, at various times, the mill produced several other forms of paper products. Multiple fires occurred at the plant during its operating history. In 1959, the company was reorganized as the Rondout Corporation and was again involved in the production of packing and wrapping paper (E.A., 1986 and ES, 1992).

In September of 1972 the mill closed after two small buildings were destroyed by fire. Approximately 7,000 gallons of #6 fuel oil from an above ground storage tank was spilled on-site and into Rondout Creek as a result of the fire. Afterwards, approximately 400 gallons remained in the creek and was later contained and removed by NYSDEC, the Ulster County Department of Health (UCDOH) and the Town of Wawarsing. Following another series of owner transfers and foreclosures, the plant was totally destroyed by fire in May of 1977.

Hazardous waste was generated at the site from 1949 until the plant fire in 1977. Part of the paper mill processes included discharge of waste water into lagoons located on the site. It is generally known (E.A., 1986 and ES, 1992) that hazardous wastes were discharged with the process water into the lagoons. The likely sources of these hazardous wastes were waste oils from equipment maintenance and/or from the actual pulp/paper production process. The overflow from the process waste water lagoons ultimately discharged into Rondout Creek. These lagoons were confirmed to have contained sludge contaminated with PCBs at levels up to 350 mg/kg and perchloroethylene (PCE) at concentrations as high as 160 mg/kg. Total VOCs and semivolatile organic compounds (SVOCs) were also found in the 2 to 50 mg/kg range in soil and sediment samples collected at the site by the NYSDEC (E.A., 1986 and ES, 1992).

A Phase I Investigation was completed in August, 1986 by E.A. Science and Technology and an IRM was completed in the Fall of 1992. The primary activity accomplished during the IRM was the removal of approximately 6,750 tons of the sludge and underlying soil. The material was dewatered on-site and the dewatered sludge and soil was transported to a NYSDEC-approved facility for incineration. The contaminated water was pre-treated on-site and subsequently trucked to an industrial

waste water treatment facility for disposal. The engineering consultant overseeing the IRM was Metcalf & Eddy of New York, and the removal and treatment operations were conducted by Westinghouse Haztech, Inc. of Baton Rouge, Louisiana.

The PRPs for the site have been identified and are unwilling to undertake remediation. On July 6, 1992, work assignment number D002478-15 was issued by NYSDEC to Engineering-Science to perform an RI/FS under Superfund Standby Contract. These investigations were initiated and directed by the New York State Department of Environmental Conservation (NYSDEC) Division of Hazardous Waste under the State Superfund program (NYSDEC, 1991a).

In September 1993, the NYSDEC Region 3 Emergency Spill Response Team, excavated and stockpiled approximately 3,000 cubic yards of petroleum-contaminated soil. These activities were related to the 1972 plant fire when approximately 7,000 gallons of fuel spilled into Rondout Creek. The removal action was concentrated around the former #6 fuel oil AST and associated piping located east and south of the main plant ruins. During excavation activities, a second underground storage tank (UST) was discovered and removed. NYSDEC has proposed that the final remedial alternative will be on-site thermal treatment of the soil. On December 16, 1993, a public meeting for comments was held to present the remedial alternative.

2.3 GEOLOGY AND HYDROGEOLOGY

2.3.1 Regional Geology

Regional geology is characterized by middle and upper Devonian-aged sedimentary units along the western flank of the Shawangunk Mountains. These units are comprised of shales, siltstones, sandstones and conglomerates. The Shawangunk Mountains include lower Devonian and upper undifferentiated Silurian sedimentary rocks of sandstone, dolostone and limestone. In addition, middle and upper Ordovician-aged metamorphic units of quartzite, graywacke and schist are found in the higher elevations of eastern Ulster County to the Hudson River (Fisher, et al, 1970).

The geology and resulting topography in the area is characteristic of lower Catskill Mountain terrain with multiple lateral drainage valleys. Rondout Creek runs through such a valley having steeply sloping sides, numerous bedrock outcrops, and an irregular drainage course. Water in the creek flows generally from north to south.

Due to varied erosional capacities of the steeply dipping sedimentary bedrock formations, on-site topography is very irregular with bedrock cropping out intermittently across the site. The strike of the bedrock is generally perpendicular to Rondout Creek. The most resistant bedrock is often exposed along the trend of this strike.

2.3.2 Site Geology

Bedrock units of shales, siltstones, and sandstone of the undifferentiated Hamilton Group underlie and crop out throughout the Napanoch Paper Mill site. Structural influences from the formation of the Shawangunk Mountains is obvious within the sedimentary rocks at the site. Bedrock outcrops on the site and in Rondout Creek retain a high angle dip (approximately 60 to 75 degrees) to the north-northwest.

Overall, bedrock on the site is overlain by a thin veneer of unconsolidated deposits of glacial origin (USDA Soil Conservation Service, 1979). These unconsolidated sediments are composed of Pleistocene till derived mainly from sandstone, siltstone and shale. The till is a mixture of various sizes of sediments deposited by glacial ice, ranging from clay particles to boulders and/or slabs of shales, sandstone, or siltstones. Based on the observed outcrops, the IRM activities and the well boring logs from this investigation (Appendix H), the thickness of the overburden ranges from zero to 24.5 feet.

Based on the well logs, the geology at the Napanoch Paper Mill Site may be summarized as glacially-derived silt, fine to medium sand, gravel, and rock slabs (glacial drift) overlying weathered and unweathered shale, sandstone and siltstone of the Hamilton Group. The well boring logs were used to construct a geological cross section which is located on Plate 2.1 and presented in Figure 2.2. The fill and surficial sediments found at monitoring well locations from this investigation typically range in thickness from 6.0 feet in MW-7 to 11.5 feet in MW-5. However, surficial sediments in boring MW-1 were 24.5 feet thick. The dominant, naturally-occurring constituents in the overburden are light brown to brown, fine to medium sand and silt. Slabs of shale, sandstone, and siltstone and medium to coarse gravel were also identified throughout the site. Sediments in MW-1, however, are predominantly a homogeneous, light brown, very fine sand and silt. The uncharacteristic sediments deposited in that location are likely to be related to outwash sediments at a gravel pit, located just north-northeast of the site.

During drilling, fill material from former plant(s) or fill used in the IRM was encountered throughout the site. Plant-derived fill material included typical industrial materials such as brick, wood, concrete, coal, glass, and some steel. The fill material used in the IRM was obtained from the local gravel pit.

A weathered bedrock zone of interbedded shale, sandstone, and siltstone was encountered in most of the borings. This zone consists of weathered, dipping beds (60° to 75°) which grade into more competent beds of the same material. Competent shale, sandstone, and siltstone bedrock was encountered at depths ranging from 8.5 feet in borings MW-9 and 24.5 feet in boring MW-1.

2.3.3 Hydrogeology

The hydrogeology at the site is characterized as an unconfined (water table) aquifer within the upper bedrock and portions of the shallow overburden. Conditions in the intermediate and deep bedrock groundwater systems are considered complex yet less influential on shallow groundwater flow. Based on the data from this investigation, groundwater flow characteristics, (movement and direction) related to this site, are controlled primarily by the shallow bedrock system. Ultimately groundwater flow on the site discharges to Rondout Creek.

2.3.2.1 Monitoring Well Installation and Placement

Eleven shallow bedrock wells, MW-1 through MW-11, and three overburden/bedrock interface monitoring wells, MW-1S, MW-9S, and MW-10S were installed in January, 1993. The three interface wells were each paired with one

bedrock well (see Plate 2.1 for locations). The wells were installed to determine the overall impact of the Napanoch Paper Mill Site on groundwater quality and to determine groundwater flow directions. Figures 2.3a and 2.3b show well locations and groundwater flow directions on two different dates. Details of flow directions are discussed in Section 2.3.2.2.

The bedrock monitoring wells were specifically constructed to obtain groundwater level and quality data in the shallow bedrock aquifer below the overburden/bedrock interface. The overburden/bedrock interface wells were constructed to provide similar data in the overburden and at the interface. Both designs allowed for a determination of the degree of interaction between the shallow and deeper groundwater zones.

2.3.2.2 Shallow Groundwater System

Water table conditions exist within the deposits of unconsolidated silt, fine to medium sand, gravel, and rock slabs (glacial drift). However, these deposits have limited areal and vertical extent. Unconsolidated deposits are considered to be hydraulically connected to the weathered and fractured bedrock. The saturated portion of the unconsolidated deposits is relatively thin, and in most areas, non-existent (near MW-2, 3, 4, 6, 7, and 8). Ultimately, shallow groundwater in unconsolidated sediments beneath the site is controlled by the shallow bedrock system through topographic variations and/or direct connection to fractures within the bedrock.

Shallow groundwater occurs mainly within the weathered and fractured shale, siltstone, and sandstone across the site. Groundwater flow in the bedrock is limited to secondary porosity features such as fractures and to a lesser extent, bedding planes or joints. These features and the high angle dip in the bedrock contribute significantly to the movement and direction of groundwater flow. The thickness of the weathered bedrock zone at the Napanoch Paper Mill Site generally ranges from 0.0 feet thick in MW-1 and MW-5 to 3.7 feet in MW-9. However, MW-7 and MW-8 have anomalously thick fractured/weathered zones of 9.0 and 7.5 feet respectively. These monitoring wells are located within the IRM area. The thickness of the weathered/fractured zones may be related to past construction activities of the lagoons such as blasting and may not represent overall site conditions.

Two groundwater elevation contour maps were constructed from water level data for January, 1993 and July, 1993 (Figures 2.3a and 2.3b). Water level monitoring data from January, 1993 and July 1993, respectively are presented in Table 2.1. Horizontal hydraulic gradients based on the contours across the site are quite steep, ranging from 0.19 ft/ft north of and including the main plant ruins to 0.37 ft/ft in the northeast portion of the site north of Area 8. The average hydraulic gradient for the entire site is approximately 0.27 ft/ft.

The groundwater flow direction within the shallow bedrock inferred from the water level contour lines includes two dominant components of flow. The ultimate discharge of both components is to Rondout Creek. In the west and northwestern portion of the site north of and including the main plant ruins, flow is generally south-southwesterly toward Rondout Creek. Groundwater flow outside the immediate areas of the dams is unlikely to exhibit any significant changes due to the shallow fractured bedrock.

However, in the eastern portion of the site, flow is directed more easterly. This deflection of flow can be attributed to a general widening and flattening of the valley and to the topographic low in Areas 8 and 9. Based on groundwater elevations from MW-5, MW-7, MW-9, MW-10, MW-10S, and three staff gages (SG-1, SG-2, and SG-3) shallow groundwater from this portion of the site discharges at Area 8 and along the Area 9 ditch. The discharged water in Area 9 then drains southward into Rondout Creek.

Specific evidence of groundwater discharge to the Area 9 ditch can be observed in the January, 1993 monitoring data. January 1993 groundwater levels in MW-10 (shallow bedrock) and MW-10S (overburden/bedrock interface) were 344.14 and 342.52 feet above sea level respectively. Staff gauge SG-3 showed that the water level in the Area 9 ditch opposite the MW-10 well pair was 341.23 feet. This data indicates that at that time, there existed an upward gradient from the shallow bedrock toward the overburden and the Area 9 ditch. Furthermore, data from the overburden/bedrock interface well (MW-10S), also reveals a gradient toward the ditch.

To summarize:

- (1) the ditch constitutes a discharge area for shallow groundwater, and influences groundwater flow directions on both sides of it;
- (2) the ditch appears to act as a barrier to groundwater flow from the site towards the residential wells.

These determinations are based on the present groundwater conditions. The groundwater flow system may have behaved differently when the lagoons were in operation and a higher flow rate existed in the Area 9 ditch. Higher water levels in the lagoons or the ditch may have induced groundwater flow away from Area 9 towards the residential areas.

The measured, upward vertical hydraulic gradient is relatively small between wells screened across the thin overburden/bedrock interface (MW-9S and MW-10S) and wells installed into shallow bedrock (MW-9 and MW-10). See Table 2.1 for comparison of water levels between shallow and deep well pairs. However, water levels measured in MW-1 and MW-1S in the north-northwest corner of the site (upgradient), indicate a significant downward gradient from the overburden to the shallow bedrock system. The steeper vertical gradient in this area is likely to be associated with the thicker overburden sediments in that area. A very fine sand and silt unit, up to 24.5 feet thick at MW-1, could produce steeper vertical gradients relative to other areas of the site because of a stronger hydraulic separation between deep and shallow water bearing zones. As stated previously, groundwater from the overburden will ultimately be controlled by the shallow bedrock system.

2.3.2.3 Seasonal Fluctuations

As part of this investigation, seasonal changes in the shallow bedrock groundwater system were evaluated. Water levels throughout the site fell an average of two feet at the site between January and July, 1993. There were minor variations of water levels near surface drainage features. Overall, there were no significant differences noted between the two maps in the horizontal and vertical hydraulic gradients or in the

groundwater flow directions. The only noted exception was an approximate 7 foot change in MW-6. This change is likely due to variations in degree of fracturing in the bedrock.

In July, surface water was no longer present at SG-1 and SG-2. This indicated that the hydrology at the site had changed and that it was likely that some change had occurred in groundwater levels in that area of the site. As a result, the July 1993 monitoring data in and around Areas 8 and 9 was closely evaluated. Water levels in MW-10, MW-10s, and SG-3 were 343.74, 341.81, and 341.04 feet above sea level respectively. This confirmed that groundwater in the area of the residences continued to discharge into the Area 9 ditch.

2.3.2.4 Deep Groundwater System

The intermediate and deep groundwater flow systems cannot easily be determined, due mainly to the dipping nature of the bedrock. Alternating, near-vertical beds having differing hydrogeologic properties complicate the intermediate and deep flow systems.

The vertical hydraulic separation and consequently, vertical gradients between the shallow groundwater system and deeper zones vary significantly across the site. The variable nature of the vertical hydrogeologic system depends on several site-specific factors: the degree of interconnected fractures, depth of well, depth and type of overburden, and lateral position on the site.

As an example of the variability in vertical gradients in the deeper groundwater system, the water levels in PW-1 (existing plant well) were compared with those in one of the nearby residential wells, RES-5. In PW-1, which is 157 feet deep, a water level of 45.77 feet from top of casing was recorded. Assuming the average water level in the shallow bedrock for the rest of the site was similar at PW-1, a downward vertical gradient would exist below the shallow bedrock system. In addition, the water level in RES-5, which is 95 feet deep and located 500 feet east-northeast of PW-1, actually flows above ground level. This shows an upward gradient in that zone of the bedrock. It is likely that alternating layers of dipping formations are the main variable affecting hydraulic head at a given depth in the intermediate and deep bedrock.

2.4 CLIMATE AND SURFACE HYDROLOGY

The climate of Ulster County is characterized by short, moderately cool to warm summers and long, cold winters. The precipitation is distributed evenly throughout the year and receives an abundant average precipitation of approximately 48 inches of rainfall per year, of which a significant portion falls as snow (USDC, 1983). The average temperature in the county ranges from 25°F in January to 70°F in July. The average groundwater recharge rate (infiltration) is expected to be between 6 and 10 inches per year.

The lakes closest to the Napanoch Paper Mill Site are Honk Lake and Rondout Reservoir, which are approximately 2,000 feet north and four miles northwest of the site, respectively. The lakes are approximately 250 and 450 feet higher in elevation than the site, respectively. Local hydrology is dominated by Rondout Creek which runs generally southward along the west-southwestern boundary of the site. Along the

path of the Creek adjacent to the site are two cement dams. The dams are referred to throughout the text of this report as the upper and lower dams. The upper dam is situated in Rondout Creek upstream of the main plant ruins. The lower dam is located approximately 1,600 feet downstream from the upper dam where it forms a large ponded area in Rondout Creek, measuring approximately 700 feet by 180 feet.

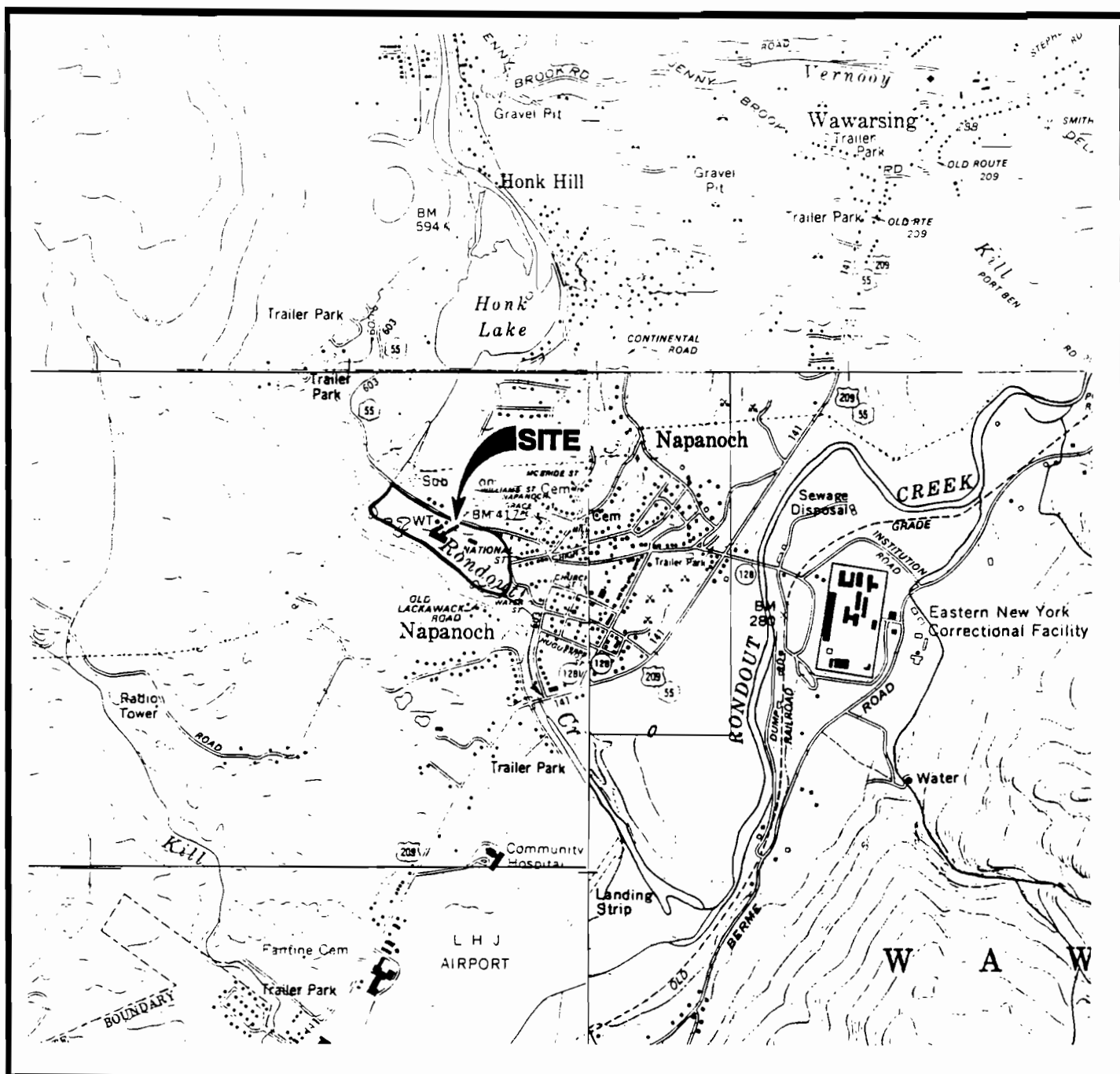
On the site, there exist several man-made, stone-sided or concrete drainage ditches. In the northern portion of the site, near MW-1, a concrete-lined ditch parallels Route 55 for approximately 400 feet. The ditch is approximately five feet wide by six feet deep. This ditch is located along the eastern border and may have been used to supply water to some part of the paper mill or for power generation at the wheel house located approximately 900 feet to the south. A much larger ditch in the southern portion of the site (Area 9) is approximately 12 feet wide by 10 feet deep and is lined with stone. This ditch was used as a drain or outfall for the process waste water lagoons on the site. The ditch begins in the northeastern corner of the site in Area 8 and eventually terminates in the ponded area in Rondout Creek. As mentioned in Section 2.3, this ditch receives groundwater discharge and exerts a measurable influence on groundwater flow direction.

Another stone-lined ditch begins at the lower dam on the mill side of Rondout Creek. This ditch is slightly downstream of the site and runs approximately 240 feet to an abandoned pulp mill. The ditch is approximately 12 feet wide by 10 feet deep. At the dam, the water flow into the ditch is partially blocked. Ultimately, precipitation that falls on the site becomes runoff or shallow groundwater and discharges into Rondout Creek. Eventually, these waters will enter the Hudson River approximately 25 miles northeast of the site near Kingston, New York.

2.5 LOCAL LAND USE

Land use on and near the project site is classified as industrial/residential. The site is bordered by Rondout Creek on the west-southwest and south, and by private residences to the north, across Route 55 and to the east. The site is situated approximately ½ mile southeast of US Route 209, a major north-south highway in the region. The Hudson River is about 25 miles to the northeast. Within about ½ mile of the site are the Jamesway shopping plaza and the Northeastern Correctional Facility. The land where the Napanoch Paper Mill Site is situated has no current use.

FIGURE 2.1



SOURCE: NYSDOT 7.5 MINUTE SERIES PLANIMETRIC MAPS; NAPANOCH (1973), KERHONKSON (1973), RONDOUT RESERVOIR (1973), AND ELLENVILLE (1976) QUADRANGLES.



LATITUDE: 41°44'55"
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ENGINEERING-SCIENCE

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
RI/FS INVESTIGATION

**SITE LOCATION
MAP
NAPANOCH PAPER MILL
SITE**

TABLE 2.1
NAPANOCH PAPER MILL SITE
WATER LEVEL DATA

WELL/ STAFF GAUGE NUMBER	MEASURING POINT ELEVATION (FEET) ⁽¹⁾	OPEN INTERVAL (FEET) ⁽²⁾	SCREEN/ OPEN HOLE	DATE: 1/21/93		DATE: 7/21/93	
				DEPTH TO WATER LEVEL (FEET) ⁽³⁾	WATER LEVEL ELEVATION (FEET) ⁽¹⁾	DEPTH TO WATER LEVEL (FEET) ⁽³⁾	WATER LEVEL ELEVATION (FEET) ⁽¹⁾
MW-1	433.060	30.0 - 40.5	O	22.95	410.11	23.45	409.61
MW-1S	432.910	16.0 - 26.0	S	10.75	422.16	12.44	420.47
MW-2	404.425	14.0 - 34.8	O	11.15	393.28	13.45	390.98
MW-3	393.340	16.5 - 33.25	O	12.68	380.66	13.25	380.09
MW-4	394.020	20.0 - 33.5	O	15.22	378.80	15.96	378.06
MW-5	383.350	16.0 - 24.5	O	6.71	376.64	8.14	375.21
MW-6	378.495	19.5 - 34.5	O	14.83	363.67	22.43	356.07
MW-7	368.470	17.25 - 31.0	O	18.82	349.65	20.75	347.72
MW-8	368.610	22.5 - 34.0	O	25.09	343.52	26.66	341.95
MW-9	357.860	14.5 - 29.75	O	8.10	349.76	8.41	349.45
MW-9S	358.775	3.0 - 13.0	S	9.70	349.08	10.16	348.62
MW-10	351.995	17.0 - 27.5	O	7.86	344.14	8.26	343.74
MW-10S	353.065	3.0 - 13.0	S	10.55	342.52	11.26	341.81
MW-11	343.175	15.0 - 24.0	O	5.11	338.07	6.10	337.08
PW-1	426.180	N/A	O	---	---	45.77	380.41
SG-1	392.825	N/A	O	1.61	391.22	DRY	DRY
SG-2	350.580	N/A	O	1.91	348.67	DRY	DRY
SG-3	343.945	N/A	O	2.72	341.23	2.90	341.04
SG-4	338.215	N/A	O	1.79	336.43	2.17	336.05

⁽¹⁾ ELEVATION IN FEET ABOVE SEA LEVEL.

⁽²⁾ DEPTH IN FEET BELOW GROUND SURFACE

⁽³⁾ DEPTH IN FEET BELOW TOP OF INNER WELL CASING

Note: MW = site monitoring well; PW = plant production well; SG = staff gauge

SECTION 3

FIELD INVESTIGATION METHODS

The purpose of this section is to describe the field methods that were used for the Napanoch Paper Mill Site field investigations. Field activities were conducted over four separate events. The Phase I field activities were initiated by Engineering-Science on December 21, 1992 with the site reconnaissance and soil sampling and completed 7 weeks later on February 5, 1993. Test pit activities were conducted during the week of April 5, 1993. Additional Sampling field activities were initiated on July 12, 1993 and completed 3 weeks later on July 29, 1993. The final field activity, to conduct a single soil boring near MW-1, was completed on October 5, 1993.

The objectives of the Napanoch Paper Mill Site Phase I field investigation were to provide data on the presence and extent of PCB and other contaminants found in and around the plant ruins, Rondout Creek, Areas 7, 8, 9, 10, and the remainder of the 19 acre site. During the course of Phase I activities, it became apparent that additional data were needed in order to finalize the RI and satisfy FS data requirements.

In February, 1993, ES and the NYSDEC Project Manager jointly determined that test pits were needed in the fill areas. These areas are located immediately west of the main plant ruins and next to the main entrance near Route 55. On March 3, 1993, Work Plan Addendum No. 1 (Test Pit Excavations) was submitted to the Department. At the conclusion of test pit activities, the ES Project Manager, ES Field Team Leader, and the NYSDEC Project Manager discussed and located additional samples necessary to complete the RI/FS. These samples and their locations were finalized at a meeting held on May 13, 1993 at the ES office in Syracuse, New York. On June 24, 1993, the final, revised Work Plan Addendum No. 2 (Additional Sampling) was submitted to the Department.

The objectives of Test Pit activities and the Additional Sampling were twofold; to significantly accelerate the project schedule, and to map the presence and extent (filling in data gaps) of hazardous waste for the Feasibility Study. The information from all field activities has been combined and used herein to assess the need for, and the scope of, remedial actions at the Napanoch Paper Mill Site. Samples collected by ES and analyzed by NYSDEC will be discussed herein. All of the data generated by NYSDEC during the IRM will be presented in Section 4. All work during this investigation was performed in accordance with the NYSDEC-approved Work Plan (including Addendums No. 1 and 2), QA/QC Plan and Health and Safety Plan (ES, 1992). Specific sampling methods and protocols can be found in these Plans, otherwise, only deviations from those Plans will be discussed in the text.

Field activities for the Phase I investigation consisted of soil borings and monitoring well installations, sediment sampling using manual sampling techniques in shallow and deeper water, sediment sampling using VibraCore technology, surface and subsurface soil sampling, surface water sampling, and groundwater sampling.

Additional sampling field activities (including the Test Pit activities) were comprised of soil borings beneath the building ruins utilizing a *Minuteman*[™] portable drilling rig, surface water sampling, soil sampling, paper roll sampling, and concrete sampling.

All samples collected during this investigation were placed in a laboratory cooler, packed in ice and shipped overnight to RECRA Environmental Laboratories, Inc. located in Amherst, New York. ES chain-of-custody procedures were strictly followed as outlined in the Quality Assurance Project Plan. Exceptions to these procedures were for concrete, groundwater, and soil samples collected by ES for analysis in Saratoga Springs, New York by NYSDEC and surface water samples that were sent for special, low detection PCB analysis to Aquatec Laboratories in Colchester, Vermont.

Prior to the start of field activities, a public meeting was held at the Wawarsing Town Hall on October 15, 1992, to present the Draft Work Plan to the public and receive public recommendations on the investigation. After addressing both public and NYSDEC comments, the Final Work Plan (September, 1992 and later revised, December, 1992) was completed.

3.1 SITE RECONNAISSANCE ACTIVITIES

3.1.1 Site Reconnaissance

The site reconnaissance was conducted on December 21 and 22, 1992 to plan the site activities, locate utilities, locate work areas, identify sediment sampling locations, and lay out the sampling grid in the ponded area with buoys.

Prior to drilling activities, ES contacted the Underground Facilities Protection Organization (UFPO). On-site utilities were identified for worker health and safety and to prevent damage to underground utilities during drilling. The NYSDEC contacted property owners by mail to inform them of the activities and schedule. NYSDEC and ES staff later visited property owners whose residential wells were to be sampled.

A total of five surface soil samples (SS-1 through SS-5) were collected during the site reconnaissance. These samples will be discussed later in this section with all surface soils samples collected during this investigation.

As part of the reconnaissance effort, ES reviewed historical air photos and maps to identify potential disposal areas or other areas of concern on or near the site. Historical air photos available from the NYSDEC, Soil Conservation Service, and the Cornell Laboratory for Environmental Application of Remote Sensing (*CLEARs*) were reviewed by ES technical staff. Sanborn maps and other historical records also were reviewed for site activities. In addition, books and maps were searched and historical files were reviewed at the local library in Ellenville, New York.

3.1.2 Site Survey

A site survey was conducted by Modi Associates located in Cicero, New York, a New York State licensed land surveyor. Initially, the site was photographed via aerial photography on October 28, 1992 and again on January 26, 1993 when it was determined that the October flyover was inadequate because of heavy vegetation. The

site base map was developed from these photographs. Final base map development from involved surveying the site fence, monitoring well locations, Rondout Creek, building ruins, test pit locations, the upper and lower dams, and any other features pertinent to the investigation. The prepared map shows the locations and appropriate elevations (i.e., ground surface and top of monitoring well casing) for each monitoring well and surface elevation at each test pit locations, all site property boundaries, and other key points as determined by ES and NYSDEC (see Plate 2.1).

The locations of sediment sample points, soil sample points, and other samples collected by ES and NYSDEC were located in the field by ES and plotted on the base map. These data were used to create a site-wide sample location map (Plate 3.1). Vertical control to the nearest 0.01 foot was established for the ground surface and the top of each monitoring well casing. Elevations were determined relative to a USGS benchmark on the opposite side of Route 55, 417 feet above sea level (ASL). Horizontal control for monitoring wells and other pertinent points were located by ties (location and distance) relative to one another and the specified datum point.

3.2 SOIL BORINGS/MONITORING WELL INSTALLATIONS

3.2.1 Well Installations/Soil Borings

Fourteen monitoring wells were installed by American Auger and Ditching Company, Inc. of Constantia, New York under the supervision of ES geologists from January 5 through January 21, 1993. The well borings were drilled using a truck-mounted Mobile B-59 and/or an all-terrain vehicle (ATV), Mobile B-57 drilling rig. The wells were installed to determine groundwater quality, the presence of any subsurface soil contamination, and to characterize the geology and hydrogeology beneath the site. All of the monitoring wells were located in or adjacent to areas of concern for potential groundwater contamination (Plate 3.1). All well boring logs are presented in Appendix H.

Bedrock Wells

Eleven shallow bedrock monitoring wells were installed at the site. The specific objectives of the bedrock wells were to determine geology, groundwater quality in the shallow bedrock, and to determine hydrogeologic conditions, particularly groundwater flow directions and horizontal hydraulic gradients. Depths of bedrock wells ranged from 41.5 feet in MW-1 to 26.3 feet in MW-11.

Bedrock wells were typically installed using a combination of four-inch spin-casing, HQ (four-inch) and NQ (three-inch) core barrels. Where the ATV rig was utilized (MW-4 and MW-9), 4.25-inch inside diameter (ID) hollow stem augers were used in the overburden instead of the spin casing. Spin casing or augers were advanced into the unconsolidated sediments and/or weathered bedrock until refusal or competent bedrock was encountered. Depth to bedrock ranged between 6.0 (MW-7) and 24.5 feet (MW-1) below ground surface. When augers were used, drilling continued using HQ coring techniques until competent rock was encountered. When competent bedrock was encountered, the borehole was advanced at least five feet into the bedrock using HQ coring methods. At that point, three-inch PVC casing was installed and grouted in place. Grouting the PVC riser was accomplished by injecting grout into the PVC riser

until grout appeared on the outside of the riser at ground surface (pressure grouting). Once the grout was in place, the drill rig was pulled off the well location to allow the grout to harden for a minimum of twenty-four hours. This phase of drilling ('top holing') was completed at each of the eleven bedrock well locations prior to continuing with final coring of the boreholes, thereby allowing the grout to set for several days. After the three-inch PVC casing and grout was allowed to set, bedrock was cored until there was clear evidence that groundwater was present. Because of the competency (no caving) of the bedrock, the open borehole was left as the well.

The top of the casing at each well extends to approximately two feet above the ground surface. Each monitoring well has a vented cap and a four-inch diameter steel casing with slide on locking cap placed over the monitoring well. The protective casing for each well is cemented in place along with a 2-by 2-foot by 4-inch cement pad. A weep hole was drilled at the base of the protective casing to allow any water between the inner and outer casing to drain. Steel, concrete-filled guardposts were constructed around the surface casing at well locations susceptible to damage. A typical bedrock well is shown on Figure 3.1.

Overburden/Interface Wells

Because groundwater was encountered in the unconsolidated sediments and/or weathered bedrock at locations MW-1, MW-9, and MW-10, three shallow monitoring wells were installed near the bedrock wells to form well pairs. These wells were screened across the overburden/bedrock interface to determine groundwater quality and to specifically assess vertical hydraulic gradients. Depths of the overburden/interface wells ranged from 27.94 feet in MW-1S to 16.0 feet in MW-9S.

Overburden wells MW-1S and MW-10S were installed using four-inch spin-casing while MW-9S was installed using a combination of 4.25-inch inside diameter (ID) hollow stem augers and HQ (four-inch) coring techniques. The ATV rig was used to install MW-9S. Spin casing or augers were advanced into the unconsolidated sediments and/or weathered bedrock until refusal (augers) or competent bedrock was drilled sufficiently to screen the interface (spin casing). Following auger refusal in MW-9S, HQ coring techniques were used to penetrate the bedrock and install the interface well.

Overburden/interface wells were constructed with two-inch diameter, threaded, PVC flush-joint casing with 0.010-inch slotted screen. The annulus around the outside of the screen was backfilled with silica sand to one to two feet above the screen, followed by a one to two-foot bentonite pellet seal. The seal was allowed to hydrate before placement of a cement/bentonite grout above the seal. The top of the casing extended to approximately two feet above the ground surface. Each monitoring well has a vented cap and a four-inch diameter steel casing with slide-on locking cap placed over the monitoring well. The protective casing for each well is cemented in place along with a 2-by 2-foot by 4-inch cement pad. A weep hole was drilled at the base of the protective casing to allow any water between the inner and outer casing to drain. Steel, concrete-filled guardposts were constructed around the surface casing at well locations susceptible to damage. A typical overburden/bedrock interface well is shown on Figure 3.2.

Soil Boring Samples

Thirteen soil samples were collected from monitoring well borings. Continuous split spoon sampling was conducted at each well location in accordance with ASTM specification D-1586-84 for standard penetration test and split barrel sampling. The ES geologist visually inspected and screened each soil sample for VOCs using a photoionization detector (PID). PID readings were generally less than 5 ppm in all samples. Each sample was logged and recorded in a field logbook.

All well boring samples were analyzed for target compound list (TCL) Pesticides/PCBs. Approximately 50% of the samples were analyzed for full TCL and total organic carbon as directed by NYSDEC. Selection of samples for full TCL (volatiles, semivolatiles, pesticides/PCBs), and Target Analyte List metals (TAL) was based on proximity to areas of concern and the associated potential for contamination to exist in those areas. The well boring intervals sampled and parameters analyzed are summarized in Table 3.1A.

Well Development/Decontamination Procedures

Monitoring wells were developed using *Waterra*™ positive displacement pumps with dedicated foot valves and polyethylene tubing. ES developed the wells until they became reasonably free of sediment (<50 NTU). However, monitoring well MW-1s would not clear sufficiently during developing and was not sampled during the January sampling event. A more detailed description of development procedure is discussed in Section 3.3.1.

The field geologists were also responsible for oversight of decontamination procedures. All drilling equipment was steam cleaned prior to the start of the project, between each boring and at the conclusion of the site investigation. All cuttings were screened with a *MicroTIP* PID for the presence of volatile organic compounds. Drill cuttings were spread out on the ground in close proximity to the borehole. Drilling water was also left to infiltrate in close proximity to the borehole (per NYSDEC approval).

Water used for drilling rig decontamination, development water, and purge water were contained in 55-gallon drums and stored at the site. Drumming of this water was a deviation of the work plan as requested by NYSDEC. The well development and water drumming procedures were overseen by an ES geologist or technician and recorded in the field book.

3.2.2 *Minuteman*™ Soil Borings

The *Minuteman*™ portable drill rig employed a cat-head, drive hammer, and rope system attached to a split-spoon sampler which was driven into the soil. All split-spoon sampling was conducted in accordance with ASTM Specification D-1586-84 for standard penetration test and split barrel sampling. All samples were screened with a photoionization detector (PID), visually inspected, and the information recorded in the field book.

Eleven *Minuteman*™ soil borings were performed to investigate the presence of contamination in subsurface soils both on and adjacent to the site. Eight of these

borings were associated with installation of monitoring wells. Three others were performed adjacent to MW-1, near IRM sample 90, and north of Route 55.

Five soil boring samples near MW-1 (SS-11 through SS-15) were collected in July to confirm PCB analytical results obtained from initial soil sampling in monitoring well boring MW-1. The samples were collected at five-foot intervals to a depth of 24 feet (top of bedrock). The samples were sent for analysis to NYSDEC in Saratoga Springs.

Three soil boring samples, SS-16 through SS-18, were collected adjacent to NYSDEC sample No. 90 to confirm PCB contamination in that location. The samples were sent for analysis to NYSDEC in Albany. These samples were collected from 0-2, 2-4, and 4-6 feet respectively.

The six off-site samples (SS-50 through SS-55), were collected across Route 55 from MW-1 and MW-1S. Samples were collected from ground surface to a depth of 16.5 feet (top of bedrock) to determine if any potential contamination sources existed upgradient of MW-1 and MW-1S. The samples were sent for analysis to NYSDEC in Saratoga Springs, New York.

A total of twenty seven split-spoon samples were collected from the eleven borings, for chemical analysis. Samples collected from monitoring well borings were analyzed for the full TCL/TAL by RECRA Environmental, Inc. As stated previously, all other soil boring samples were analyzed for TCL PCBs only by the NYSDEC laboratory in Saratoga Springs, New York. The analyses for each sample are summarized in Table 3.1A. All soil sampling locations are shown on Plate 3.1.

3.3 ENVIRONMENTAL SAMPLING

The primary objective of the environmental sampling and analysis was to obtain samples representative of site conditions and to obtain valid analyses of those samples. The field sampling procedures were standardized to ensure reproducible results and minimize external contamination. All procedures in the Work Plan and Addendums No. 1 and 2, and the Quality Assurance Project Plan (QAPP) were followed except as noted in the following discussions.

3.3.1 Groundwater Sampling

Two rounds of groundwater sampling were conducted in January and July of 1993, respectively. The objective of the initial round of sampling was to determine the overall water quality of the shallow groundwater system beneath the site. The second round of sampling was to confirm first round results, and to include sampling of nearby residential wells. This subsection summarizes the groundwater sample collection procedures and presents the analysis of each sample.

All monitoring wells, the plant well, and residential wells that were sampled and the specific parameters analyzed in both rounds are summarized in Table 3.1B. Groundwater sampling locations and their proximity to areas of potential groundwater contamination are shown on Plate 3.1.

All groundwater sampling consisted of three procedures: well development and purging, analytical field tests, and sample collection. Each of these procedures is described below with a brief description of quality assurance/quality control.

Quality Assurance/Quality Control

At a minimum, sampling procedures were in accordance with the most recent NYSDEC guidelines and/or regulations, per the QAPP developed for this project (ES, 1992). Appropriate and NYSDEC-approved techniques based on sample type and location were utilized when such NYSDEC guidelines and/or regulations were non-existent.

Quality assurance blanks were collected as required by the QAPP (ES, 1992). All samples were shipped overnight to RECRA Environmental in Tonawanda, New York, or NYSDEC laboratories in Saratoga Springs when required in Addendum No. 2.

Development/Purging and Field Testing

Prior to developing or purging a monitoring well, the static water level was measured from the rim of the PVC well with a Slope Indicator Model 51453 electric water level indicator to the nearest 0.01 feet and recorded. The wells were evacuated to assure that the water was representative of groundwater in the surrounding formation. All well data were recorded on the well sampling records (Appendix I). The monitoring wells were purged of at least 3 volumes of water. Additional purging was done as needed to ensure that pH, temperature (°C), specific conductance (umhos/cm) and turbidity (NTU) had stabilized. Every attempt was made to insure that the water measured less than 50 NTUs.

Purging was accomplished by using a *Waterra*™ positive displacement pump system consisting of dedicated polyethylene tubing with a check valve at its lower end, and either motor-driven or hand-powered lifting action from the surface.

Following purging of each monitoring well, the *Waterra*™ dedicated polyethylene tubing was removed and placed in a plastic bag at the request of the NYSDEC Project Manager. Groundwater samples were then collected using dedicated polypropylene rope and polyethylene disposable bailers with ball check valves at the lower end. The *Waterra*™ tubing was later placed back into each well for later sampling events. Following purging for the second round of sampling in July, 1993, the tubing and foot valve were permanently removed, cut up, and stored on-site for later disposal.

Groundwater Samples

In January 1993, a total of 13 groundwater samples were collected from 13 of the 14 monitoring wells on-site. QA/QC samples included one duplicate, one trip blank, and one wash blank. MW-1S was not sampled because of excessive sediment in the well. As previously mentioned this initial round of sampling was conducted as a baseline characterization of groundwater quality in and around the Napanoch Paper Mill Site. All samples were analyzed for full TCL/TAL (see Table 3.1B).

Based on the results obtained from the initial groundwater sampling event, a second round of samples was collected in July, 1993. In this event, a total of 15 samples were collected from the 14 monitoring wells plus the existing plant well (PW-1). MW-1S was sampled during this round as per NYSDEC, even though the well still contained large amounts of sediment. Additionally, seven nearby residential wells were sampled to determine off-site and upgradient groundwater quality for specific

parameters. Based on results from the January round, all samples in the second round were analyzed for VOCs, PCBs, and metals (see Table 3.1B). QA/QC samples collected during the second round included one duplicate, one trip blank, and one wash blank.

The plant well was sampled in July by ES prior to and following purging procedures as per the NYSDEC Project Manager. The sample obtained prior to purging was collected with a disposable bailer and sent to Saratoga Springs for VOC analysis by NYSDEC. Standard purging techniques and procedures, as described above, were then followed using the NYSDEC's, *Ready-Flow II*[™] submersible pump and polyethylene tubing. The specific parameters analyzed in the plant well sample (PW-1) are summarized in Table 3.1B.

A total of 7 residential wells were sampled during the July groundwater sampling event. The residences whose wells were sampled included; Mr. Bruce Jackson located at 21 National Street, P.O. Box 904 (RES-001); Mr. Jon Pomeroy, 20 National Street (RES-002); Mr. Mychajlo Luczkiw, 73 West Route 55 (RES-003); Ms. Angeline Delgaizo, P.O. Box 194, Route 55 (RES-004); Mrs. Frances Fritz, P.O. Box 238, Route 55 (RES-005); Mr. Edward Avery, P.O. Box 238, Route 55 (RES-006); and, Ms. Donna Slater, P.O. Box 263, Route 55 (RES-007). All of the residences addresses were in the Hamlet of Napanoch.

Well casings were inaccessible in all of the residential wells except for RES-001 and RES-005, preventing water level measurements. None of the residential wells had water treatment systems (i.e. water softener). Therefore, all of the samples that were collected from either an inside tap or outside spigot were considered representative of the groundwater. Each of the wells was purged between 15 and 30 minutes prior to sample collection to ensure formation water was being sampled. Standard sample collection techniques and procedures were followed to ensure consistency and reproducible results. All residential wells sampled and the specific parameters analyzed are summarized in Table 3.1B.

3.3.2 Surface Soil Samples

Extensive surface soil sampling was conducted at specific areas of concern throughout the site to (1) supplement PCB data previously collected by the NYSDEC, and (2) determine if other contaminants of concern in addition to PCBs were present in the surficial soils.

A total of 41 surface soil samples ranging from 0-2 feet in depth were collected throughout the site. This includes the five samples that were collected during the site reconnaissance. The remaining 36 surface soil samples were collected during the Additional Sampling activities (Addendum No. 2) carried out in July, 1993. Surface soil locations were identified where data was lacking or where better definition of horizontal extent of contamination was required. The sample analysis for each location are listed on Table 3.1C

The five site reconnaissance soil samples were analyzed for full TCL/TAL to provide baseline data across the site. SS-1 was collected in the northwest part of the site (near MW-1) and represented a background location; SS-2 was collected next to the

foundation between the plant office and the decon pad; SS-3 was collected immediately south of the main plant ruins adjacent to Area 10; SS-4 was collected in the center of Area 7; and SS-5 was collected at the southern corner of the fenceline below the IRM Area (see Plate 3.1 for locations).

Thirty-six surface soil samples, including five background samples, were collected near the former lagoon areas, Areas 7, 8, 9, 10, and the Main Plant Ruins. The sampling density was higher in these areas because of the potential for greater exposure associated with dermal contact or inhalation of contaminants present in soils. The five background surface soil samples (SS-19 through SS-23) were collected at off-site locations for representative background data (see Plate 3.1).

Surface soil samples were collected using either the *Minuteman*[™] drilling rig or a stainless steel spoon and bowl. Surface soils collected with the *Minuteman*[™] equipment were obtained from beneath the building foundations (SS-31 and SS-32 and SS-33 through SS-37). The selection of these sampling sites covered a majority of the foundations of the Main Plant Ruins (see Plate 3.1). These samples were obtained by first coring through the concrete floors of the four main plant building foundations using the *Minuteman*[™] rig. After the concrete core was removed, the sample was collected by pounding a split-spoon sampler by hand into the soils. Surface soil samples were collected with a stainless steel spoon as per the Work Plan. All sampling equipment was decontaminated between sample collection. Sample descriptions, locations and other pertinent data were recorded in the field book.

3.3.3 Paper Roll Sampling

Two paper samples were collected in July 1993 from two of the large (up to 6-foot) paper rolls on the site as per Addendum No. 2. One of the rolls sampled was located on the floor of the main plant building adjacent to MW-3. The second roll sampled was adjacent to Test Pit 13 of Test Pit Area B (see Plate 3.1). The samples were collected by cutting into the paper roll with a clean blade then placing pieces of paper into the sample jars. All sampling equipment was decontaminated between samples. Sample descriptions, locations and other pertinent data were recorded in the field book. Samples were sent to RECRA Environmental for full TCL/TAL analysis. The sample analyses for each paper roll are listed on Table 3.1C. Paper roll analytical data are presented in Appendix E.

3.3.4 Concrete Sampling

One concrete sample was collected in July from the foundation flooring of the main plant building. The location was selected because of its proximity to the existing piles of paper rolls and former plant processing activities (see Plate 3.1). The sample was collected to determine if PCBs were being absorbed into the concrete on the site. The sample was collected by knocking out concrete pieces from the flooring, then crushing them further and placed into the sample jar. The sample was sent to NYSDEC in Saratoga Springs and analyzed for PCBs (see Table 3.1C). Concrete analytical data are presented in Appendix C.

3.3.5 Sediment Sampling

Twenty-nine sediment samples were collected to confirm results obtained by NYSDEC personnel during IRM events and to define the extent of contamination in Rondout Creek. NYSDEC has conducted sediment sampling upstream of the Napanoch Paper Mill Site, and downstream sampling adjacent to the site and downstream of the site. Locations and results of the IRM sampling event are briefly discussed in Section 4. Only the sediment samples that were collected and analyzed as part of this RI are discussed in this subsection.

Nine of the 29 sediment samples were collected from cores obtained in the ponded area upstream of the lower dam in Rondout Creek. Locations of the samples are shown on Plate 3.1. Each of the samples in the ponded area were collected by Soil Testing, Inc. of Oxford, CT utilizing *VibraCore*[™] flotation/sampling technology. Each core was visually inspected and selected for analysis. Due to relatively thin sediments and an abundance of boulders and rock slabs, vertical profiling of the ponded area sediments was not possible. The field sampling report submitted by Soil Testing is presented in Section 2 of the RI Data Report (ES, 1993).

Eleven sediment samples were collected at regular intervals along Rondout Creek from above the Route 55 bridge to the ponded area (see Plate 3.1). SS-1 through SS-4 were considered background samples due to their location upstream of the main plant area. In addition, nine sediment samples were collected at regular intervals below the ponded area to a point adjacent to the Eastern New York Correctional Facility, approximately 2 miles downstream (Figure 3.3).

All sediment samples outside of the ponded area were collected with a stainless steel spoon and transferred directly into the sample bottle. All sediment sampling equipment was decontaminated between samples. Sample descriptions, locations and other pertinent data were recorded in the field book. The analyses for each sediment sample are listed on Table 3.1D. Sediment analytical data are presented in Appendix D.

3.3.6 Surface Water Samples

Two rounds of surface water sampling were conducted in Rondout Creek during January 1993 and July 1993 respectively. The primary objective was to determine if contaminants from the site were impacting water quality in the creek.

Samples were collected in January 1993 at six locations along Rondout Creek (see Plate 3.1). These locations include:

- one background location upstream of the Route 55 bridge (SW-1);
- one location immediately upstream of the upper dam (SW-2);
- one sample located midway between the upper dam and the ponded area adjacent to the main plant building; and (SW-3)
- two samples within the ponded area upstream of the lower dam (SW-4 and SWA5#26);
- one sample located immediately downstream of the lower dam (see Plate 3.1).

The second round sampling followed a review of the data. The NYSDEC Project Manager requested that ES resample the surface water at locations SW-1 through SW-5 for PCBs at a low detection limit of 0.01 ug/l to meet NYS surface water standards. The second round of sampling during the July field activities included the same sample locations as Round 1 with the exception of SWA5#26. This sample was analyzed only for total petroleum hydrocarbons due to the presence of a sheen on the water surface during sediment core sampling (see Plate 3.1 and Table 3.1E).

In addition to surface water samples collected from the creek, two additional "surface water" samples were collected during the second sampling round. These samples (SW-6 and SW-7) were collected from standing water which appeared to be associated with groundwater seeps emanating from near the main plant building. These two samples were analyzed for full TCL/TAL, including PCBs with a detection limit of 1.0 ug/l.

Two more "surface water" samples were collected from test pit excavations and are discussed in Section 3.3.7.

Prior to sample collection, field parameters such as temperature, pH, and intrinsic conductivity were measured. Sample descriptions, locations and other pertinent data were recorded in the field book. The parameters analyzed between both rounds of surface water sampling are listed on Table 3.1E. Surface water analytical data are presented in Appendix F.

3.3.7 Test Pit Excavations/Test Pit Sampling

Test Pit Excavations

Thirteen test pits were excavated to determine whether any waste materials were present in surface and subsurface soils beneath the site. The need for test pits was identified following a review of the historical background of the site and visual observations of exposed drums and other abandoned materials.

Upon written authorization from the NYSDEC Project Manager, Addendum No. 1 to the original Work Plan (revised Work Plan, December 1992) was prepared for the completion of test pit excavations. All test pit excavation activities were conducted in Level B protection; therefore, the Site Health and Safety Plan was modified to include Level B requirements. Test pit excavations proceeded in accordance with Addendum No. 1, the site QAPP, and the modified Site Health and Safety Plan.

The test pit excavations (TP-1 through TP-13) were conducted from April 5 through April 7, 1993 in Areas A & B (Plate 2.1). Area A is located in a fill area west of the main plant building. Area B is located in a fill area just south of the main entrance.

Test pits were excavated with a trackhoe equipped with a straight blade and capable of excavating to a depth of approximately 15 feet. Each test pit was between 5 to 10 feet wide and 15 to 20 feet long. Excavation of each pit continued until the excavation reached the equipment's limit, or until visually clean, native soil was encountered. No intact drums were encountered during the excavations. Logs of each test pit are presented in Appendix H.

Test Pit Sampling

Fifteen soil samples were collected from the 13 test pits including 1 duplicate and one additional surface sample at TP-5. The samples were collected as either a discrete sample from a particular zone in the test pit or a composite sample from various locations in the pit.

Soils were sampled manually by ES when test pits were less than four feet in depth. For deeper pits, soil was collected with the excavating equipment, and transferred manually into the sample jars. All samples were collected using the procedures specified in Section A.1 of the QAPP. Decontamination procedures for sampling equipment are described in Section A.1 of the QAPP and Addendum No. 1. The analyses for each sample are listed on Table 3.1F.

Water samples were collected from two test pits excavated below the water table (TP-6 and TP-13). Test pit water samples were collected from the excavator bucket in TP-6 and from the edge of the excavation in TP-13. The parameters analyzed for each sample are listed on Table 3.1E.

3.3.8 Air Monitoring

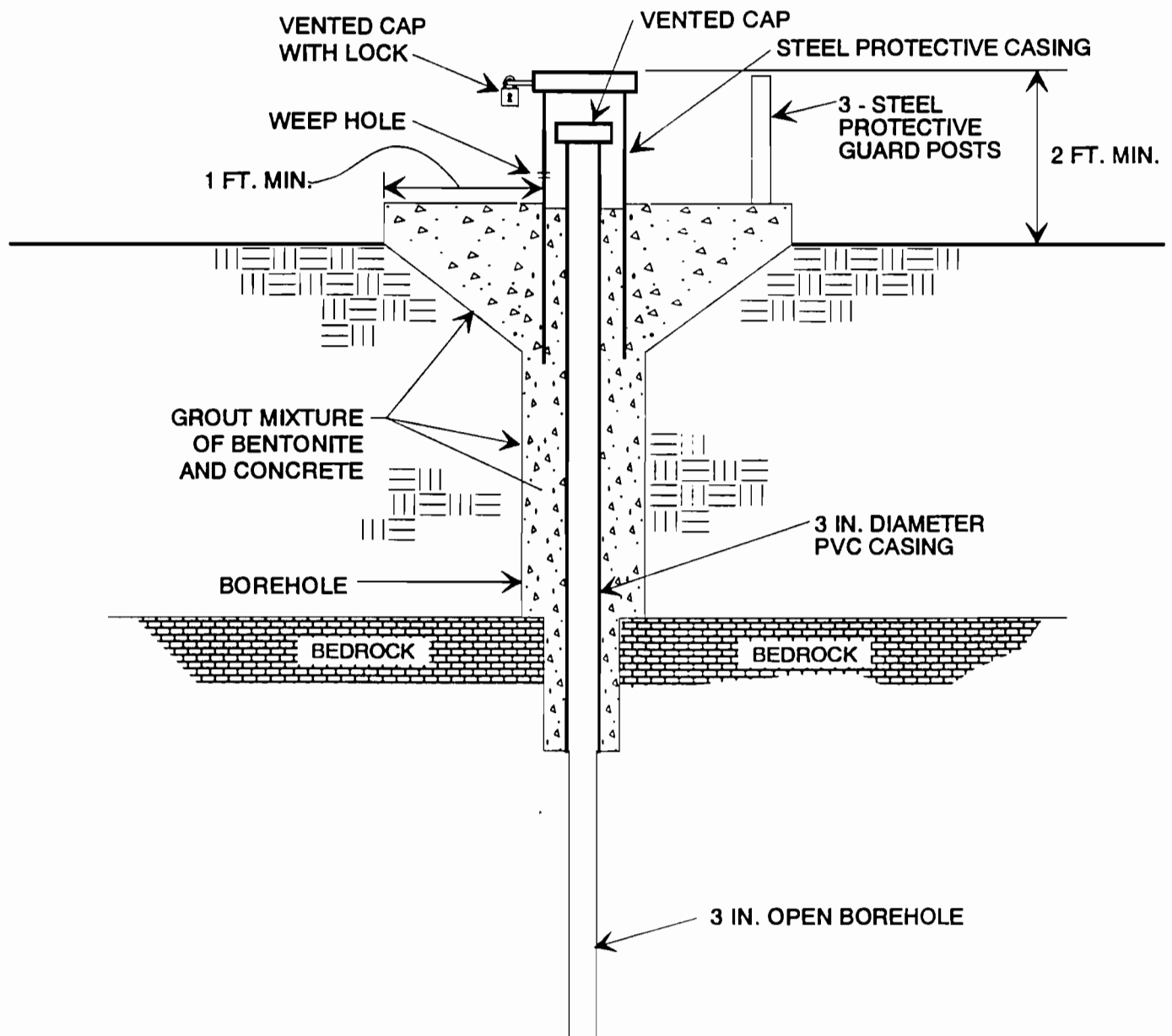
Air monitoring was conducted with a Photovac *MicroTip* photoionization detector (PID) during all field activities, particularly to screen soil samples for potential chemical analysis. A PID and MSA combination detector (oxygen, lower explosive limit, and toxicity to hydrogen sulfide) was used during test pit activities. The PID and MSA were used to monitor for dangerous organic or explosive vapors inside and outside the perimeter of the exclusion zone during level B activities. No readings were detected at the exclusion zone perimeter during test pitting activities.

3.3.9 Habitat Based Assessment (HBA)

The scope of the HBA was designed to fulfill the requirements of the NYSDEC 1991 guidance, "Fish and Wildlife Impact Assessment for Inactive Hazardous Waste Sites." The scope of work for the HBA Step I consisted of a description of existing environmental conditions. A site description was prepared from field observations made during three site visits in December, 1992, January, 1993 and July, 1993. The field observations characterized and evaluated existing general terrestrial, wetland, and aquatic conditions and identified the presence, location and uses of special ecological resources. Step I tasks also included extensive site-related research into vegetative cover types, wildlife populations, wetlands, hydrologic conditions, surface water chemistry, fishery resources, climate, geology, soils types, significant habitats, and endangered species.

Detailed results of the HBA, including Step I and Step II (Ecological Risk Assessment) tasks, are contained in Section 5.2, Ecological Risk Assessment.

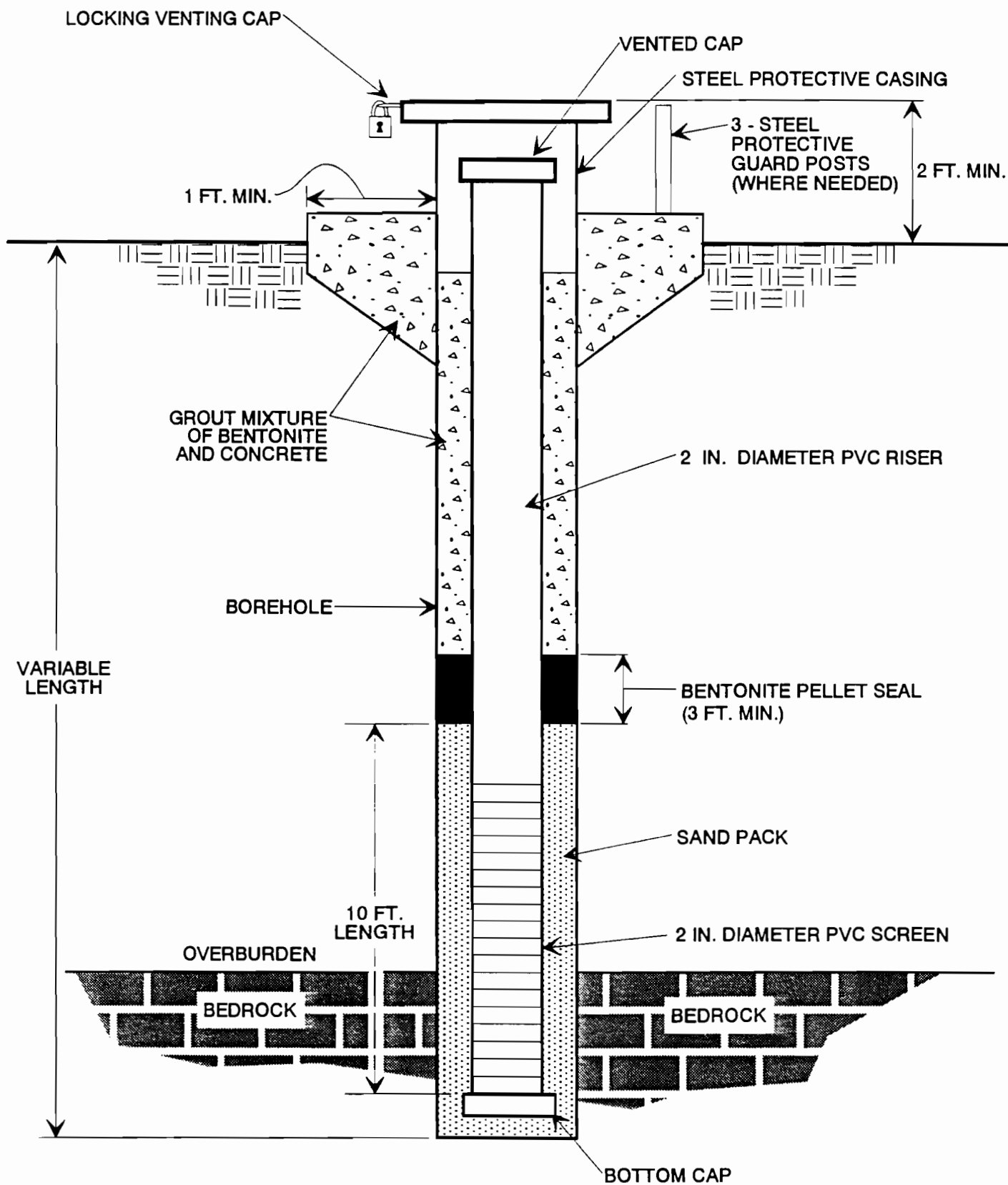
TYPICAL BEDROCK WELL CROSS SECTION



NOT TO SCALE

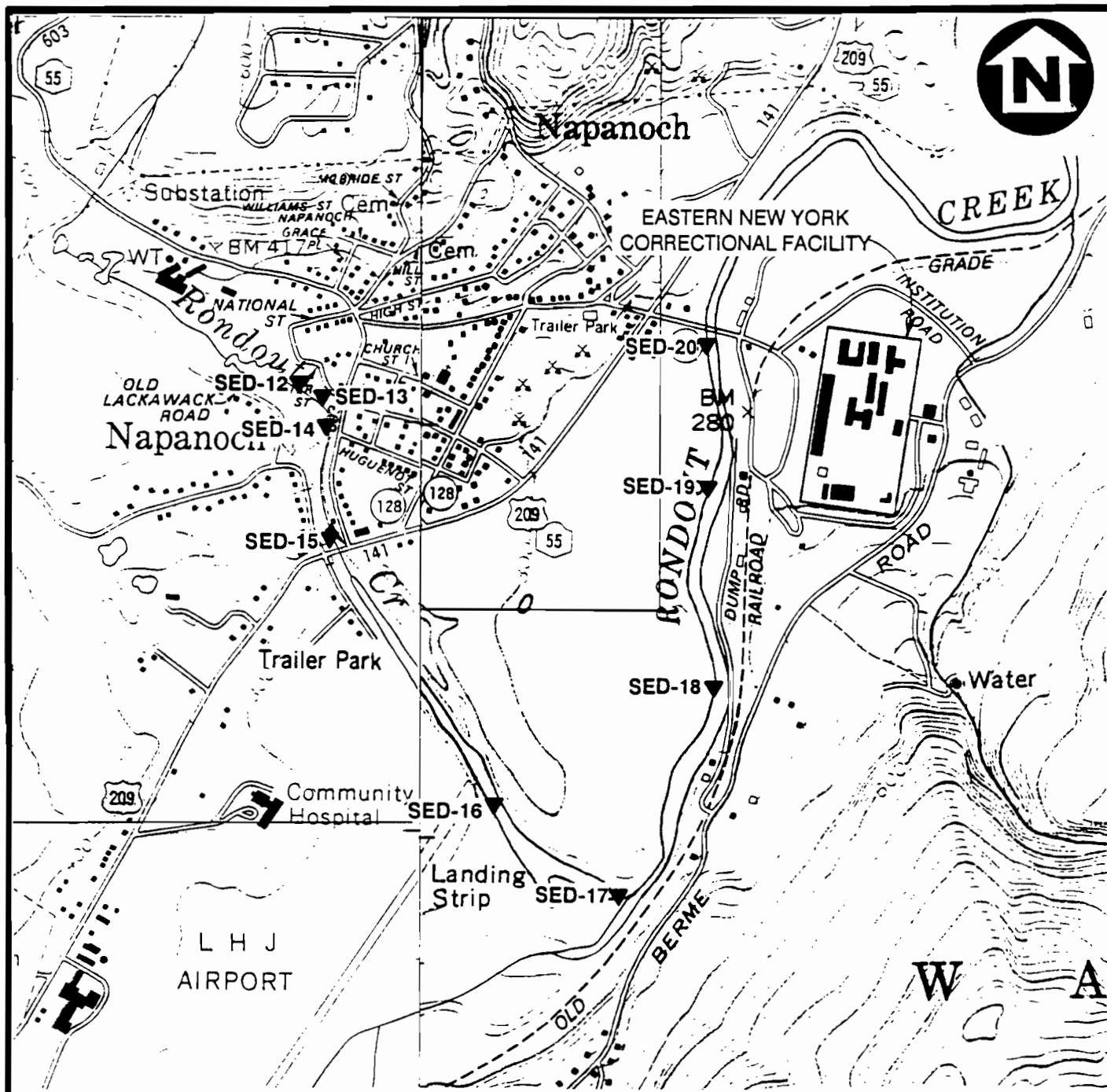
FIGURE 3.2

TYPICAL OVERBURDEN/BEDROCK INTERFACE MONITORING WELL CROSS SECTION



NOT TO SCALE

FIGURE 3.3



LEGEND
 SED-12 ▼ SEDIMENT SAMPLE LOCATION

SCALE
 1000 0 1000 FT.

DOWN-STREAM SEDIMENT LOCATION MAP NAPANOCH PAPER MILL SITE

SOURCE: NYSDOT 7.5 MINUTE SERIES PLANIMETRIC
 MAPS; NAPANOCH (1973), AND ELLENVILLE (1976)
 QUADRANGLES.

TABLE 3.1A
NAPANOCH PAPER MILL SITE
 SOIL BORING SAMPLE SUMMARY

SAMPLE LOCATION DEPTH (FEET)	DATE SAMPLED	VOCs	SVOCs	PAHs	PESTS and PCBs	METALS	TOC	Hardness
SS11 (5-7)	07/13/93				X			
SS12 (10-12)	07/13/93				X			
SS13 (15-17)	07/13/93				X			
SS14 (19-20)	07/13/93				X			
SS15 (23-24)	07/13/93				X			
SS16 (0-2)	07/13/93				X			
SS17 (2-4)	07/13/93				X			
SS18 (4-6)	07/13/93				X			
SS50 (0-2)	10/06/93				X			
SS51 (4-6)	10/06/93				X			
SS52 (8-10)	10/06/93				X			
SS53 (12-14)	10/06/93				X			
SS54 (14-16)	10/06/93				X			
SS55 (16-16.5)	10/06/93				X			
SS/MW01 (23-24)	01/06/93	X	X		X	X	X	
SS/MW03 (0-2)	01/08/93	X	X		X	X	X	
SS/MW03 (4-6)	01/08/93				X			
SS/MW04 (0-2)	01/14/93	X	X		X	X	X	
SS/MW04 (8-10.5)	01/14/93				X			
SS/MW05 (8-11)	01/13/93				X			
SS/MW06 (1-3)	01/15/93	X	X		X	X	X	
SS/MW09 (0-2)	01/13/93	X	X		X	X	X	
SS/MW09 (2-4.5)	01/13/93				X			
SS/MW10 (0-2)	01/07/93	X	X		X	X	X	
SS/MW10 (8-10)	01/07/93				X			
SS/MW11 (2-4)	01/07/93	X	X		X	X	X	
SS/MW11 (6-8)	01/07/93				X			

BOLD FACE Sampled for PCBs only.

Note: SS-11 through SS-15 were collected adjacent to Soil Boring MW-1.

SS-16 through SS-18 were collected adjacent to IRM sample #90.

SS-50 through SS-55 were collected north of Route 55 near substation.

TABLE 3.1B
NAPANOCH PAPER MILL SITE
GROUNDWATER SAMPLE SUMMARY

SAMPLE LOCATION	DATE SAMPLED	VOCs	SVOCs	PAHs	PESTS and PCBs	METALS	TOC	Hardness
MW01	02/03/93	X	X		X	X		
MW01	07/22/93				X	X		
MW01	07/23/93	X						
MW01S	07/22/93				X	X		
MW02	02/03/93	X	X		X	X		
MW02	07/22/93				X	X		
MW02	07/23/93	X						
MW03	02/03/93	X	X		X	X		
MW03-DUP	02/03/93	X	X		X	X		
MW03	07/22/93				X	X		
MW03	07/23/93	X						
MW04	02/04/93	X	X		X	X		
MW04	07/22/93				X	X		
MW04	07/23/93	X						
MW05	02/04/93	X	X		X	X		
MW05	07/22/93				X	X		
MW05	07/23/93	X						
MW06	02/04/93	X	X		X	X		
MW06	07/22/93				X	X		
MW06	07/23/93							
MW07	02/04/93		X		X	X		
MW07	07/22/93				X	X		
MW07	07/23/93	X						
MW08	02/04/93	X	X		X	X		
MW08	07/22/93				X	X		
MW08	07/23/93	X						
MW09	02/05/93	X	X		X	X		
MW09	07/22/93				X	X		
MW09	07/23/93	X						
MW09S	02/05/93	X	X		X	X		
MW09S	07/22/93				X	X		
MW09S	07/23/93	X						
MW10	02/04/93	X	X		X	X		
MW10	07/22/93				X	X		
MW10	07/23/93	X						
MW10S	02/04/93	X	X		X	X		
MW10S	07/22/93				X	X		
MW10S	07/23/93	X						
MW11	02/04/93	X	X		X	X		
MW11	07/22/93				X	X		
MW11	07/23/93	X						
PW01	07/23/93	X	X		X	X		
RES001	07/27/93				X	X		
RES001	07/29/93	X						
RES002	07/27/93				X	X		
RES002	07/29/93	X						
RES003	07/27/93				X	X		
RES003	07/29/93	X						
RES004	07/27/93				X	X		
RES004	07/29/93	X						
RES005	07/27/93				X	X		
RES005	07/29/93	X						
RES006	07/27/93				X	X		
RES006	07/29/93	X						
RES007	07/27/93				X	X		
RES007	07/29/93	X						

BOLD FACE Sampled for PCBs only.

TABLE 3.1C
NAPANOCH PAPER MILL SITE
 SURFACE SOIL SAMPLE SUMMARY

SAMPLE LOCATION	DATE SAMPLED	VOCs	SVOCs	PAHs	PESTS and PCBs	METALS	TOC	Hardness
SS01	12/23/92	X	X		X	X	X	
SS02	12/23/92	X	X		X	X	X	
SS03	12/23/92	X	X		X	X	X	
SS04	12/23/92	X	X		X	X	X	
SS05	12/23/92	X	X		X	X	X	
SS06	07/13/93				X			
SS07	07/13/93				X			
SS08	07/13/93				X			
SS09	07/13/93				X			
SS10	07/13/93				X			
SS19	07/14/93					X		
SS20	07/14/93			X	X	X		
SS21	07/14/93					X		
SS22	07/14/93			X	X	X		
SS23	07/14/93					X		
SS24	07/14/93	X	X		X	X		
SS25	07/14/93	X	X		X	X		
SS26	07/14/93			X		X		
SS27	07/14/93			X		X		
SS28	07/14/93	X	X		X	X		
SS29	07/15/93	X	X		X	X		
SS30	07/15/93	X	X		X	X		
SS31	07/15/93	X	X		X	X		
SS32	07/15/93	X	X		X	X		
SS33	07/15/93	X	X		X	X		
SS34	07/15/93	X	X		X	X		
SS35	07/15/93	X	X		X	X		
SS36	07/15/93	X	X		X	X		
SS37	07/15/93	X	X		X	X		
SS38	07/16/93	X	X		X	X		
SS39	07/16/93	X	X		X	X		
SS40	07/16/93	X	X		X	X		
SS41	07/16/93				X			
SS42	07/16/93	X	X		X	X		
SS43	07/19/93			X		X		
SS44	07/19/93			X		X		
SS45	07/19/93	X	X		X	X		
SS46	07/20/93	X	X		X	X		
SS47	07/20/93	X	X		X	X		
SS48	07/20/93	X	X		X	X		
SS49	07/20/93	X	X		X	X		
PAP1*	07/15/93	X	X		X	X		
PAP2*	07/16/93	X	X		X	X		
CC01**	07/13/93				X			

BOLD FACE Sampled for PCBs only.

* Paper Roll Samples

** Concrete Sample

TABLE 3.1D
NAPANOCH PAPER MILL SITE
 SEDIMENT SAMPLE SUMMARY

SAMPLE LOCATION	DATE SAMPLED	VOCs	SVOCs	PAHs	PESTS and PCBs	METALS	TOC	Hardness
SED-01	12/29/92	X	X		X	X		
SED-02	12/28/92	X	X		X	X		
SED-03	12/28/92				X			
SED-04	12/28/92				X			
SED-05	12/28/92				X			
SED-06	12/28/92				X			
SED-07	12/28/92	X	X		X	X		
SED-08	12/28/92				X			
SED-09	12/28/92				X			
SED-10	12/28/92	X	X		X	X		
SED-11	12/28/92					X		
SED-12	12/29/92	X	X		X	X		
SED-13	12/29/92				X			
SED-14	12/29/92				X			
SED-15	12/29/92				X			
SED-16	12/29/92				X			
SED-17	12/29/92	X	X		X	X		
SED-18	12/29/92				X			
SED-19	12/29/92				X			
SED-20	12/29/92	X	X		X	X		
SED-A1#26	01/05/93		X		X	X		
SED-A5#29	01/06/93		X		X	X		
SED-B1#25	01/05/93	X	X		X	X		
SED-C1#24	01/05/93	X	X		X	X		
SED-C1#27	01/06/93		X			X		
SED-C3#23	01/05/93		X		X	X		
SED-D1#22	01/05/93	X	X		X	X		
SED-D1#28	01/06/93		X			X		
SED-D3#21	01/04/93	X	X		X	X		

TABLE 3.1E
NAPANOCH PAPER MILL SITE
 SURFACE WATER SAMPLE SUMMARY

SAMPLE LOCATION	DATE SAMPLED	VOCs	SVOCs	PAHs	PESTS and PCBs	METALS	TOC	Hardness
SW A5#26*	01/06/93							
SW001	01/06/93							X
SW001	07/12/93				X			
SW001	12/22/92	X	X		X	X		
SW002	01/06/93							X
SW002	07/12/93				X			
SW002	12/22/92	X	X		X	X		
SW003	01/06/93							X
SW003	07/12/93				X			
SW003	12/22/92	X	X		X	X		
SW004	01/06/93							X
SW004	07/12/93				X			
SW004	12/22/92	X	X		X	X		
SW005	01/06/93							X
SW005	07/12/93				X			
SW005	12/22/92	X	X		X	X		
SW006	07/16/93	X	X		X	X		
SW007	07/27/93	X	X		X	X		
TP06-W**	4/6/93	X	X		X	X		
TP13-W**	4/7/93	X	X		X	X		

*Sampled for total petroleum hydrocarbons (TPH)

** Water sample from test pit.

TABLE 3.1F
NAPANOCH PAPER MILL SITE
 TEST PIT SAMPLE SUMMARY

SAMPLE LOCATION	DATE SAMPLED	VOCs	SVOCs	PAHs	PESTS and PCBs	METALS	TOC	Hardness
TP01	04/05/93	X	X		X	X		
TP02	04/05/93	X	X		X	X		
TP03	04/05/93	X	X		X	X		
TP04	04/06/93	X	X		X	X		
TP05	04/06/93	X	X		X	X		
TP05S(0-2)	04/06/93	X	X		X	X		
TP06	04/06/93	X	X		X	X		
TP07	04/06/93	X	X		X	X		
TP08	04/06/93	X	X		X	X		
TP09	04/06/93	X	X		X	X		
TP10	04/07/93	X	X		X	X		
TP11	04/07/93	X	X		X	X		
TP12	04/07/93	X	X		X	X		
TP13	04/07/93	X	X		X	X		

SECTION 4

NATURE AND EXTENT OF CONTAMINATION

This section summarizes the laboratory analytical results of all environmental sampling conducted at and near the site, and describes the nature and horizontal and vertical extent of any detected contaminants identified during the investigation.

The primary objective of the Remedial Investigation was to define the extent, nature, and source(s) (if possible) of surface and subsurface contamination in soils, sediments, groundwater, and surface water. The Phase I included the following elements:

- A site-wide geologic investigation characterizing the nature and distribution of the surficial deposits, and determining surface and subsurface soil quality;
- A groundwater investigation consisting of on-site and off-site sampling of groundwater quality in unconsolidated deposits and bedrock, and characterization of the site hydrogeology;
- Sampling of sediments in Rondout Creek adjacent to, upstream and downstream of the site, and within a ponded area adjacent to the site;

Following evaluation of the Phase I results, data gaps were identified and a supplemental Work Plan was prepared to address the deficiencies. Additional sampling was conducted followed by data evaluation which included the following activities:

- Excavation of test pits to determine the presence or absence of buried waste materials; and
- Collection of additional surface soil samples throughout various areas of the site to define the extent of PCBs, metals, and PAHs;
- Collection of a second round of groundwater samples to confirm first round results, and to include residential wells. Residential wells included those which might be impacted by the site and others for determining background water quality.
- Collection of samples from other matrices such as concrete foundations, paper rolls, and leachate outbreaks;
- Further characterization of the hydrogeology through additional monitoring of water levels in observation wells, and measuring water levels in some residential wells; and
- Ecological and human health risk assessments.

4.1 NATURE OF CONTAMINATION

The purpose of this subsection is to describe the types of analytes detected in each environmental media. Analytical results from each parameter group are compared to the appropriate standard or criterion for each analyte detected. Background or upstream samples were collected for soil, sediment and surface water matrices. In

some cases, the average site background concentrations were used in lieu of NYSDEC recommended standards or criteria. A detailed discussion of how the standards and criteria for each parameter group were developed is provided in Section 7.1.

A summary of analytical results for each media sampled are presented in Tables 4.1 through 4.8. A list of laboratory qualifiers is presented in Table 4.9. Full analytical summary tables containing results for all compounds, whether or not they were detected, are presented in Appendices C through F. The distribution and the extent of contamination in each media is presented in map form and discussed in Section 4.2.

Units of measurement reported by the laboratory for most data packages were micrograms per kilogram (ug/kg) or parts per billion (ppb) for soil and sediment matrices and micrograms per liter (ug/l) for water. Thus, these units were used for all data tables with the exception of the NYSDEC IRM data (Table 4.1). However, for ease of discussion and presentation, mg/kg (or parts per million, ppm) was used for soil and sediment in figures and discussions in the text of the report.

In many samples, laboratory results were reported as estimated values, in which the analyte was confirmed as being present, but below the detection limit. In some cases, these estimated concentrations exceeded cleanup objectives or standards and were highlighted as such in the data summary tables.. However, because the concentrations are estimated and below detection limits, it should be recognized that there is a level of uncertainty in the actual concentration. Some of these samples may in reality not exceed the standard or criteria to which it is being compared. Thus, reporting the samples as exceeding a particular criteria or standard is a conservative approach followed in conducting this assessment.

Background soil, sediment, groundwater, and surface water samples were collected during the RI. Background soil and sediment samples were used to assist in developing cleanup objectives for the on-site or "downstream" samples. In some cases, NYSDEC cleanup objectives require using an established level or site background, whichever is higher. Thus, for soil and sediment samples, cleanup objectives were compared only to on-site or downstream samples. Using this approach, samples which exceed cleanup objectives also exceed background concentrations and are likely related to on-site contamination. Details of the development of cleanup objectives (standards, criteria, and guidelines) are provided in Section 7.1 of the feasibility study.

Groundwater and surface water have established NYSDEC standards. Thus, all samples, whether upstream or background, were compared to these standards. Where appropriate to the discussion, a comparison of concentrations between upstream/background and downstream/on-site samples was made.

4.1.1 Results of Surface Soil Sampling

Introduction

Extensive surface soil sampling was conducted by the NYSDEC prior to and during the IRM completed in the Fall of 1992 and prior to the initiation of the RI/FS field work in December 1992. These samples were analyzed primarily for PCB aroclors. In addition, several soil samples collected during the RI/FS were analyzed by

the NYSDEC laboratory rather than the ES Standby Subcontract laboratory, RECRA Environmental, Inc.

Samples collected prior to the RI/FS and concurrently with the IRM activities are tabulated in Table 4.1. Several of the IRM samples were analyzed only by the *Millipore*[™] field screening technique for PCBs rather than by an analytical laboratory. These samples were, however, plotted on site maps and utilized to identify areas of concern.

The laboratory results for all surface soil samples collected during the RI/FS, including samples analyzed by the NYSDEC, are summarized in Table 4.2. All samples were analyzed for TCL PCBs/Pesticides, and selected samples were analyzed for TCL VOCs/SVOCs and TAL Metals. These tables provide a summary of all compounds detected in samples collected on and adjacent to the site, and also clearly indicate samples in which concentrations exceeded applicable standards, criteria, or background values.

Full analytical summary tables containing results for all compounds, whether or not they were detected, are presented in Appendix C. Sample locations for all soil samples are presented on Plate 3.1. The spatial distribution of detected compounds is presented in map form on Figures 4.1 through 4.4.

Five samples, SS-19 through SS-24 were collected outside of the site boundaries to provide background concentrations, primarily for TAL metals. Samples SS-19, SS-20, and SS-21 were collected north of State Route 55, and samples SS-22 and SS-23 were collected from the south side of Rondout Creek (see Plate 3.1 for locations). All five samples were analyzed for TAL metals, and SS-20 and SS-22 were also analyzed for PAHs and PCBs. These samples were used to assist in developing cleanup objectives for samples collected within the site boundaries.

PCBs/Pesticides

PCBs, including aroclors 1242, 1248, and 1254 were detected above the surficial soil cleanup objective of 1.0 mg/kg in numerous samples. When IRM and RI/FS samples are considered as a whole, total PCBs ranged from less than the detection limit in many samples to a maximum of 160.0 mg/kg in IRM sample No. 56 (see Tables 4.1 and 4.2 for results).

A total of 20 surficial soil samples were analyzed for TCL pesticides. Concentrations for individual pesticides were low, ranging from below detection limits to 0.77 mg/kg. Only a single pesticide was detected above soil cleanup objectives in one sample. Beta-BHC was detected at a concentration of 0.36 mg/kg in sample SS-41 (near Test Pit Area B), above the standard of 0.20 mg/kg (see Table 4.2).

Six samples, SS-50 through SS-55 were collected by NYSDEC personnel during the RI/FS from the vicinity of the substation north of Route 55. The samples, collected from a single boring at depths ranging from 2.0 - 16.5 feet, were analyzed only for PCB aroclors. Results for all six samples were below detection limits (see Table 4.2).

A total of 26 surficial soil samples were analyzed for VOCs. Concentrations of individual VOCs ranged from below detection limits to 0.15 mg/kg (acetone in SS-49).

No VOCs were detected in excess of soil cleanup objectives among these samples (Table 4.2).

SVOCs

Twenty-six surficial soil samples were analyzed for SVOCs, and six additional samples were analyzed for only PAHs. Eight individual PAHs were detected at concentrations exceeding the corresponding soil cleanup objectives. Chrysene, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene were detected above standards more frequently than other PAHs. Concentrations ranged from 7.90 (dibenzo(a,h)anthracene, SS-44) to 21.00 mg/kg of chrysene in sample SS-3 (see Table 4.2).

Metals

A total of 35 surficial soil samples were analyzed for TAL metals. In 32 of the 35 samples, at least one metal exceeded the soil cleanup criteria. Eleven individual metals were detected at concentrations exceeding the proposed soil cleanup objectives. Of these 11, six metals (arsenic, cadmium, chromium, lead, manganese, and mercury) occurred most frequently. A summary of detected TAL metals is presented in Table 4.2.

4.1.2 Results of Subsurface Soil Boring Samples

A total of 27 soil samples were collected from selected depth intervals in eight monitoring well borings and three soil borings. Subsurface soil samples ranged in depth from 2 feet to a maximum of 24 feet in SS/MW-1. All samples were analyzed for TCL PCBs and selected samples were analyzed for TCL VOCs, SVOCs, Pesticides, and TAL Metals. Analytical results of detected compounds are summarized in Table 4.3 and full analytical summary tables containing results for all compounds are presented in Appendix C.

Only a single VOC, acetone, was detected above soil cleanup objectives in one sample, SSMW-4(0-2). Acetone was detected at a concentration of 0.26 mg/kg in this sample, slightly above the cleanup objective of 0.20 mg/kg.

No PCBs or pesticides were detected above the soil cleanup objectives. The maximum PCB concentration was 1.20 mg/kg of Aroclor 1242 in sample SS/MW-1 at a depth of 23-24 feet. This is below the cleanup objective of 10.00 mg/kg for subsurface soil samples, greater than two feet in depth. This same interval was resampled during the July 1993 sampling round from a boring located immediately adjacent to MW-1. PCBs were again detected at the same depth, but at a concentration of only 0.133 mg/kg.

SVOCs, all PAHs, were detected above criteria in five of the seven samples analyzed. With the exception of SS/MW-10(0-2), concentrations were generally low, reported as estimated values below the detection limit. Contamination was limited primarily to the surficial soils, occurring in the 0 - 2 foot depth range. Only a single PAH, exceeded the cleanup objective at a sample depth greater than two feet. Benzo(a)pyrene was detected slightly above the cleanup objective of 0.061 mg/kg (0.079 mg/kg) at a depth of 2-4 feet in sample SS/MW11(2-4).

In SS/MW-10, at a depth of 0-2 feet, six PAHs were detected above the cleanup objective, and respective concentrations were notably higher than in the other six samples.

Five metals were detected above cleanup objectives in all seven samples analyzed. These included arsenic, chromium, lead, manganese, and mercury. Three of these seven samples exceeded two feet in depth.

4.1.3 Test Pit Analytical Results

One composite soil sample was collected from each of thirteen test pits. All thirteen samples were analyzed for the full TCL/TAL parameter list, including VOCs, SVOCs, Pesticides/PCBs, and TAL metals. Analytical results of detected compounds are summarized in Table 4.4 and full analytical summary tables containing results for all compounds are presented in Appendix C.

Only four VOCs, acetone, 2-butanone, benzene, and toluene were detected in the test pit samples, but the concentrations were below soil cleanup objectives.

No PCBs or pesticides were detected in excess of the soil cleanup objectives. A total of 10 pesticides and two PCB aroclors were detected in various samples at concentrations below the cleanup objectives.

In nine of the thirteen test pit samples, TP-1, TP-3 through TP-9, and TP-13, no SVOCs were detected above cleanup objectives. A single PAH, chrysene, was detected above the cleanup objective in TP-2. Another PAH, benzo(a)anthracene, was detected in TP-13 above the cleanup objective. Test pit samples TP-10 through TP-12 contained six PAHs above the corresponding cleanup objectives. These were benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

Six metals were detected above the cleanup objectives in soil samples collected from test pits: arsenic, barium, chromium, lead, manganese, and mercury. With the exception of barium, these metals were also detected above cleanup levels in both the surficial soils and soil boring samples.

4.1.4 Soil Sampling Summary

Surficial soils, defined as 0-2 feet below ground surface, were investigated through surface soil sampling, soil borings, and test pit excavations.

During the course of the investigation, PCBs in excess of 1.0 mg/kg were detected in surficial soils in several distinct areas of the site:

- Main Plant Ruins - two areas;
- Test Pit Area A;
- Areas 7 and 8;
- Area 9 - drainage ditch;
- Bank of Rondout Creek east of the Main Plant Ruins - three small areas;.

Total PCB concentrations in these areas typically ranged from 1.0 to 10.0 mg/kg, with smaller subareas or pockets of surface contamination where levels exceeded 10 mg/kg.

Metals were detected at concentrations above cleanup criteria in the majority of on-site sample locations. Thus, distinct areas of metals contamination were not defined. The most commonly occurring metals in concentrations above cleanup objectives were arsenic, chromium, lead, manganese, and mercury.

PAHs exceeding cleanup objectives were detected most frequently in the Main Plant Ruins, Test Pit Area B, and Area No. 9. The most commonly occurring PAHs exceeding cleanup objectives were benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene.

Pesticides and VOCs did not constitute a problem in surficial soils. Only a single pesticide, beta-BHC, was detected above soil cleanup objectives in one sample.

Subsurface soils (greater than two feet) were determined not to be contaminated with respect to VOCs, PCBs/pesticides, and SVOCs. Three subsurface soil samples contained metals exceeding cleanup objectives.

4.1.5 Sediment Sampling Analytical Results

Twenty sediment samples were collected from Rondout Creek upstream and downstream of the ponded area and nine additional samples were collected for analysis within the ponded area. In Rondout Creek, 19 of the 20 samples were analyzed for TCL PCBs and Pesticides, seven samples were analyzed for TCL VOCs and SVOCs, and eight were sampled for TAL metals. In the ponded area, four of the nine samples were analyzed for TCL VOCs, seven were analyzed for TCL PCBs/Pesticides, and all nine were analyzed for TCL SVOCs and TAL metals.

In addition to RI/FS sediment samples, the NYSDEC collected 12 sediment samples from Rondout Creek during the time frame of the IRM activities. These were plotted on the sample location map, and analytical results are presented in Table 4.1. These samples were included in the contamination assessment.

Sample locations for all sediment samples are presented on Plate 3.1.

Four sediment samples, SED-1 through SED-4 were collected upstream of the site to provide background concentrations of various parameters (see Plate 3.1 for locations). All four samples were analyzed for pesticides and PCBs. In addition, SED-1 and SED-2 were also analyzed for VOCs and SVOCs. These samples were used to assist in developing cleanup objectives for samples collected in Rondout Creek adjacent to and downstream of the site boundaries. Details of cleanup objective development are provided in Section 7.1

The primary compounds detected at concentrations exceeding sediment criteria were PCBs, several pesticides, PAHs and various metals. Analytical results of detected compounds are summarized in Table 4.5 and full analytical summary tables containing results for all compounds are presented in Appendix D.

PCBs/Pesticides

Total PCBs, including Aroclors 1242, 1248, and 1254 were detected above the sediment criterion of 1.00 mg/kg in five samples, but only within the ponded area of the creek (see Table 4.5). The maximum concentration was 22.00 mg/kg (Aroclor 1242) in SED-B1 #25.

Six pesticides were detected at concentrations exceeding sediment criteria in various samples. These were 4,4-DDD, 4,4-DDE, 4,4-DDT, Endosulfan I, endrin, and methoxychlor. The most frequently occurring pesticide exceeding the cleanup criterion was 4,4-DDD, detected at levels above the criterion in 10 of 22 samples.

Although sediment criteria were exceeded, nearly all detected concentrations were low, reported by the laboratory as estimated values less than the method detection limit.

SVOCs

Among the SVOCs, PAHs were the most commonly detected group of compounds at levels above the respective sediment criteria (Table 4.5). These included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, phenanthrene, and indeno(1,2,3-cd)pyrene. Concentrations ranged from non-detect to 1.20 mg/kg benzo(b)fluoranthene. The most frequently occurring PAH exceeding the cleanup criterion was chrysene, which was detected at levels above the criterion in 10 of 14 samples.

The only other SVOCs detected above the sediment criteria were bis(2-ethylhexyl)phthalate, which exceeded the criterion of 4.10 mg/kg in 4 of 14 samples and 1,2-dichlorobenzene, which exceeded the cleanup criterion of 0.015 mg/kg in just 1 of 14 samples (0.38 mg/kg). Concentrations of bis(2-ethylhexyl)phthalate ranged from not-detected in several samples to a maximum of 16.00 mg/kg in SED-20 (see Table 4.5).

Metals

A total of nine metals were detected in sediment samples at concentrations which exceeded the sediment criteria (see Table 4.5). Of these nine, arsenic, copper, lead, and zinc were the most frequently detected above the cleanup criteria. These four TAL metals were detected above standards in eight or more of 15 samples.

Sediment Sampling Summary

In the ponded area of Rondout Creek, PAHs, PCBs, pesticides, and metals were detected above sediment cleanup criteria. PCBs in excess of 1.0 mg/kg were found in an area along the southern bank of the creek in the ponded area. Only a single pesticide, 4,4-DDD was found throughout the ponded area above the cleanup criterion. PAHs were detected at six of the seven sampling locations in the ponded area, but were distinctly higher in concentration and frequency of occurrence near the northern shoreline. Various metals were also detected above cleanup criteria at all seven sampling locations. This is consistent with the widespread distribution of metals throughout the site.

Upstream of the ponded area, PAHs were detected above criteria at SED-10 (200 feet upstream of the upper dam) and pesticides were found above criteria at SED-6

(approximately 170 feet southwest of the Main Plant Ruins on southern shoreline). No PCBs were detected above the sediment cleanup criteria of 1.0 mg/kg.

Downstream of the ponded area, PCBs were not detected above the sediment cleanup criteria of 1.0 mg/kg. Four pesticides were detected in four downstream sediment samples above cleanup criteria (SED-14, 16, 19, and 20). PAHs and metals were detected above criteria only at SED-12, located immediately downstream of the lower dam, and SED-20, near the correctional facility.

4.1.6 Groundwater Analytical Results

Two rounds of groundwater sampling were conducted at the site during February and July, 1993 respectively. Samples were collected from all on-site monitoring wells and the plant pumping well during both rounds. The second round in July also included seven nearby residential wells.

During the first sampling round in February 1993, samples were analyzed for the full TCL/TAL parameter list, including VOCs, SVOCs, PCBs/Pesticides, and metals. Only VOCs, metals and PCB aroclors were analyzed during the second sampling event. VOC samples during the second round were collected and analyzed by the NYSDEC.

Results for both rounds were tabulated jointly to facilitate comparisons between the two rounds. Analytical results showing only detected compounds are summarized in Table 4.6 and full analytical summary tables containing results for all compounds are presented in Appendix F.

Only six organic compounds were detected above groundwater standards in the samples collected from on-site wells: 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethene (1,2-DCE), tetrachloroethene (PCE), vinyl chloride, chlorobenzene, and PCBs (aroclor 1248). In most cases, these compounds were detected at concentrations within an order of magnitude of the standards. Also, several of these results were reported at low concentrations, qualified as estimated concentrations below the method detection limit.

No organic compounds were detected above groundwater standards in the residential wells.

Iron, manganese and sodium were the only analytes detected above groundwater standards in the on-site and residential wells. It is noteworthy that copper was detected at just 1 ug/l above the standard in a single residential well (RES-6). A comparison of upgradient with on-site and residential wells is presented in Section 4.2.12.

4.1.7 Surface Water Sampling Results

Two rounds of surface water sampling from Rondout Creek were conducted during December 1992/January 1993 and July 1993 respectively. Results were compared to NYSDEC Class A surface water standards where available (see Table 4.7 and Appendix F).

First Round (December 1992/January 1993)

During the first round, five of the six samples from Rondout Creek (SW-1 through SW-5) were analyzed for the full TCL parameter list and the sixth sample (SW A5#26) was analyzed only for total recoverable petroleum hydrocarbons. In addition to

samples from the creek, two water samples were collected from standing water in Test Pits 6 and 13, and designated as samples TP06-W and TP13-W respectively. They were analyzed for the full TCL parameter list.

Only two organic parameters were detected in the surface water from Rondout Creek: acetone (4 ug/l) and chloroform (0.5 ug/l). No NYSDEC surface water standards exist for either of these compounds.

Seven TAL metals were detected in the five samples analyzed from the creek. The concentrations of lead in three of the five samples exceeded the Class A standard. However, it should be noted that this standard was also exceeded in the upstream sample (7 ug/l). Also, concentrations of lead in three of the four downstream samples were equal to or less than the concentration in the upstream sample. This suggests that the lead found in the downstream samples was not site-related.

In the test pit water samples, Aroclor 1248 was detected at concentrations of 2.9 and 1.1 ug/l in TP06-2 and TP13-W respectively. Aroclor 1248 was also detected in soil samples from these test pits, but at concentrations less than 1.0 mg/kg. Numerous metals were also detected in both test pit water samples. Results were not compared to either groundwater or surface water standards.

Second Round (July 1993)

During the second sampling round SW-1 through SW-5 were resampled. Also, two samples, SW-6 and SW-7, were collected from standing water areas within the Main Plant Ruins. The water is assumed to be associated with groundwater seeps emanating from near the main plant building. Results were compared to surface water standards because of the close proximity to Rondout Creek. Water at SW-6 flows into the pool at SW-7, and water at SW-7 is within 10 to 15 feet of Rondout Creek. At times of high water and precipitation events, it is expected that there is a hydraulic connection between SW-7 and Rondout Creek. These two samples were analyzed for the full TCL parameter list, including PCBs with a detection limit of 1.0 ug/l. Samples SW-1 through SW-5, from Rondout Creek were analyzed only for PCB aroclors at a lower detection limit of 0.01 ug/l.

A single VOC, carbon disulfide, was detected in one sample (SW-7) at a concentration of 4 ug/l. No NYSDEC surface water standard exists for this compound.

Two PCB aroclors, 1248 and 1254, were detected above the surface water standard of 0.001 ug/l in sample SW-7 at concentrations of 0.55 ug/l and 1.7 ug/l respectively. These concentrations were both near the detection limit of 1.0 ug/l.

Only three metals, copper, iron, and zinc, were detected in excess of the corresponding standards. Copper was detected in SW-6 at a concentration of 7.5 ug/l, only slightly above the standard of 6.8 ug/l. Iron was detected in both SW-6 and SW-7 at concentrations approximately one order of magnitude above the standard of 300 ug/l. Zinc was also detected above the standard in both SW-6 and SW-7.

Surface Water Summary

In Rondout Creek, lead was detected above the NYSDEC Class A surface water standards both upstream of and within the ponded area. However, concentrations of

lead in three of the four samples located adjacent to and downstream of the site were equal to or less than the concentration in the upstream sample. This suggests that the lead found in the downstream samples was not site-related.

4.1.8 Paper Rolls and Concrete Samples

Two paper roll samples were collected concurrently with the July 1993 round of soil sampling and analyzed for the full TCL parameter list. Also, NYSDEC collected two paper roll samples during the IRM which were subsequently analyzed for PCBs only. Results for detected compounds (IRM and RI/FS samples) are presented in Table 4.8 and compared to soil cleanup objectives. Results were compared to soil standards because the paper is in direct contact with surface soils and partially decomposed. Full analytical summary tables containing results for all compounds are provided in Appendix C (soil and concrete) and Appendix E (paper rolls).

Two VOCs, acetone and 2-butanone, exceeded soil cleanup objectives in RI/FS sample PAP-2. Concentrations of acetone and 2-butanone were 8.70 and 1.10 mg/kg respectively.

PCBs were detected in all four samples, and exceeded the cleanup objective of 1.00 mg/kg in three of the four samples. Concentrations of total PCBs were 100, 38 and 3.3 mg/kg in IRM samples 87 and 88, and RI/FS sample PAP-1 respectively. The source of PCBs in the paper rolls is assumed to be a liquid used in the paper processing.

Only a single metal, mercury, slightly exceeded the cleanup objective in one sample, PAP-1. Mercury was detected at 0.11 mg/kg, only 10% above the objective of 0.10 mg/kg.

A single sample of concrete (CONC-1) was collected from the floor of the main plant building ruins and analyzed for PCB aroclors. Aroclor 1242 was detected at a concentration of 1.8 mg/kg. Results for this sample are presented at the end of the surficial soil analytical results in Table 4.2.

4.2 EXTENT OF CONTAMINATION

During the Remedial Investigation, contamination was found in the soils in several areas around the site, in sediments in Rondout Creek, and in groundwater. This section briefly describes the level and extent of contamination found in each of these areas in various media.

Concentrations or the presence of analytes or analyte groups exceeding cleanup objectives in on-site soils and sediments were plotted on Figures 4.1 through 4.4. PCBs, PAHs, and metals were detected above cleanup objectives in soil and sediment, and pesticides were detected above cleanup objectives in sediments from Rondout Creek. In groundwater, metals were the primary analyte group detected above standards.

4.2.1 Background Soil Samples

Five samples, SS-19 through SS-24, were collected outside of the site boundaries to provide background concentrations, primarily for TAL metals. Background samples

SS-19, SS-20, and SS-21 were collected north of State Route 55, and samples SS-22 and SS-23 were collected from the south side of Rondout Creek (see Plate 3.1 for locations). These samples were used to assist in developing cleanup objectives for samples collected within the site boundaries. They were also used as a screening criteria in determining compounds of concern for the human health evaluation. Results for these samples are provided in Table 4.2 and in Appendix C.

All five samples were analyzed for TAL metals, and SS-20 and SS-22 were also analyzed for PAHs and PCBs. No PCBs were detected in these samples (see Table 4.2).

4.2.2 Rondout Creek Upstream of Poned Area

Sediment

Samples SED-1 through SED-4 were collected as background samples and utilized to develop cleanup (see Section 7.1 for details). The term sediment clean-up criteria used throughout this report represents clean-up objectives and not statutory requirements.

The section of Rondout Creek that was sampled upstream of the ponded area, including samples SED-1 through SED-11, was relatively free of contamination. PAHs were detected in excess of the sediment criteria only in SED-10, and pesticides were detected at concentrations only slightly exceeding criteria at location SED-6 (see Figure 4.2a). No PCBs were detected above the sediment cleanup criteria of 1.00 mg/kg.

Surface Water

Lead was detected above the NYSDEC surface water standard in the three surface water samples located upstream of the ponded area (see Plate 3.1 for sample locations). Several other metals were detected for which no standards exist. No other parameters were detected above surface water standards.

4.2.3 Rondout Creek Poned Area

Sediments

The thickness of the sediments in the ponded area was highly variable, ranging from 0 - 5 feet, but generally less than two feet. At many attempted sample locations, particularly in the middle of the pond, refusal was encountered on bedrock or boulders during coring, and no sample was obtained.

In the ponded area, PCBs in excess of 1.00 mg/kg were detected in shallow sediments in an elliptical area measuring approximately 300 feet long (parallel to flow direction) by 60 feet wide (see Figure 4.1b). The area extends from sample location SW-4 to the lower dam. A small zone within this area contained PCBs exceeding 10.00 mg/kg between SED-C1 and SED-A5. A second zone of PCBs exceeding 10.00 mg/kg is inferred to exist around SED-D-1.

A single pesticide, 4,4-DDD, exceeded sediment cleanup criteria in the ponded area at all seven sample locations. Its occurrence was near the northern shoreline in a similar distribution to the PCBs. It also was detected in two locations on the opposite shore at SED-D3 and SED-C3 (see Figure 4.2b). The concentrations were low,

Several metals were detected above sediment cleanup criteria at each of the seven locations sampled within the ponded area (see Figure 4.4b). The presence of multiple metals exceeding cleanup criteria at each sampling location indicates a ubiquitous distribution in the ponded area. However, the numbers of individual metals and their respective concentrations were highest at sampling location SED-D1. The lowest concentrations and number of metals exceeding criteria were found on the south shore of the creek at samples SED-C3 and SED-D3 (Table 4.5).

One or more PAHs were detected above sediment cleanup criteria at six of seven sampling locations within the ponded area (see Figure 4.3b). Chrysene, the most commonly detected compound above the sediment criterion, was detected at six of the seven locations. A greater number of individual PAHs and higher concentrations were observed at locations SED-C1 and SED-D1 (Table 4.5), near the northern shore of Rondout Creek.

PCBs, PAHs, and metals detected above sediment cleanup objectives in Rondout Creek are likely associated with contamination originating from within the site boundaries. Analytes in all three of these groups were also detected above cleanup objectives in on-site soils. Pesticides are potentially from gypsy moth spraying conducted in the area during the 1980s.

Surface Water

Only two samples, SW-4 and SW-5, and were analyzed for TCL and TAL parameters in the ponded area. Lead was detected at 7.0 ug/l in SW-5, in excess of the surface water standard of 1.07 ug/l. However, it should be noted that lead was also detected at 7.0 ug/l in SW-1, located more than 1100 feet upstream of the site boundary. Also, concentrations of lead in three of the four samples located adjacent to and downstream of the site were equal to or less than the concentration in the upstream sample. This suggests that the lead found in the downstream samples was not site-related.

4.2.4 Rondout Creek Downstream of Ponded Area

No PCBs were detected above the sediment cleanup criteria of 1.00 ug/kg in sediments downstream of the ponded area.

Four pesticides, including 4,4-DDD, 4,4-DDE, 4,4-DDT, and endrin were detected in four downstream sediment samples above cleanup criteria (SED-14, 16, 19, and 20) (see Figure 3.3 for locations).

Metals were analyzed at three downstream locations, SED-12, SED-17, and SED-20, and were only detected above sediment criteria at SED-12 and SED-20 (Figure 3.3).

As with the metals, PAHs were also only analyzed at SED-12, SED-17, and SED-20, and were detected above sediment criteria at SED-12 and SED-20. At SED-12, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene were found above the criteria, and at SED-20, benzo(a)pyrene, benzo(k)fluoranthene, and chrysene were detected above the corresponding criteria.

4.2.5 Main Plant Ruins

PCBs

Surface soils in three primary areas within the Main Plant Ruins contained PCBs in excess of the 1.00 mg/kg soil cleanup objective. Areas of contamination were contoured by interpolating between data points. For clarity, only contour lines without data points were presented on Figures 4.1a and 4.1b. Figures showing PCB concentrations measured at each sample location are presented at the end of Appendix C.

One area is located in the southern portion of the ruins near the bank of Rondout Creek (see Figure 4.1a). The area in which concentrations exceed 1.00 mg/kg measures approximately 120 feet by 80 feet. It can be seen from the concentration contours on Figure 4.1a that an area of 1 mg/kg surrounds smaller zones in which concentrations exceed 10 and 50 mg/kg respectively. Contours are not closed at the shoreline of Rondout Creek, indicating that contaminated soils extend to the banks of the creek.

A second, larger area where concentrations exceed 1 mg/kg is found in the northeastern section of the Main Plant Ruins (Figure 4.1a). An irregular shaped area measuring approximately 300 feet in the east-west direction extends from IRM sample CF3-04 near Route 55 to CF4-02 near the main plant building ruins. A small area in which PCBs exceed 10 mg/kg is located around sample CF4-01.

Most of the samples within this second area exceeding 1 mg/kg were analyzed during the IRM using the *Millipore*[™] field screening technique. Results were reported as greater than or less than 1 and 10 mg/kg respectively.

A third area which contains PCBs in excess of 1 mg/kg is located at the southern edge of the main plant building (Figure 4.1a). This area measures approximately 160 by 120 feet. Within this area are two small zones in which concentrations exceed 50 and 100 mg/kg respectively. As with the first area described, contours are not closed at the shoreline of Rondout Creek, indicating that contaminated soils extend to the banks of the creek.

In addition to these three areas, one isolated sampling point contained PCBs in excess of 1 mg/kg. PCBs in sample SS-38, located at the northeastern corner of the main plant building ruins, were detected at 3.2 mg/kg.

The remaining surficial soils within the Main Plant Ruins were relatively free of PCBs. This was confirmed by the high density of sampling points and large percentage of points in which concentrations were below detection limits.

The source of PCBs in the Main Plant Ruins and other areas on the site is likely a result of its former use in the paper production process.

Metals

Metals were detected at concentrations above cleanup criteria (and above background levels) in all sampled locations within the Main Plant Ruins except at sample SS-30 (see Figure 4.4a).

Samples collected in the western half of the Main Plant Ruins tended to have more individual metals exceeding soil cleanup criteria than those on the eastern side. These locations (SS-35, SS-36, SS-38, SS-39, SS-42, SS-44, SS-45, SS-46, SS-47, SS-48) roughly coincide with the outline of the main plant building ruins.

Metallic debris was observed throughout the site, constituting a non-point source for metals both here and in other areas of the site.

PAHs

PAHs were less prevalent in their spatial distribution than metals. Ten sampling locations contained PAHs exceeding their respective cleanup criteria (see Figure 4.3a). This contamination is likely the result of the fire in 1977, which destroyed the main plant area and several adjacent buildings.

4.2.6 Test Pit Area A

An area of surficial soils where total PCB concentrations exceed 1 mg/kg was defined in the vicinity of Test Pit Area A (see Figure 4.1a). This area measures about 120 by 50 feet in size and has a concentration distribution similar to the area within the Main Plant Ruins previously described. An area in which concentrations exceed 1 mg/kg envelops smaller areas where PCB levels exceed 10 and 50 mg/kg respectively.

Only sample TP-2 contained a PAH, benzo(a)anthracene, above the soil cleanup objective. Otherwise, this area was essentially free of PAH contamination. PAHs were detected in most samples, but at concentrations below the cleanup objectives.

Multiple metals were detected above cleanup objectives at TP-1, TP-2, TP-5, TP-6, and TP-7 (see Figure 4.4a). This is consistent with the ubiquitous distribution of metals throughout the site. Also, exposed metallic debris was observed at the surface of this area.

4.2.7 Test Pit Area B and Vicinity

There were no PCBs in excess of the 1.0 mg/kg soil cleanup criteria in Test Pit Area B. The horizontal extent of PCBs in this area was well defined by several soil samples and test pit soil samples.

Multiple PAHs above cleanup levels were, however detected in test pit soil samples in this area. PAHs in this area were likely associated with asphalt road debris found throughout these test pits.

Metals, including chromium, lead, manganese, and mercury were detected in this area. These metals were found above objectives in test pit samples TP-10 through TP-13, and in soil samples SS-24, SS-26, and SS-37. This is consistent with the distribution of metals throughout the site. Exposed metallic debris was observed at the surface of this area, but to a lesser extent than in Test Pit Area A.

4.2.8 Area No. 7 and Area No. 8 (Former Lagoons)

The former lagoons could have at one time represented a significant source area for various contaminants now present on the site, including organic and inorganic compounds.

These adjacent areas contained the highest concentrations of PCBs in surficial soils found on the site. An elliptical area of surface soils measuring approximately 220 feet by 140 feet had PCBs in excess of the 1.0 mg/kg cleanup criteria (see Figure 4.1b). Within this elliptical area are progressively smaller zones in which PCB concentrations exceed 10, 50 and 100 mg/kg respectively. The eastern limit of this zone of contamination is defined by the edge of the IRM soil removal operation.

Metals were also detected above cleanup levels in Areas 7 and 8 (see Figure 4.4b). Arsenic, chromium, lead, manganese, and mercury were detected in three surficial soil samples.

PAHs, benzo(a)pyrene and dibenzo(a,h)anthracene were both detected above cleanup objectives in two of the same three sample locations referenced for metals.

4.2.9 Area No. 9

In general, the sediments and soils in the bottom of the ditch contained PCBs above 1.0 mg/kg with isolated areas above 10 mg/kg. This distribution is shown on Figure 4.1b, the PCB concentration map. The source of PCBs in the ditch is likely from the former process water lagoons represented by Areas 7 and 8.

4.2.10 Area No. 10

PCB, metals and PAH soil contamination in Area 10 was previously discussed in Section 4.2.5, the Main Plant Ruins area. The two surface water samples, SW-6 and SW-7 were discussed in Section 4.1.7. The source of the PCBs and metals detected in these samples is likely the surficial soils within and in the immediate vicinity of Area 10.

4.2.11 Other Areas

PCBs

Three other significant areas of surficial soil contamination involving PCBs were identified during the RI/FS. The first of these is located around IRM samples 30 and 35 and is bordered by the edge of the IRM soil removal area near the bank of Rondout Creek. PCBs were detected in excess of 1.0 mg/kg in a 160-foot by 40-foot area, with a smaller interior area exceeding 10 mg/kg (see Figure 4.1b).

The second area is also located between the edge of the IRM removal and Rondout Creek. It is defined by a roughly rectangular area measuring 100 feet long by 50 feet wide near IRM samples 29 and 33 and RI/FS sample SS-42 (see Figure 4.1b). PCBs exceeded 1.0 mg/kg within this zone, and were as high as 130 mg/kg at the edge of the IRM excavation at SS-42. Concentration contours are not closed at the shoreline of Rondout Creek, indicating that contaminated soils extend to the banks of the creek.

A smaller, third area of concern where PCBs exceed 1.0 mg/kg is located south of the previously described area. It encompasses an area of approximately 50 feet by 50 feet and is defined by IRM sampling points 26 and 28 (Figure 4.1b).

In addition to these three areas, one isolated sampling point contained PCBs in excess of 1.0 mg/kg. PCBs in IRM sample 34, located at the edge of Rondout Creek, were detected at 3.0 mg/kg (Figure 4.1b).

PAHs and Metals

PAHs and metals were detected above cleanup objectives in soil samples collected from the 0 - 2-foot interval in borings MW-9 and MW-10. These two borings are located near the eastern boundary of the site outside of the previously defined areas. At MW-9, benzo(a)anthracene and benzo(a)pyrene, arsenic, chromium, lead, and manganese were above cleanup objectives. This low level contamination is likely to be related to the former axe head plant located in that area.

At MW-10, six PAHs and chromium, manganese, and mercury were detected in excess of the cleanup objectives. This low level contamination is likely to be related to road runoff from National Street.

4.2.12 Groundwater

On-site Wells

Organic compounds were detected above Class GA standards only at five well locations across the site.

Three VOCs, vinyl chloride, 1,2-DCE, and PCE were detected slightly above water quality standards at MW-4, and two VOCs, vinyl chloride and chlorobenzene, were detected above standards at MW-8. A possible source of these VOCs are chlorinated organic compounds, such as solvents, spilled at the surface. Although concentrations in soil were low and distribution was limited, several chlorinated organic compounds were detected in surficial soil samples. These included TCE, PCE, 1,2-DCA and 1,1,1-TCA.

PCBs were detected in MW-3 at a concentration of 0.79 ug/l, above the groundwater standard (0.1 ug/l). The source is apparently PCBs in surficial soils upgradient of MW-3. Even though PCBs are relatively immobile in soil, it is not unlikely that small concentrations, such as detected at MW-3, would be released to groundwater.

The chrysene detected above the groundwater standard in MW-10 is consistent with presence of chrysene in surficial soil sample MW-10 at 1.90 mg/kg. Even though PAHs have a tendency to remain in soil preferentially to water, the low concentration of chrysene in MW-10 (1.0 ug/l) is not unexpected.

The occurrence of three metals exceeding groundwater standards was more prevalent than the organic compounds. At least one of three metals (iron, manganese, and sodium) exceeded the corresponding standard in each sample. No distinct patterns of metals contamination exist; however, the highest concentrations of manganese and iron were found in the vicinity of wells MW-7 and MW-8, which border the largest former process lagoon. This lagoon could represent a source area for metals found in these two wells.

Residential Wells

No volatile, semi-volatile, PCBs or pesticides were detected in any of the residential well samples. Metals exceeding the groundwater standard in residential wells included iron, manganese, sodium, and copper. No definite patterns were

discernible, except that RES-3, RES-4, and RES-7 had generally lower concentrations of these metals than other residential wells.

It is not believed that metals detected above groundwater standards in the residential wells are site-related. This is discussed in the following subsection.

Interpretation

Iron, manganese, and sodium were detected above groundwater standards in several samples in both site monitoring wells and residential wells. These three analytes were plotted on bar charts to afford a comparison between upgradient, on-site, and boundary wells (Figures 4.5 through 4.7). This also facilitates an evaluation of potential sources.

Although concentrations among residential and on-site wells were made, it should be noted that depths of residential wells are greater than on-site monitoring wells. Thus, concentrations of metals detected in these wells may not be directly comparable to on-site wells.

Despite the discrepancies in total depth, the following observations were made.

On-site and residential wells are likely within the same aquifer because there are known confining units separating deep and shallow zones.

For iron and manganese, it is clear from the concentration plots (Figures 4.5 and 4.6) that wells on the site are impacted by on-site sources of metals.

Wells located at the eastern boundary of the site have higher concentrations than the upgradient wells, but lower than the on-site wells.

These boundary wells are not hydraulically downgradient from the former plant operations area (see Section 2, Figure 2.3b). Thus, they would not be directly impacted by on-site metals. Historically, a former manufacturing facility involved in the production of axe heads and knives was in operation in the vicinity of the residential area at this eastern boundary. Some of these residences were reported to have been constructed on top of fill material generated by this former industry. This is one possible explanation for the presence of iron and manganese in this area.

Sodium was below the groundwater standard in the background wells, but exceeded the standard in several on-site and boundary wells (Figure 4.7). No significant difference in concentrations was observed between the on-site and boundary wells, although both groups had higher concentrations than in the upgradient wells. As with iron and manganese, the sources for elevated metals in the two groups of wells may be separate.

In summary, concentrations of metals, particularly iron and manganese, are higher in on-site wells than in upgradient or boundary wells. However, variations in bedrock mineralogy across the site could be responsible for much of the spatial variation in water quality. Due to steeply dipping bedrock units, wells across the site do not penetrate the same stratigraphic units. Thus, variations in these naturally-occurring metals are expected.

NAPANOCH PAPER MILL SITE

IRON CONCENTRATION IN GROUNDWATER

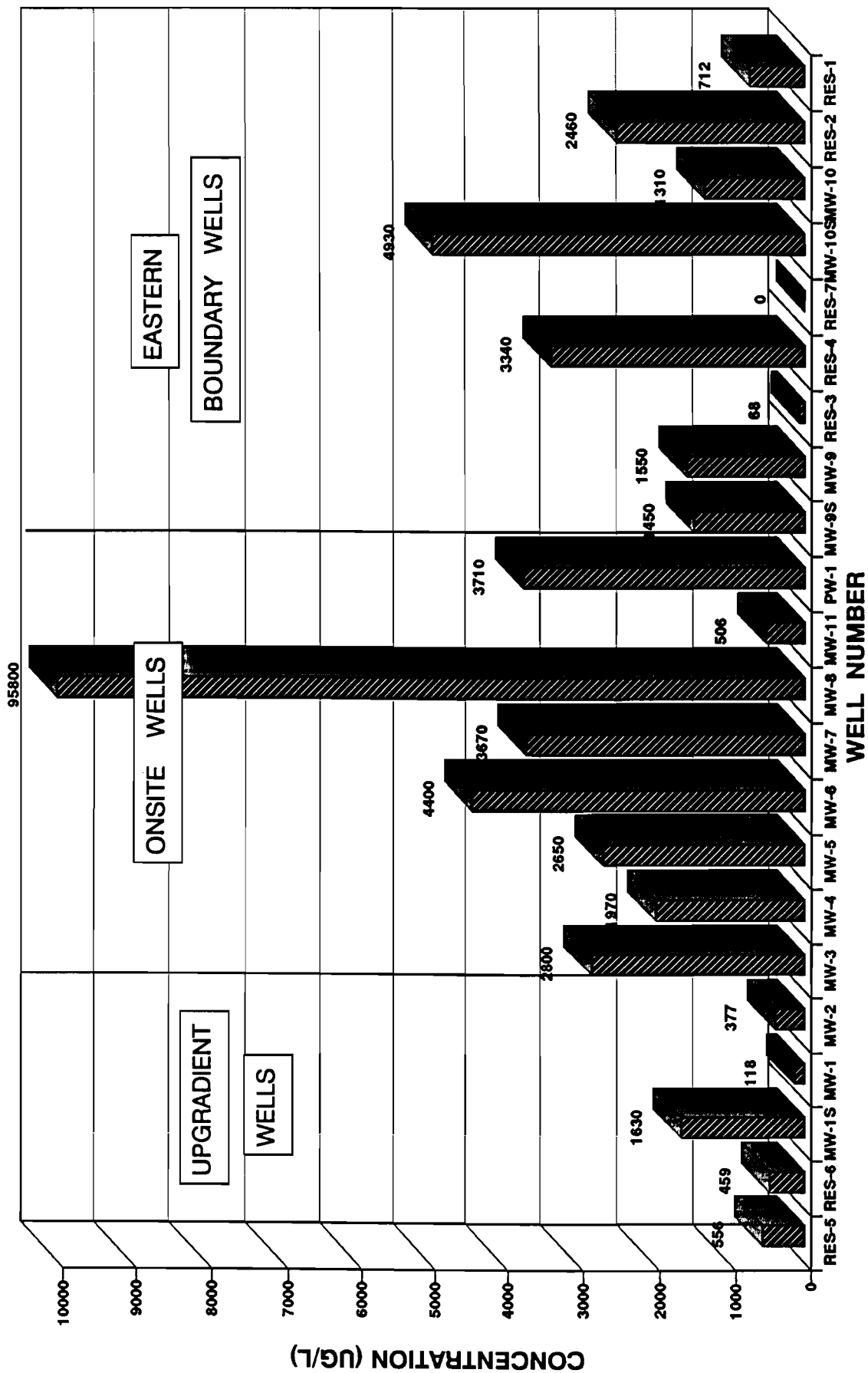


FIGURE 4.5

NAPANOCH PAPER MILL SITE

MANGANESE CONCENTRATION IN GROUNDWATER

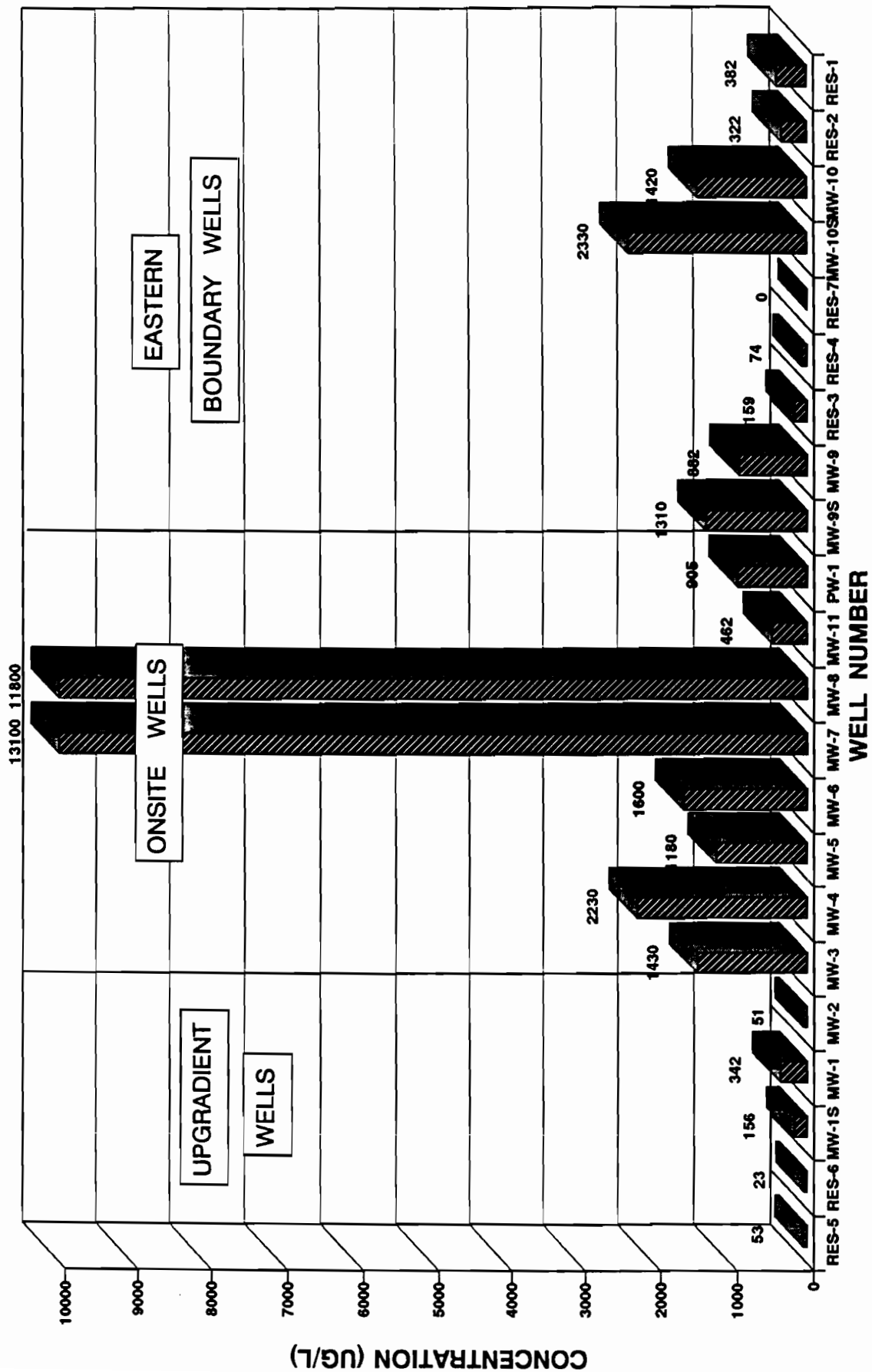


FIGURE 4.6

NAPANOCH PAPER MILL SITE

SODIUM CONCENTRATION IN GROUNDWATER

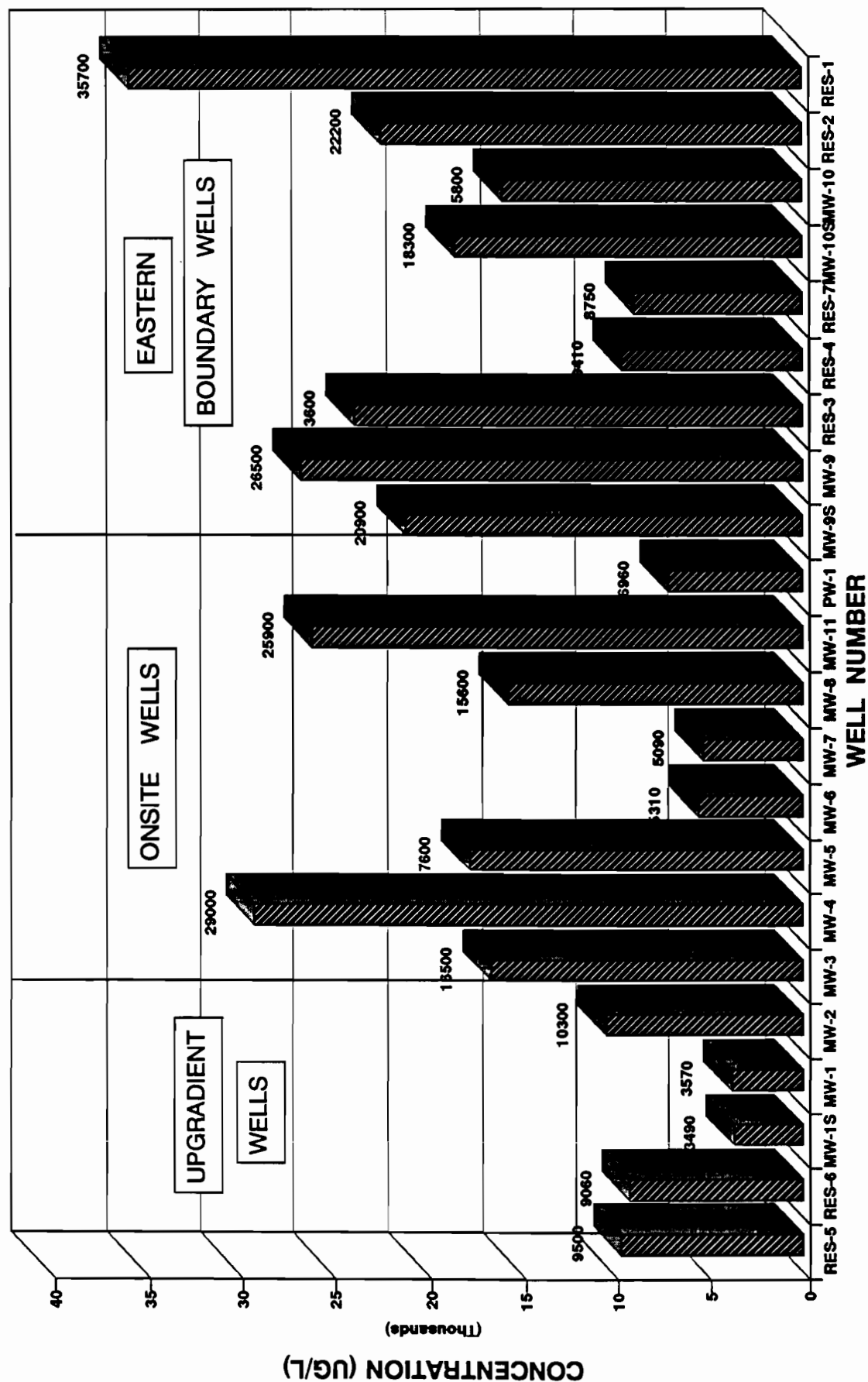


FIGURE 4.7

TABLE 4.1
SUMMARY OF IRM PCB
SAMPLE RESULTS
 Napanoch Paper Mill Site

Sample #	Sample Date	Sample Depth	PCB Concentration (ug/kg)
1	10/25/92	Surface	500 U
2	10/25/92	Surface	500 U
3	10/25/92	Surface	500 U
4	10/25/92	Surface	500 U
5	10/25/92	Surface	16,000
6	10/25/92	Surface	500 U
7	10/25/92	Surface	500 U
8	10/25/92	Surface	500 U
9	10/25/92	Surface	500 U
10	10/25/92	Surface	500 U
11	10/25/92	Surface	500 U
12	10/25/92	Surface	500 U
13	10/25/92	Surface	500 U
14	10/25/92	Surface	500 U
15	10/25/92	Surface	79,000
16	10/25/92	Surface	500 U
17	10/25/92	Surface	500 U
18	10/25/92	Surface	Removed by IRM
19	10/25/92	Surface	500 U
20	10/25/92	Surface	500 U
21	10/25/92	Surface	500 U
22	10/25/92	Surface	12,000
23	10/25/92	Surface	500 U
24	10/25/92	Surface	79
25	10/25/92	Surface	500 U
26	10/25/92	Surface	10,000
27	10/25/92	Surface	Removed by IRM
28	10/25/92	Surface	41
29	10/25/92	Surface	500 U
30	10/25/92	Surface	2,900
31	10/25/92	Surface	Removed by IRM
32	10/25/92	Surface	?
33	10/25/92	Surface	7,300
34	10/25/92	Surface	3,000
35	10/25/92	Surface	13,000
36	10/25/92	Surface	7,900
37	10/25/92	Surface	Removed by IRM
38	10/25/92	Surface	500 U
39	10/25/92	Surface	500 U
40	10/25/92	Surface	550
41	10/25/92	Surface	25,000
42	10/25/92	Surface	11,000
43	10/25/92	Surface	1,400
44	10/25/92	Surface	6,600
45	10/25/92	Surface	6,400
46	10/25/92	Surface	500 U
47	10/25/92	Surface	500 U
48	10/25/92	Surface	500 U
49	10/25/92	Surface	500 U

Sample #	Sample Date	Sample Depth	PCB Concentration (ug/kg)
50	12/17/92	—	Removed by IRM
51	12/17/92	—	Removed by IRM
52	12/17/92	—	Removed by IRM
53	12/17/92	—	Removed by IRM
54	12/17/92	—	Removed by IRM
55	12/17/92	—	Removed by IRM
56	12/17/92	0–6"	160,000
57	12/17/92	0–6"	150,000
58	12/17/92	0–6"	51,000
59	12/17/92	6–12"	430
60	12/17/92	0–6"	15,000
61	12/17/92	6–12"	72,000
62	12/17/92	18–24"	68,000
63	12/17/92	6–12"	48,000
64	12/17/92	18–24"	160
65	12/17/92	6–12"	44,000
66	12/17/92	18–24"	54,000
67	12/17/92	6–12"	65,000
68	12/17/92	18–24"	57,000
69	12/17/92	6–12"	59,000
70	12/17/92	18–24"	17,000
71	12/17/92	6–12"	32,000
72	12/17/92	18–24"	14,000
73	12/17/92	6–12"	120
74	12/17/92	18–24"	140
75	12/17/92	6–12"	7,400
76	12/17/92	18–24"	17,000
77	12/17/92	6–12"	4,400
78	12/17/92	18–24"	6,000
79	12/17/92	6–12"	2,900
80	12/17/92	18–24"	15,000
81	12/17/92	6–12"	69,000
82	12/17/92	18–24"	1,300
83	12/17/92	6–12"	10,000
84	12/17/92	18–24"	12,000
85	12/17/92	Surface	370
86	12/17/92	Surface	93,000
87	12/17/92	Paper Rolls	100,000
88	12/17/92	Paper Rolls	38,000
89	12/17/92	Sludge	25,000
90	12/17/92	Surface	42,000

U — Indicates that PCBs were not detected.

? — Sample could not be located on map supplied by NYSDEC.

TABLE 4.1
SUMMARY OF IRM PCB
SAMPLE RESULTS
 Napanoch Paper Mill Site

Soil Sample Results

Sample #	Sample Date	Sample Depth	PCB Concentration (ug/kg)
OSS-01	11/03/92	Surface	120 U
OSS-02	10/21/92	Surface	1,000
259-01	09/23/92	Surface	2,500
259-02	09/23/92	Surface	2,500
259-03	09/23/92	Surface	2,500
259-04	09/18/92	Surface	130,000
259-05	09/23/92	Surface	2,500
259-06	09/18/92	Surface	5,400
259-07	09/23/92	Surface	2,500
259-08	09/18/92	Surface	400
259-09	09/18/92	Surface	210
CF3-01	10/21/92	Surface	>1,000 , <10,000
CF3-02	10/21/92	Surface	>1,000 , <10,000
CF3-03	10/21/92	Surface	>1,000 , <10,000
CF3-04	10/21/92	Surface	>1,000 , <10,000
CF3-05	10/21/92	Surface	<1,000
CF3-06	10/21/92	Surface	<1,000
CF4-01	11/06/92	Surface	12,000
CF4-02	11/06/92	Surface	1,300
SLG-01	10/21/92	Surface	<1,000
SLG-02	10/21/92	Surface	<1,000
SLG-03	10/21/92	Surface	>1,000 , <10,000
SLG-04	10/21/92	Surface	>1,000 , <10,000
PMR-01	11/06/92	Surface	120 U
PMR-02	11/06/92	Surface	120 U

Sediment Sample Results

Sample #	Sample Date	PCB Concentration (ug/kg)
OSD-01	10/21/92	<1,000
OSD-02	10/21/92	<1,000
OSD-03	11/06/92	120 U
OSD-04	11/06/92	120 U
OSD-05	11/06/92	120 U
OSD-06	11/06/92	120 U
OSD-07	11/06/92	120 U
OSD-08	11/06/92	370
OSD-09	11/06/92	120 U
OSD-10	11/06/92	320
OSD-11	11/06/92	120 U
OSD-12	11/06/92	120

Note: < or > indicates *Millipore™* screening analysis.

U – Indicates that PCB's were not detected.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample ID: Lab Sample ID: Soil Sampled: Validated:	9501 AS023714 851 12/23/92 02/10/93	9502 AS023715 851 12/23/92 02/10/93	9503 AS023716 851 12/23/92 02/10/93	9503-DL AS023716DL 851 12/23/92 02/10/93	9503-RE AS023716RI 851 12/23/92 02/10/93	9504 AS023717 851 12/23/92 02/10/93	9504-DL AS023717DL 851 12/23/92 02/10/93	9504-RE AS023717RI 851 12/23/92 02/10/93	9506 AS023718 851 12/23/92 02/10/93	9506 AS023718 851 12/23/92 02/10/93	SS06 393-196-01 NYDEC 07/13/93
78-06-2	AS091-1 - VOLATILES (ug/kg)	100		ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
67-64-1	Methylene chloride	200	6 J	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
78-15-0	Acetone	2700	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
67-66-3	Carbon Disulfide	300	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
107-06-2	Chloroform	100	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
78-03-3	1,2-Dichloroethane	300	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
71-55-6	2-Butanone	800	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
78-01-6	1,1,1-Trichloroethane	700	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
127-18-4	Trichloroethene	1400	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
108-88-3	Toluene	1500	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
100-41-4	Ethyl benzene	5500	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
1330-20-7	Total Xylenes	1200	ND	ND	ND	ND	NA	ND	ND	NA	NA	ND	ND	NA
98-48-7	AS091-2 - SEMIVOLATILES (ug/kg)	900		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
105-67-9	2-Methylphenol	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
91-20-3	2,4-Dimethylphenol	13000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
91-57-6	Naphthalene	36400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
95-95-4	2-Methylnaphthalene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
208-96-8	2,4,6-Trichlorophenol	41000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
63-32-9	Acenaphthylene	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
132-64-9	Acenaphthene	6200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
68-73-7	Dibenzofuran	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
86-30-6	Fluorene	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
87-86-5	N-nitrosodibenzylamine	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
85-01-8	Parathion	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
120-12-7	Phenanthrene	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
84-74-2	Anthracene	8100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
206-44-0	Carbazole	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
128-00-0	Di-n-butylphthalate	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
85-88-7	Pyrene	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
218-01-9	Benzophenone	220	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
117-81-7	Benzophenone	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
205-99-2	Benzophenone	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
207-08-9	Benzophenone	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
50-32-6	Benzophenone	81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
193-39-5	Indeno(1,2,3-cd)pyrene	3200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
53-70-3	Dibenz(a,h)anthracene	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
191-24-2	Benzophenone	50000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
319-85-7	beta-BHC	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
1024-87-3	delta-BHC	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
858-98-8	Heptachlor epoxide	900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
60-57-1	Endosulfan I	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
72-85-9	Endosulfan II	2100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
33213-66-9	Endosulfan II	900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
1031-07-8	Endosulfan Sulfate	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
50-29-3	4,4'-DDD	2100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
72-43-6	4,4'-DDT	10000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
53494-70-5	Methoxychlor	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
53469-21-9	Endrin ketone	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
12672-29-6	Acroder 1242	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
11097-69-1	Acroder 1254	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA

* - Collected adjacent to boring MW-1.
J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	S501 AS023714 SS1 12/23/92 02/10/93	S502 AS023715 SS1 12/23/92 02/10/93	S503 AS023716 SS1 12/23/92 02/10/93	S503-DL AS023716DL SS1 12/23/92 02/10/93	S503-RE AS023716RI SS1 12/23/92 02/10/93	S504 AS023717 SS1 12/23/92 02/10/93	S504-DL AS023717DL SS1 12/23/92 02/10/93	S504-RE AS023717RI SS1 12/23/92 02/10/93	S505 AS023718 SS1 12/23/92 02/10/93	S506 383-196-01 NYSDEC 07/13/93
7429-90-5	TOTAL METALS (mg/kg)	NS											
7440-36-0	Aluminum - Total	31		7140 J	1480 J	8720 J	NA	NA	5730 J	NA	NA	8520 J	NA
7440-36-0	Antimony - Total	31	ND	ND	ND	ND	NA	NA	ND	NA	NA	ND	NA
7440-36-0	Arsenic - Total	7.5	2.5	2.5	30.4	61.8	NA	NA	42	NA	NA	68	NA
7440-36-0	Berkium - Total	300	43.7 J	43.7 J	89.1	234	NA	NA	95.7	NA	NA	208	NA
7440-41-7	Berkium - Total	1.0	ND	ND	ND	ND	NA	NA	ND	NA	NA	ND	NA
7440-43-9	Berkium - Total	1.0	ND	ND	ND	ND	NA	NA	ND	NA	NA	ND	NA
7440-70-2	Calcium - Total	NS	966 J	966 J	2960	4970	NA	NA	7060	NA	NA	4290	NA
7440-47-3	Chromium - Total	10	7.8 J	7.8 J	15.3 J	82.4 J	NA	NA	10.1 J	NA	NA	15.8 J	NA
7440-48-4	Cobalt - Total	NS	6.1 J	6.1 J	ND	ND	NA	NA	12.9	NA	NA	7.7 J	NA
7440-50-8	Copper - Total	3200	9.8	9.8	23.7	2450	NA	NA	109	NA	NA	129	NA
7439-89-6	Iron - Total	NS	14200 J	14200 J	9060 J	72200 J	NA	NA	40300 J	NA	NA	42300 J	NA
7439-82-1	Lead - Total	100	29.2 J	29.2 J	61.8	2190	NA	NA	185 J	NA	NA	654	NA
7439-85-4	Magnesium - Total	NS	2850	2850	462 J	764 J	NA	NA	1440	NA	NA	2000	NA
7439-96-5	Manganese - Total	400	441 J	441 J	62.3 J	873 J	NA	NA	491 J	NA	NA	501 J	NA
7439-97-6	Mercury - Total	0.1	ND	ND	ND	17 J	NA	NA	0.18 J	NA	NA	0.88 J	NA
7440-02-0	Nickel - Total	1800	14.9	14.9	19.7	76.5	NA	NA	17.7	NA	NA	20.1	NA
7440-09-7	Potassium - Total	4000	585 J	585 J	438 J	352 J	NA	NA	511 J	NA	NA	653 J	NA
7782-49-2	Selenium - Total	2.0	ND	ND	ND	ND	NA	NA	ND	NA	NA	2.1 J	NA
7440-22-4	Silver - Total	200	ND	ND	ND	7.4 J	NA	NA	24 J	NA	NA	39 J	NA
7440-23-5	Sodium - Total	3000	ND	ND	ND	ND	NA	NA	ND	NA	NA	ND	NA
7440-82-2	Vanadium - Total	550	10.9 J	10.9 J	73.1 J	291 J	NA	NA	12.9 J	NA	NA	26.9 J	NA
7440-86-6	Zinc - Total	24000	44.2 J	44.2 J	120 J	1830 J	NA	NA	131 J	NA	NA	244 J	NA
87-12-6	Cyanide - Total	1800	ND	ND	ND	35.1	NA	NA	ND	NA	NA	1.9	NA

J - Indicates an estimated value.
 NA - Not analyzed.
 ND - Not detected at laboratory's method of detection limit.
 NS - No standard.
 See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
 - - - - - Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Gas No.	Parameter	Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS07 393-196-02 NYSDEC 07/13/93	SS08 393-196-03 NYSDEC 07/13/93	SS09 393-196-04 NYSDEC 07/13/93	SS10 393-196-05 NYSDEC 07/13/93	SS11 (6-7) 393-196-06 NYSDEC 07/13/93	SS12 (10-12) 393-196-07 NYSDEC 07/13/93	SS13 (15-17) 393-196-08 NYSDEC 07/13/93	SS14 (19-20) 393-196-09 NYSDEC 07/13/93	SS15 (23-24)* 393-196-10 NYSDEC 07/13/93	SS16 (0-2) 393-196-12 NYSDEC 07/13/93
76-09-2	ASPG1-1-VOLATILES (ug/kg)	100											
67-64-1	Methylene chloride	200											
76-16-0	Acetone	2700											
67-66-3	Carbon Disulfide	300											
107-06-2	Chloroform	100											
78-83-3	1,2-Dichloroethane	300											
71-55-6	2-Butanone	900											
78-01-6	1,1,1-Trichloroethane	700											
127-18-4	Trichloroethene	1400											
108-88-3	Tetrachloroethene	1500											
100-41-4	Toluene	5500											
1330-20-7	Ethyl benzene	1200											
96-48-7	Total Xylenes	900											
105-67-9	ASPG1-2-SEMI-VOLATILES (ug/kg)	NS											
91-20-3	2-Methylphenol	13000											
91-57-6	2,4-Dimethylphenol	36400											
95-96-4	Naphthalene	100											
208-96-6	2-Methylnaphthalene	41000											
83-32-9	2,4,5-Trichlorophenol	50000											
132-64-9	Acenaphthylene	6200											
86-73-7	Acenaphthene	50000											
86-30-6	Dibenzofuran	NS											
87-60-5	Fluorene	1000											
85-01-8	N-nitrosodiphenylamine	50000											
120-12-7	Pentachlorophenol	50000											
84-74-2	Phenanthrene	NS											
205-44-0	Carbazole	8100											
128-00-0	Di-n-butyl phthalate	50000											
95-88-7	Pyrene	50000											
95-85-3	Benzobenzanthracene	220											
218-01-9	Benzofluoranthene	400											
205-99-2	Benzo(a)fluoranthene	1100											
207-08-9	Benzo(b)fluoranthene	1100											
90-32-8	Benzo(k)fluoranthene	61											
183-39-6	Indeno(1,2,3-cd)pyrene	3200											
53-70-3	Indeno(1,2,3-cd)pyrene	14											
191-24-2	Dibenzofluoranthene	50000											
319-85-7	ASPG1-3-PESTICIDES/PCBS (ug/kg)	200											
319-86-6	beta-BHC	300											
1024-57-3	delta-BHC	20											
958-98-6	Heptachlor epoxide	900											
60-57-1	Endosulfan I	44											
72-55-9	Dieldrin	2100											
72-20-8	4,4'-DDE	100											
33213-66-9	Endrin	900											
72-84-8	Endosulfan II	2600											
1031-07-6	4,4'-DDD	1000											
50-29-3	Endosulfan Sulfate	2100											
72-43-5	4,4'-DDT	10000											
53464-70-6	Methoxychlor	NS											
53469-21-9	Endrin ketone	1000											
12872-29-6	Aroclor 1242	1000											
11097-69-1	Aroclor 1248	1000											
	Aroclor 1254	1000											

* - Collected adjacent to boring MW-1.

J - Indicates an estimated value.

NA - Not analyzed.

ND - Not detected at laboratory's method of detection limit.

NS - No standard.

See Table 4.9 for complete list of laboratory qualifiers.

ND - Indicates the maximum concentration for all soil samples.

Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
 Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
 Detected Compound Summary

Gas No.	Parameter	Soil Cleanup Objective	Sample Id: Lab Sample Id: Sdg: Validated:	S507 393-106-02 NYSDEC 07/13/93	S508 393-106-03 NYSDEC 07/13/93	S509 393-106-04 NYSDEC 07/13/93	S510 393-106-05 NYSDEC 07/13/93	S511 (6-7) 393-106-06 NYSDEC 07/13/93	S512 (10-12) 393-106-07 NYSDEC 07/13/93	S513 (15-17) 393-106-08 NYSDEC 07/13/93	S514 (19-20) 393-106-09 NYSDEC 07/13/93	S515 (23-24)* 393-106-10 NYSDEC 07/13/93	S516 (0-2) 393-106-12 NYSDEC 07/13/93
7428-90-6	Aluminum - Total	NS		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-36-0	Antimony - Total	31		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-38-2	Arsenic - Total	7.5		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-39-3	Barium - Total	300		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-41-7	Beryllium - Total	1.0		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-43-9	Cadmium - Total	1.0		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-70-2	Calcium - Total	NS		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-47-3	Chromium - Total	10		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-48-4	Cobalt - Total	NS		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-50-8	Copper - Total	3200		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7438-89-6	Iron - Total	NS		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7438-92-1	Lead - Total	100		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7439-96-4	Magnesium - Total	NS		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7439-96-6	Manganese - Total	400		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7439-97-8	Mercury - Total	0.1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-02-0	Nickel - Total	1800		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-06-7	Potassium - Total	4000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7782-49-2	Selenium - Total	2.0		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-22-4	Silver - Total	200		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-23-6	Sodium - Total	3000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-62-2	Vanadium - Total	550		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7440-66-6	Zinc - Total	24000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
57-12-5	Cyanide - Total	1600		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

J - Indicates an estimated value.
 NA - Not analyzed.
 ND - Not detected at laboratory's method of detection limit.
 NS - No standard.
 See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
 - Indicates a concentration above the soil cleanup objective

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Case No.	Premises	Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS17 (2-4) 383-186-13 NYSDC 07/13/93	SS18 (4-6) 383-186-14 NYSDC 07/13/93	SS19 A9039370 89019 07/14/93 09/15/93	SS20 A9039371 89019 07/14/93 09/15/93	SS21 A9039376 89019 07/14/93 09/15/93	SS22 A9039374 89019 07/14/93 09/15/93	SS23 A9039372 89019 07/14/93 09/15/93	SS24 A9039377 89019 07/14/93 09/15/93	SS24-RE A9039377RE 89019 07/14/93 09/15/93	SS25 A9039378 89019 07/14/93 09/15/93
75-08-2	ASPR1-1-VOLATILES (ug/kg)	100		NA	NA	NA	NA	NA	NA	NA	ND	NA	9 J
67-64-1	Methylene chloride	200		NA	NA	NA	NA	NA	NA	NA	ND	NA	8 J
75-16-0	Acetone	2700		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
67-66-3	Carbon Disulfide	300		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
107-06-2	Chloroform	100		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
78-93-3	1,2-Dichloroethane	300		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
71-55-6	2-Butanone	800		NA	NA	NA	NA	NA	NA	NA	ND	NA	1 J
79-01-6	1,1,1-Trichloroethane	700		NA	NA	NA	NA	NA	NA	NA	ND	NA	2 J
127-18-4	Trichloroethene	1400		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
108-88-3	Tetrachloroethene	1500		NA	NA	NA	NA	NA	NA	NA	ND	NA	2 J
100-41-4	Toluene	8500		NA	NA	NA	NA	NA	NA	NA	ND	NA	59
1330-20-7	Total Xylenes	1200		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
95-48-7	ASPR1-2-SEMI-VOLATILES (ug/kg)	900		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
105-87-9	2-Methylphenol	NS		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
91-20-3	2,4-Dimethylphenol	13000		NA	NA	NA	NA	NA	NA	NA	ND	NA	7000
91-57-8	Naphthalene	35400		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
95-96-4	2-Methylnaphthalene	100		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
208-96-8	2,4,6-Trichlorophenol	41000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
83-32-9	Acenaphthylene	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	1600 J
132-64-9	Acenaphthene	4200		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
86-73-7	Dibenzofuran	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	4200
86-30-6	Fluorene	NS		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
87-88-5	N-Nitrosodiphenylamine	1000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
85-01-8	Pentachlorophenol	50000		NA	NA	NA	NA	NA	NA	NA	12 J	NA	ND
120-12-7	Phenanthrene	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	11000
86-74-8	Anthracene	NS		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
84-74-2	Carbazole	8100		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
208-44-0	Di-n-butyl phthalate	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
129-00-0	Fluoranthene	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
85-68-7	Pyrene	220		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
58-55-3	Benzyl benzoate	400		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
117-81-7	Benzofuran	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
205-99-2	Bis(2-ethylhexyl) phthalate	1100		NA	NA	NA	NA	NA	NA	NA	17 J	NA	ND
207-08-9	Benzophenanthrene	1100		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
50-32-8	Benzofluorene	81		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
183-39-6	Indeno(1,2,3-cd)pyrene	3200		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
53-70-3	Dibenz(a,h)anthracene	14		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
191-24-2	Benzogluiperylene	50000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
319-85-7	ASPR1-3-PESTICIDES/PCBS (ug/kg)	200		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
319-86-8	beta-BHC	300		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
1024-87-3	delta-BHC	20		NA	NA	NA	NA	NA	NA	NA	ND	NA	7.5 J
959-98-8	Heptachlor epoxide	900		NA	NA	NA	NA	NA	NA	NA	ND	NA	9.2 J P
60-57-1	Endosulfan I	44		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
72-55-9	Dieldrin	2100		NA	NA	NA	NA	NA	NA	NA	ND	NA	22 J P
72-20-8	4,4'-DDE	100		NA	NA	NA	NA	NA	NA	NA	ND	NA	34 J P
33213-65-9	Endosulfan II	900		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
72-54-8	4,4'-DDD	2900		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
1031-07-8	Endosulfan Sulfate	1000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
50-28-3	4,4'-DDT	2100		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
72-43-5	Methoxychlor	10000		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
53494-70-5	Endrin ketone	NS		NA	NA	NA	NA	NA	NA	NA	ND	NA	ND
53489-21-9	Arador 1242	1000		45	45	NA	NA	NA	NA	NA	ND	NA	23 J P
12872-28-8	Arador 1248	1000		380	380	NA	NA	NA	NA	NA	ND	NA	ND
11097-69-1	Arador 1254	1000		450	450	NA	NA	NA	NA	NA	ND	NA	ND

* - Collected adjacent to boring MW-1.

J - Indicates an estimated value.

NA - Not analyzed.

ND - Not detected at laboratory's method of detection limit.

NS - No standard.

See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all soil samples.

- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS17 (2-4) 383-196-13 NYS DEC 07/13/93	SS16 (4-8) 383-196-14 NYS DEC 07/13/93	SS19 A5039370 89019 07/14/93 09/15/93	SS20 A5039371 89019 07/14/93 09/15/93	SS21 A5039376 89019 07/14/93 09/15/93	SS22 A5039374 89019 07/14/93 09/15/93	SS23 A5039372 89019 07/14/93 09/15/93	SS24 A5039377 89019 07/14/93 09/15/93	SS24-RE A5039377RE 89019 07/14/93 09/15/93	SS25 A5039378 89019 07/14/93 09/15/93
7429-90-6	Aluminum - Total	NS		NA	NA	4340 J	8510 J	7420 J	7650 J	7480 J	12600 J	NA	4650 J
7440-38-0	Antimony - Total	31		NA	NA	ND	ND	ND	ND	ND	ND	NA	ND
7440-38-2	Arsenic - Total	7.5		NA	NA	3.1 J	5.1 J	6.8 J	3.5 J	3 J	6.9 J	NA	8.4 J
7440-39-3	Barium - Total	300		NA	NA	16 J	48.4 J	40.1 J	58.9 J	28.6 J	82.5 J	NA	82.2 J
7440-41-7	Beryllium - Total	1.0		NA	NA	ND	ND	ND	ND	ND	ND	NA	87 J
7440-43-9	Cadmium - Total	1.0		NA	NA	.04 J	18 J	17 J	17 J	.08 J	.11 J	NA	.08 J
7440-70-2	Calcium - Total	NS		NA	NA	ND	1040 J	354 J	1030 J	284 J	1890 J	NA	4000 J
7440-47-3	Chromium - Total	10		NA	NA	2.9 J	10.2 J	10.5 J	8.4 J	6.8 J	16.5 J	NA	6.2 J
7440-48-4	Cobalt - Total	NS		NA	NA	ND	6 J	9.8 J	7.4 J	ND	12.4 J	NA	5.9 J
7440-50-8	Copper - Total	3500		NA	NA	ND	7.7 J	9.8 J	7.4 J	ND	22.7 J	NA	8.2 J
7439-89-6	Iron - Total	NS		NA	NA	5910 J	15700 J	12400 J	13300 J	10400 J	27300 J	NA	7060 J
7439-92-1	Lead - Total	100		NA	NA	22.9 J	126 J	111 J	30.7 J	28.7 J	124 J	NA	21.9 J
7439-96-4	Magnesium - Total	NS		NA	NA	351 J	1520 J	1260 J	1710 J	1310 J	4040 J	NA	63.5 J
7439-97-5	Manganese - Total	400		NA	NA	51.9 J	203 J	74.7 J	609 J	158 J	559 J	NA	960 J
7439-97-6	Mercury - Total	0.1		NA	NA	ND	0.2 J	ND	0.15 J	0.15 J	ND	NA	133 J
7440-02-0	Nickel - Total	1800		NA	NA	ND	17.1 J	11.6 J	19.8 J	11.8 J	31.5 J	NA	18.9 J
7440-06-7	Potassium - Total	4000		NA	NA	162 J	476 J	398 J	382 J	251 J	978 J	NA	309 J
7782-49-2	Selenium - Total	2.0		NA	NA	ND	ND	ND	ND	ND	ND	NA	ND
7440-23-4	Silver - Total	200		NA	NA	ND	.13 J	.1 J	ND	ND	ND	NA	ND
7440-23-5	Sodium - Total	3000		NA	NA	ND	ND	ND	ND	ND	ND	NA	ND
7440-82-2	Vanadium - Total	550		NA	NA	10.6 J	72.8 J	65.2 J	17.3 J	16.6 J	18.1 J	NA	23 J
7440-86-6	Zinc - Total	24000		NA	NA	11.6 J	43.9 J	39 J	49.5 J	35.1 J	66.6 J	NA	137 J
87-12-6	Cyanide - Total	1600		NA	NA	ND	ND	ND	ND	ND	ND	NA	ND

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 NA - Not analyzed.
 ND - Not detected at laboratory's method of detection limit.
 NS - No standard.
 See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
 - - - - - Indicates a concentration above the soil cleanup objective.

TABLE 4.2

NAPANOCH PAPER MILL SITE

Surface Soil Sampling Rounds: 12/22/93 - 10/6/93

Detected Compound Summary

Case No.	Parameter	Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS25-RE A5039378RI SS019 07/14/93 09/15/93	SS26 A5039373 SS019 07/14/93 09/15/93	SS27 A5039376 SS019 07/14/93 09/15/93	SS28 A5039379 SS019 07/14/93 09/15/93	SS29 A5039390 SS019 07/15/93 09/15/93	SS30 A5039391 SS019 07/15/93 09/15/93	SS31 A5039392 SS019 07/15/93 09/15/93	SS32 A5039393 SS019 07/15/93 09/15/93	SS33 A5039394 SS019 07/15/93 09/15/93	SS33-DL A5039394DL SS019 07/15/93 09/15/93
75-06-2	ASPR1-1-VOLATILES (ug/kg)	100		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
87-84-1	Methylene chloride	200		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
75-18-0	Acetone	2700		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
87-86-3	Carbon Disulfide	300		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
107-08-2	Chloroform	100		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
75-83-3	1,2-Dichloroethane	300		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
71-86-6	2-Butanone	800		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
79-01-6	1,1,1-Trichloroethane	700		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
127-18-4	Tetrachloroethane	1400		NA	NA	NA	7 J	ND	ND	ND	ND	19	NA
108-88-3	Toluene	1600		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
100-41-4	Ethyl benzene	8500		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
1330-20-7	Total Xylenes	1200		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
95-48-7	ASPR1-2-SEMI-VOLATILES (ug/kg)	900		ND	NA	NA	ND	ND	ND	ND	ND	ND	ND
105-87-9	2-Methylphenol	NS		ND	NA	NA	ND	ND	ND	ND	ND	ND	ND
91-20-3	2,4-Dimethylphenol	13000		1000 J	ND	71 J	ND	71 J	ND	ND	ND	ND	ND
91-87-8	Naphthalene	36400		7600 J	ND	NA	ND	ND	ND	ND	ND	ND	ND
95-88-4	2-Methylnaphthalene	100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
208-86-6	2,4,6-Trichlorophenol	41000		ND	ND	ND	19 J	19 J	18 J	ND	ND	ND	ND
83-32-9	Acenaphthylene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
132-84-9	Acenaphthene	4300		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
88-73-7	Dibenzofuran	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
88-30-6	Fluorene	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
87-68-6	N-nitrodiphenylamine	1000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-01-6	Pentachlorophenol	50000		8100 J	ND	130 J	ND	260 J	ND	10 J	ND	36 J	ND
120-12-7	Anthracene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-74-8	Carbazole	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
84-74-2	Di-n-butyl phthalate	8100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
208-44-0	Fluorenone	50000		130 J	ND	300 J	ND	37 J	ND	ND	ND	ND	ND
129-00-0	Pyrene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-68-7	Benzofluoranthene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
56-55-3	Benz(a)anthracene	220		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
117-81-7	Chrysene	400		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
205-80-2	Benzo(e)fluoranthene	1100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
207-08-9	Benzofluoranthene	1100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
183-39-5	Benzo(k)fluoranthene	81		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
183-70-3	Indeno(1,2,3-cd)pyrene	3200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
181-24-2	Dibenz(a,h)anthracene	14		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
319-85-7	Benzogluaperylene	50000		150 J	ND	240 J	ND	74 J	ND	ND	ND	ND	ND
319-85-7	beta-BHC	200		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
319-85-8	delta-BHC	300		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
1024-57-3	Heptachlor epoxide	20		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
959-98-6	Endosulfan I	900		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
50-57-1	Dieldrin	44		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
72-55-9	4,4'-DDE	2100		NA	NA	NA	11	3.1 J	6	ND	ND	ND	NA
72-20-8	Endrin	100		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
33213-65-9	Endosulfan II	900		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
72-54-8	4,4'-DDD	2900		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
1031-07-8	Endosulfan Sulfate	1000		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
50-29-3	4,4'-DDT	2100		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
72-43-5	Methoxychlor	10000		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
53484-70-5	Endrin ketone	NS		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
53489-21-9	Aroclor 1242	1000		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
12872-29-6	Aroclor 1248	1000		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
11087-69-1	Aroclor 1254	1000		NA	NA	NA	ND	ND	ND	ND	ND	ND	NA

J - Indicates adjacent to boring MW-1.

* - Indicates an estimated value.

NA - Not analyzed.

ND - Not detected at laboratory's method of detection limit.

NS - No standard.

See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all soil samples.

- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS25-RE A5039378RI S5019 07/14/93 09/15/93	SS26 A5039373 S5019 07/14/93 09/15/93	SS27 A5039375 S5019 07/14/93 09/15/93	SS28 A5039379 S5019 07/14/93 09/15/93	SS29 A5039380 S5019 07/15/93 09/15/93	SS30 A5039391 S5019 07/15/93 09/15/93	SS31 A5039392 S5019 07/15/93 09/15/93	SS32 A5039393 S5019 07/15/93 09/15/93	SS33 A5039394 S5019 07/15/93 09/15/93	SS33-DL A5039394DL S5019 07/15/93 09/15/93
7429-90-5	Aluminum - Total	NS	NA	7150 J	6810 J	4820 J	7060 J	7680 J	8330 J	11700 J	5600 J	NA
7440-38-0	Antimony - Total	31	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
7440-38-2	Arsenic - Total	7.5	NA	4.4 J	6.6 J	3.4 J	6.5 J	6.3 J	3.2 J	6.1 J	5.1 J	NA
7440-39-3	Barium - Total	300	NA	71.4 J	70 J	52.8 J	90 J	58.7 J	42.2 J	28.7 J	26.1 J	NA
7440-41-7	Beryllium - Total	1.0	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
7440-43-9	Cadmium - Total	1.0	NA	28 J	2 J	1 J	13 J	21 J	54 J	.09 J	.11 J	NA
7440-70-2	Calcium - Total	NS	NA	1390 J	689 J	349 J	3750 J	1990 J	790 J	798 J	3060 J	NA
7440-47-3	Chromium - Total	10	NA	9.2 J	10.2 J	5.3 J	11.7 J	8.8 J	10.7 J	13 J	8.5 J	NA
7440-48-4	Cobalt - Total	NS	NA	6.1 J	8.1 J	6.5 J	6.1 J	7.5 J	20 J	10.9 J	8.7 J	NA
7440-50-8	Copper - Total	3200	NA	1.7 J	48.7 J	11.2 J	37.8 J	13.6 J	ND	6.9 J	13.0 J	NA
7439-89-8	Iron - Total	NS	NA	11700 J	13600 J	21000 J	23500 J	13700 J	14600 J	20300 J	13100 J	NA
7439-89-1	Lead - Total	100	NA	66.1 J	134 J	88.9 J	129 J	76.8 J	8.8 J	15.5 J	12.3 J	NA
7439-86-4	Magnesium - Total	NS	NA	1550 J	1600 J	1640 J	2970 J	2010 J	2270 J	2560 J	1860 J	NA
7439-86-5	Manganese - Total	400	NA	88.5 J	129 J	238 J	374 J	318 J	208 J	289 J	199 J	NA
7439-97-8	Mercury - Total	0.1	NA	ND	0.24 J	ND	0.34 J	ND	ND	ND	ND	NA
7440-02-0	Nickel - Total	1800	NA	18.9 J	16.5 J	16.3 J	21.4 J	20.4 J	14.8 J	14.7 J	19.5 J	NA
7440-06-7	Potassium - Total	4000	NA	384 J	448 J	367 J	646 J	448 J	396 J	471 J	428 J	NA
7782-49-2	Selenium - Total	2.0	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
7440-22-4	Silver - Total	200	NA	.14 J	ND	ND	.16 J	ND	ND	ND	ND	NA
7440-25-5	Sodium - Total	3000	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
7440-62-2	Vanadium - Total	550	NA	32.5 J	26.6 J	17.9 J	22.8 J	382 J	ND	16.1 J	9.1 J	NA
7440-66-6	Zinc - Total	24000	NA	75.6 J	88.5 J	39.8 J	162 J	117 J	33.3 J	36.4 J	33.3 J	NA
87-12-6	Cyanide - Total	1800	NA	ND	ND	2 J	ND	ND	ND	ND	ND	NA

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Case No.	Parameter	Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS34 AS038306 SS019 07/16/93 09/15/93	SS35 AS038306 SS019 07/16/93 09/15/93	SS35-DL AS038306DL SS019 07/16/93 09/15/93	SS36 AS038307 SS019 07/16/93 09/15/93	SS37 AS038308 SS019 07/16/93 09/15/93	SS38 AS038659 SS019 07/16/93 09/15/93	SS38-RE AS038659RI SS019 07/16/93 09/15/93	SS39 AS038655 SS039 07/16/93 09/15/93	SS39-DL AS038655DL SS039 07/16/93 09/15/93	SS39-RE AS038655RI SS039 07/16/93 09/15/93
75-00-2	Asphalt	100	ND	ND	ND	NA	ND	5 J	ND	ND	ND	NA	NA
67-64-1	Methylene chloride	200	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
76-15-0	Acetone	2700	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
67-66-3	Carbon Disulfide	300	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
107-06-2	Chloroform	100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
78-93-3	1,2-Dichloroethane	300	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
71-55-8	2-Butanone	800	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
79-01-8	1,1,1-Trichloroethane	700	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
127-18-4	Trichloroethene	1400	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
108-88-3	Tetachloroethene	1500	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
100-41-4	Toluene	8500	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
1330-20-7	Ethyl benzene	1200	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
95-48-7	Total Xylenes	900	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
105-87-9	2-Methylphenol	NS	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
91-20-3	2,4-Dimethylphenol	13000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
91-57-6	Naphthalene	36400	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
98-95-4	2-Methylnaphthalene	100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
208-96-8	2,4,6-Trichlorophenol	41000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
83-32-9	Acenaphthylene	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
132-64-9	Acenaphthene	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
86-73-7	Dibenzofuran	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
86-30-8	Fluorene	NS	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
87-86-5	N-nitrosodiphenylamine	1000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
85-01-8	Pentachlorophenol	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
120-12-7	Anthracene	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
68-74-8	Carbazole	NS	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
84-74-2	Di-n-butyl phthalate	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
208-44-0	Fluoranthene	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
129-00-0	Pyrene	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
88-68-7	Benzofluoranthene	220	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
58-66-3	Chrysene	400	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
117-81-7	Bis(2-ethylhexyl) phthalate	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
208-99-2	Benzofluoranthene	1100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
207-08-9	Benzofluoranthene	1100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
50-32-8	Benzofluoranthene	61	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
183-39-6	Indeno(1,2,3-cd)pyrene	3200	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
53-70-3	Dibenz(a,h)anthracene	14	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
181-24-2	Benzofluoranthene	50000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
319-85-7	beta-BHC	200	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
319-86-8	delta-BHC	300	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
1024-87-3	Heptachlor epoxide	20	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
989-98-8	Endosulfan I	900	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
96-57-1	Endosulfan II	44	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
72-55-9	4,4'-DDE	2100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
72-20-8	Endosulfan II	100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
33213-05-9	4,4'-DDD	900	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
72-54-6	4,4'-DDT	2900	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
1031-07-8	Endosulfan Sulfate	1000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
50-29-3	4,4'-DDT	2100	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
72-43-5	Methoxychlor	10000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
53494-70-6	Endrin ketone	NS	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
53499-21-9	Aroclor 1242	1000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
12872-29-8	Aroclor 1248	1000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA
11087-89-1	Aroclor 1254	1000	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA

* - Collected adjacent to boring MW-1.

J - Indicates an estimated value.

NA - Not analyzed.

ND - Not detected at laboratory's method of detection limit.

NS - No standard.

See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all soil samples.

- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE

Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample Id: Lab Sample Id: Sdp: Sampled: Validated:	SS34 A5039306 SS019 07/16/93 09/15/93	SS36 A5039306 SS018 07/16/93 09/15/93	SS35 - DL A5039306DL SS019 07/16/93 09/15/93	SS36 A5039307 SS019 07/16/93 09/15/93	SS37 A5039308 SS019 07/16/93 09/15/93	SS38 A5039309 SS019 07/16/93 09/15/93	SS38 - RE A5039309RI SS019 07/16/93 09/15/93	SS39 A5039406 SS039 07/16/93 09/15/93	SS39 - DL A5039406DL SS039 07/16/93 09/15/93	SS39 - RE A5039406RI SS039 07/16/93 09/15/93
7429-90-5	Aluminum - Total	NS		7620 J	6890 J	NA	6020 J	5140 J	9770 J	NA	18000	NA	NA
7440-36-0	Antimony - Total	31		ND	ND	NA	ND	ND	ND	NA	ND	NA	NA
7440-38-2	Arsenic - Total	7.5		6.2 J	5.6 J	NA	7.1 J	1.8 J	42.3 J	NA	29.7 J	NA	NA
7440-39-3	Barium - Total	300		43.6 J	63.1 J	NA	ND	46 J	153 J	NA	89 J	NA	NA
7440-41-7	Beryllium - Total	1.0		ND	ND	NA	ND	ND	ND	NA	ND	NA	NA
7440-43-9	Cadmium - Total	1.0		.11 J	.24 J	NA	.51 J	.16 J	2.1 J	NA	.87 J	NA	NA
7440-70-2	Calcium - Total	NS		1890 J	6490 J	NA	10500 J	700 J	7740 J	NA	2830	NA	NA
7440-47-3	Chromium - Total	10		9 J	14.7 J	NA	11.8 J	4.7 J	57.5 J	NA	45.3 J	NA	NA
7440-48-4	Cobalt - Total	NS		64.3 J	17.6 J	NA	136 J	6.9 J	ND	NA	10.1 J	NA	NA
7440-50-8	Copper - Total	3200		6 J	60.4 J	NA	104 J	6.3 J	106 J	NA	711	NA	NA
7439-99-6	Iron - Total	NS		16100 J	18300 J	NA	16100 J	10600 J	64100 J	NA	18400 J	NA	NA
7439-92-1	Lead - Total	100		24.7 J	263 J	NA	238 J	7 J	363 J	NA	413	NA	NA
7439-95-4	Magnesium - Total	NS		2390 J	2250 J	NA	1600 J	2090 J	1840 J	NA	1790 J	NA	NA
7439-98-6	Manganese - Total	400		376 J	445 J	NA	227 J	451 J	376 J	NA	113 J	NA	NA
7439-97-6	Mercury - Total	0.1		ND	0.18 J	NA	ND	ND	0.29 J	NA	1.6	NA	NA
7440-02-0	Nickel - Total	1600		24.8 J	18.1 J	NA	24.8 J	17.2 J	28.1 J	NA	34.3	NA	NA
7440-06-7	Potassium - Total	4000		421 J	678 J	NA	1016 J	500 J	737 J	NA	296 J	NA	NA
7782-49-2	Selenium - Total	2.0		ND	ND	NA	ND	ND	ND	NA	ND	NA	NA
7440-22-4	Silver - Total	200		ND	ND	NA	.18 J	ND	8 J	NA	ND	NA	NA
7440-23-6	Sodium - Total	3000		8.9 J	ND	NA	278 J	ND	525 J	NA	331 J	NA	NA
7440-62-2	Vanadium - Total	860		44.1 J	10 J	NA	21.5 J	ND	24.5 J	NA	106 J	NA	NA
7440-99-6	Zinc - Total	24000		ND	94.3 J	NA	204 J	31.5 J	1360 J	NA	501	NA	NA
57-12-5	Cyanide - Total	1600		ND	1.1 J	NA	ND	ND	3.4 J	NA	4.8 J	NA	NA

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	AS40 AS039668 85039 07/19/93 09/15/93	SS41 AS039667 85039 07/19/93 09/15/93	SS41-DL AS039667DL 85039 07/19/93 09/15/93	SS42 AS039668 85039 07/19/93 09/15/93	SS42-DL AS039668DL 85039 07/19/93 09/15/93	SS42-RE AS039668RI 85039 07/19/93 09/15/93	SS43 AS039713 85039 07/19/93 09/15/93	SS44 AS039715 85039 07/19/93 09/15/93	SS45 AS039714 85039 07/19/93 09/15/93	SS46-DL AS039714DL 85039 07/19/93 09/15/93
Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS40 AS039668 85039 07/19/93 09/15/93	SS41 AS039667 85039 07/19/93 09/15/93	SS41-DL AS039667DL 85039 07/19/93 09/15/93	SS42 AS039668 85039 07/19/93 09/15/93	SS42-DL AS039668DL 85039 07/19/93 09/15/93	SS42-RE AS039668RI 85039 07/19/93 09/15/93	SS43 AS039713 85039 07/19/93 09/15/93	SS44 AS039715 85039 07/19/93 09/15/93	SS45 AS039714 85039 07/19/93 09/15/93	SS46-DL AS039714DL 85039 07/19/93 09/15/93
76-09-2	ASB91-1-VOLATILES (ug/kg)	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
87-64-1	Methylene chloride	78 J	NA	NA	ND	NA	ND	NA	NA	ND	NA
75-15-0	Acetone	33 J	NA	NA	ND	NA	ND	NA	NA	ND	NA
67-66-3	Carbon Disulfide	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
107-06-2	Chloroform	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
78-83-3	1,2-Dichloroethane	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
71-55-6	2-Butanone	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
79-01-8	1,1,1-Trichloroethane	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
127-18-4	Trichloroethane	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
106-88-3	Tetachloroethane	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
100-41-4	Toluene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
1330-20-7	Ethyl benzene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
95-48-7	Total Xylenes	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
105-87-9	2-Methylphenol	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
91-20-3	2,4-Dimethylphenol	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
91-67-8	Naphthalene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
95-85-4	2-Methylnaphthalene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
208-86-8	2,4,6-Trichlorophenol	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
83-32-8	Acenaphthylene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
132-84-9	Acenaphthene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
86-73-7	Dibenzofuran	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
86-30-6	Fluorene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
87-66-5	N-nitrosodiphenylamine	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
85-01-8	Pentachlorophenol	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
120-12-7	Anthracene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
86-74-8	Carbazole	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
84-74-2	DI-n-butyl phthalate	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
208-44-0	Fluoranthene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
129-00-0	Pyrene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
85-88-7	Benzofluoranthene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
218-01-9	Benz(a)anthracene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
117-81-7	Chrysene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
205-99-2	Bis(2-ethylhexyl) phthalate	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
207-08-9	Benzofluoranthene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
50-32-8	Benzofluoranthene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
183-39-5	Indeno(1,2,3-cd)pyrene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
53-70-3	Benzo(a,h)anthracene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
191-24-2	Benzo(g,h,i)perylene	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
319-85-7	ASP91-3-PESTICIDES/PCBS (ug/kg)	ND	NA	NA	ND	NA	ND	NA	NA	ND	NA
319-85-7	beta-BHC	ND	340 P	340	ND	ND	NA	NA	NA	ND	ND
1024-57-3	delta-BHC	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
959-98-8	Heptachlor epoxide	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
90-57-1	Endosulfan I	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
72-55-9	4,4'-DDE	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
72-20-8	Endrin	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
33213-06-9	Endosulfan II	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
72-64-8	4,4'-DDD	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
1031-07-8	Endosulfan Sulfate	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
60-29-3	4,4'-DDT	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
72-43-5	Methoxychlor	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
53494-70-5	Endrin ketone	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
53468-21-9	Arador 1242	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
12672-29-6	Arador 1248	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND
11097-69-1	Arador 1254	ND	850 J	750 J	ND	ND	NA	NA	NA	ND	ND
	Collected adjacent to boring MW-1.	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit
NS - No standard.
See Table 3.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	S540 A5039666 S5039 07/16/93 09/15/93	S541-DL A5039667DL S5039 07/16/93 09/15/93	S542 A5039668 S5039 07/16/93 09/15/93	S542-DL A5039668DL S5039 07/16/93 09/15/93	S542-RE A5039668RI S5039 07/16/93 09/15/93	S543 A5039713 S5039 07/16/93 09/15/93	S544 A5039716 S5039 07/16/93 09/15/93	S545 A5039714 S5039 07/16/93 09/15/93	S545-DL A5039714DL S5039 07/16/93 09/15/93
7429-90-5	Aluminum - Total	NS		6690	NA	21200	NA	NA	5090	4100	6870	NA
7440-36-0	Antimony - Total	31		ND	NA	ND	NA	NA	ND	30.8 J	59.3 J	NA
7440-38-2	Arsenic - Total	7.5		7 J	NA	95.4 J	NA	NA	15.1 J	13.2 J	59.3 J	NA
7440-39-3	Barium - Total	300		63.9 J	NA	148 J	NA	NA	66.3 J	268 J	288 J	NA
7440-41-7	Beryllium - Total	1.0		ND	NA	ND	NA	NA	ND	ND	ND	NA
7440-43-9	Bismuth - Total	1.0		18 J	NA	1.5 J	NA	NA	38 J	2 J	3.1 J	NA
7440-70-2	Cadmium - Total	NS		1130 J	NA	4390	NA	NA	1100	8210	2790	NA
7440-47-3	Chromium - Total	10		10.1 J	NA	85.3 J	NA	NA	7.1 J	13.6 J	29 J	NA
7440-48-4	Cobalt - Total	NS		13.8 J	NA	10.3 J	NA	NA	14.3	7.8 J	8.5 J	NA
7440-50-8	Copper - Total	3200		13	NA	303	NA	NA	31900 J	220	169	NA
7439-88-6	Lead - Total	NS		16700 J	NA	41900 J	NA	NA	23.8	28300 J	49000 J	NA
7439-92-1	Magnesium - Total	100		2020	NA	523	NA	NA	1310	842 J	515 J	NA
7439-96-4	Manganese - Total	NS		161 J	NA	1450 J	NA	NA	788 J	1330	2290	NA
7439-97-6	Mercury - Total	0.1		ND	NA	1.2	NA	NA	0.11	1.7	1.1	NA
7440-02-0	Nickel - Total	1800		13.9	NA	63.2	NA	NA	30.7	61.7	59.7	NA
7440-06-7	Potassium - Total	4000		360 J	NA	264 J	NA	NA	377 J	330 J	662 J	NA
7782-49-2	Selenium - Total	2.0		ND	NA	ND	NA	NA	1.1 J	1.2 J	.9 J	NA
7440-22-4	Silver - Total	200		ND	NA	11.8 J	NA	NA	ND	28 J	.17 J	NA
7440-23-6	Sodium - Total	3000		ND	NA	ND	NA	NA	ND	ND	258 J	NA
7440-62-2	Vanadium - Total	550		10.8 J	NA	106 J	NA	NA	12.7 J	187 J	504 J	NA
7440-96-6	Zinc - Total	24000		88.9	NA	1270	NA	NA	45.2	964	890	NA
67-12-5	Cyanide - Total	1800		REJ	NA	9.6 J	NA	NA	REJ	REJ	REJ	NA

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample ID: Lab Sample ID: Sdg: Sampled: Validated:	SS46 AS039844 SS039 07/20/93 09/15/93	SS46-RE AS039844RI SS039 07/20/93 09/15/93	SS47-DL AS039844DL SS039 07/20/93 09/15/93	SS47-RE AS039844RI SS039 07/20/93 09/15/93	SB48 AS039846 SS039 07/20/93 09/15/93	SS49 AS039847 SS039 07/20/93 09/15/93	SS49-DL AS039847DL SS039 07/20/93 09/15/93	SS49-RE AS039847RI SS039 07/20/93 09/15/93	SS50 (0-2) 383-279-01 NYSDEC 10/06/93
75-09-2	ASPH1-1-VOLATILES (ug/kg)	100										NA
87-84-1	Methylene chloride	200										NA
76-15-0	Acetone	2700										NA
87-86-3	Carbon Disulfide	300										NA
107-06-2	Chlorobrom	100										NA
78-83-3	1,2-Dichloroethane	300										NA
78-83-3	2-Butanone	800										NA
71-55-6	1,1,1-Trichloroethane	700										NA
79-01-8	Trichloroethene	1400										NA
127-18-4	Tetrachloroethene	1500										NA
106-68-3	Toluene	5500										NA
100-41-4	Ethyl benzene	1200										NA
1330-20-7	Total Xylenes											NA
95-48-7	2-Methylphenol	900										NA
105-87-9	2,4-Dimethylphenol	NS										NA
91-20-3	Naphthalene	13000										NA
91-57-6	2-Methylnaphthalene	34000										NA
86-96-4	2,4,5-Trichlorophenol	100										NA
200-96-8	Acenaphthylene	41000										NA
83-32-9	Acenaphthene	50000										NA
130-84-9	Dibenzofuran	8200										NA
86-73-7	Fluorene	50000										NA
86-30-6	N-nitrosodiphenylamine	NS										NA
87-86-5	Pentachlorophenol	1000										NA
85-01-8	Phenanthrene	50000										NA
120-12-7	Anthracene	50000										NA
86-74-8	Carbazole	NS										NA
84-74-2	Di-n-butyl phthalate	8100										NA
206-44-0	Fluoranthene	50000										NA
129-00-0	Pyrene	50000										NA
85-68-7	Benzyl benzyl phthalate	50000										NA
56-55-3	Benzofuran	200										NA
216-01-9	Chrysene	2000 J										NA
117-81-7	Bis(2-ethylhexyl) phthalate	50000										NA
208-99-2	Benzofluoranthene	1100										NA
207-08-9	Benzofluoranthene	1100										NA
50-32-8	Benzo(a)pyrene	81										NA
183-39-5	Indeno(1,2,3-cd)pyrene	3200										NA
53-70-3	Dibenzo(a,h)anthracene	14										NA
191-24-2	Benzo(g,h,i)perylene	50000										NA
319-85-7	beta-BHC	200										NA
319-86-8	delta-BHC	300										NA
1024-67-3	Heptachlor epoxide	20										NA
859-98-8	Endosulfan I	900										NA
80-57-1	Dieldrin	44										NA
72-55-9	4,4'-DDE	2100										NA
72-20-8	Endrin	100										NA
33213-66-9	Endosulfan II	900										NA
72-54-8	4,4'-DDD	2800										NA
1031-07-8	Endosulfan Sulfate	1000										NA
50-28-3	4,4'-DDT	2100										NA
72-43-5	Methoxychlor	10000										NA
53494-70-5	Endrin ketone	NS										NA
53489-21-9	Aroclor 1242	1000										NA
12672-28-8	Aroclor 1254	1000										NA
11097-89-1	Aroclor 1260	1000										NA
* - Collected adjacent to boring MW-1.												
J - Indicates an estimated value.												
NA - Not analyzed.												
ND - Not detected at laboratory's method of detection limit.												
NS - No standard.												
See Table 4.9 for complete list of laboratory qualifiers.												
Bold Face - Indicates the maximum concentration for all soil samples.												
- Indicates a concentration above the soil cleanup objective.												

18200 J 17000 PC 37 J 28000 J 42000 G 13000 J 20000 PC

TABLE 4.2
NAPANOCH PAPER MILL SITE
Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Gas No.	Parameter	Sample Id: Lab Sample Id: Soil Cleanup Objective	SS46 A5039484 SS039 07/20/93 09/15/93	SS47 A5039485 SS039 07/20/93 09/15/93	SS47-DL A9039484DL SS039 07/20/93 09/15/93	SS47-RE A5039484RI SS039 07/20/93 09/15/93	SS48 A5039486 SS039 07/20/93 09/15/93	SS49 A5039487 SS039 07/20/93 09/15/93	SS49-DL A5039487DL SS039 07/20/93 09/15/93	SS49-RE A5039487RI SS039 07/20/93 09/15/93	SS50 (0-2) 393-270-01 NYSDEC 10/06/93
7429-80-5	TOTAL METALS (mg/kg)	NS	3060	8900	NA	NA	6620	11900	NA	NA	NA
7440-36-0	Aluminum - Total	31	4.3 J	2.9 J	NA	NA	1.3 J	37.3 J	NA	NA	NA
7440-36-0	Antimony - Total	7.5	12.2 J	2.4	NA	NA	11.5 J	7.6 J	NA	NA	NA
7440-39-2	Asaric - Total	300	71.7 J	51.3 J	NA	NA	26.7	96.7 J	NA	NA	NA
7440-41-7	Barium - Total	1.0	ND	ND	NA	NA	ND	ND	NA	NA	NA
7440-43-9	Beryllium - Total	NS	18.4 J	3.8 J	NA	NA	ND	4.1 J	NA	NA	NA
7440-70-2	Cadmium - Total	NS	2690	4700	NA	NA	1060	11200	NA	NA	NA
7440-47-3	Chromium - Total	10	33.8 J	271.1 J	NA	NA	10.7 J	23.2 J	NA	NA	NA
7440-48-4	Cobalt - Total	NS	10.2 J	ND	NA	NA	9 J	ND	NA	NA	NA
7440-50-8	Copper - Total	3200	119000 J	4920 J	NA	NA	76	183	NA	NA	NA
7439-89-6	Iron - Total	NS	68.8 J	136 J	NA	NA	802 J	228 J	NA	NA	NA
7439-82-1	Lead - Total	100	1320	757 J	NA	NA	2450	1030 J	NA	NA	NA
7439-86-4	Magnesium - Total	400	701 J	124 J	NA	NA	539 J	59 J	NA	NA	NA
7439-99-5	Manganese - Total	NS	0.41	0.2	NA	NA	0.28	ND	NA	NA	NA
7439-97-8	Mercury - Total	0.1	72.5	14.8 J	NA	NA	25.7	35.9	NA	NA	NA
7440-02-0	Nickel - Total	1800	262 J	211 J	NA	NA	559 J	217 J	NA	NA	NA
7440-09-7	Potassium - Total	4000	ND	ND	NA	NA	ND	ND	NA	NA	NA
7782-49-2	Selenium - Total	2.0	38 J	4.4 J	NA	NA	11 J	2.6 J	NA	NA	NA
7440-22-4	Silver - Total	200	ND	ND	NA	NA	ND	ND	NA	NA	NA
7440-23-6	Sodium - Total	3000	241 J	10.9 J	NA	NA	19.7 J	216 J	NA	NA	NA
7440-62-2	Vanadium - Total	550	10400	655	NA	NA	REJ	1620	NA	NA	NA
7440-68-6	Zinc - Total	24000	REJ	50.8 J	NA	NA	REJ	4 J	NA	NA	NA
57-12-6	Cyanide - Total	1800			NA	NA			NA	NA	NA

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.2

NAPANOCH PAPER MILL SITE

Surface Soil Sampling Rounds: 12/22/93 – 10/6/93

Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	SS51 (4-6) 393-279-01 NYSDEC 10/06/93	SS52 (8-10) 393-279-01 NYSDEC 10/06/93	SS53 (12-14) 393-279-01 NYSDEC 10/06/93	SS54 (14-16) 393-279-01 NYSDEC 10/06/93	SS55 (16-18.5) 393-279-01 NYSDEC 10/06/93	CONC-01 393-186-11 NYSDEC 07/13/93
76-09-2	ASPR1-1 - VOLATILES (ug/kg)	100							
67-64-1	Methylene chloride	100		NA	NA	NA	NA	NA	NA
76-15-0	Acetone	200		NA	NA	NA	NA	NA	NA
76-18-0	Carbon Disulfide	2700		NA	NA	NA	NA	NA	NA
87-86-3	Chloroform	300		NA	NA	NA	NA	NA	NA
107-06-2	1,2-Dichloroethane	100		NA	NA	NA	NA	NA	NA
76-83-3	2-Butanone	300		NA	NA	NA	NA	NA	NA
71-85-6	1,1,1-Trichloroethane	800		NA	NA	NA	NA	NA	NA
79-01-8	Trichloroethane	700		NA	NA	NA	NA	NA	NA
127-18-4	Tetrachloroethane	1400		NA	NA	NA	NA	NA	NA
108-88-3	Toluene	1500		NA	NA	NA	NA	NA	NA
100-41-4	Ethyl benzene	5500		NA	NA	NA	NA	NA	NA
1330-20-7	Total Xylenes	1200		NA	NA	NA	NA	NA	NA
96-48-7	ASPR1-2 - SEMIVOLATILES (ug/kg)	900							
106-87-9	2-Methylphenol	NS		NA	NA	NA	NA	NA	NA
91-20-3	2,4-Dimethylphenol	13000		NA	NA	NA	NA	NA	NA
91-87-6	Naphthalene	36400		NA	NA	NA	NA	NA	NA
95-95-4	2-Methylnaphthalene	100		NA	NA	NA	NA	NA	NA
208-98-6	2,4,5-Trichlorophenol	41000		NA	NA	NA	NA	NA	NA
83-32-9	Acenaphthylene	50000		NA	NA	NA	NA	NA	NA
132-84-9	Acenaphthene	6200		NA	NA	NA	NA	NA	NA
86-73-7	Dibenzofuran	50000		NA	NA	NA	NA	NA	NA
86-30-8	Fluorene	NS		NA	NA	NA	NA	NA	NA
87-86-5	N-nitrosodiphenylamine	1000		NA	NA	NA	NA	NA	NA
95-01-8	Pentachlorophenol	50000		NA	NA	NA	NA	NA	NA
120-12-7	Phenanthrene	50000		NA	NA	NA	NA	NA	NA
86-74-8	Anthracene	50000		NA	NA	NA	NA	NA	NA
84-74-2	Carbazole	NS		NA	NA	NA	NA	NA	NA
206-44-0	Di-n-butyl phthalate	8100		NA	NA	NA	NA	NA	NA
129-00-0	Fluoranthene	50000		NA	NA	NA	NA	NA	NA
85-68-7	Pyrene	50000		NA	NA	NA	NA	NA	NA
56-56-3	Benzyl benzyl phthalate	220		NA	NA	NA	NA	NA	NA
218-01-9	Benzofluorenone	400		NA	NA	NA	NA	NA	NA
117-81-7	Bis(2-ethylhexyl) phthalate	50000		NA	NA	NA	NA	NA	NA
208-99-2	Benzofluorenone	1100		NA	NA	NA	NA	NA	NA
207-08-9	Benzofluorenone	1100		NA	NA	NA	NA	NA	NA
50-32-8	Benzofluorenone	81		NA	NA	NA	NA	NA	NA
193-39-5	Indeno(1,2,3-cd)pyrene	3200		NA	NA	NA	NA	NA	NA
53-70-3	Dibenzo(a,h)anthracene	14		NA	NA	NA	NA	NA	NA
181-24-2	Benzofluorenone	50000		NA	NA	NA	NA	NA	NA
319-85-7	ASPR1-3 - PESTICIDES/PCBS (ug/kg)	200							
319-85-8	beta-BHC	300		NA	NA	NA	NA	NA	NA
1024-87-3	delta-BHC	20		NA	NA	NA	NA	NA	NA
958-98-8	Heptachlor epoxide	900		NA	NA	NA	NA	NA	NA
60-57-1	Endosulfan I	44		NA	NA	NA	NA	NA	NA
72-66-9	4,4'-DDE	2100		NA	NA	NA	NA	NA	NA
72-20-8	Endrin	100		NA	NA	NA	NA	NA	NA
33213-85-9	Endosulfan II	900		NA	NA	NA	NA	NA	NA
72-54-8	4,4'-DDD	2900		NA	NA	NA	NA	NA	NA
1031-07-8	Endosulfan Sulfate	1000		NA	NA	NA	NA	NA	NA
50-28-3	4,4'-DDT	2100		NA	NA	NA	NA	NA	NA
72-43-5	Methoxychlor	10000		NA	NA	NA	NA	NA	NA
53494-70-5	Endrin ketone	NS		NA	NA	NA	NA	NA	NA
53489-21-9	Aroclor 1242	1000		ND	ND	ND	ND	ND	ND
12672-28-8	Aroclor 1248	1000		ND	ND	ND	ND	ND	ND
11097-69-1	Aroclor 1254	1000		ND	ND	ND	ND	ND	ND

* - Collected adjacent to boring MW-1.

J - Indicates an estimated value.

NA - Not analyzed.

ND - Not detected at laboratory's method of detection limit.

NS - No standard.

See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all soil samples.

- Indicates a concentration above the soil cleanup objective.

TABLE 4.2

NAPANOCH PAPER MILL SITE

Surface Soil Sampling Rounds: 12/22/93 – 10/6/93
Detected Compound Summary

Cas No.	Parameter	Soil Cleanup Objective	Sample Id: Lab Sample Id: Sdg: Validated:	SS51 (4-6) 393-279-01 NYSDEC 10/06/93	SS52 (8-10) 393-279-01 NYSDEC 10/06/93	SS53 (12-14) 393-279-01 NYSDEC 10/06/93	SS54 (14-16) 393-279-01 NYSDEC 10/06/93	SS55 (16-18.5) 393-279-01 NYSDEC 10/06/93	CONC-01 393-195-11 NYSDEC 07/13/93
7429-90-6	TOTAL METALS (mg/kg)	NS							
7440-36-0	Aluminum - Total	31		NA	NA	NA	NA	NA	NA
7440-36-0	Antimony - Total	7.5		NA	NA	NA	NA	NA	NA
7440-36-0	Arsenic - Total	300		NA	NA	NA	NA	NA	NA
7440-39-3	Barium - Total	1.0		NA	NA	NA	NA	NA	NA
7440-41-7	Beryllium - Total	1.0		NA	NA	NA	NA	NA	NA
7440-43-9	Cadmium - Total	NS		NA	NA	NA	NA	NA	NA
7440-70-2	Calcium - Total	10		NA	NA	NA	NA	NA	NA
7440-47-3	Chromium - Total	NS		NA	NA	NA	NA	NA	NA
7440-48-4	Cobalt - Total	3200		NA	NA	NA	NA	NA	NA
7440-50-8	Copper - Total	NS		NA	NA	NA	NA	NA	NA
7439-89-8	Iron - Total	100		NA	NA	NA	NA	NA	NA
7438-92-1	Lead - Total	NS		NA	NA	NA	NA	NA	NA
7438-96-4	Magnesium - Total	400		NA	NA	NA	NA	NA	NA
7439-96-5	Manganese - Total	0.1		NA	NA	NA	NA	NA	NA
7439-97-8	Mercury - Total	1800		NA	NA	NA	NA	NA	NA
7440-02-0	Nickel - Total	4000		NA	NA	NA	NA	NA	NA
7440-08-7	Potassium - Total	200		NA	NA	NA	NA	NA	NA
7782-49-2	Selenium - Total	3000		NA	NA	NA	NA	NA	NA
7440-22-4	Silver - Total	550		NA	NA	NA	NA	NA	NA
7440-23-5	Sodium - Total	24000		NA	NA	NA	NA	NA	NA
7440-62-2	Vanadium - Total	1800		NA	NA	NA	NA	NA	NA
7440-66-6	Zinc - Total	1800		NA	NA	NA	NA	NA	NA
67-12-6	Cyanide - Total								

J - Indicates an estimated value.

NA - Not analyzed.

ND - Not detected at laboratory's method of detection limit.

NS - No standard.

See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all soil samples.

- Indicates a concentration above the soil cleanup objective.

TABLE 4.3
NAPANOCH PAPER MILL SITE
Soil Boring Sampling Round: 01/06/93 - 01/14/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	NYSDC (2) Soil Cleanup Objective ug/kg	SAMPLE ID: LAB SAMPLE: SDG: SAMPLING: VALIDATED: UNITS:	SS/MW-1 (23-24) AS024116 SEDA1 01/06/93 03/10/93	SS/MW-1-RE AS024116R1 SEDA1 01/06/93 03/10/93	SS/MW-3(10-2) AS024265 SEDA1 01/06/93 03/10/93	SS/MW-3(4-9) AS024266 SEDA1 01/06/93 03/10/93	SS/MW-4(10-2) AS024651 SS/MW5 01/14/93 03/10/93	SS/MW-4(10-2)DLSS AS024651DL SS/MW5 01/14/93 03/10/93	SS/MW-4(10-2)HSS AS024651H1 SS/MW5 01/14/93 03/10/93	AS024652 SS/MW5 01/14/93 03/10/93
75-08-2	ASPG1-1 - VOLATILES	100	ug/kg	NO	NO	NO	NA	3 J	ND	ND	NA
87-84-1	Methylene chloride	200	ug/kg	NO	NO	NO	NA	280	85 D	76	NA
71-55-8	Acetone	800	ug/kg	NO	NO	NO	NA	NO	ND	ND	NA
79-01-6	1,1,1-Trichloroethane	700	ug/kg	NO	NO	NO	NA	NO	ND	ND	NA
108-10-1	Trichloroethene	1000	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
591-78-6	4-Methyl-2-pentanone	NS	ug/kg	FEJ	FEJ	0.8 J	NA	2 J	ND	ND	NA
127-18-4	2-Hexanone	1400	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
79-34-5	Tetrachloroethene	800	ug/kg	FEJ	FEJ	0.5 J	NA	410 J	86 D	150 J	NA
108-88-3	1,1,2,2-Tetrachloroethane	1500	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
108-90-7	Toluene	1700	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
100-41-4	Chlorobenzene	5500	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
100-42-5	Ethyl benzene	NS	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
1330-20-7	Styrene	1200	ug/kg	FEJ	FEJ	NO	NA	NO	ND	ND	NA
81-20-3	Total Xylenes	13000	ug/kg	NO	NO	NO	NA	NO	NA	NA	NA
81-57-8	ASPG1-2 - SEMIVOLATILES	36400	ug/kg	NO	NA	NO	NA	10 J	NA	NA	NA
208-96-8	Naphthalene	41000	ug/kg	NO	NA	NO	NA	10 J	NA	NA	NA
85-01-8	2-Methylthiophthalene	6200	ug/kg	NO	NA	160 J	NA	94 J	NA	NA	NA
120-12-7	Acenaphthylene	50000	ug/kg	NO	NA	10 J	NA	5 J	NA	NA	NA
86-74-8	Dibenzofuran	NS	ug/kg	NO	NA	NO	NA	NO	NA	NA	NA
84-74-2	Phenanthrene	8100	ug/kg	NO	NA	370 J	NA	300 J	NA	NA	NA
208-44-0	Anthracene	50000	ug/kg	NO	NA	180 J	NA	430 J	NA	NA	NA
129-00-0	Carbazole	220 or MDL	ug/kg	NO	NA	210 J	NA	350 J	NA	NA	NA
56-55-3	Benzo(a)anthracene	400	ug/kg	96J	NA	490	NA	220 J	NA	NA	NA
218-01-9	Chrysene	50000	ug/kg	NO	NA	290 J	NA	170 J	NA	NA	NA
117-81-7	Bis(2-ethylhexyl) phthalate	NS	ug/kg	NO	NA	230 J	NA	680	NA	NA	NA
117-84-0	Di-n-octyl phthalate	1100	ug/kg	NO	NA	180 J	NA	300 J	NA	NA	NA
205-99-2	Benzo(b)fluoranthene	1100	ug/kg	NO	NA	170 J	NA	370 J	NA	NA	NA
207-08-9	Benzo(k)fluoranthene	81 or MDL	ug/kg	NO	NA	110 J	NA	170 J	NA	NA	NA
50-32-8	Benzo(a)pyrene	3200	ug/kg	NO	NA	NO	NA	58 J	NA	NA	NA
183-39-5	Indeno(1,2,3-cd)pyrene	14 or MDL	ug/kg	NO	NA	78 J	NA	140 J	NA	NA	NA
53-70-3	Dibenzo(a,h)anthracene	50000	ug/kg	NO	NA	0.85 J	ND	NO	NA	NA	ND
191-24-2	Benzo(ghi)perylene	20	ug/kg	NO	NA	16	5.8 J	NO	NA	NA	ND
ASPG1-3 - PESTICIDES/APOCLOPS											
1024-57-3	Hepachlor epoxide	44	ug/kg	NO	NA	NO	ND	NO	NA	NA	ND
60-57-1	Dieldrin	2100	ug/kg	NO	NA	NO	ND	NO	NA	NA	ND
72-55-9	4,4'-DDE	900	ug/kg	NO	NA	NO	ND	NO	NA	NA	ND
33213-65-9	Endosulfan II	2900	ug/kg	25J	NA	NO	ND	NO	NA	NA	ND
72-54-8	4,4'-DDD	2100	ug/kg	NO	NA	NO	ND	NO	NA	NA	ND
50-28-3	4,4'-DDT	10000	ug/kg	NO	NA	NO	ND	NO	NA	NA	ND
72-43-5	Methoxychlor	1000	ug/kg	1200 J	NA	NO	ND	NO	NA	NA	ND
53498-21-9	Aroclor 1242		ug/kg		NA	NO	ND	NO	NA	NA	ND

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYSDC - TAGM Memorandum (11/16/92).
NS - No standard.
MDL - Method of detection limit.
(3) For surface soils (<2' deep). For subsurface soils the cleanup objective is 10,000 ug/kg.
U - Indicates a compound was analyzed for, but not detected.
J - Indicates an estimated value.
FEJ - Indicates unusable data.
ND - Not detected.
NA - Not analyzed.
See Table 4.8 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration found for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.3
NAPANOCH PAPER MILL SITE
Soil Boring Sampling Round: 01/06/93 – 01/14/93
Detected Compound Summary

CAS NO.	PARAMETER ⁽¹⁾	NYSDEC ⁽²⁾ Soil Cleanup Objective mg/Kg	SAMPLE ID: LAB SAMPLE: SOC: SAMPLED: VALIDATED: UNITS:	SS/MW-1 (23-24) ASO24116 SEDA1 01/06/93 03/10/93	SS/MW-1-RE ASO24116RI SEDA1 01/06/93 03/10/93	SS/MW-3 (0-2) ASO24285 SEDA1 01/06/93 03/10/93	SS/MW-3 (4-9) ASO24286 SEDA1 01/06/93 03/10/93	SS, MW-4 (0-2) ASO24851 SS/MW5 01/14/93 03/10/93	SS, MW-4 (0-2) DL ASO24851DL SS/MW5 01/14/93 03/10/93	SS, MW-4 (0-2) HESS, MW-4 (8-10.5) ASO24852 SS/MW5 01/14/93 03/10/93
7429-80-5	TOTAL METALS	NS	mg/Kg	11400	NA	11300	NA	7580 J	NA	NA
7440-38-2	Aluminum - Total	7.5	mg/Kg	7.7 J	NA	43.7 J	NA	11.8 J	NA	NA
7440-38-2	Arsenic - Total	300	mg/Kg	53.7	NA	86.0	NA	145	NA	NA
7440-38-3	Barium - Total	NS	mg/Kg	17200	NA	48100	NA	24900 J	NA	NA
7440-70-2	Calcium - Total	10	mg/Kg	17.1	NA	28.1	NA	32.1 J	NA	NA
7440-47-3	Chromium - Total	30	mg/Kg	11.5	NA	6.1 J	NA	15.8	NA	NA
7440-48-4	Cobalt - Total	3200	mg/Kg	15.5	NA	8.8	NA	145	NA	NA
7440-50-8	Copper - Total	NS	mg/Kg	27400	NA	24700	NA	71400	NA	NA
7439-86-8	Iron - Total	100	mg/Kg	22.2 J	NA	113	NA	174	NA	NA
7439-82-1	Lead - Total	NS	mg/Kg	5510	NA	4650	NA	3280	NA	NA
7439-85-4	Magnesium - Total	400	mg/Kg	878 J	NA	758 J	NA	NO	NA	NA
7439-86-5	Manganese - Total	0.1	mg/Kg	NO	NA	0.44	NA	0.18	NA	NA
7439-87-6	Mercury - Total	1800	mg/Kg	38.4	NA	28.8	NA	84.2	NA	NA
7440-02-0	Nickel - Total	NS	mg/Kg	1780	NA	1640	NA	881 J	NA	NA
7440-09-7	Potassium - Total	NS	mg/Kg	NO	NA	NO	NA	NO	NA	NA
7440-22-4	Silver - Total	550	mg/Kg	17.1	NA	38.2	NA	240	NA	NA
7440-62-2	Vanadium - Total	24000	mg/Kg	72.8	NA	538	NA	284 J	NA	NA
7440-66-8	Zinc - Total	NA	ug/g	NO	NA	1980	NA	11300	NA	NA
7440-44-0	WET CHEMISTRY ANALYSIS Leachable Total Organic Carbon									

(1) Analyzed by: PECSA Environmental, Inc.
(2) NYSDEC - TAGM Memorandum (11/18/92).
NS - No standard.
MDL - Method of detection limit.
U - Indicates a compound was analyzed for, but not detected.
J - Indicates an estimated value.
FEJ - Indicates unuseable data.
See Table 4.8 for complete list of laboratory qualifiers.
Table Face - Indicates the maximum concentration for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.3
NAPANOCH PAPER MILL SITE
Soil Boring Sampling Round: 01/06/93 – 01/14/93
Detected Compound Summary

CAS NO.	PARAMETER ⁽¹⁾	NYSDC ⁽²⁾ Soil Cleanup Objective ug/kg	SAMPLE ID: LAB SAMPLE: SDG: SAMPLING: VALIDATED: UNITS:	SS/MW-5(8-11) ASQ24571 SS/MW5 01/13/93 03/10/93	SS/MW-6(1-3) ASQ24850 SS/MW5 01/13/93 03/10/93	SS/MW-9(2-4.5) ASQ24572 SS/MW5 01/13/93 03/10/93	SS/MW-10(0-2) ASQ24162 SED1 01/07/93 03/10/93	SS/MW-10(8-10) ASQ24163 SED1 01/07/93 03/10/93	SS/MW-11(8-8) ASQ24161 SED1 01/07/93 03/10/93
75-08-2	Asphaltene	100	ug/kg	NA	ND	NA	ND	NA	NA
87-84-1	Methylene chloride	200	ug/kg	NA	21	NA	ND	NA	NA
71-55-8	Acetone	800	ug/kg	NA	2 J	NA	ND	NA	NA
78-01-8	1,1,1-Trichloroethane	700	ug/kg	NA	1 J	NA	ND	NA	NA
108-10-1	Trichloroethane	1000	ug/kg	NA	ND	NA	ND	NA	NA
591-78-8	4-Methyl-2-pentanone	NS	ug/kg	NA	ND	NA	ND	NA	NA
127-18-4	2-Hexanone	1400	ug/kg	NA	ND	NA	ND	NA	NA
78-34-5	Tetrachloroethene	600	ug/kg	NA	ND	NA	ND	NA	NA
108-88-3	1,1,2,2-Tetrachloroethane	1500	ug/kg	NA	8 J	NA	ND	NA	NA
108-90-7	Toluene	1700	ug/kg	NA	48	NA	ND	NA	NA
100-41-4	Chlorobenzene	5500	ug/kg	NA	ND	NA	ND	NA	NA
100-42-5	Ethylbenzene	NS	ug/kg	NA	ND	NA	ND	NA	NA
1330-20-7	Styrene	1200	ug/kg	NA	ND	NA	ND	NA	NA
81-20-3	Total Xylenes	13000	ug/kg	NA	ND	NA	ND	NA	NA
81-57-8	ASP91-2 - SEMIVOLATILES	38400	ug/kg	NA	ND	NA	ND	NA	NA
208-96-8	Naphthalene	41000	ug/kg	NA	21 J	NA	440 J	NA	NA
132-84-9	2-Methylnaphthalene	6200	ug/kg	NA	7 J	NA	1200	NA	82 J
85-01-8	Acenaphthylene	50000	ug/kg	NA	54 J	NA	170 J	NA	NA
120-12-7	Dibenzofuran	50000	ug/kg	NA	ND	NA	88 J	NA	NA
88-74-6	Phenanthrene	NS	ug/kg	NA	40 J	NA	3100	NA	240 J
64-74-2	Anthracene	8100	ug/kg	NA	480	NA	2900	NA	220 J
208-44-0	Di-n-butyl phthalate	50000	ug/kg	NA	380 J	NA	1800	NA	NA
129-00-0	Fluoranthene	220 or MDL	ug/kg	NA	310 J	NA	1800	NA	NA
56-55-3	Pyrene	400	ug/kg	NA	41 J	NA	210 J	NA	48 J
218-01-9	Benzo(a)anthracene	50000	ug/kg	NA	180 J	NA	ND	NA	NA
117-81-7	Bis(2-ethylhexyl) phthalate	NS	ug/kg	NA	30 J	NA	370 J	NA	110 J
205-96-2	Di-n-octyl phthalate	1100	ug/kg	NA	33 J	NA	2300	NA	NA
207-06-9	Benzo(b)fluoranthene	1100	ug/kg	NA	17 J	NA	1800	NA	NA
50-32-8	Benzo(k)fluoranthene	81 or MDL	ug/kg	NA	21 J	NA	1700	NA	78 J
183-38-5	Benzo(e)pyrene	3200	ug/kg	NA	150 J	NA	800	NA	74 J
53-70-3	Indeno(1,2,3-cd)pyrene	14 or MDL	ug/kg	NA	ND	NA	180 J	NA	13 J
181-24-2	Dibenz(a,h)anthracene	50000	ug/kg	NA	100 J	NA	560	NA	55 J
1024-97-3	Benzo(ghi)perylene	20	ug/kg	ND	ND	ND	ND	ND	ND
60-57-1	Heptachlor epoxide	44	ug/kg	ND	ND	ND	ND	ND	ND
72-55-9	Dieldrin	2100	ug/kg	ND	1.3 J	ND	15 J	ND	2.9 J
33213-65-8	4,4'-DDE	800	ug/kg	ND	1.8 J	ND	9.0 J	ND	ND
72-54-8	Endosulfan II	2800	ug/kg	ND	0.86 J	ND	3.3 J	ND	ND
50-29-3	4,4'-DDD	2100	ug/kg	ND	0.90 J	ND	62 J	ND	2.5 J
72-43-5	4,4'-DDT	10000	ug/kg	ND	7.8 J	ND	ND	ND	ND
53489-21-8	Methoxychlor	1000	ug/kg	ND	2.7 J	ND	ND	ND	ND
	Aroclor 1242	1000 ⁽³⁾	ug/kg	ND	ND	ND	ND	ND	ND

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYSDC - TAGM Memorandum (11/18/92).
NS - No standard.
MDL - Method of detection limit.
(3) For surface soils (<2' deep). For subsurface soils the cleanup objective is 10,000 ug/kg.
U - Indicates a compound was analyzed for, but not detected.
J - Indicates an estimated value.
PEJ - Indicates unusable data.
ND - Not detected.
NA - Not analyzed.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration found for all soil samples.
- Indicates a concentration above the soil cleanup objective.

TABLE 4.3
NAPANOCH PAPER MILL SITE
Soil Boring Sampling Round: 01/06/93 – 01/14/93
Detected Compound Summary

CAS NO.	PARAMETER ⁽¹⁾	NYSDEC ⁽²⁾ Soil Cleanup Objective mg/Kg	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED: UNITS:	SS/MW-5(8-11) ASD24571 SSMW5 01/13/93 03/10/93	SS/MW-8(1-3) ASD24850 SSMW5 01/15/93 03/10/93	SS/MW-8(10-2) ASD24572 SSMW5 01/13/93 03/10/93	SS/MW-9(2-4.5) ASD24573 SSMW5 01/13/93 03/10/93	SS/MW-10(8-10) ASD24183 SEDA1 01/07/93 03/10/93	SS/MW-11(2-4) ASD24180 SEDA1 01/07/93 03/10/93	SS/MW-11(6-8) ASD24181 SEDA1 01/07/93 03/10/93
7428-60-5	Aluminum – Total	NS	mg/Kg	NA	7220 J	9290 J	NA	NA	5670	NA
7440-39-2	Arsenic – Total	7.5	mg/Kg	NA	11.2 J	8.6 J	NA	NA	12.1 J	NA
7440-39-3	Barium – Total	300	mg/Kg	NA	124	141	NA	NA	88.6	NA
7440-70-2	Calcium – Total	NS	mg/Kg	NA	2510 J	18500 J	NA	NA	3470	NA
7440-47-3	Chromium – Total	10	mg/Kg	NA	15.8 J	13 J	NA	NA	7.1	NA
7440-48-4	Cobalt – Total	30	mg/Kg	NA	7.5 J	11.0 J	NA	NA	9.1 J	NA
7440-50-8	Copper – Total	3200	mg/Kg	NA	12.6	1490	NA	NA	23.0	NA
7439-89-6	Iron – Total	NS	mg/Kg	NA	15300	70100	NA	NA	22100	NA
7439-82-1	Lead – Total	100	mg/Kg	NA	21.6 J	534	NA	NA	64.7	NA
7439-85-4	Magnesium – Total	NS	mg/Kg	NA	1110 J	1760	NA	NA	1870	NA
7439-88-5	Manganese – Total	400	mg/Kg	NA	158 J	668 J	NA	NA	320 J	NA
7439-97-6	Mercury – Total	0.1	mg/Kg	NA	ND	ND	NA	NA	ND	NA
7440-02-0	Nickel – Total	1600	mg/Kg	NA	19.8	308	NA	NA	16.3	NA
7440-09-7	Potassium – Total	NS	mg/Kg	NA	862 J	1870	NA	NA	848 J	NA
7440-22-4	Silver – Total	NS	mg/Kg	NA	ND	2.3 J	NA	NA	ND	NA
7440-62-2	Vanadium – Total	550	mg/Kg	NA	21.3	24.9	NA	NA	9.1 J	NA
7440-68-6	Zinc – Total	24000	mg/Kg	NA	22.4 J	1250 J	NA	NA	77.1	NA
7440-44-0	WET CHEMISTRY ANALYSIS Leachable Total Organic Carbon	NA	ug/g	NA	1310	2310	NA	NA	1340	NA

(1) Analyzed by: RECORA Environmental, Inc.
(2) NYSDEC – TAGM Memorandum (11/16/92).
NS – No standard.
MDL – Method of detection limit.
U – Indicates a compound was analyzed for, but not detected.
J – Indicates an estimated value.
REJ – Indicates unusable data.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face – Indicates the maximum concentration for all soil samples.
– Indicates a concentration above the soil cleanup objective.

TABLE
NAPANOCH PAF L-1 MILL SITE
Test Pit Soil Sampling Round: 04/05/93 – 04/07/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	NYDEC #	Soil Cleanup Objective	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED:	TP01 AS032376 SSTP-1 04/05/93 08/31/93	TP02 AS032377 SSTP-1 04/05/93 08/08/93	TP02-RE AS032377RI SSTP-1 04/05/93 08/08/93	TP03 AS032378 SSTP-1 04/05/93 08/08/93	TP03-RE AS032378RI SSTP-1 04/05/93 08/08/93	TP04 AS032379 SSTP-1 04/05/93 08/08/93	TP05 AS032380 SSTP-1 04/05/93 08/08/93	TP05S(0-2) AS032381 SSTP-1 04/05/93 08/08/93	TP05-RE AS032380RI SSTP-1 04/05/93 08/08/93
67-84-1	Acetone	200	(ug/kg)		ND	ND	NA	ND	NA	ND	ND	ND	NA
78-83-3	2-Butanone	300		ND	ND	NA	NA	ND	NA	ND	ND	ND	NA
71-43-2	Benzene	60		ND	ND	NA	NA	ND	NA	ND	ND	ND	NA
108-88-3	Toluene	1500		1 J	ND	NA	NA	ND	NA	ND	ND	ND	NA
81-20-3	ASP91-2 SEMIVOLATILES	13000	(ug/kg)		ND	ND	ND	ND	ND	ND	ND	ND	ND
91-57-6	Naphthalene	39400		62 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
208-98-8	2-Methylthiophthalene	41000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
83-32-9	Acenaphthylene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
132-84-9	Acenaphthene	6200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
88-73-7	Dibenzofuran	50000		280 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
85-01-6	Fluorene	50000		34 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
120-12-7	Phenanthrene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-74-8	Carbazole	NS		ND	ND	14 J	ND	ND	ND	ND	ND	ND	ND
84-74-2	Di-n-butylphthalate	8100		ND	ND	ND	ND	ND	ND	ND	25 J	ND	ND
208-44-0	Fluoranthene	50000		480	760	730	ND	110 J	100 J	ND	140 J	ND	150 J
129-00-0	Pyrene	50000		430	730	380 J	ND	140 J	170 J	ND	ND	ND	ND
85-68-7	Butyl benzyl phthalate	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
81-84-1	3,3'-Dichlorobenzidine	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
56-55-3	Benzofluanthracene	220 or MDL		ND	350 J	330 J	ND	ND	ND	ND	51 J	ND	60 J
218-01-9	Chrysene	400		280 J	310 J	370 J	ND	87 J	87 J	ND	73 J	ND	78 J
117-81-7	Bis(2-ethylhexyl) phthalate	50000		170 J	1100 J	1100 J	ND	110 J	130 J	1700 J	230 J	110 J	290 J
117-84-0	Di-n-octyl phthalate	NS		ND	REJ	REJ	ND	ND	ND	ND	ND	ND	ND
205-99-2	Benzofluoranthene	1100		270 J	980 J	590 J	ND	150 J	160 J	ND	81 J	ND	120 J
207-8-8	Benzofluoranthene	1100		100 J	REJ	240 J	ND	72 J	70 J	ND	35 J	ND	49 J
50-32-8	Benzofluoranthene	81 or MDL		170 J	REJ	ND	ND	ND	ND	ND	ND	ND	ND
183-39-5	Indeno(1,2,3-cd)pyrene	3200		ND	REJ	ND	ND	ND	ND	ND	ND	ND	ND
53-70-3	Dibenzofluoranthene	14 or MDL		ND	REJ	ND	ND	ND	ND	ND	ND	ND	ND
181-24-2	Benzofluoranthene	50000		ND	REJ	ND	ND	ND	ND	ND	ND	ND	ND
1024-57-3	ASP91-3-PESTICIDES/PCBS	20	(ug/kg)		ND	ND	NA	ND	NA	ND	ND	ND	NA
60-57-1	Heptachlor epoxide	44		ND	ND	28 J	NA	ND	NA	ND	ND	ND	NA
72-55-9	Dieldrin	2100		12	8.8 J	ND	NA	1.7 J	NA	ND	6.8 J	ND	NA
72-20-8	Endrin	100		ND	ND	ND	NA	ND	NA	ND	ND	ND	NA
33213-65-9	Endosulfan II	600		0.47 J	ND	ND	NA	ND	NA	ND	1.2 J	ND	NA
72-54-8	4,4'-DDD	2800		3.8	8.4 J	ND	NA	ND	NA	ND	21 J	ND	NA
50-28-3	4,4'-DDT	2100		18	45 J	ND	NA	5.4	NA	ND	140 J	ND	NA
72-43-5	Methoxychlor	10000		ND	ND	ND	NA	ND	NA	ND	ND	ND	NA
5103-71-9	alpha-Chlordane	540		ND	ND	ND	NA	ND	NA	ND	ND	ND	NA
5103-74-2	gamma-Chlordane	540		ND	ND	ND	NA	ND	NA	ND	ND	ND	NA
12872-28-6	Aroclor 1248	1000		ND	ND	ND	NA	37	NA	ND	180 J	ND	NA
11097-68-1	Aroclor 1254	1000		ND	65 J	ND	NA	ND	NA	ND	ND	ND	NA

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYDEC – TAGM Memorandum (11/18/92).
NS – No standard.
MDL – Method of detection limit.

U – Indicates a compound was analyzed for, but not detected.
D – Indicates a compound was analyzed in an analysis at a secondary dilution.
J – Indicates an estimated value.
P – Indicates a pesticide/Aroclor with a 25% or greater concentration difference between two GC columns.
FEJ – Indicates unusable data.
NA – Not analyzed.
ND – Not detected.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face – Indicates the maximum concentration for all soil samples.
– Indicates a concentration above the soil cleanup objective.

TABLE
NAPANOCH PAP_{L-1} MILL SITE
Test Pit Soil Sampling Round: 04/05/93 – 04/07/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	NYSDC (2)	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED:	TP01 AS032376 SSTP-1 04/05/93 08/03/93	TP02 AS032377 SSTP-1 04/05/93 08/08/93	TP02-FE AS032377RI SSTP-1 04/05/93 08/08/93	TP03 AS032378 SSTP-1 04/05/93 08/08/93	TP03-FE AS032378RI SSTP-1 04/05/93 08/08/93	TP04 AS032379 SSTP-1 04/05/93 08/08/93	TP05 AS032380 SSTP-1 04/05/93 08/08/93	TP05S(0-2) AS032381 SSTP-1 04/05/93 08/08/93	TP05-FE AS032380RI SSTP-1 04/05/93 08/08/93
7429-80-5	TOTAL METALS											
7440-38-2	Aluminum – Total	NS		4320	7890	NA	6590	NA	9690	8210	6350	NA
7440-38-2	Arsenic – Total	7.5		8	7.7	NA	4.4	NA	4.5	3.3	2.4	NA
7440-38-3	Barium – Total	300		109	222	NA	32.5 J	NA	58	870	39 J	NA
7440-41-7	Beryllium – Total	1.0		ND	ND	NA	ND	NA	ND	ND	ND	NA
7440-43-8	Cadmium – Total	1.0		0.34 J	.51 J	NA	.22 J	NA	.06 J	.71 J	.08 J	NA
7440-70-2	Calcium – Total	NS		4890 J	8610 J	NA	10700 J	NA	575 J	8210 J	530 J	NA
7440-47-3	Chromium – Total	10		11.7	18.5	NA	7.2	NA	10	21.3	6.3	NA
7440-48-4	Cobalt – Total	NS		8.8 J	5.9 J	NA	ND	NA	6.5 J	8.1 J	ND	NA
7440-50-8	Copper – Total	3200		108	88.2	NA	7.1	NA	29.4	53.2	8.3	NA
7439-89-6	Iron – Total	NS		54800 J	31300 J	NA	12800 J	NA	17300 J	19000 J	13800 J	NA
7439-82-1	Lead – Total	100		214 J	421 J	NA	31.9 J	NA	13.6 J	662 J	8.4 J	NA
7438-85-4	Magnesium – Total	NS		1770	2410	NA	2370	NA	2130	2830	2170	NA
7439-86-5	Manganese – Total	400		535 J	632 J	NA	381 J	NA	ND	ND	331 J	NA
7439-87-6	Mercury – Total	0.1		0.41	0.82	NA	ND	NA	ND	ND	ND	NA
7440-02-0	Nickel – Total	1800		9.3	16.8	NA	10.8	NA	16.1	13.8	8.7	NA
7440-08-7	Potassium – Total	4000		511 J	854 J	NA	758 J	NA	665 J	825 J	823 J	NA
7440-22-4	Silver – Total	200		ND	ND	NA	ND	NA	ND	ND	ND	NA
7440-23-5	Sodium – Total	3000		ND	ND	NA	ND	NA	ND	ND	ND	NA
7440-62-2	Vanadium – Total	550		12.4	30.4	NA	8.4 J	NA	ND	ND	7.4 J	NA
7440-66-6	Zinc – Total	24000		302	293	NA	54.8	NA	51.5	968	118	NA
57-12-5	Cyanide – Total	1800		1.5	ND	NA	ND	NA	1.2	1.3	1.5	NA

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYSDC – TAGM Memorandum (11/18/82).
NS – No standard.
MDL – Method of detection limit.
U – Indicates a compound was analyzed for, but not detected.
D – Indicates a compound was analyzed in an analysis at a secondary dilution.
J – Indicates an estimated value.
P – Indicates a pesticide/Aroclor with a 25% or greater concentration difference between two GC columns.
FEJ – Indicates unusable data.
ND – Not detected.
NA – Not analyzed.
Bold Face – Indicates the maximum concentration for all soil samples.
– – Indicates a concentration above the proposed soil criterion.

TABLE
NAPANOCH PAPER MILL SITE
Test Pit Soil Sampling Round: 04/05/93 – 04/07/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	NYSEDEC (2)	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED:	TP06 AS032450 SSTP-1 04/08/93 06/08/93	TP07 AS032451 SSTP-1 04/09/93 08/31/93	TP08 AS032452 SSTP-1 04/08/93 09/31/93	TP09 AS032453 SSTP-1 04/07/93 06/08/93	TP10 AS032454 SSTP-1 04/07/93 08/31/93	TP10-DL AS032454DL SSTP-1 04/07/93 08/08/93	TP10-DLP AS032455 SSTP-1 04/07/93 06/08/93	TP10-DLPRE AS032455PRE SSTP-1 04/07/93 08/31/93	TP10-DUPOL AS032455DL SSTP-1 04/07/93 06/08/93
67-64-1	Asbestos	200		ND	ND	ND	ND	ND	NA	ND	NA	NA
78-83-3	2-Butanone	300		ND	ND	ND	ND	ND	NA	ND	NA	NA
71-43-2	Benzene	80		ND	ND	ND	ND	ND	NA	ND	NA	NA
108-88-3	Toluene	1500		ND	ND	ND	ND	ND	NA	ND	NA	NA
91-20-3	AsP81-1 VOLATILES	13000		ND	ND	ND	ND	ND	ND	53 J	35 J	ND
91-57-8	Naphthalene	38400		ND	ND	ND	ND	ND	ND	42 J	46 J	230 DJ
208-88-8	2-Methylphtthalene	41000		ND	ND	ND	ND	ND	ND	310 J	230 J	44 DJ
83-32-9	Acenaphthylene	50000		ND	ND	ND	ND	ND	ND	75 J	42 J	ND
132-84-8	Acenaphthene	6200		ND	ND	ND	ND	ND	ND	47 J	ND	ND
86-73-7	Dibenzofuran	50000		ND	ND	ND	ND	ND	ND	150 J	83 J	ND
85-01-8	Fluorene	50000		45 J	62 J	38 J	24 J	820 J	850 J	2100	1400	1400 D
120-12-7	Phenanthrene	50000		ND	ND	ND	ND	140 J	130 J	250 J	180 J	170 DJ
86-74-8	Anthracene	50000		ND	ND	ND	ND	83 J	86 J	180 J	130 J	130 DJ
84-74-2	Carbazole	8100		ND	ND	ND	ND	ND	ND	17 J	18 J	ND
208-44-0	Di-n-butyl phtthalate	50000		130 J	140 J	81 J	48 J	1200 J	1800 J	2400	2400	2800 D
128-00-0	Fluoranthene	50000		140 J	150 J	58 J	45 J	4700 J	2100 J	13000 J	3100 J	3000 D
85-68-7	Pyrene	50000		ND	ND	ND	ND	ND	ND	ND	ND	ND
91-84-1	Butyl benzyl phtthalate	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND
56-55-3	3,3'-Dichlorobenzidine	220 or MDL		74 J	78 J	25 J	29 J	850 J	860 J	1900 J	1200	1200 D
218-01-9	Benzoc(a)anthracene	400		83 J	84 J	35 J	31 J	1100 J	1000 J	2800 J	1500	1500 D
117-81-7	Bis(2-ethylhexyl) phtthalate	50000		180 J	630	1700	84 J	810 J	480 J	17000 J	4800 J	4500 D
117-84-0	Di-n-octyl phtthalate	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND
205-99-2	Benzoc(b)fluoranthene	1100		83 J	88 J	ND	31 J	1400 J	1200 J	3100 J	1800 J	1800 J
207-8-9	Benzoc(k)fluoranthene	1100		73 J	72 J	ND	29 J	890 J	820 D	1800 J	1200 J	1100 J
50-32-8	Benzoc(a)pyrene	81 or MDL		83 J	88 J	ND	22 J	910 J	820 J	2000 J	1200 J	1100 J
183-39-5	Indeno(1,2,3-cd)pyrene	3200		ND	ND	ND	ND	REJ	300 J	1100 J	360 J	400 J
53-70-3	Dibenzoc(a,h)anthracene	14 or MDL		ND	ND	ND	ND	REJ	42 J	180 J	83 J	88 J
191-24-2	Benzoc(ghi)perylene	50000		ND	ND	ND	ND	REJ	170 J	750 J	200 J	220 J
1024-57-3	AsP81-3--PESTICIDES/PCBS	20		ND	ND	ND	ND	ND	NA	1.8 J	NA	NA
60-57-1	Heptachlor epoxide	44		ND	ND	ND	ND	ND	NA	ND	NA	NA
72-55-9	Dieldrin	2100		ND	3.2 JP	11 J	29 J	4.8	NA	7.7 J	NA	NA
72-20-8	4,4'-DDE	100		ND	ND	ND	ND	ND	NA	13 J	NA	NA
33213-85-8	Endrin	900		ND	ND	ND	ND	1.1 J	NA	6.8 J	NA	NA
72-54-8	Endosulfan II	2800		ND	ND	ND	ND	4 J	NA	4.7 J	NA	NA
50-29-3	4,4'-DDD	2100		ND	5.8 J	7.3	.84 J	27	NA	97 J	NA	NA
72-43-5	4,4'-DDT	10000		ND	72 JP	6.1 J	1.8 J	ND	NA	ND	NA	NA
5103-71-9	Methoxychlor	540		ND	ND	ND	ND	ND	NA	ND	NA	NA
5103-74-2	alpha-Chlordane	540		ND	ND	ND	ND	ND	NA	ND	NA	NA
12872-28-8	gamma-Chlordane	1000		78 J	ND	ND	ND	ND	NA	ND	NA	NA
11087-88-1	Aroclor 1248	1000		77 J	ND	ND	ND	49	NA	ND	NA	NA
	Aroclor 1254	1000		ND	ND	ND	ND	ND	NA	ND	NA	NA

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYSEDEC – TAGM Memorandum (11/18/92).
NS – No standard.
MDL – Method of detection limit.
U – Indicates a compound was analyzed for, but not detected.
D – Indicates a compound was analyzed in an analysis at a secondary dilution.
J – Indicates an estimated value.
P – Indicates a pesticide/Aroclor with a 25% or greater concentration difference between two GC columns.
REJ – Indicates unusable data.
ND – Not detected.
NA – Not analyzed.
See Table 4.9 for complete list of laboratory qualifiers.
Table Face – Indicates the maximum concentration for all soil samples.
– Indicates a concentration above the soil cleanup objective.

TABLE
NAPANOCH PAPER MILL SITE
Test Pit Soil Sampling Round: 04/05/93 – 04/07/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	NYDEC (2)	Soil Cleanup Objective	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED:	TP08 AS032450 SSTP1 04/08/93 08/08/93	TP07 AS032451 SSTP1 04/08/93 08/31/93	TP08 AS032452 SSTP1 04/08/93 08/31/93	TP09 AS032453 SSTP1 04/08/93 08/08/93	TP10 AS032454 SSTP1 04/07/93 08/31/93	TP10-DL AS032454DL SSTP1 04/07/93 08/08/93	TP10-DUP AS032455 SSTP1 04/07/93 08/08/93	TP10-DUPFE AS032455FE SSTP1 04/07/93 08/31/93	TP10-DUPFDL AS032455DL SSTP1 04/07/93 08/08/93
7429-90-5	Aluminum – Total	NS			6190	6130	6330	8510	5750	NA	8140	NA	NA
7440-38-2	Asenic – Total	7.5			4.7	4.4	4.2	3.1	3.9	NA	4.5	NA	NA
7440-39-3	Barium – Total	300			41.9 J	39.7 J	48.8 J	43 J	37 J	NA	48.3	NA	NA
7440-41-7	Beryllium – Total	1.0			ND	ND	ND	ND	ND	NA	ND	NA	NA
7440-43-8	Cadmium – Total	1.0			.08 J	.26 J	.1 J	.12 J	.21 J	NA	.32 J	NA	NA
7440-70-2	Calcium – Total	NS			533 J	784 J	628 J	421 J	8760 J	NA	18000 J	NA	NA
7440-47-3	Chromium – Total	10			8.5	8.1	7.7	8.7	8.7	NA	9.1	NA	NA
7440-48-4	Cobalt – Total	NS			5.9 J	5.7 J	ND	ND	ND	NA	5.1 J	NA	NA
7440-50-8	Copper – Total	3200			28.5	9.8	4.8 J	5.3 J	8.8	NA	10.2	NA	NA
7439-88-8	Iron – Total	NS			18000 J	13400 J	11100 J	12100 J	12300 J	NA	14000 J	NA	NA
7439-62-1	Lead – Total	100			17.7 J	78.3 J	45.2 J	23 J	64.8 J	NA	162 J	NA	NA
7439-65-4	Magnesium – Total	NS			2040	2080	1310	1450	2320	NA	3280	NA	NA
7439-86-5	Manganese – Total	400			444 J	422 J	243 J	287 J	334 J	NA	363 J	NA	NA
7439-87-8	Mercury – Total	0.1			ND	ND	ND	ND	ND	NA	ND	NA	NA
7440-02-0	Nickel – Total	1600			11	13.1	7.7 J	ND	10.3	NA	12.8	NA	NA
7440-06-7	Potassium – Total	4000			483 J	436 J	379 J	558 J	647 J	NA	625 J	NA	NA
7440-22-4	Silver – Total	200			ND	ND	ND	ND	ND	NA	ND	NA	NA
7440-23-5	Sodium – Total	3000			ND	ND	ND	ND	ND	NA	ND	NA	NA
7440-62-2	Vanadium – Total	550			8.5 J	8.9 J	17.3	25.8	9.8 J	NA	11.9	NA	NA
7440-66-8	Zinc – Total	24000			73.8	85.7	40.5	44.5	98.4	NA	108	NA	NA
57-12-5	Cyanide – Total	1800			NA	NA	NA	NA	NA	NA	NA	NA	NA

(1) Analyzed by: RECRA Environmental, Inc.
 (2) NYDEC – TAGM Memorandum (11/18/92).
 NS – No standard.
 MDL – Method of detection limit.

U – Indicates a compound was analyzed for, but not detected.
 D – Indicates a compound was analyzed in an analysis at a secondary dilution.
 J – Indicates an estimated value.
 P – Indicates a pesticide/atoclor with a 25% or greater concentration difference between two GC columns.
 FEJ – Indicates unuseable data.
 ND – Not detected.
 NA – Not analyzed.

Bold Face – Indicates the maximum concentration for all soil samples.
MDL – Indicates a concentration above the proposed soil criterion.

TABLE
NAPANOCH PAPERMILL SITE
Test Pit Soil Sampling Round: 04/05/93 – 04/07/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	NYSDC (2) Soil Cleanup Objective	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED:	TP10-DUF/DRE AS032453V SSTP1 04/07/93 06/08/93	TP11 AS032456 SSTP1 04/07/93 06/08/93	TP11-DL AS032450DL SSTP1 04/07/93 06/08/93	TP11-RE AS032456RI SSTP1 04/07/93 06/08/93	TP12 AS032457 SSTP1 04/07/93 06/08/93	TP12-DL AS032457DL SSTP1 04/07/93 06/08/93	TP12-RE AS032457RI SSTP1 04/07/93 06/08/93	TP13 AS032458 SSTP1 04/07/93 06/08/93	TP13-RE AS032458RI SSTP1 04/07/93 06/08/93
87-84-1	Acetone	200		NA	ND	NA	NA	ND	NA	NA	41 J	NA
78-83-3	2-Butanone	300		NA	ND	NA	NA	ND	NA	NA	11 J	NA
71-43-2	Benzene	80		NA	27	NA	NA	ND	NA	NA	ND	NA
108-88-3	Toluene	1500		NA	ND	NA	NA	ND	NA	NA	ND	NA
91-20-3	ASP91-1 VOLATILES											
91-57-8	Naphthalene	13000		ND	41 J	ND	31 J	57 J	52 DJ	56 J	ND	ND
208-98-8	2-Methylthiophthalene	36400		ND	38 J	ND	30 J	56 J	ND	82 J	ND	ND
83-32-9	Acenaphthylene	41000		220 DJ	510	440 DJ	370	370	410 DJ	380	47 J	47 J
132-84-9	Acenaphthene	50000		38 DJ	33 J	28 DJ	28 J	51 J	47 DJ	53 J	ND	ND
88-73-7	Dibenzofuran	6200		ND	38 J	ND	28 J	43 J	ND	110 J	ND	ND
85-01-8	Fluorene	50000		ND	130 J	80 DJ	100 J	110 J	ND	110 J	ND	ND
120-12-7	Phenanthrene	50000		1300 D	630	580 DJ	550	1600	1500 D	1600	230 J	230 J
88-74-8	Anthracene	50000		170 DJ	200 J	180 DJ	140 J	240 J	250 DJ	33 J	34 J	34 J
84-74-2	Carbazole	NS		130 DJ	34 J	36 DJ	30 J	150 J	180 DJ	170 J	22 J	28 J
208-44-0	Di-n-butyl phthalate	8100		ND	ND	1100 D	780	16 J	ND	ND	19 J	19 J
128-00-0	Fluoranthene	50000		2500 D	880	ND	4000 J	11000 J	2800 D	2100	300 J	360 J
85-68-7	Pyrene	50000		3200 D	8100 J	3200 J	ND	ND	5000 J	7800 J	1800 J	1300 J
91-84-1	Butyl benzyl phthalate	50000		ND	REJ	ND	ND	ND	ND	ND	ND	ND
56-55-3	3,3'-Dichlorobenzidine	NS		ND	REJ	ND	ND	ND	ND	ND	ND	ND
218-01-9	Benzol(e)anthracene	220 or MDL		1300 D	1800 J	1100 J	1100 J	1700 J	1500 J	1500 J	270 J	280 J
117-81-7	Chrysene	400		1500 D	1700 J	1200 J	1100 J	2200 J	2000 J	2000 J	340 J	330 J
117-84-0	Bis(2-ethylhexyl) phthalate	50000		4800 D	1600 J	600 J	730 J	6700 J	3600 J	4600 J	4100 J	2300 J
205-99-2	Di-n-octyl phthalate	NS		ND	REJ	ND	REJ	REJ	ND	REJ	REJ	REJ
207-8-9	Benzol(b)fluoranthene	1100		1800 J	2400 J	1800 J	1500 J	2800 J	2800 J	2800 J	710 J	530 J
50-32-8	Benzol(k)pyrene	81 or MDL		1100 J	1900 J	1200 J	870 J	2200 J	2200 J	1400 J	280 J	370 J
183-38-5	Indeno(1,2,3-cd)pyrene	3200		1100 J	2100 J	1300 J	1200 J	2100 J	1500 J	1800 J	REJ	REJ
53-70-3	Dibenzol(a,h)anthracene	14 or MDL		410 J	1000 J	500 J	550 J	1300 J	560 J	880 J	REJ	REJ
191-24-2	Benzol(g)perylene	50000		100 J	REJ	ND	230 J	REJ	ND	220 J	REJ	REJ
1024-57-3	ASP91-3-PESTICIDES/PCBS			210 J	710 J	250 J	380 J	800 J	340 J	530 J	REJ	REJ
80-57-1	Heptachlor epoxide	20		NA	ND	NA	NA	ND	NA	NA	ND	NA
72-55-9	Dieldrin	44		NA	ND	NA	NA	ND	NA	NA	ND	NA
72-20-8	4,4'-DDE	2100		NA	6.6 J	NA	NA	11 J	NA	NA	18	NA
33213-65-9	Endrin	100		NA	ND	NA	NA	NA	NA	NA	1.4 JP	NA
72-54-8	Endosulfan II	800		NA	4 J	NA	NA	3.1 J	NA	NA	24	NA
50-28-3	4,4'-DDD	2600		NA	4.7 J	NA	NA	11 J	NA	NA	8.7	NA
72-43-5	4,4'-DDT	2100		NA	17 J	NA	NA	ND	NA	NA	ND	NA
5103-71-9	Methoxychlor	10000		NA	ND	NA	NA	4.8 J	NA	NA	ND	NA
5103-74-2	alpha-Chlordane	540		NA	6.7 J	NA	NA	1.4 J	NA	NA	ND	NA
12872-28-6	gamma-Chlordane	540		NA	1000 J	NA	NA	ND	NA	NA	240	NA
11087-68-1	Aroclor 1248	1000		NA	ND	NA	NA	ND	NA	NA	ND	NA
11087-68-1	Aroclor 1254	1000		NA	ND	NA	NA	ND	NA	NA	ND	NA

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYSDC – TAGM Memorandum (11/16/82).
NS – No standard.
MDL – Method of detection limit.
U – Indicates a compound was analyzed for, but not detected.
D – Indicates a compound was analyzed in an analysis at a secondary dilution.
J – Indicates an estimated value.
P – Indicates a pesticide/Aroclor with a 25% or greater concentration difference between two GC columns.
REJ – Indicates unusable data.
ND – Not detected.
NA – Not analyzed.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face – Indicates the maximum concentration for all soil samples.
– – Indicates a concentration above the soil cleanup objective.

TABLE
NAPANOCH PAPUWA MILL SITE
Test Pit Soil Sampling Round: 04/05/93 – 04/07/93
Detected Compound Summary

CAS NO.	PARAMETER (1)	(mg/kg)	NYSDEC #	Soil Cleanup Objective	SAMPLE ID: LAB SAMPLE: SDG: SAMPLED: VALIDATED:	TP10-DUPDLRE AS03245SV SSTP-1 04/07/93 06/08/93	TP11 AS032456 SSTP-1 04/07/93 06/08/93	TP11-DL AS03245DL SSTP-1 04/07/93 06/08/93	TP11-RE AS03245RI SSTP-1 04/07/93 06/08/93	TP12 AS032457 SSTP-1 04/07/93 06/08/93	TP12-DL AS03245DL SSTP-1 04/07/93 06/08/93	TP12-RE AS03245RI SSTP-1 04/07/93 06/08/93	TP13 AS032458 SSTP-1 04/07/93 06/08/93	TP13-RE AS03245RI SSTP-1 04/07/93 06/08/93
7428-90-5	Aluminum – Total		NS			NA	5820	NA	NA	6040	NA	NA	7830	NA
7440-38-2	Arsenic – Total		7.5			NA	2.2	NA	NA	12.9	NA	NA	4	NA
7440-38-3	Barium – Total		300			NA	50.8	NA	NA	62.3	NA	NA	77.1	NA
7440-41-7	Beryllium – Total		1.0			NA	ND	NA	NA	ND	NA	NA	ND	NA
7440-43-8	Cadmium – Total		1.0			NA	4 J	NA	NA	44 J	NA	NA	37 J	NA
7440-70-2	Calcium – Total		NS			NA	2110 J	NA	NA	10200 J	NA	NA	2320 J	NA
7440-47-3	Chromium – Total		10			NA	19.7	NA	NA	10.8	NA	NA	11.1	NA
7440-48-4	Cobalt – Total		NS			NA	4.9 J	NA	NA	ND	NA	NA	ND	NA
7440-50-8	Copper – Total		3200			NA	18.3	NA	NA	18.2	NA	NA	15.2	NA
7438-99-8	Iron – Total		NS			NA	12900 J	NA	NA	14700 J	NA	NA	11800 J	NA
7438-92-1	Lead – Total		100			NA	104 J	NA	NA	102 J	NA	NA	55.8 J	NA
7438-95-4	Magnesium – Total		NS			NA	1890	NA	NA	2500	NA	NA	1760	NA
7438-98-5	Manganese – Total		400			NA	354 J	NA	NA	515 J	NA	NA	157 J	NA
7438-97-8	Mercury – Total		0.1			NA	ND	NA	NA	ND	NA	NA	0.64	NA
7440-02-0	Nickel – Total		1600			NA	12.9	NA	NA	18.8	NA	NA	10 J	NA
7440-09-7	Potassium – Total		4000			NA	498 J	NA	NA	498 J	NA	NA	483 J	NA
7440-22-4	Silver – Total		200			NA	2.8 J	NA	NA	ND	NA	NA	ND	NA
7440-23-5	Sodium – Total		3000			NA	ND	NA	NA	ND	NA	NA	234 J	NA
7440-82-2	Vanadium – Total		550			NA	10.9	NA	NA	22.3	NA	NA	25.2	NA
7440-88-6	Zinc – Total		24000			NA	210	NA	NA	133	NA	NA	123	NA
57-12-5	Cyanide – Total		1600			NA	NA	NA	NA	NA	NA	NA	NA	NA

(1) Analyzed by: RECRA Environmental, Inc.
(2) NYSDEC – TAGM Memorandum (11/18/92).
NS – No standard.
MDL – Method of detection limit.

U – Indicates a compound was analyzed for, but not detected.
D – Indicates a compound was analyzed in an analysis at a secondary dilution.
J – Indicates an estimated value.
P – Indicates a pesticide/Aroclor with a 25% or greater concentration difference between two GC columns.
FEJ – Indicates unuseable data.
ND – Not detected.
NA – Not analyzed.

Bold Face – Indicates the maximum concentration for all soil samples.
– Indicates a concentration above the proposed soil criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/28/82 - 01/8/93
Detected Compound Summary

RONDOUT CREEK												
Cas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	SED-01 AS023876 SED2 12/28/92 03/11/93	SED-01RE AS023876R1 SED2 12/28/92 03/11/93	SED-02 AS023838 SED2 12/28/92 03/11/93	SED-02 DUP AS023848 SED2 12/28/92 03/11/93	SED-03 AS023839 SED2 12/28/92 03/11/93	SED-04 AS023840 SED2 12/28/92 03/11/93	SED-05 AS023841 SED2 12/28/92 03/11/93	SED-06 AS023842 SED2 12/28/92 03/11/93	SED-07 AS023843 SED2 12/28/92 03/11/93
67-84-1	ASP91-1-VOLATILES (ug/kg)											
78-83-3	Acetone	NS		ND	NA	ND	ND	NA	NA	NA	NA	ND
108-90-7	2-Butanone	NS		ND	NA	ND	ND	NA	NA	NA	NA	ND
75-09-2	Chlorobenzene	4.4		ND	NA	ND	ND	NA	NA	NA	NA	ND
108-88-3	Methylene chloride	NS		ND	NA	ND	ND	NA	NA	NA	NA	ND
1330-20-7	Toluene	NS		ND	NA	ND	ND	NA	NA	NA	NA	ND
	Total Xylenes	NS		ND	NA	ND	ND	NA	NA	NA	NA	ND
83-32-9	ASP91-2-SEMIVOLATILES (ug/kg)											
208-98-6	Acenaphthene	820		ND	ND	ND	ND	NA	NA	NA	NA	ND
120-12-7	Acenaphthylene	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
58-55-3	Anthracene	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
50-32-8	Benzo(a)anthracene	130		180 J	180 J	18 J	63 J	NA	NA	NA	NA	43 J
205-99-2	Benzo(a)pyrene	41		ND	ND	18 J	41 J	NA	NA	NA	NA	ND
191-24-2	Benzo(b)fluoranthene	150		220 J	230 J	26 J	52 J	NA	NA	NA	NA	40 J
207-08-9	Benzo(g,h,i)perylene	NS		ND	ND	ND	11 J	NA	NA	NA	NA	ND
117-81-7	Benzo(k)fluoranthene	80		95 J	92 J	9 J	22 J	NA	NA	NA	NA	16 J
85-68-7	Bis(2-ethylhexyl) phthalate	4100		7300	8000	98 J	81 J	NA	NA	NA	NA	63 J
68-74-6	Butyl benzyl phthalate	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
218-01-9	Carbazole	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
84-74-2	Chrysene	78		ND	ND	27 J	78 J	NA	NA	NA	NA	46 J
95-50-1	Di-n-butyl phthalate	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
84-68-2	1,2-Dichlorobenzene	15		ND	ND	ND	ND	NA	NA	NA	NA	ND
208-44-0	Diethyl phthalate	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
86-73-7	Fluoranthene	NS		300 J	ND	ND	110 J	NA	NA	NA	NA	60 J
193-39-5	Fluorene	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
91-57-6	Indeno(1,2,3-cd)pyrene	16		ND	ND	7 J	16 J	NA	NA	NA	NA	ND
91-20-3	2-Methylnaphthalene	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
85-01-8	Naphthalene	NS		ND	ND	ND	ND	NA	NA	NA	NA	ND
129-00-0	Phenanthrene	180		ND	ND	ND	80 J	NA	NA	NA	NA	68 J
	Pyrene	NS		ND	ND	ND	120 J	NA	NA	NA	NA	69 J
319-84-6	ASP91-3-PESTICIDES/PCBS (ug/kg)											
319-86-8	alpha-BHC	NS		ND	NA	ND	ND	ND	ND	ND	ND	ND
72-54-6	delta-BHC	NS		ND	NA	ND	ND	ND	ND	ND	ND	ND
72-55-9	4,4'-DDD	3.1		ND	NA	ND	ND	ND	3.1 J	ND	4 J	ND
50-29-3	4,4'-DDE	4.7		5.5 J	NA	ND	ND	5 J	3.5 J	ND	9.4 J	82 J
959-98-8	4,4'-DDT	2.8		5.3 J	NA	ND	1.2 J	1.8 J	2.9 J	ND	7 J	1.1 J
72-20-8	Endosulfan I	0.04		ND	NA	ND	ND	ND	ND	ND	4.3 J	ND
72-43-5	Endrin	1.7		ND	NA	ND	ND	ND	1.7 J	ND	18 J	ND
53469-21-9	Methoxychlor	12		ND	NA	ND	ND	ND	12 J	ND	ND	ND
12672-29-6	Aroclor 1242	1000		ND	NA	ND	ND	ND	ND	ND	ND	ND
11087-89-1	Aroclor 1248	1000		ND	NA	ND	ND	ND	ND	ND	ND	ND
	Aroclor 1254	1000		ND	NA	ND	ND	ND	ND	ND	ND	ND

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
- Indicates a concentration above the proposed sediment criterion

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/28/92 - 01/9/93
Detected Compound Summary

RONDOUT CREEK													
Cas No.	Parameter	Proposed Sediment Criterion	Sample Id:		SED-01	SED-01RE	SED-02	SED-02 DUP	SED-03	SED-04	SED-05	SED-06	SED-07
			Lab	Sdg:	AS023876	AS023876RI	AS023838	AS023848	AS023839	AS023840	AS023841	AS023842	AS023843
			Sediment		SED2	SED2	SED2	SED2	SED2	SED2	SED2	SED2	SED2
			Sampled:	Validated:	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92	12/28/92
				03/11/93	03/11/93	03/11/93	03/11/93	03/11/93	03/11/93	03/11/93	03/11/93	03/11/93	
7429-90-5	TOTAL METALS (mg/kg)												
7440-38-2	Aluminum - Total	NS		1980	NA	3750	4620	NA	NA	NA	NA	NA	4840
7440-38-2	Arsenic - Total	5		3.9J	NA	1.3 J	.95 J	NA	NA	NA	NA	NA	ND
7440-39-3	Barium - Total	NS		67.1	NA	32.5 J	48.2	NA	NA	NA	NA	NA	42.2 J
7440-70-2	Calcium - Total	NS		2020	NA	ND	ND	NA	NA	NA	NA	NA	798 J
7440-47-3	Chromium - Total	28		ND	NA	4.8	3.9	NA	NA	NA	NA	NA	5.1
7440-48-4	Cobalt - Total	NS		ND	NA	ND	ND	NA	NA	NA	NA	NA	6 J
7440-50-8	Copper - Total	19		14.5	NA	5.2 J	8.2	NA	NA	NA	NA	NA	5.8 J
7439-89-8	Iron - Total	24000		4920	NA	8900	9930	NA	NA	NA	NA	NA	9900
7439-92-1	Lead - Total	30		27.8J	NA	32.7	11.8 J	NA	NA	NA	NA	NA	13.4
7439-95-4	Magnesium - Total	NS		598J	NA	1480	1980	NA	NA	NA	NA	NA	1920
7439-96-5	Manganese - Total	820		612	NA	624	1010	NA	NA	NA	NA	NA	251
7439-97-8	Mercury - Total	0.11		ND	NA	ND	ND	NA	NA	NA	NA	NA	ND
7440-02-0	Nickel - Total	22		9.6J	NA	13.6	17.6	NA	NA	NA	NA	NA	12
7440-09-7	Potassium - Total	NS		203J	NA	431 J	409 J	NA	NA	NA	NA	NA	360 J
7440-62-2	Vanadium - Total	NS		ND	NA	5.1 J	ND	NA	NA	NA	NA	NA	7.1 J
7440-68-6	Zinc - Total	85		48.5	NA	40.9	51.1	NA	NA	NA	NA	NA	51.3
57-12-5	Cyanide - Total	NS		ND	NA	ND	ND	NA	NA	NA	NA	NA	ND

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
- Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/29/92 - 01/6/93
Detected Compound Summary

RONDOUT CREEK												
Cas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	SED-08	SED-09	SED-10	SED-10RE	SED-11	SED-12	SED-13	SED-14	SED-15
				AS023844 SED2 12/28/92 03/11/93	AS023845 SED2 12/28/92 03/11/93	AS023848 SED2 12/28/92 03/11/93	AS023848RI SED2 12/28/92 03/11/93	AS023847 SED2 12/28/92 03/11/93	AS023877 SED2 12/29/92 03/11/93	AS023878 SED2 12/29/92 03/11/93	AS023879 SED2 12/29/92 03/11/93	AS023880 SED2 12/29/92 03/11/93
87-64-1	Acetone	NS		NA	NA	ND	NA	NA	ND	NA	NA	NA
78-83-3	2-Butanone	NS		NA	NA	ND	NA	NA	ND	NA	NA	NA
108-90-7	Chlorobenzene	4.4		NA	NA	ND	NA	NA	ND	NA	NA	NA
75-09-2	Methylene chloride	NS		NA	NA	ND	NA	NA	ND	NA	NA	NA
108-88-3	Toluene	NS		NA	NA	ND	NA	NA	ND	NA	NA	NA
1330-20-7	Total Xylenes	NS		NA	NA	ND	NA	NA	ND	NA	NA	NA
83-32-9	ASP91-1-VOLATILES (ug/kg)											
208-96-8	Acenaphthene	920		NA	NA	ND	ND	NA	ND	NA	NA	NA
120-12-7	Acenaphthylene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
58-55-3	Anthracene	130		NA	NA	ND	ND	NA	ND	NA	NA	NA
50-32-8	Benzo(a)anthracene	41		NA	NA	ND	ND	NA	ND	NA	NA	NA
205-99-2	Benzo(a)pyrene	150		NA	NA	ND	ND	NA	ND	NA	NA	NA
191-24-2	Benzo(b)fluoranthene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
207-08-9	Benzo(g,h,i)perylene	60		NA	NA	ND	ND	NA	ND	NA	NA	NA
117-81-7	Benzo(k)fluoranthene	4100		NA	NA	140 J	150 J	NA	140 J	NA	NA	NA
85-68-7	Bis(2-ethylhexyl) phthalate	NS		NA	NA	ND	ND	NA	16000	NA	NA	NA
88-74-8	Butyl benzyl phthalate	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
218-01-9	Carbazole	78		NA	NA	77 J	74 J	NA	376 J	NA	NA	NA
84-74-2	Chrysene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
95-50-1	Di-n-butyl phthalate	15		NA	NA	ND	ND	NA	ND	NA	NA	NA
84-66-2	1,2-Dichlorobenzene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
208-44-0	Diethyl phthalate	NS		NA	NA	ND	ND	NA	530 J	NA	NA	NA
88-73-7	Fluoranthene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
193-39-5	Fluorene	18		NA	NA	ND	ND	NA	ND	NA	NA	NA
91-57-6	Indeno(1,2,3-cd)pyrene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
91-20-3	2-Methylnaphthalene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
85-01-8	Naphthalene	180		NA	NA	ND	10 J	NA	ND	NA	NA	NA
129-00-0	Phenanthrene	NS		NA	NA	12 J	12 J	NA	850 J	NA	NA	NA
319-84-8	Pyrene	NS		NA	NA	ND	ND	NA	ND	NA	NA	NA
319-88-8	ASP91-3-3-PESTICIDES(PCBS (ug/kg)											
72-54-8	alpha-BHC	NS		ND	ND	ND	NA	NA	57	ND	ND	ND
72-55-9	delta-BHC	3.1		.79 J	ND	.67 J	NA	NA	ND	ND	ND	ND
50-28-3	4,4'-DDD	4.7		1.6 J	ND	ND	NA	NA	ND	ND	ND	ND
959-98-8	4,4'-DDE	2.8		1.5 J	1.4 J	ND	NA	NA	ND	ND	ND	ND
72-20-8	4,4'-DDT	0.04		ND	ND	ND	NA	NA	ND	ND	ND	ND
72-43-5	Endosulfan I	1.7		ND	ND	ND	NA	NA	ND	ND	ND	ND
53469-21-9	Endrin	12		.83 J	ND	2.9 J	NA	NA	ND	ND	ND	ND
12672-28-8	Methoxychlor	1000		ND	ND	ND	NA	NA	ND	ND	ND	ND
1097-69-1	Aroclor 1242	1000		ND	ND	28 J	NA	NA	180 J	ND	ND	ND
	Aroclor 1248	1000		ND	ND	ND	NA	NA	180 J	80	30 J	470
	Aroclor 1254	1000		ND	ND	ND	NA	NA	180 J	80	30 J	190 JP

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
- Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/29/92 - 01/8/93
Detected Compound Summary

Cas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	RONDOUT CREEK											
				SED -08 AS023844 SED2 12/28/92 03/11/93	SED -09 AS023845 SED2 12/28/92 03/11/93	SED -10 AS023848 SED2 12/28/92 03/11/93	SED -10RE AS023848RI SED2 12/28/92 03/11/93	SED -11 AS023847 SED2 12/28/92 03/11/93	SED -12 AS023877 SED2 12/29/92 03/11/93	SED -13 AS023878 SED2 12/29/92 03/11/93	SED -14 AS023879 SED2 12/29/92 03/11/93	SED -15 AS023880 SED2 12/29/92 03/11/93			
7429-90-5	TOTAL METALS (mg/kg)														
7440-36-2	Aluminum - Total	NS		NA	NA	8250	NA	8830	10800			NA	NA	NA	NA
7440-36-2	Arsenic - Total	5		NA	NA	3 J	NA	2.1 J	10.5 J			NA	NA	NA	NA
7440-39-3	Barium - Total	NS		NA	NA	39.8 J	NA	78.8	276 J			NA	NA	NA	NA
7440-70-2	Calcium - Total	NS		NA	NA	730 J	NA	541 J	8560 J			NA	NA	NA	NA
7440-47-3	Chromium - Total	28		NA	NA	7	NA	10.1	ND			NA	NA	NA	NA
7440-48-4	Cobalt - Total	NS		NA	NA	5.2 J	NA	8.9 J	ND			NA	NA	NA	NA
7440-50-8	Copper - Total	18		NA	NA	25	NA	42.3	70.9			NA	NA	NA	NA
7439-89-8	Iron - Total	24000		NA	NA	14700	NA	21800	27200			NA	NA	NA	NA
7439-92-1	Lead - Total	30		NA	NA	35.2 J	NA	28.8	175 J			NA	NA	NA	NA
7439-95-4	Magnesium - Total	NS		NA	NA	2080	NA	2400	3300 J			NA	NA	NA	NA
7439-96-5	Manganese - Total	820		NA	NA	240	NA	695	4960			NA	NA	NA	NA
7439-97-8	Mercury - Total	0.11		NA	NA	ND	NA	66	ND			NA	NA	NA	NA
7440-02-0	Nickel - Total	22		NA	NA	16.7	NA	22.9	63.3			NA	NA	NA	NA
7440-09-7	Potassium - Total	NS		NA	NA	368 J	NA	475 J	3760 J			NA	NA	NA	NA
7440-62-2	Vanadium - Total	NS		NA	NA	14.4	NA	14.1	ND			NA	NA	NA	NA
7440-66-6	Zinc - Total	85		NA	NA	82.1	NA	71.5	289			NA	NA	NA	NA
57-12-5	Cyanide - Total	NS		NA	NA	ND	NA	NA	ND			NA	NA	NA	NA

J - Indicates an estimated value.
 NA - Not analyzed.
 ND - Not detected at laboratory's method of detection limit.
 NS - No standard.
 see Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
 - Indicates a concentration above the proposed sediment criterion.

TABLE 4.5 NAPANOCH PAPER MILL SITE

Sediment Data for Rounds: 12/29/92 - 01/6/93
Detected Compound Summary

RONDOUT CREEK										
Case No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Validated:	SED - 16	SED - 17	SED - 17DL	SED - 18	SED - 19	SED - 20	SED - 20DL
				AS023881 SED2 12/29/92 03/11/93	AS023882 SED2 12/29/92 03/11/93	AS023882DL SED2 12/29/92 03/11/93	AS023883 SED2 12/29/92 03/11/93	AS023884 SED2 12/29/92 03/11/93	AS023885 SED2 12/29/92 03/11/93	AS023885DL SED2 12/29/92 03/11/93
67-64-1	ASP91-1 - VOLATILES (ug/kg)	NS		NA	ND	NA	NA	NA	ND	NA
78-63-3	Acetone	NS		NA	ND	NA	NA	NA	ND	NA
108-90-7	2-Butanone	NS		NA	ND	NA	NA	NA	ND	NA
75-08-2	Chlorobenzene	4.4		NA	7 J	NA	NA	NA	1 J	NA
108-88-3	Methylene chloride	NS		NA	ND	NA	NA	NA	1 J	NA
1330-20-7	Toluene	NS		NA	ND	NA	NA	NA	ND	NA
	Total Xylenes	NS		NA	ND	NA	NA	NA	ND	NA
83-32-9	ASP91-2 - SEMIVOLATILES (ug/kg)	920		NA	ND	ND	NA	NA	ND	ND
208-98-6	Acenaphthene	NS		NA	ND	ND	NA	NA	ND	ND
120-12-7	Acenaphthylene	NS		NA	ND	ND	NA	NA	ND	ND
58-55-3	Anthracene	130		NA	ND	ND	NA	NA	130 J	ND
50-32-6	Benzo(a)anthracene	41		NA	ND	ND	NA	NA	100 J	ND
205-99-2	Benzo(a)pyrene	150		NA	ND	ND	NA	NA	150 J	130 DJ
191-24-2	Benzo(b)fluoranthene	NS		NA	ND	ND	NA	NA	ND	ND
207-08-9	Benzo(k)fluoranthene	60		NA	ND	ND	NA	NA	69 J	55 DJ
117-81-7	Bis(2-ethylhexyl) phthalate	4100		NA	9500 J	9500 D	NA	NA	7900 J	9700 D
85-68-7	Butyl benzyl phthalate	NS		NA	ND	ND	NA	NA	ND	ND
68-74-8	Carbazole	NS		NA	ND	ND	NA	NA	ND	ND
218-01-9	Chrysene	78		NA	ND	ND	NA	NA	140 J	ND
84-74-2	Di-n-butyl phthalate	NS		NA	ND	ND	NA	NA	ND	ND
95-50-1	1,2-Dichlorobenzene	15		NA	ND	ND	NA	NA	ND	ND
84-68-2	Diethyl phthalate	NS		NA	ND	ND	NA	NA	230 J	ND
206-44-0	Fluoranthene	NS		NA	ND	ND	NA	NA	ND	ND
86-73-7	Fluorene	NS		NA	ND	ND	NA	NA	ND	ND
193-39-5	Indeno(1,2,3-cd)pyrene	16		NA	ND	ND	NA	NA	ND	ND
91-57-6	2-Methylnaphthalene	NS		NA	ND	ND	NA	NA	ND	ND
91-20-3	Naphthalene	NS		NA	ND	ND	NA	NA	120 J	120 DJ
85-01-8	Phenanthrene	180		NA	ND	ND	NA	NA	250 J	ND
128-00-0	Pyrene	NS		NA	ND	ND	NA	NA	ND	ND
	ASP91-3 - PESTICIDES/PCBS (ug/kg)			ND	ND	NA	ND	ND	ND	NA
319-84-6	alpha-BHC	NS		ND	ND	NA	ND	ND	98 J	NA
319-86-6	delta-BHC	NS		ND	ND	NA	ND	ND	18	NA
72-54-8	4,4'-DDD	3.1		13	ND	NA	ND	2.8 J	ND	NA
72-55-9	4,4'-DDE	4.7		ND	ND	NA	ND	4 J	ND	NA
50-28-3	4,4'-DDT	2.8		ND	56 J	NA	ND	ND	ND	NA
959-98-8	Endosulfan I	0.04		ND	ND	NA	ND	ND	ND	NA
72-20-8	Endrin	1.7		12 J	ND	NA	ND	ND	ND	NA
72-43-5	Methoxychlor	12		ND	ND	NA	ND	ND	5.1 J	NA
53469-21-9	Aroclor 1242	1000		ND	ND	NA	ND	ND	ND	NA
12672-29-8	Aroclor 1248	1000		65 J	ND	NA	ND	ND	49 J	NA
11067-69-1	Aroclor 1254	1000		ND	ND	NA	11 J	ND	ND	NA

J - Indicates an estimated value.
 NA - Not analyzed.
 ID - Not detected at laboratory's method of detection limit.
 IS - No standard.
 ee Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
 - Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/28/92 - 01/6/93
Detected Compound Summary

RONDOUT CREEK												
Gas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	SED - 18	SED - 17	SED - 17DL	SED - 18	SED - 19	SED - 20	SED - 20DL		
				AS023881 SED2 12/29/82 03/11/83	AS023882 SED2 12/29/82 03/11/83	AS023882DL SED2 12/29/82 03/11/83	AS023883 SED2 12/29/82 03/11/83	AS023884 SED2 12/29/82 03/11/83	AS023885 SED2 12/29/82 03/11/83	AS023885DL SED2 12/29/82 03/11/83		
7428-90-5	Aluminum - Total	NS		NA	8950	NA	NA	NA	8430	NA		
7440-38-2	Arsenic - Total	5		NA	3.3 J	NA	NA	NA	5.8 J	NA		
7440-39-3	Barium - Total	NS		NA	55.8	NA	NA	NA	77.4	NA		
7440-70-2	Calcium - Total	NS		NA	1980	NA	NA	NA	1180 J	NA		
7440-47-3	Chromium - Total	28		NA	9.4	NA	NA	NA	15.1	NA		
7440-48-4	Cobalt - Total	NS		NA	7.2 J	NA	NA	NA	ND	NA		
7440-50-8	Copper - Total	19		NA	6.8	NA	NA	NA	19	NA		
7438-88-8	Iron - Total	24000		NA	18200	NA	NA	NA	13800	NA		
7438-92-1	Lead - Total	30		NA	8.4 J	NA	NA	NA	45.5	NA		
7438-95-4	Magnesium - Total	NS		NA	2730	NA	NA	NA	2320	NA		
7438-98-5	Manganese - Total	820		NA	324	NA	NA	NA	588	NA		
7438-97-8	Mercury - Total	0.11		NA	ND	NA	NA	NA	ND	NA		
7440-02-0	Nickel - Total	22		NA	14.7	NA	NA	NA	15.6	NA		
7440-08-7	Potassium - Total	NS		NA	703 J	NA	NA	NA	611 J	NA		
7440-82-2	Vanadium - Total	NS		NA	8.6 J	NA	NA	NA	8.9 J	NA		
7440-88-8	Zinc - Total	85		NA	62.3	NA	NA	NA	91.9	NA		
77-12-5	Cyanide - Total	NS		NA	ND	NA	NA	NA	ND	NA		

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ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
Boxed - Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/28/92 - 01/8/93
Detected Compound Summary

Case No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	POND AREA									
				SED-A1#26 AS024058 SEDA1 01/05/93 03/10/93	SED-1A#28RE AS024058RI SEDA1 01/05/93 03/10/93	SED-A5#29 AS024114 SEDA1 01/08/93 03/10/93	SED-A5#28DL AS024114DL SEDA1 01/08/93 03/10/93	SED-A5#28RE AS024114RI SEDA1 01/08/93 03/10/93	SED-B1#25 AS024057 SEDA1 01/05/93 03/10/93	SED-B1#25DL AS024057DL SEDA1 01/05/93 03/10/93	SED-B1#25RE AS024057RI SEDA1 01/05/93 03/10/93	SED-C1#24 AS024058 SEDA1 01/05/93 03/10/93	
87-84-1	ASP91-1-VOLATILES (ug/kg)	NS		NA	NA	NA	NA	NA	NA	ND	NA	ND	
78-83-3	Acetone	NS		NA	NA	NA	NA	NA	NA	ND	NA	ND	
108-90-7	2-Butanone	4.4		NA	NA	NA	NA	NA	NA	ND	NA	2 J	
75-09-2	Chlorobenzene	NS		NA	NA	NA	NA	NA	NA	ND	NA	ND	
108-88-3	Methylene chloride	NS		NA	NA	NA	NA	NA	NA	2 J	NA	ND	
1330-20-7	Toluene	NS		NA	NA	NA	NA	NA	NA	ND	NA	ND	
83-32-9	Total Xylenes	NS		ND	ND	ND	NA	ND	ND	ND	NA	ND	
208-98-8	ASP91-2-SEMI-VOLATILES (ug/kg)	920		ND	ND	ND	NA	ND	34 J	ND	ND	ND	
120-12-7	Acenaphthene	NS		ND	ND	ND	NA	ND	ND	ND	ND	ND	
56-55-3	Acenaphthylene	NS		180 J	ND	72 J	NA	77 J	170 J	ND	ND	ND	
50-32-8	Anthracene	130		R	R	ND	NA	ND	R	ND	ND	R	
205-99-2	Benzo(a)anthracene	41		R	R	170 J	NA	150 J	R	ND	ND	R	
191-24-2	Benzo(a)pyrene	150		R	R	ND	NA	ND	R	ND	ND	R	
207-08-9	Benzo(b)fluoranthene	NS		R	R	ND	NA	ND	R	ND	ND	R	
117-81-7	Benzo(ghi)perylene	80		R	R	1400	NA	1200	1400 J	NA	1400 J	ND	
85-68-7	Bis(2-ethylhexyl) phthalate	4100		ND	ND	250 J	NA	250 J	380 J	NA	380 J	ND	
88-74-8	Butyl benzyl phthalate	NS		ND	35 J	6 J	NA	7 J	13 J	NA	22 J	ND	
218-01-9	Carbazole	78		320 J	340 J	88 J	NA	95 J	280 J	NA	400 J	ND	
84-74-2	Chrysene	NS		ND	ND	43 J	NA	47 J	730	NA	680	750	
95-50-1	Di-n-butyl phthalate	15		ND	ND	ND	NA	ND	ND	NA	ND	ND	
84-66-2	1,2-Dichlorobenzene	NS		23 J	ND	ND	NA	15 J	25 J	NA	ND	ND	
208-44-0	Diethyl phthalate	NS		280 J	300 J	120 J	NA	120 J	310 J	NA	410 J	ND	
88-73-7	Fluoranthene	NS		43 J	ND	ND	NA	ND	ND	NA	ND	ND	
193-39-5	Fluorene	NS		R	R	ND	NA	ND	R	NA	ND	R	
91-57-6	Indeno(1,2,3-cd)pyrene	16		ND	ND	ND	NA	ND	33 J	NA	ND	ND	
91-20-3	2-Methylnaphthalene	NS		150 J	130 J	ND	NA	ND	47 J	NA	ND	83 J	
85-01-8	Naphthalene	180		200 J	170 J	76 J	NA	78 J	180 J	NA	190 J	ND	
129-00-0	Phenanthrene	NS		ND	ND	ND	NA	ND	ND	NA	ND	ND	
319-84-6	Pyrene	NS		ND	ND	ND	NA	ND	ND	NA	ND	ND	
319-86-8	ASP91-3-PESTICIDES/PCBS (ug/kg)	NS		ND	NA	ND	ND	NA	ND	ND	NA	ND	
72-54-8	alpha-BHC	NS		ND	NA	ND	ND	NA	ND	ND	NA	ND	
72-55-9	delta-BHC	3.1		19 J	NA	13 J	ND	NA	44 J	ND	NA	22 J	
50-29-3	4,4'-DDD	4.7		ND	NA	ND	ND	NA	ND	ND	NA	ND	
959-98-8	4,4'-DDE	2.8		ND	NA	ND	ND	NA	ND	ND	NA	ND	
72-20-8	4,4'-DDT	0.04		ND	NA	ND	ND	NA	ND	ND	NA	ND	
72-43-5	Endosulfan I	1.7		ND	NA	ND	ND	NA	ND	ND	NA	ND	
53469-21-9	Endrin	12		ND	NA	ND	ND	NA	ND	ND	NA	ND	
12672-28-6	Methoxychlor	1000		7500	NA	6700	8100	NA	18000	22000	NA	3000	
11087-69-1	Aroclor 1242	1000		ND	NA	ND	ND	NA	ND	ND	NA	ND	
	Aroclor 1248	1000		ND	NA	ND	ND	NA	ND	ND	NA	ND	
	Aroclor 1254	1000		ND	NA	ND	ND	NA	ND	ND	NA	ND	

J - Indicates an estimated value.
 NA - Not analyzed.
 ND - Not detected at laboratory's method of detection limit.
 NS - No standard.
 See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
 - Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/28/92 - 01/6/93
Detected Compound Summary

Cas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sampled: Validated:	POND AREA											
				SED-A1#26 AS024058 SEDA1 01/05/93 03/10/93	SED-1A#26RE AS024058RI SEDA1 01/05/93 03/10/93	SED-A5#28 AS024114 SEDA1 01/08/93 03/10/93	SED-A5#28DL AS024114DL SEDA1 01/08/93 03/10/93	SED-A5#28RE AS024114RI SEDA1 01/08/93 03/10/93	SED-B1#25 AS024057 SEDA1 01/05/93 03/10/93	SED-B1#25DL AS024057DL SEDA1 01/05/93 03/10/93	SED-B1#25RE AS024057RI SEDA1 01/05/93 03/10/93	SED-C1#24 AS024056 SEDA1 01/05/93 03/10/93			
7428-90-5	TOTAL METALS (mg/kg)	NS		11500	NA	8150	NA	NA	NA	9470	NA	NA	11900		
7440-38-2	Aluminum - Total	5		9 J	NA	5.2 J	NA	NA	NA	5.6 J	NA	NA	3.1 J		
7440-39-3	Arsenic - Total	NS		145	NA	52.3 J	NA	NA	NA	82.1 J	NA	NA	98.9		
7440-70-2	Barium - Total	NS		2460 J	NA	ND	NA	NA	NA	ND	NA	NA	ND		
7440-47-3	Calcium - Total	28		19.4	NA	12.1	NA	NA	NA	12.7	NA	NA	17.1		
7440-48-4	Chromium - Total	NS		12.5 J	NA	ND	NA	NA	NA	11.6 J	NA	NA	ND		
7440-50-6	Cobalt - Total	19		73.8	NA	26.5	NA	NA	NA	34.3	NA	NA	65.4		
7439-89-6	Copper - Total	24000		28300	NA	22600	NA	NA	NA	15600	NA	NA	9550		
7439-82-1	Iron - Total	30		253 J	NA	48.9 J	NA	NA	NA	60.9 J	NA	NA	84.2 J		
7439-95-4	Lead - Total	NS		2460 J	NA	2630	NA	NA	NA	2550	NA	NA	1210 J		
7439-98-5	Magnesium - Total	820		533 J	NA	337 J	NA	NA	NA	358 J	NA	NA	202 J		
7439-97-6	Manganese - Total	0.11		.45	NA	ND	NA	NA	NA	.98	NA	NA	.88		
7440-02-0	Mercury - Total	22		41.1	NA	26.3	NA	NA	NA	26.6	NA	NA	15.3 J		
7440-09-7	Nickel - Total	NS		931 J	NA	971 J	NA	NA	NA	752 J	NA	NA	488 J		
7440-82-2	Potassium - Total	NS		38.1	NA	13.4 J	NA	NA	NA	32.2	NA	NA	30.8		
7440-68-6	Vanadium - Total	85		370	NA	265	NA	NA	NA	160	NA	NA	151		
57-12-5	Zinc - Total	NS		ND	NA	ND	NA	NA	NA	ND	NA	NA	2.6		
	Cyanide - Total	NS			NA		NA	NA	NA		NA	NA			

J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
- Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/28/92 - 01/8/93
Detected Compound Summary

Cas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Validated:	SED-C1#24RE AS024056RI 01/05/93 03/10/93	SED-C1#27 AS024112 01/08/93 03/10/93	SED-C1#27RE AS024112RI 01/08/93 03/10/93	SED-C3#23 AS024055 01/05/93 03/10/93	POND AREA SED-D1#22 AS024054 01/05/93 03/10/93	SED-D1#28 AS024113 01/08/93 03/10/93	SED-D1#28RE AS024113RI 01/08/93 03/10/93	SED-D3#21 AS024053 01/04/93 03/10/93	SED-D3#21RE AS024053RI 01/04/93 03/10/93
67-64-1	Acetone	NS	NA	NA	NA	NA	NA	220 J	NA	NA	NA	NA
76-83-3	2-Butanone	NS	NA	NA	NA	NA	NA	72 J	NA	NA	NA	NA
108-90-7	Chlorobenzene	4.4	NA	NA	NA	NA	NA	170	NA	NA	NA	NA
75-08-2	Methylene chloride	NS	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA
108-88-3	Toluene	NS	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA
1330-20-7	Total Xylenes	NS	NA	NA	NA	NA	NA	5 J	NA	NA	NA	NA
63-32-9	Acenaphthene	920	ND	ND	ND	ND	ND	ND	ND	29 J	35 J	35 J
208-98-8	Acenaphthylene	NS	ND	62 J	62 J	62 J	62 J	85 J	ND	ND	ND	ND
120-12-7	Anthracene	NS	ND	52 J	52 J	52 J	52 J	300 J	ND	66 J	62 J	62 J
58-55-3	Benzo(a)anthracene	130	ND	770	770	760	67 J	300 J	ND	180 J	200 J	200 J
50-32-8	Benzo(a)pyrene	41	ND	ND	ND	ND	91 J	R	ND	ND	ND	ND
205-99-2	Benzo(b)fluoranthene	150	ND	1200 J	1100 J	1100 J	33 J	R	ND	ND	ND	ND
191-24-2	Benzo(ghi)perylene	NS	ND	84 J	140 J	140 J	170 J	R	ND	ND	ND	ND
207-08-9	Benzo(k)fluoranthene	60	ND	580 J	440 J	440 J	25 J	4300 J	ND	ND	ND	ND
117-81-7	Bis(2-ethylhexyl) phthalate	4100	ND	ND	ND	ND	11 J	1900 J	ND	12 J	15 J	15 J
85-68-7	Butyl benzyl phthalate	NS	ND	11 J	9 J	9 J	76 J	37 J	ND	15 J	15 J	15 J
88-74-8	Carbazole	NS	ND	610	600	600	120 J	580 J	210 J	280 J	280 J	280 J
218-01-9	Chrysene	78	ND	170 J	160 J	160 J	120 J	700 J	ND	390 J	390 J	390 J
64-74-2	Di-n-butyl phthalate	NS	ND	ND	ND	ND	ND	360 J	ND	ND	ND	ND
95-50-1	1,2-Dichlorobenzene	15	ND	ND	ND	ND	ND	ND	ND	190 J	190 J	190 J
64-66-2	Diethyl phthalate	NS	ND	ND	ND	ND	170 J	580 J	300 J	410 J	470 J	470 J
208-44-0	Fluoranthene	NS	ND	870	860	860	ND	98 J	22 J	50 J	48 J	48 J
88-73-7	Fluorene	NS	ND	35 J	28 J	28 J	ND	R	ND	ND	ND	ND
183-39-5	Indeno(1,2,3-cd)pyrene	18	ND	160 J	230 J	230 J	ND	ND	ND	58 J	62 J	62 J
91-57-8	2-Methylnaphthalene	NS	ND	ND	ND	ND	23 J	ND	ND	200 J	200 J	200 J
91-20-3	Naphthalene	NS	73 J	23 J	24 J	24 J	120 J	580 J	28 J	34 J	320 J	320 J
85-01-8	Phenanthrene	180	ND	130 J	120 J	120 J	130 J	420 J	150 J	150 J	320 J	320 J
129-00-0	Pyrene	NS	ND	1400	1800	1800	130 J	ND	ND	ND	ND	ND
319-84-8	ASP91-3-PESTICIDES/PCBS (ug/kg)	NS	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
319-88-8	alpha-BHC	NS	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
72-54-8	delta-BHC	3.1	NA	NA	NA	NA	3.9 J	180 J	NA	14 J	NA	NA
72-55-9	4,4'-DDD	4.7	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
50-28-3	4,4'-DDE	2.8	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
959-98-8	4,4'-DDT	0.04	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
72-20-8	Endosulfan I	1.7	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
72-43-5	Endrin	12	NA	NA	NA	NA	ND	ND	NA	ND	NA	NA
53469-21-8	Methoxychlor	1000	NA	NA	NA	NA	280 J	10000 J	NA	8.1 J	490	490
12672-29-8	Aroclor 1242	1000	NA	NA	NA	NA	ND	ND	NA	NA	ND	ND
11097-69-1	Aroclor 1254	1000	NA	NA	NA	NA	ND	ND	NA	NA	ND	ND

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 NA - Not analyzed.
 ND - Not detected at laboratory's method of detection limit.
 NS - No standard.
 See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
 - Indicates a concentration above the proposed sediment criterion.

TABLE 4.5
NAPANOCH PAPER MILL SITE
Sediment Data for Rounds: 12/29/92 - 01/6/93
Detected Compound Summary

Gas No.	Parameter	Proposed Sediment Criterion	Sample Id: Lab Sample Id: Sdg: Sediment Sampled: Validated:	POND AREA									
				SED - C1#24RE AS024058RI SEDA1 01/05/93 03/10/93	SED - C1#27 AS024112 SEDA1 01/06/93 03/10/93	SED - C1#27RE AS024112RI SEDA1 01/06/93 03/10/93	SED - C3#23 AS024055 SEDA1 01/05/93 03/10/93	SED - D1#22 AS024054 SEDA1 01/05/93 03/10/93	SED - D1#28 AS024113 SEDA1 01/06/93 03/10/93	SED - D1#28RE AS024113RI SEDA1 01/06/93 03/10/93	SED - D3#21 AS024053RI SEDA1 01/04/93 03/10/93	SED - D3#21RE AS024053RI SEDA1 01/04/93 03/10/93	
TOTAL METALS (mg/kg)													
7429-90-5	Aluminum - Total	NS		NA	9830	NA	7480	11900	6780	NA	5760	NA	
7440-38-2	Arsenic - Total	5		NA	6.5 J	NA	2.5 J	24.1 J	9.2 J	NA	5 J	NA	
7440-39-3	Barium - Total	NS		NA	78.1	NA	81.6	152	75.1 J	NA	55.2 J	NA	
7440-70-2	Calcium - Total	NS		NA	3810	NA	ND	3320 J	1670 J	NA	1400 J	NA	
7440-47-3	Chromium - Total	26		NA	15.3	NA	12.5	48.9	16.6	NA	12.6	NA	
7440-48-4	Cobalt - Total	NS		NA	10.7 J	NA	5.5 J	16.7 J	11.1 J	NA	ND	NA	
7440-50-6	Copper - Total	19		NA	36.3	NA	25.6	201	73.6	NA	34.2	NA	
7439-69-6	Iron - Total	24000		NA	19700	NA	18300	47600	21800	NA	8780	NA	
7439-92-1	Lead - Total	30		NA	62.5 J	NA	37.4 J	335 J	96.3	NA	113 J	NA	
7439-95-4	Magnesium - Total	NS		NA	2960	NA	2510	2800 J	1510 J	NA	1700 J	NA	
7439-96-5	Manganese - Total	820		NA	609 J	NA	285 J	884 J	ND	NA	188 J	NA	
7439-97-6	Mercury - Total	0.11		NA	22	NA	ND	1	49	NA	ND	NA	
7440-02-0	Nickel - Total	22		NA	34.5	NA	18.1	34.1	18.6	NA	18.5	NA	
7440-09-7	Potassium - Total	NS		NA	888 J	NA	632 J	849 J	749 J	NA	550 J	NA	
7440-82-2	Vanadium - Total	NS		NA	23.6	NA	11.4 J	65.2	34.2	NA	10 J	NA	
7440-66-6	Zinc - Total	85		NA	135	NA	87.4	427	188	NA	94.4	NA	
57-12-5	Cyanide - Total	NS		NA	ND	NA	ND	ND	ND	NA	ND	NA	

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NA - Not analyzed.
ND - Not detected at laboratory's method of detection limit.
NS - No standard.
See Table 4.8 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all sediment samples.
- Indicates a concentration above the proposed sediment criterion.

TABLE 4.6
NAPANOCH PAPER MILL SITE
Groundwater Sampling Rounds: 02/93 - 07/93
Detected Compound Summary

Cas No.	Parameter (1)	(ug/l)	NYSDEC (2)	Sample id: Lab Sample id: SDG: Water Quality Standards	MW01 AS040161 SW006 07/22/93 09/22/93	MW01 383-294-47 DEC-356014 07/23/93 09/22/93	MW01B 383-294-48 DEC-356014 07/23/93 09/22/93	MW01S AS040162 SW006 07/22/93 09/22/93	MW02 AS028071 GWMW1 02/03/93 03/19/93	MW02 AS040163 SW006 07/22/93 09/22/93	MW02 383-294-49 DEC-356014 07/23/93 09/22/93	MW03 AS028068 GWMW1 02/03/93 03/19/93
75-01-4	VOLATILES											
75-34-3	Vinyl chloride	2			ND	ND	ND	NA	ND	NA	ND	ND
540-59-0	1,1-Dichloroethane	5			ND	ND	ND	NA	ND	NA	ND	ND
87-66-3	1,2-Dichloroethane (Total)	5			ND	ND	ND	NA	ND	NA	ND	ND
79-01-6	Chloroform	7			ND	ND	ND	NA	ND	NA	ND	ND
127-18-4	Trichloroethene	5			ND	ND	ND	NA	ND	NA	ND	ND
108-90-7	Tetrachloroethene	5			ND	ND	ND	NA	ND	NA	ND	ND
84-66-2	Chlorobenzene	5			ND	ND	ND	NA	ND	NA	ND	ND
84-74-2	Semivolatiles											
85-68-7	Dibutyl phthalate	50			ND	ND	ND	NA	ND	NA	ND	ND
218-01-8	Di-n-butyl phthalate	50			ND	ND	ND	NA	ND	NA	ND	ND
	Butyl benzyl phthalate	50			ND	ND	ND	NA	ND	NA	ND	ND
	Chrysene	0.002			ND	ND	ND	NA	ND	NA	ND	ND
	PCBS											
12672-20-8	Aroclor 1248	0.1			ND	ND	ND	NA	ND	NA	ND	ND
7428-90-5	TOTAL METALS											
7440-38-2	Aluminum - Total	188J			108 J	NA	NA	1220	1580	384	NA	138 J
7440-38-3	Arsenic - Total	10			8 J	NA	NA	ND	21.2 J	ND	NA	8 J
7440-43-8	Barium - Total	35.3J			34.8 J	NA	NA	ND	ND	ND	NA	72.5 J
7440-70-2	Cadmium - Total	ND			ND	NA	NA	ND	9570	10500	NA	ND
7440-48-4	Calcium - Total	38500			38500	NA	NA	13600	ND	ND	NA	30800
7440-50-8	Cobalt - Total	ND			ND	NA	NA	ND	ND	ND	NA	ND
7438-88-8	Copper - Total	300			118	NA	NA	ND	ND	ND	NA	13.2 J
7438-92-1	Iron - Total	25			ND	NA	NA	1830	1400 J	377	NA	3260 J
7438-95-4	Lead - Total	35000			3740 J	NA	NA	ND	ND	ND	NA	ND
7438-98-5	Magnesium - Total	300			342	NA	NA	2800 J	2860 J	2830 J	NA	7080
7438-97-8	Manganese - Total	2			ND	NA	NA	156	188	51.4	NA	1590
7440-02-0	Mercury - Total	NS			ND	NA	NA	ND	ND	ND	NA	ND
7440-08-7	Nickel - Total	NS			ND	NA	NA	ND	ND	ND	NA	31.8 J
7440-23-5	Potassium - Total	20000			481 J	NA	NA	853 J	1010 J	588 J	NA	1310 J
7440-68-8	Sodium - Total	300			3570 J	NA	NA	3480 J	9380 J	10300	NA	18000 J
	Zinc - Total	100			ND	NA	NA	13.7 J	12 J	10.8 J	NA	24.4
57-12-5	Cyanide - Total				ND	NA	NA	ND	44.8	ND	NA	ND

(1) Analyzed by: RECRA Environmental, Inc. and NYSDEC lab.
(2) NYSDEC - Water Quality Standards and Guidance Values (11/91)
NS - No standard.
(G) - Guidance value.

Qualifier Definitions:
U - Indicates a compound was analyzed for but not detected.
J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at the laboratory's method of detection limit.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all groundwater samples.
ND - Indicates a concentration above the groundwater standard.

TABLE 4.6
NAPANOCH PAPER MILL SITE
Groundwater Sampling Rounds: 02/93 - 07/93
Detected Compound Summary

Cas No.	Parameter (1)	NYSDEC (2) CLASS GA Water Quality Standards (ug/l)	Sample Id: Lab Sample Id: SDG: Sampled: Validated:	MW03-DUP AS026088 GWMW1 02/04/93 03/19/93	MW03 AS040164 SW006 07/22/93 08/22/93	MW03 383-294-50 DEC-356014 07/23/93 09/22/93	MW04 AS026155 GWMW1 02/04/93 03/19/93	MW04 AS040165 SW006 07/22/93 08/22/93	MW04 383-294-51 DEC-356014 07/23/93 08/22/93	MW05 AS026157 GWMW1 02/04/93 03/19/93	MW05 AS040166 SW006 07/22/93 08/22/93	MW05 383-294-52 DEC-356014 07/23/93 08/22/93
75-01-4	VOLATILES (ug/l)	2		ND	NA	ND	9 J	NA	ND	ND	NA	ND
75-34-3	Vinyl chloride	5		ND	NA	ND	ND	NA	1 J	ND	NA	ND
540-59-0	1,1-Dichloroethane	5		ND	NA	NA	5 J	NA	NA	ND	NA	ND
67-68-3	1,2-Dichloroethane (Total)	7		ND	NA	ND	ND	NA	NA	ND	NA	ND
79-01-8	Chloroform	5		ND	NA	2 J	ND	NA	4 J	ND	NA	2 J
127-18-4	Trichloroethene	5		ND	NA	ND	12	NA	10	ND	NA	ND
108-90-7	Tetrachloroethene	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
64-68-2	Chlorobenzene	50		ND	NA	NA	7 J	NA	NA	2 J	NA	NA
84-74-2	Diethyl phthalate	50		0.7 J	NA	NA	8 J	NA	NA	ND	NA	NA
85-68-7	Di-n-butyl phthalate	50		ND	NA	NA	ND	NA	NA	ND	NA	NA
218-01-9	Butyl benzyl phthalate	0.002		ND	NA	NA	ND	NA	NA	ND	NA	NA
	Chrysene			ND	NA	NA	ND	NA	NA	ND	NA	NA
	PCBS (ug/l)			ND	0.79	NA	ND	ND	NA	ND	ND	NA
12672-29-6	Aroclor 1248	0.1		ND	88.6 J	NA	88.1	228	NA	1480	981	NA
7428-90-5	TOTAL METALS (ug/l)	NS		ND	5 J	NA	ND	ND	NA	ND	4 J	NA
7440-38-2	Aluminum - Total	25		ND	68.6 J	NA	60 J	45.3 J	NA	51.6 J	42.6 J	NA
7440-38-3	Arsenic - Total	1000		73.2 J	4 J	NA	ND	9 J	NA	ND	ND	NA
7440-43-9	Barium - Total	10		6.5	30300	NA	55200	50700	NA	20200	18100	NA
7440-70-2	Cadmium - Total	NS		30500	ND	NA	ND	ND	NA	ND	ND	NA
7440-48-4	Calcium - Total	NS		ND	8.5 J	NA	ND	ND	NA	ND	6.9 J	NA
7440-50-8	Cobalt - Total	200		10.3 J	2800	NA	1810 J	1970	NA	3070 J	2850	NA
7439-89-8	Copper - Total	300		3120 J	ND	NA	ND	ND	NA	ND	ND	NA
7439-89-8	Iron - Total	300		6960	ND	NA	ND	ND	NA	ND	ND	NA
7439-82-1	Lead - Total	25		1820	7170	NA	11900	11500	NA	5190	5190	NA
7439-95-4	Magnesium - Total	35000		1820	1430	NA	2040	2230	NA	1090	1190	NA
7439-98-5	Manganese - Total	300		ND	ND	NA	ND	ND	NA	ND	ND	NA
7439-97-8	Mercury - Total	2		ND	ND	NA	57.2	49.5	NA	21.1 J	ND	NA
7440-02-0	Nickel - Total	NS		ND	1820 J	NA	5480	2410 J	NA	7400	976 J	NA
7440-08-7	Potassium - Total	NS		1420 J	18500	NA	30900 J	28000	NA	22400 J	17600	NA
7440-23-5	Sodium - Total	20000		18400 J	13 J	NA	ND	ND	NA	18.3 J	58.6	NA
7440-68-8	Zinc - Total	300		24	ND	NA	41.2	ND	NA	ND	ND	NA
57-12-5	Cyanide - Total	100		ND	ND	NA	ND	ND	NA	ND	ND	NA

(1) Analyzed by: RECRA Environmental, Inc. and NYSDEC lab.
(2) NYSDEC - Water Quality Standards and Guidance Values (11/91)
NS - No standard.
(3) - Guidance value.

Qualifier Definitions:
U - Indicates a compound was analyzed for but not detected.
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NA - Not analyzed.
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See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all groundwater samples.
- Indicates a concentration above the groundwater standard.

TABLE 4.6
NAPANOCH PAPER MILL SITE
Groundwater Sampling Rounds: 02/93 - 07/93
Detected Compound Summary

Cas No.	Parameter (1)	NYSDEC (2) CLASS GA Water Quality Standards (ug/l)	Sample Id: Lab Sample Id: SDG: Sampled: Validated:	MW06 AS028156 GWMW1 02/04/93 03/19/93	MW06 AS040187 SW008 07/22/93 08/22/93	MW06 383-294-53 DEC-356014 07/23/93 09/22/93	MW07 AS028156 GWMW1 02/04/93 03/19/93	MW07 AS040188 SW008 07/22/93 08/22/93	MW07 383-294-54 DEC-356014 07/23/93 09/22/93	MW08 AS028156 GWMW1 02/04/93 03/19/93	MW08 AS040188 SW008 07/22/93 09/22/93	MW08 383-294-55 DEC-356014 07/23/93 09/22/93
75-01-4	VOLATILES (ug/l)	2		ND	NA	ND	5 J	NA	ND	3 J	NA	ND
75-34-3	Vinyl chloride	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
540-59-0	1,1-Dichloroethane	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
87-68-3	1,2-Dichloroethane (Total)	7		ND	NA	ND	ND	NA	ND	ND	NA	ND
79-01-6	Chloroform	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
127-18-4	Trichloroethene	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
108-90-7	Tetrachloroethene	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
84-68-2	Chlorobenzene	5		ND	NA	ND	ND	NA	ND	ND	NA	ND
84-74-2	SEMI-VOLATILES (ug/l)	50		2 J	NA	NA	2 J	NA	NA	1 J	NA	NA
85-68-7	Diethyl phthalate	50		ND	NA	NA	ND	NA	NA	7 J	NA	NA
218-01-9	D-n-butyl phthalate	50		ND	NA	NA	.8 J	NA	NA	1 J	NA	NA
	Butyl benzyl phthalate	0.002		ND	NA	NA	ND	NA	NA	ND	NA	NA
	Chrysene			ND	NA	NA	ND	NA	NA	ND	NA	NA
12672-28-8	PCBS	0.1		ND	ND	NA	ND	ND	NA	ND	ND	NA
7429-90-5	Aroclor 1248			373	191 J	NA	1450	2800	NA	368	106 J	NA
7440-38-2	Aluminum - Total	25		ND	ND	NA	ND	ND	NA	ND	ND	NA
7440-39-3	Arsenic - Total	1000		48.1 J	38.8 J	NA	60.2 J	80 J	NA	178 J	241	NA
7440-43-9	Barium - Total	10		ND	.3 J	NA	ND	.2 J	NA	ND	ND	NA
7440-70-2	Cadmium - Total	NS		11600	11300	NA	48900	47600	NA	95100	71200	NA
7440-48-4	Calcium - Total	NS		20.7 J	ND	NA	53.9	22.8 J	NA	ND	ND	NA
7440-50-8	Cobalt - Total	200		ND	ND	NA	ND	ND	NA	ND	ND	NA
7439-89-8	Copper - Total	300		3020 J	4400	NA	8030 J	9870	NA	58500 J	85800	NA
7439-92-1	Iron - Total	25		4150 J	4410 J	NA	10700	11700	NA	23800	30700	NA
7439-95-4	Lead - Total	35000		2090	1600	NA	12000	13100	NA	7830	11800	NA
7439-96-5	Magnesium - Total	300		ND	ND	NA	2	ND	NA	ND	ND	NA
7439-97-8	Manganese - Total	2		44.1	38.4 J	NA	160	149	NA	76.9	123	NA
7440-02-0	Mercury - Total	NS		2980 J	1060 J	NA	3110 J	2730 J	NA	3380 J	2820 J	NA
7440-08-7	Nickel - Total	NS		5890 J	5310	NA	4940 J	5060	NA	14400 J	15600	NA
7440-23-5	Potassium - Total	20000		38	27.5	NA	25.2	11.1 J	NA	ND	ND	NA
7440-68-8	Sodium - Total	300		ND	ND	NA	ND	ND	NA	ND	ND	NA
57-12-5	Zinc - Total	100		ND	ND	NA	ND	ND	NA	ND	ND	NA
	Cyanide - Total											

(1) Analyzed by: RECRA Environmental, Inc. and NYSDEC lab.
(2) NYSDEC - Water Quality Standards and Guidance Values (11/91)
NS - No standard.
(G) - Guidance value.

Qualifier Definitions:
U - Indicates a compound was analyzed for but not detected.
J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at the laboratory's method of detection limit.
See Table 4.9 for complete list of laboratory qualifiers.
Table Face - Indicates the maximum concentration for all groundwater samples.
Table Face - Indicates a concentration above the groundwater standard.

TABLE 4.6
NAPANOCH PAPER MILL SITE
Groundwater Sampling Rounds: 02/93 – 07/93
Detected Compound Summary

Cas No.	Parameter (1)	NYSDCE (2)	Sample Id: Lab Sample Id: SDG: Sampled: Validated:	MW09 AS040170 SW008 07/22/93 08/22/93	MW09 393-294-58 DEC-356014 07/23/93 08/22/93	MW06S AS026172 GWMW1 02/05/93 02/05/93	MW06S AS040171 SW008 07/22/93 08/22/93	MW06S 393-294-57 DEC-356014 07/23/93 08/22/93	MW10 AS026160 GWMW1 02/04/93 03/18/93	MW10 AS040172 SW008 07/22/93 09/22/93	MW10 393-294-58 DEC-356014 07/23/93 08/22/93
75-01-4	VOLATILES (ug/l)	2									
75-34-3	Vinyl chloride	5	ND	NA	ND	ND	NA	ND	ND	NA	ND
540-59-0	1,1-Dichloroethane	5	ND	NA	ND	ND	NA	ND	ND	NA	ND
87-88-3	1,2-Dichloroethane (Total)	7	ND	NA	ND	ND	NA	ND	ND	NA	ND
78-01-6	Chloroform	5	ND	NA	ND	ND	NA	ND	ND	NA	ND
127-18-4	Trichloroethene	5	ND	NA	ND	ND	NA	ND	ND	NA	ND
108-90-7	Tetrachloroethene	5	ND	NA	ND	ND	NA	ND	ND	NA	ND
84-88-2	Chlorobenzene	5	ND	NA	ND	ND	NA	ND	ND	NA	ND
84-74-2	SEMI-VOLATILES (ug/l)	50									
85-88-7	Diethyl phthalate	50	ND	NA	ND	ND	NA	ND	1 J	NA	NA
218-01-8	Di-n-butyl phthalate	50	ND	NA	ND	ND	NA	ND	1 J	NA	NA
	Butyl benzyl phthalate	50	ND	NA	ND	ND	NA	ND	8 J	NA	NA
	Chrysene	0.002	ND	NA	ND	ND	NA	ND	1 J	NA	NA
12672-29-8	PCBS	0.1									
7429-80-5	Aroclor 1248	NS	ND	ND	NA	ND	ND	NA	ND	ND	NA
7440-38-2	Aluminum - Total	25	788	291	NA	2580	395	NA	2040	188 J	NA
7440-38-3	Arsenic - Total	1000	220	208	NA	71.8 J	132 J	NA	288	211	NA
7440-43-9	Barium - Total	10	ND	2 J	NA	ND	2 J	NA	ND	7 J	NA
7440-70-2	Cadmium - Total	NS	120000	80400	NA	74000	117000	NA	65300	66300	NA
7440-48-4	Calcium - Total	NS	ND	ND	NA	ND	ND	NA	ND	ND	NA
7440-50-8	Cobalt - Total	200	15.8 J	11.3 J	NA	39.9	9.3 J	NA	16.1 J	ND	NA
7438-89-8	Copper - Total	300	1300 J	1350	NA	4420 J	1450	NA	3080 J	1310	NA
7439-82-1	Iron - Total	25	ND	3 J	NA	14.5	ND	NA	ND	ND	NA
7439-85-4	Lead - Total	35000	34700	25700	NA	9160	24000	NA	12500	12000	NA
7439-86-5	Magnesium - Total	300	840	862	NA	548	1310	NA	885	1420	NA
7438-97-6	Manganese - Total	2	ND	ND	NA	50.5	ND	NA	ND	ND	NA
7440-02-0	Mercury - Total	NS	23.9 J	ND	NA	50.5	33.4 J	NA	ND	ND	NA
7440-08-7	Nickel - Total	NS	1360 J	1020 J	NA	2170 J	1210 J	NA	1480 J	787 J	NA
7440-23-5	Potassium - Total	20000	18600 J	28500	NA	28200 J	20900	NA	14100 J	15800	NA
7440-98-6	Sodium - Total	300	12.9 J	12.8 J	NA	118	22.1	NA	20.3	ND	NA
57-12-5	Zinc - Total	100	ND	ND	NA	ND	ND	NA	ND	ND	NA
	Cyanide - Total										

(1) Analyzed by: RECRA Environmental, Inc. and NYSDCE Lab.
(2) NYSDCE - Water Quality Standards and Guidance Values (11/91)
NS - No standard.
(G) - Guidance value.

Qualifier Definitions:
U - Indicates a compound was analyzed for but not detected.
J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at the laboratory's method of detection limit.
See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all groundwater samples.
— - Indicates a concentration above the groundwater standard.

TABLE 4.6 NAPANOCH PAPER MILL SITE

Groundwater Sampling Rounds: 02/93 - 07/93
Detected Compound Summary

Cas No.	Parameter (1)	NYSDEC (2) CLASS GA Water Quality Standards (ug/l)	Sample Id: Lab Sample Id: SDG: Sampled: Validated:	MW10S AS028161 GWMW1 02/04/93 03/19/93	MW10S AS040173 SW008 07/22/93 09/22/93	MW10S 383-294-59 DEC-356014 07/23/93 09/22/93	MW10S-DUP 383-294-81 DEC-356014 07/23/93 09/22/93	MW10SA 383-294-82 DEC-356014 07/23/93 09/22/93	MW11 AS028162 GWMW1 02/04/93 03/19/93	MW11 AS040174 SW008 07/22/93 09/22/93	MW11 383-294-80 DEC-356014 07/23/93 09/22/93
75-01-4	VOLATILES (ug/l)	2									
75-34-3	Vinyl chloride	5	ND	NA	ND	ND	ND	ND	ND	NA	ND
540-59-0	1,1-Dichloroethane	5	ND	NA	ND	ND	ND	ND	ND	NA	ND
87-66-3	1,2-Dichloroethane (Total)	7	ND	NA	ND	ND	ND	ND	ND	NA	ND
78-01-8	Chloroform	5	ND	NA	ND	ND	ND	ND	ND	NA	ND
127-18-4	Trichloroethene	5	ND	NA	ND	ND	ND	ND	ND	NA	ND
108-90-7	Tetrachloroethene	5	ND	NA	ND	ND	ND	ND	ND	NA	ND
	Chlorobenzene	5	ND	NA	ND	ND	ND	ND	ND	NA	ND
	SEMI-VOLATILES (ug/l)										
84-68-2	Diethyl phthalate	50	2 J	NA	NA	NA	NA	NA	ND	NA	NA
84-74-2	Di-n-butyl phthalate	50	ND	NA	NA	NA	NA	NA	1 J	NA	NA
85-68-7	Butyl benzyl phthalate	50	ND	NA	NA	NA	NA	NA	0.8 J	NA	NA
218-01-9	Chrysene	0.002	ND	NA	NA	NA	NA	NA	ND	NA	NA
	PCBS (ug/l)										
12872-29-8	Aroclor 1248	0.1	ND	ND	NA	NA	NA	NA	ND	ND	NA
	TOTAL METALS (ug/l)										
7429-90-5	Aluminum - Total	NS	11100	3020	NA	NA	NA	NA	757	274	NA
7440-38-2	Arsenic - Total	25	ND	ND	NA	NA	NA	NA	ND	ND	NA
7440-38-3	Barium - Total	1000	243	259	NA	NA	NA	NA	88.5 J	88.7 J	NA
7440-43-9	Cadmium - Total	10	ND	4 J	NA	NA	NA	NA	ND	ND	NA
7440-70-2	Calcium - Total	NS	62800	85100	NA	NA	NA	NA	48100	44800	NA
7440-48-4	Cobalt - Total	NS	ND	ND	NA	NA	NA	NA	ND	ND	NA
7440-50-8	Copper - Total	200	ND	ND	NA	NA	NA	NA	ND	ND	NA
7439-89-6	Iron - Total	300	13300 J	4930	NA	NA	NA	NA	1030 J	508	NA
7439-82-1	Lead - Total	25	7	ND	NA	NA	NA	NA	7810	7850	NA
7439-85-4	Magnesium - Total	35000	13500	12900	NA	NA	NA	NA	483	482	NA
7439-86-5	Manganese - Total	300	2490	2530	NA	NA	NA	NA	0.2	ND	NA
7439-97-6	Mercury - Total	2	ND	ND	NA	NA	NA	NA	ND	ND	NA
7440-02-0	Nickel - Total	NS	44.8	41.8	NA	NA	NA	NA	1040 J	918 J	NA
7440-09-7	Potassium - Total	NS	2630 J	1490 J	NA	NA	NA	NA	22000 J	25900	NA
7440-23-5	Sodium - Total	20000	16800 J	18300	NA	NA	NA	NA	ND	ND	NA
7440-68-6	Zinc - Total	300	39.3	12.6 J	NA	NA	NA	NA	ND	ND	NA
57-12-5	Cyanide - Total	100	35.8	ND	NA	NA	NA	NA	ND	ND	NA

(1) Analyzed by: RECRA Environmental, Inc. and NYSDEC lab.
(2) NYSDEC - Water Quality Standards and Guidance Values (11/81)
NS - No standard.
(G) - Guidance value.

Qualifier Definitions:

U - Indicates a compound was analyzed for but not detected.
J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at the laboratory's method of detection limit.
See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all groundwater samples.

Boxed - Indicates a concentration above the groundwater standard.

TABLE 4.6
NAPANOCH PAPER MILL SITE
Groundwater Sampling Rounds: 02/93 - 07/93
Detected Compound Summary

Cas No.	Parameter (1)	(ug/l)	NYSDEC (2)	Sample Id: Lab Sample Id: SDG: Sampled: Validated:	PW01 AS040178 SW006 07/23/93 09/22/93	PW01-FD AS040178FD SW006 07/23/93 09/22/93	PW01A 383-284-60 DEC-356014 07/23/93 09/22/93	RES001 AS040512 RES01 07/27/93 09/22/93	RES001 383-210-01 DEC-356014 07/28/93 09/22/93	RES001-DUP 383-210-06 DEC-356014 07/28/93 09/22/93	RES002 AS040513 RES01 07/27/93 09/22/93	RES002 383-210-02 DEC-356014 07/28/93 09/22/93
75-01-4	VOLATILES	(ug/l)										
75-34-3	Vinyl chloride	2			ND	NA	ND	NA	ND	ND	NA	ND
75-34-3	1,1-Dichloroethane	5			ND	NA	NA	NA	ND	ND	NA	ND
540-59-0	1,2-Dichloroethane (Total)	5			ND	NA	NA	NA	NA	NA	NA	NA
87-68-3	Chloroform	7			ND	NA	ND	NA	ND	ND	NA	ND
78-01-8	Trichloroethene	5			ND	NA	ND	NA	ND	ND	NA	ND
127-18-4	Tetrachloroethene	5			ND	NA	ND	NA	ND	ND	NA	ND
108-90-7	Chlorobenzene	5			ND	NA	ND	NA	ND	ND	NA	ND
84-68-2	SEMI-VOLATILES	(ug/l)										
84-74-2	Diethyl phthalate	50			ND	NA	NA	NA	NA	NA	NA	NA
85-68-7	Di-n-butyl phthalate	50			ND	NA	NA	NA	NA	NA	NA	NA
218-01-8	Butyl benzyl phthalate	50			ND	NA	NA	NA	NA	NA	NA	NA
	Chrysene	0.002			ND	NA	NA	NA	NA	NA	NA	NA
	PCBS	(ug/l)										
12672-29-6	Aroclor 1248	0.1			ND	ND	NA	ND	NA	NA	ND	NA
7428-90-5	TOTAL METALS	(ug/l)										
7440-38-2	Aluminum - Total	NS			ND	ND	NA	250	NA	NA	ND	NA
7440-38-2	Arsenic - Total	25			ND	ND	NA	ND	NA	NA	ND	NA
7440-38-3	Barium - Total	1000			32 J	35.9 J	NA	59.6 J	NA	NA	103 J	NA
7440-43-9	Cadmium - Total	10			ND	ND	NA	ND	NA	NA	ND	NA
7440-70-2	Calcium - Total	NS			22200	22300	NA	43000	NA	NA	51800	NA
7440-48-4	Cobalt - Total	NS			ND	ND	NA	ND	NA	NA	ND	NA
7440-50-8	Copper - Total	200			ND	ND	NA	11.4 J	NA	NA	6.7 J	NA
7438-88-8	Iron - Total	300			3670	3710	NA	712	NA	NA	2460	NA
7438-92-1	Lead - Total	25			ND	ND	NA	ND	NA	NA	ND	NA
7438-95-4	Magnesium - Total	35000			5890	5970	NA	7610	NA	NA	10600	NA
7438-98-5	Manganese - Total	300			881	905	NA	362	NA	NA	322	NA
7438-97-8	Mercury - Total	2			ND	ND	NA	ND	NA	NA	ND	NA
7440-02-0	Nickel - Total	NS			ND	ND	NA	ND	NA	NA	ND	NA
7440-08-7	Potassium - Total	NS			491 J	512 J	NA	1320 J	NA	NA	767 J	NA
7440-23-5	Sodium - Total	20000			6900	6960	NA	35700	NA	NA	22200	NA
7440-66-8	Zinc - Total	300			22	31.1	NA	30.2	NA	NA	ND	NA
57-12-5	Cyanide - Total	100			ND	ND	NA	ND	NA	NA	ND	NA

(1) Analyzed by: REORA Environmental, Inc. and NYSDEC lab.
(2) NYSDEC - Water Quality Standards and Guidance Values (11/91)
NS - No standard.
(G) - Guidance value.

Qualifier Definitions:
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See Table 4.9 for complete list of laboratory qualifiers.
Bold Face - Indicates the maximum concentration for all groundwater samples.
_____ - Indicates a concentration above the groundwater standard.

TABLE 4.6
NAPANOCH PAPER MILL SITE
Groundwater Sampling Rounds: 02/93 – 07/93
Detected Compound Summary

Case No.	Parameter (f)	(ug/l)	NYSDEC (2)	CLASS GA	Water Quality	Standards	Sample Id:	Lab Sample Id:	SDG:	Sampled:	Validated:	RES003	RES003	RES004	RES004	RES005	RES005	RES006	RES006	RES007	RES007
75-01-4	VOLATILES	(ug/l)																			
75-34-3	Vinyl chloride	2	2	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
540-59-0	1,1-Dichloroethane	5	5	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
87-86-3	1,2-Dichloroethane (Total)	5	5	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
78-01-8	Chloroform	7	7	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
127-18-4	Trichloroethene	5	5	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
108-90-7	Tetrachloroethene	5	5	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
	Chlorobenzene	5	5	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
	SEMI-VOLATILES (ug/l)																				
84-86-2	Diethyl phthalate	50	50	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
84-74-2	Di-n-butyl phthalate	50	50	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
85-68-7	Butyl benzyl phthalate	50	50	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
218-01-9	Chrysene	0.002	0.002	AS040514	AS040514	RES001	07/27/93	09/22/93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	PCBS																				
12872-29-8	Aroclor 1248	0.1	0.1	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
	TOTAL METALS (ug/l)																				
7428-90-5	Aluminum - Total	NS	NS	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-38-2	Arsenic - Total	25	25	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-39-3	Barium - Total	1000	1000	AS040514	AS040514	RES001	07/27/93	09/22/93	71.3 J	38.2 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-43-9	Cadmium - Total	10	10	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-70-2	Calcium - Total	NS	NS	AS040514	AS040514	RES001	07/27/93	09/22/93	38000	14200	NA	NA	NA	NA	NA	NA	NA	NA	NA	15200	NA
7440-48-4	Cobalt - Total	NS	NS	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-50-8	Copper - Total	200	200	AS040514	AS040514	RES001	07/27/93	09/22/93	11 J	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	38.9	NA
7439-89-8	Iron - Total	300	300	AS040514	AS040514	RES001	07/27/93	09/22/93	68.2 J	556	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7438-92-1	Lead - Total	25	25	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	6 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7438-95-4	Magnesium - Total	35000	35000	AS040514	AS040514	RES001	07/27/93	09/22/93	7700	5090	NA	NA	NA	NA	NA	NA	NA	NA	NA	3110 J	NA
7439-98-5	Manganese - Total	300	300	AS040514	AS040514	RES001	07/27/93	09/22/93	159	53.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7439-97-8	Mercury - Total	2	2	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-02-0	Nickel - Total	NS	NS	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA
7440-09-7	Potassium - Total	NS	NS	AS040514	AS040514	RES001	07/27/93	09/22/93	569 J	487 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	561 J	NA
7440-23-5	Sodium - Total	20000	20000	AS040514	AS040514	RES001	07/27/93	09/22/93	9410	9500	NA	NA	NA	NA	NA	NA	NA	NA	NA	8750	NA
7440-68-8	Zinc - Total	300	300	AS040514	AS040514	RES001	07/27/93	09/22/93	16.4 J	17.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	50.9	NA
57-12-5	Cyanide - Total	100	100	AS040514	AS040514	RES001	07/27/93	09/22/93	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	28.4	NA

(1) Analyzed by: RECRA Environmental, Inc. and NYSDEC lab.
(2) NYSDEC - Water Quality Standards and Guidance Values (11/91)
NS - No standard.
(G) - Guidance value.

Qualifier Definitions:

U - Indicates a compound was analyzed for but not detected.
J - Indicates an estimated value.
NA - Not analyzed.
ND - Not detected at the laboratory's method of detection limit.
See Table 4.9 for complete list of laboratory qualifiers.

Bold Face - Indicates the maximum concentration for all groundwater samples.

- Indicates a concentration above the groundwater standard.

TABLE 4.7
NAPANOCH PAPER MILL SITE
Surface Water Sampling Rounds: 12/22/92 – 07/27/93
Detected Compound Summary

Cas No.	Parameter	NYSDEC (3) Class A Surface Water Standard	Sample Id: Lab Id: SDG: Sampled:	SW001 (1) 188975 07/12/93	SW002 (2) AS023690 SW1 12/22/92	SW002 (1) 188975 07/12/93	SW003 (2) AS023691 SW1 12/22/92	SW003 (1) 188975 07/12/93	SW004 (2) AS023692 SW1 12/22/92	SW004 (1) 188975 07/12/93
67-84-1	VOLATILES (ug/l)									
75-15-0	Acetone	NS		NA	ND	NA	ND	NA	ND	NA
67-66-3	Carbon Disulfide	NS		NA	ND	NA	ND	NA	ND	NA
108-88-3	Chloroform	NS		NA	ND	NA	ND	NA	ND	NA
	Toluene	NS		NA	ND	NA	ND	NA	ND	NA
12672-29-6	PCB'S	0.001		ND	ND	ND	ND	ND	ND	ND
11097-69-1	Aroclor 1248	0.001		ND	ND	ND	ND	ND	ND	ND
	Aroclor 1254									
7429-90-5	Aluminum – Total	100		NA	ND	NA	ND	NA	ND	NA
7440-38-2	Arsenic – Total	190		NA	ND	NA	ND	NA	ND	NA
7440-39-3	Barium – Total	NS		NA	21.2 J	NA	20 J	NA	20.3 J	NA
7440-41-7	Beryllium – Total	11		NA	ND	NA	ND	NA	ND	NA
7440-43-9	Cadmium – Total	0.56 (4)		NA	ND	NA	ND	NA	ND	NA
7440-70-2	Calcium – Total	NS		NA	5840	NA	5870	NA	5740	NA
7440-47-3	Chromium – Total	11		NA	ND	NA	ND	NA	ND	NA
7440-48-4	Cobalt – Total	5		NA	ND	NA	ND	NA	ND	NA
7440-50-8	Copper – Total	5.5 (4)		NA	ND	NA	ND	NA	ND	NA
7439-89-6	Iron – Total	300		NA	ND	NA	ND	NA	ND	NA
7439-92-1	Lead – Total	1 (4)		NA	ND	NA	ND	NA	ND	NA
7439-95-4	Magnesium – Total	NS		NA	1380 J	NA	1330 J	NA	1340 J	NA
7439-96-5	Manganese – Total	NS		NA	20.5	NA	21.2	NA	30.7	NA
7439-97-6	Mercury – Total	0.2		NA	ND	NA	ND	NA	ND	NA
7440-02-0	Nickel – Total	46.3 (4)		NA	ND	NA	ND	NA	ND	NA
7440-09-7	Potassium – Total	NS		NA	496 J	NA	477 J	NA	444 J	NA
7440-22-4	Silver – Total	0.1 (IONIC)		NA	ND	NA	ND	NA	ND	NA
7440-23-5	Sodium – Total	NS		NA	4880 J	NA	4900 J	NA	4820 J	NA
7440-62-2	Vanadium – Total	14		NA	ND	NA	ND	NA	ND	NA
7440-66-6	Zinc – Total	30		NA	ND	NA	ND	NA	ND	NA
57-12-5	Cyanide – Total	5.2		NA	ND	NA	ND	NA	ND	NA
ES-5002	Total Hardness as CaCO ₃ (mg/l)	NA		NA	39.8	NA	43.8	NA	39.8	NA
ES-5003	Recoverable Hydrocarbons (mg/l)	NA		NA	NA	NA	NA	NA	NA	NA

(1) Analyzed by: Aquatec, Inc.
(2) Analyzed by: RECRA Environmental, Inc.
(3) NYSDC – Water Quality Standards and Guidance Values (11/91).
NS – No Standard
4) Based on an average hardness of 41 ppm.
J – Indicates an estimated value.
NA – Indicates a compound was not analyzed for.
D – Indicates a compound was analyzed for but not detected at the lab's MDL.
see Table 4.9 for complete list of laboratory qualifiers.
Bold Face – Indicates the maximum concentration found for all surface water samples
– Indicates a concentration above the surface water standard.

TABLE 4.7
NAPANOCH PAPER MILL SITE
Surface Water Sampling Rounds: 12/22/92 – 07/27/93
Detected Compound Summary

Cas No.	Parameter	(ug/l)	NYSDEC (3) Class A Surface Water Standard	Sample Id: Lab Id: SDG: Sampled:	SW005 (2) AS023693 SW1 12/22/92	SW005 (1) 189979 189975 07/12/93	SW005D (1) 189980 189975 07/12/93	SW A5 #26 (2) AS024115 SEDA1 12/22/92	SW006 (3) AS039671 SW006 07/16/93	SW007 (3) AS040519 RES01 07/27/93	TP06 – W (1) AS032463 ASTP6 04/06/93	TP13 – W (1) AS032465 ASTP6 04/07/93
67-64-1	VOLATILES											
75-15-0	Acetone		NS		4 J	NA	NA	ND	ND	ND	11	ND
67-66-3	Carbon Disulfide		NS		ND	NA	NA	ND	ND	4 J	ND	ND
108-88-3	Chloroform		NS		ND	NA	NA	ND	ND	ND	ND	ND
	Toluene		NS		ND	NA	NA	ND	ND	ND	7 J	ND
12672-29-6	PCB'S											
11097-69-1	Aroclor 1248		0.001		ND	ND	ND	ND	ND	0.55 J	2.9	1.1
	Aroclor 1254		0.001		ND	ND	ND	ND	ND	1.7 J	ND	ND
7429-90-5	TOTAL METALS	(ug/l)										
7440-38-2	Aluminum – Total		100		ND	NA	NA	ND	ND	84.7 J	400000 J	5870 J
7440-39-3	Arsenic – Total		190		ND	NA	NA	ND	ND	ND	69 J	5 J
7440-41-7	Barium – Total		NS		20 J	NA	NA	111 J	111 J	83 J	7400 J	90.7 J
7440-43-9	Beryllium – Total		11		ND	NA	NA	ND	ND	ND	23.9 J	ND
7440-47-3	Cadmium – Total		0.56 (1)		ND	NA	NA	ND	ND	ND	35 J	5 J
7440-70-2	Calcium – Total		NS		5820	NA	NA	44400	44400	48900	135000 J	10800 J
7440-48-4	Chromium – Total		11		ND	NA	NA	ND	ND	ND	814 J	13.2 J
7440-50-8	Cobalt – Total		5		ND	NA	NA	ND	ND	ND	293 J	ND
7440-50-8	Copper – Total		5.5 (1)		ND	NA	NA	ND	ND	ND	2900 J	31.5 J
7439-92-1	Iron – Total		300		ND	NA	NA	7.5 J	7.5 J	ND	1160000 J	10800 J
7439-92-1	Lead – Total		1 (1)		7	NA	NA	3000	3000	2900	12500 J	150 J
7439-95-4	Magnesium – Total		NS		1350 J	NA	NA	ND	ND	ND	86500 J	2510 J
7439-96-5	Manganese – Total		NS		19.5	NA	NA	4540 J	4540 J	4670 J	15500 J	186 J
7439-97-6	Mercury – Total		0.2		ND	NA	NA	345	345	173	4.8 J	ND
7440-02-0	Nickel – Total		46.3 (1)		ND	NA	NA	ND	ND	ND	1160 J	ND
7440-09-7	Potassium – Total		NS		474 J	NA	NA	ND	ND	4010 J	20100 J	2020 J
7440-22-4	Silver – Total		0.1 (IONIC)		ND	NA	NA	NA	2910 J	ND	51.3 J	14 J
7440-23-5	Sodium – Total		NS		4980 J	NA	NA	NA	24700	28400	13700 J	6580 J
7440-62-2	Vanadium – Total		14		ND	NA	NA	NA	ND	ND	2680 J	23.7 J
7440-66-6	Zinc – Total		30		ND	NA	NA	NA	83.5	35.2	24000 J	275 J
57-12-5	Cyanide – Total		5.2		ND	NA	NA	NA	ND	ND	66.8 J	10 J
ES-5002	Total Hardness as CaCO ₃ (mg/l)		NA		37.8	NA	NA	NA	NA	NA	NA	NA
ES-5003	Recoverable Hydrocarbons (mg/l)		NA		NA	NA	NA	0.78	NA	NA	NA	NA

1) Analyzed by: Aquatec, Inc.
2) Analyzed by: RECRA Environmental, Inc.
3) NYSDEC – Water Quality Standards and Guidance Values (11/91).
NS – No Standard
4) Based on an average hardness of 41 ppm.
I – Indicates an estimated value.
IEJ – Indicates unuseable data.
A – Indicates a compound was not analyzed for.
D – Indicates a compound was analyzed for but not detected at the lab's MDL.
see Table 4.9 for complete list of laboratory qualifiers.
Bold Face – Indicates the maximum concentration found for all surface water samples
– Indicates a concentration above the surface water standard.

TABLE 4.8
NAPANOCH PAPER MILL SITE
 Paper Roll Samples
 Detected Compound Summary

PARAMETER	Soil Cleanup Objective	IRM Samples		RI Samples	
		87	88	PAP-1	PAP-2
ASP91-1 - VOLATILES (µg/kg)					
Acetone	200	NA	NA	96	8700
Carbon Disulfide	2700	NA	NA	14	ND
1,1-Dichloroethene	400	NA	NA	10	ND
2-Butanone	300	NA	NA	ND	1100
2-Hexanone	NS	NA	NA	6	77
ASP91-2 - SEMIVOLATILES (µg/kg)					
Pentachlorophenol	1000	NA	NA	770	63
Phenanthrene	50000	NA	NA	52	87
Di-n-butyl phthalate	8100	NA	NA	320	290
Fluoranthene	50000	NA	NA	320	62
Butyl benzyl phthalate	50000	NA	NA	320	2400
Bis(2-ethylhexyl) phthalate	50000	NA	NA	280	2400
ASP91-3 - PESTICIDES/PCBs (µg/kg)					
PCBs	1000	100000	38000		
Aroclor 1242				3300	290 P
Aroclor 1254					130
TOTAL METALS (mg/kg)					
Aluminum - Total	NS	NA	NA	413	307
Barium - Total	300	NA	NA	29	11.1
Cadmium - Total	1	NA	NA	0.16	0.08
Calcium - Total	NS	NA	NA	710	1690
Chromium - Total	10	NA	NA	8.6	4.3
Copper - Total	3200	NA	NA	7.3	12.7
Iron - Total	NS	NA	NA	146	162
Lead - Total	100	NA	NA	41.9	23.9
Magnesium - Total	NS	NA	NA	76.7	151
Manganese - Total	400	NA	NA	8.1	9.0
Mercury - Total	0.10	NA	NA	0.11	ND
Potassium - Total	NS	NA	NA	ND	173
Silver - Total	400	NA	NA	3.1	0.080
Sodium - Total	NS	NA	NA	ND	177
Zinc - Total	24000	NA	NA	289	23.8

— Indicates a concentration above the soil cleanup objective.

NS = No Standard

NA = Not Analyzed

See Table 4.9 for complete list of laboratory qualifiers.

TABLE 4.9
NAPANOCH PAPER MILL SITE
 Footnote/Qualifier List

DATA QUALIFIERS (ORGANIC COMPOUNDS):

B: This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

J: Indicates an estimated value.

ND: Indicates compound was analyzed for but not detected. Refer to Appendix D for detection limit.

X or T: Mass spectrum does not meet CLP criteria for confirmation, but compound presence is strongly suspected.

E: This flag is used to indicate that the quantitation of the analyte is outside the curve and that dilution was required to properly quantitate.

D: Flag is used to indicate the value for the target analyte was calculated from a dilution (see E flag above).

Y: Flag used when a matrix spike compound is also confirmed present in the unspiked sample.

R: Data Validation recommends that this value be rejected due to blank contamination.

U: Indicates the compound was analyzed for but was not detected. The number is the minimum attainable detection limit for the sample.

N: Presumptive evidence of presence of material.

NJ: Presumptive evidence of material at an estimated quantity.

NS: No standard or guidance value established.

F: Surrogate recovery values were outside the CLP criteria windows. Value is considered an estimated concentration.

NA: Not analyzed.

P: Greater than 25% exists for detected concentrations between the two GC columns for pesticide/aroclor.

Values shaded and boxed exceed quoted standards.

DL following the sample ID indicates that a dilution was performed.

RE following the sample ID indicates that a reanalysis was performed.

DATA QUALIFIERS (METALS):

B: Reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL).

U or -: Reported value is less than IDL.

N: Spiked sample recovery not within control limits.

*: Duplicate analysis (Relative Percent Difference) not within control limits.

W: Post digestion spike for Furnace AA analysis is out of control limits (85–115%), while sample absorbance is less than 50% of spike absorbance.

S: The reported value was determined by the Method of Standard Additions (MSA).

+: Correlation coefficient for the MSA is less than 0.995.

E: Reported value is estimated because of the presence of interference.

M: Duplicate injection precision not met.

NS: No standard or guidance value established.

NA: Not analyzed.

Values shaded and boxed exceed quoted standards.

SECTION 5

BASELINE RISK ASSESSMENT

5.1 BASELINE HUMAN HEALTH EVALUATION

5.1.1 Summary

A baseline human health evaluation (HHE) was conducted for the Napanoch Paper Mill Site. The purpose of the HHE was to assess the potential risks to human health which may be caused by chemicals originating from the site in the absence of any actions to control or mitigate their impact.

The results of the HHE indicate that adverse health effects due to noncarcinogenic and carcinogenic chemical activity may occur in both current residents and hypothetical future residents. If any adverse health effects result at all, they would most likely result from repeated long-term exposure to site media. Water in Rondout Creek does not appear to pose any significant health risk. Groundwater use by at least one current user may present a health risk due to elevated concentrations of manganese. The presence of manganese in the groundwater currently in use may not be due to the site. No fish caught in Rondout Creek were found to have concentrations of chemicals in their tissues exceeding appropriate federal criteria.

The highest risks, which will be used for decision-making purposes, were calculated using a number of exposure assumptions, including the following:

- (1) Residents contact on-site soil and sediment 350 days/year for 30 years. The first 6 years are spent as children, ingesting 800 mg/day of soil or sediment. The balance of 24 years is spent ingesting 100 mg/day of soil or sediment.
- (2) Hypothetical future residents will utilize on-site groundwater for their domestic needs.
- (3) The concentrations of chemicals will not change over the course of 30 years.

The first assumption will overestimate risks for the bulk of the population if not the entire population. At most, only a small percentage of the population would be expected to actually be exposed at these rates. Likewise, the third assumption is likely to overestimate risks, as the concentrations of organic compounds will probably decline significantly over the course of 30 years.

Local residents have been observed on the site. Rondout Creek downstream of the site is used for recreational fishing. It is also likely that children swim or wade in portions of Rondout Creek adjacent to or downstream of the site.

A number of organic and inorganic chemicals were detected in surface and subsurface soil on site, and were retained for quantitative assessment. Current nearby residents have been observed on the site. These residents could be exposed to site surface soil. It has been assumed that excavation could take place in the future, exposing the hypothetical future residents to surface and subsurface soil.

Sediment samples from Rondout Creek were found to contain a number of organic and inorganic chemicals. Many of these chemicals were retained for quantitative assessment. Current and future residents would be exposed to these sediments during recreational activities in the creek such as wading, swimming, canoeing, and fishing.

In the HHE, the likelihood of noncarcinogenic effects is indicated by the hazard index, while the risk of carcinogenic effects is presented as a probability. Two estimates of hazard and risk are presented: a central tendency estimate and a high end estimate. For decision-making purposes, the high end estimate is used. A hazard index greater than 1 indicates that adverse noncarcinogenic effects may occur. A risk greater than the USEPA target risk range of 1 in 1,000,000 to 1 in 10,000 indicates that there is a significant risk of carcinogenic effects.

The high end hazard index for noncarcinogenic effects in current residents is 44, while that for hypothetical future residents is 68. The comparable central tendency hazard indices are 5 and 24, respectively. The elevated hazard indices are due primarily to the presence of manganese in soil and sediment from Rondout Creek, as well as in a residential well; PCBs in soil and sediment; and other metals in soil and sediment.

The high end risk for carcinogenic effects in both current and hypothetical future residents is 6 in 10,000. The central tendency risks for current and hypothetical future residents are 4 in 100,000 and 5 in 100,000, respectively. These risks are due primarily to the presence of vinyl chloride in groundwater; PCBs in a seep; PCBs, PAHs, and arsenic in soil and sediment; and pesticides in soil.

Potential receptor groups are summarized and defined as follows:

- **Current Residents** - includes all people now living on or near the site. These residents are assumed to regularly spend time on the site. Site conditions are assumed to remain as they presently exist over the next 30 years.
- **Hypothetical Future Residents** - includes all people who may live on or near the site in the future. It is assumed that these residents will regularly spend time on the site. Future land use assumes that these residents will meet domestic water needs from an on-site or downgradient well, and that excavation will take place, thereby exposing these receptors to subsurface soils.

The following pathways and receptors were quantitatively evaluated:

- (1) ingestion of and dermal contact with downgradient private well water (current residents);
- (2) ingestion of and dermal contact with site groundwater (future residents);
- (3) inhalation of volatile organic compounds released from site groundwater while showering (future residents);
- (4) dermal contact with surface water (current and future residents);
- (5) ingestion of and dermal contact with surface soils (current residents);
- (6) ingestion of and dermal contact with combined surface and subsurface soils (future residents); and

- (7) ingestion of and dermal contact with Rondout Creek sediment (current and future residents).

Lead present in site soil was determined not to present a significant health threat. This determination was made using the USEPA Lead Uptake Biokinetic (UBK) Model.

5.1.2 Introduction

A baseline human health evaluation (HHE) was conducted for the Napanoch Paper Mill site. The objective of this HHE was to assess the potential risks to human health which may be caused by chemicals originating from the site in the absence of any actions to control or mitigate their presence. The most up-to-date versions of USEPA guidance available have been used to conduct the HHE. As currently required (USEPA, 1992b), the central tendency and high end portions of the hazard and risk distributions have been quantified. The primary references used include the following:

- (1) Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual Part A (USEPA, 1989);
- (2) Exposure Factors Handbook (USEPA, 1990);
- (3) Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" (USEPA, 1991);
- (4) Dermal Exposure Assessment: Principles and Applications (USEPA, 1992a);
- (5) Guidance on Risk Characterization for Risk Managers and Risk Assessors (USEPA, 1992b);
- (6) Guidelines for Exposure Assessment (USEPA, 1992g);
- (7) Supplemental Guidance to RAGS: Calculating the Concentration Term (USEPA, 1992f);
- (8) Integrated Risk Information System (IRIS; USEPA, 1993b); and
- (9) Health Effects Assessment Summary Tables (HEAST; USEPA, 1993a).

The high end estimate of hazard or risk is equivalent to the "reasonable maximum exposure" (RME) estimate (USEPA, 1992b). It is not a "worst case" or "bounding" estimate. Rather, it is the plausible estimate of the individual hazard or risk for those persons at the upper end of the risk distribution. The high end estimate is intended to fall within the true distribution. Conceptually, high end estimates are those for the 90th percentile of the population.

This HHE is based on an unrestricted current and future land use scenario where residents and persons working on site (the receptors) are assumed to receive a "reasonable maximum exposure." This is a highly conservative (health-protective) approach.

5.1.3 Identification of the Chemicals of Concern

The analytical data base and background information considered for this evaluation came from the following reports:

- (1) Draft Phase I Report for New York State Superfund Standby Contract, Napanoch Paper Mill Site, April 1992 (ES, 1992a); and
- (2) Phase II Data Report, New York State Superfund Standby Contract, Napanoch Paper Mill Site, August 1992 (ES, 1992b).

Phase I samples were analyzed for the entire Target Compound List (TCL) and Target Analyte List (TAL) parameters. Phase II samples were analyzed as follows:

- (1) monitoring wells - PCBs, full TAL;
- (2) residential wells - PCBs, full TAL;
- (3) production well - full TCL/TAL;
- (4) surface water - two samples full TCL/TAL; balance PCBs, full TAL;
- (5) soil (including paper) - full TCL/TAL; and
- (6) concrete - PCBs.

All data were validated.

Chemicals of potential concern were identified and retained for quantitative evaluation. All organic compounds detected in greater than or equal to 5 percent of the groundwater, soil, and sediment samples were considered to be chemicals of potential concern. For purposes of this risk assessment, chemical data for paper rolls on the ground, as well as a sample of concrete, were combined with that for surface soils. Organic compounds in surface water which were present at concentrations exceeding New York State Class A water standards were considered to be chemicals of potential concern.

Inorganic chemicals detected in greater than or equal to 5 percent of the groundwater, soil, and sediment samples at maximum concentrations greater than or equal to three times the maximum background concentrations were retained for quantitative assessment. No inorganic chemicals detected in surface water were retained as chemicals of concern. Manganese was the only inorganic present in surface water at greater than or equal to three times the upgradient value, and it was present in one sample at a concentration greater than the New York State Class A standard of 300 ppb. However, the average concentration of manganese in the downgradient samples was well below the standard.

Chemicals detected in environmental samples that were also present in associated blanks were either accepted or rejected as bona fide detects based on criteria in the USEPA *Functional Guidelines* (USEPA, 1988a; 1988b). The following compounds are common laboratory contaminants: methylene chloride, acetone, toluene, methyl ethyl ketone, and common phthalate esters. These compounds are only accepted as bona fide detects in a sample when they are present at concentrations greater than ten times their respective concentrations in associated blanks. All other chemicals are accepted if the concentration in the sample is greater than five times that detected in the associated blanks. There is no specific rationale in the USEPA *Functional Guidelines* for the so-called "10x rule" and "5x rule." Presumably these are somewhat arbitrary values judged to be sufficient to reduce the likelihood of false positive results.

Table 5.1 presents a comparison of the maximum background and on-site inorganic data in all site media sampled. Tables 5.2 through 5.6 contain data summaries for the chemicals of concern identified in each medium. The data in Tables 5.2 through 5.6 were used to establish representative site concentrations. The representative site concentrations were used to calculate noncarcinogenic hazards and carcinogenic risks.

The data in Table 5.2 are from on-site and downgradient monitoring wells only, and do not include the on-site production well nor residential wells. The only chemical of concern identified for residential wells was manganese. Data for these wells are not presented in a table in this section, as the data were limited and a maximum value for manganese (382 µg/L) was used in the quantitative assessment.

Tables 5.2 through 5.6 are based solely on analytical data from on-site and downgradient samples, and do not include samples identified as upgradient or background. Table 5.4 includes all on-site and downgradient surface soil samples taken exclusively from 0 to 2 feet in depth. Table 5.5 includes all on-site and downgradient soil data; that is, surface soil data and subsurface soil data.

5.1.4 Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of exposures to the chemicals of potential concern that are present at or migrating from a site. A completed exposure pathway is comprised of the following four elements:

- a source and mechanism for chemical release;
- an environmental transport medium;
- an exposure point; and
- a human receptor and a feasible route of exposure at the exposure point.

A pathway is not complete unless all four elements are present.

5.1.4.1 Exposure Setting

The Napanoch Paper Mill Site, formerly Rondout Paper Mill, is located on Route 55 in the Hamlet of Napanoch, Town of Wawarsing, Ulster County, New York. The site occupies an area of approximately 19 acres. It is bounded on the south by Rondout Creek, and on the north by NY Route 55.

The property has undergone multiple changes of operation and ownership since 1883. The period of time associated with hazardous waste generation was from 1949 to 1977. During this time the mill produced packing, wrapping, and recycled paper. The mill was destroyed by a major fire in May of 1977.

There are residences immediately adjacent to the eastern border of the site. The wells used by the occupants of these residences are believed to be cross gradient of the site, and are probably not currently being impacted by the site, based on the probable groundwater flow path directly south to Rondout Creek. There are also residences on the opposite side (north) of Route 55 from the site. These residences are upgradient of the site. Manganese was detected in the cross gradient residential wells at concentrations greater than or equal to three times the concentrations present in upgradient residential wells. The presence of manganese may not be due to the site,

but rather may be due to other off-site sources such as the site of a nearby former axe head plant.

Local residents have been observed on the site. Rondout Creek downstream of the site is used for recreational fishing. It is also likely that children swim or wade in portions of Rondout Creek adjacent to or downstream of the site.

5.1.4.2 Exposure Pathways

Table 5.7 presents the matrix of potential exposure pathways for the site, and indicates whether or not each pathway has been quantitatively evaluated. Potential pathways include exposure to groundwater, surface water, soil, sediment, and air. Potential receptors are current residents living near the site, and hypothetical future residents living on or near the site.

Current nearby residents rely exclusively on private wells. Groundwater from crossgradient/downgradient private wells was quantitatively evaluated for current residents. Water from on-site/downgradient monitoring wells was evaluated for future residents.

PCBs were the only chemicals detected in surface water which were retained for quantitative assessment. PCBs were detected in only one sample, and this sample was collected from an on-site seep within 100 feet of Rondout Creek. The concentration of PCBs in this sample exceeded the New York State Class A standard for PCBs. Manganese and carbon disulfide were detected in one or more downstream creek samples, but were not retained. The mean concentration of manganese was below the applicable New York State Class A standard, while the single detection of carbon disulfide was below a level of concern for tap water (USEPA, 1993d). Current and future residents could be exposed to this water in the pooled seep water or in Rondout Creek during various recreational activities, including wading, swimming, canoeing, and fishing. However, at present the water in Rondout Creek does not appear to contain any site-related chemicals at levels of concern.

A number of organic and inorganic chemicals were detected in surface and subsurface soil on site, and were retained for quantitative assessment. Current nearby residents have been observed on the site. These residents could be exposed to site surface soil. It has been assumed that excavation could take place in the future, exposing the hypothetical future residents to surface and subsurface soil.

Sediment samples from Rondout Creek were found to contain a number of organic and inorganic chemicals. Many of these chemicals were retained for quantitative assessment. Current and future residents would be exposed to these sediments during recreational activities in the creek such as wading, swimming, canoeing, and fishing.

During site investigation activities, air monitoring was conducted with PIDs, colorimetric tubes, personal monitoring pumps, and organic vapor badges. At no time were site contaminants detected in the breathing zone. This indicates that the potential for significant exposure of current receptors to contaminants in air is very low.

Site contaminants have little potential to significantly impact the air pathway currently or in the future. Soil data indicate that volatile organic compounds are not

present in concentrations sufficient to impact air. Furthermore, the potential for fugitive dust generation is virtually nonexistent currently due to extensive vegetative cover, and will probably remain low due to the nature of the site soils. Site soils are high in humus and have a high moisture content. It is highly probable that any contribution of outdoor air to noncarcinogenic hazards and carcinogenic risks would be very small in relation to the contribution from other pathways. Therefore, the outdoor air pathway was not quantitatively evaluated for current or future residents.

Volatile organic compounds were detected in monitoring wells at the site. Therefore, hypothetical future residents using water from the site could be exposed to volatiles released from water to air in a bathroom during domestic use. This pathway was quantitatively evaluated.

Ingestion of fish from Rondout Creek was not evaluated quantitatively for current or future residents. Contamination of fish due to releases from the site does not appear to present a problem. Samples of fish taken from downstream of the site by NYSDEC during July and October 1989 were analyzed for pesticides and PCBs (NYSDEC, 1989). No pesticides or PCBs were detected in fish tissue at concentrations exceeding appropriate action levels established by the FDA or USEPA (Table 5.8).

Potential receptor groups are summarized and defined as follows:

- **Current Residents** - includes all people now living on or near the site. These residents are assumed to regularly spend time on the site. Site conditions are assumed to remain as they presently exist over the next 30 years.
- **Hypothetical Future Residents** - includes all people who may live on or near the site in the future. It is assumed that these residents will regularly spend time on the site. Future land use assumes that these residents will meet domestic water needs from an on-site or downgradient well, and that excavation will take place, thereby exposing these receptors to subsurface soils.

The following exposure pathways have been quantitatively evaluated:

- (1) ingestion of and dermal contact with downgradient private well water (current residents);
- (2) ingestion of and dermal contact with site groundwater (future residents);
- (3) inhalation of volatile organic compounds released from site groundwater while showering (future residents);
- (4) dermal contact with surface water (current and future residents);
- (5) ingestion of and dermal contact with surface soils (current residents);
- (6) ingestion of and dermal contact with combined surface and subsurface soils (future residents); and
- (7) ingestion of and dermal contact with Rondout Creek sediment (current and future residents).

5.1.4.3 Quantification of Exposure

Exposure Point Concentrations

Exposure point concentrations are the concentrations of chemicals in a given medium to which a hypothetical receptor may be exposed at a specific location known as the "exposure point." Exposure point concentrations can be based on analytical data obtained from on-site sampling, or they may be estimated through modeling. The exposure point concentrations for oral and dermal pathways in this evaluation are equal to the representative site concentrations for groundwater, soil, and sediment. The exposure point concentrations for the inhalation of volatiles released while showering were modeled based on the representative concentration of volatiles in groundwater.

A representative concentration, also known as the "concentration term," was calculated for each chemical in each pathway. The representative concentration is the basis for calculating both the central tendency and high end hazards and risks. The representative concentration was calculated according to current USEPA guidance (USEPA, 1992f). It was assumed that all data were lognormally distributed, as this is usually the case. Therefore, the data were transformed using the natural logarithm of each datum. The representative concentration was usually taken to be the upper 95 percent confidence limit (UCL) on the arithmetic mean of the transformed data (UCL_T).

Mean concentrations for each chemical were determined by averaging detected concentrations along with the non-detects, using one-half the sample quantitation limit (as the concentration value for nondetects). In cases where the UCL equaled or exceeded the maximum concentration detected, the maximum concentration detected was used for the representative concentration. The maximum concentration detected in residential wells was used as the representative concentration, as there are actual receptors currently using this water (as opposed to hypothetical receptors).

The representative concentration is generally an estimate of the arithmetic average concentration for a contaminant. Because of the uncertainty associated with estimating the true average concentration at a site, the UCL is normally used. The UCL provides reasonable confidence that the true site average will not be underestimated (USEPA, 1992f).

Standard statistical methods were used to calculate the 95 percent UCL on the arithmetic mean (USEPA, 1992f; Gilbert, 1987). The 95 percent UCL on a mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95 percent of the time (USEPA, 1992f). Furthermore, as sample size increases, the 95 percent UCL approaches the true mean. The 95 percent UCL on the transformed data was calculated as follows:

$$UCL_T = e^{(\bar{X} + 0.5s^2 + sH/\sqrt{n-1})}$$

Where:

$$\begin{array}{ll} \bar{X} & = \text{mean of the transformed data} \\ UCL_T & = \text{95 percent UCL for the transformed data} \end{array}$$

e	=	base of natural log (= 2.718)
s	=	standard deviation of the transformed data
H	=	H-statistic
n	=	number of samples

It should be noted that regardless of the type of data distribution, the USEPA asserts that the arithmetic mean is the appropriate basis for estimating the representative site concentration. The USEPA maintains that the geometric mean is not an appropriate basis for estimating the representative site concentration (USEPA, 1992f).

Exposure Point Concentrations in Indoor Air

Exposure point concentrations for volatile organic compounds (VOCs) released from water during showering were modeled on the basis of work conducted by Andelman (1984, 1985a, and 1985b). In the model, the air concentration is determined by a balance between the rate of release from the shower water and the rate of air exchange between the shower and the rest of the house. The constants occurring in the model have been set to match the observed efficiency of volatilization of trichloroethene (TCE) in model showers, and to fit the observed shower air concentrations of TCE in several homes with contaminated water where measurements have been made. Scaling to other compounds is accomplished by assuming that the rate of volatilization from shower water to air is proportional to the Henry's Law Constant (Table 5.9). The average concentration of a volatile compound in the shower air over a period of t_s minutes is (appropriate units in parentheses):

$$C_s = C_{inf} [1 + (1/(kt_s))(\exp(-kt_s)-1)]$$

for $t_s > 0$

C_s = average concentration of a volatile compound in the shower air over a duration of t_s minutes (mg/m³)

t_s = time in shower; typical value for an adult is 12 (min)

k = rate constant for exponential function, defined below (1/min)

$$k = F_a/V_b$$

F_a = flow rate of air in shower, typical value is 2.4 (m³/min)

V_b = volume of bathroom, typical value is 12 (m³)

C_{inf} = asymptotic concentration in air if shower ran for a long time (much longer than 5 minutes), calculated below (mg/m³)

$$C_{inf} = [(E)(F_w)(C_t/1,000)]/F_a$$

C_t = concentration in shower water, determined by case (μg/L)

E = efficiency of release of compounds from water to air, defined below (unitless)

$$E = (E_{TCE})(H)/(H_{TCE})$$

F_w = flow rate of water in shower, typical value is 8 (L/min)

E_{TCE} = efficiency of release of TCE from water to air, 0.6 is a typical value; this is assumed for all compounds (unitless)

H = Henry's Law Constant for a given organic compound ($m^3\text{-atm/mol}$)

H_{TCE} = Henry's Law Constant for TCE, typical value is 9.10×10^{-3} ($m^3\text{-atm/mol}$)

Human Intakes

Oral and dermal intakes associated with long-term exposures were calculated in terms of chronic daily intakes (CDIs) for noncarcinogenic effects and lifetime average daily exposures (LADEs) for carcinogenic effects. CDIs are averaged over the exposure time only, while LADEs are averaged over the standard assumed lifetime of 70 years. For purposes of this risk assessment, intake variables have been combined to produce terms known as intake factors. Separate intake factors were calculated for central tendency and high end estimates. The intake variables used to calculate the central tendency IFs were the 50th percentile values wherever available; while the intake variables used to calculate the high end IFs were greater than or equal to 90th percentile values. All variables and intake factors used are presented in Tables 5.10 through 5.14. The USEPA (1989, 1990, 1991, and 1992a) provides standard intake variables for most media and routes of exposure. These intake variables are based on research conducted on activity patterns of various human subpopulations.

The overall scenario for exposure to soil and sediment was modified somewhat from the standard USEPA scenario. The standard exposure frequency of 350 days/year for residents was used; however, it was assumed that residents would be exposed to soil half the time (175 days/year) and sediment half the time.

To calculate human oral intakes, the exposure point concentrations are multiplied by the appropriate intake factors. To calculate dermal intakes from groundwater, the exposure point concentrations are multiplied by the appropriate intake factors and the chemical-specific permeability coefficients (Table 5.15). To calculate dermal intakes from soil, the exposure point concentrations are multiplied by the appropriate intake factors and the chemical-specific absorption factors. The details of these calculations are presented in Appendix L, along with associated annotations. It is not necessary to calculate intakes from air, as this pathway is handled differently (see below).

As is consistent with current USEPA guidance (USEPA, 1991 and 1992e), the residential receptor intake was calculated based on adult intake rates for all pathways except soil ingestion. In the latter case, a child intake rate was assumed for 6 years, while an adult intake rate was assumed for the balance of the 30-year exposure. It is no longer necessary to evaluate children separately from adults, unless specific site characteristics necessitate this. Generally, this approach provides a satisfactory estimation of exposure for all residents.

Lead Exposure

Lead was evaluated separately from the other chemicals. There are no toxicity values available for lead, so a hazard index or risk cannot be calculated. Lead was evaluated using the USEPA Lead Uptake Biokinetic (UBK) Model, Version 0.90

(USEPA, 1993c). This model is currently in draft form, and has not been formally released by USEPA.

The UBK Model is capable of estimating the blood lead level in fetuses, infants, and/or children based on total lead exposure. Total lead exposure includes exposure to lead in air, drinking water, soil/dust, food, and paint. As applied here, the model was used to estimate blood lead levels in children 0 to 7 years old (84 months). The 95 percent UCLs for lead in site soil were input into the model; otherwise, the default values built into the model were used. Thus, output from the model is indicative of lead exposure due to site soils, as well as assumed non-site-specific exposures from four other media.

The default values used are based on nationwide surveys of lead distribution in the environment and studies of inhalation and ingestion for each biologic age modeled. Blood lead levels greater than or equal to 10 $\mu\text{g}/\text{dL}$ indicate a level of concern for potential adverse neurological effects in children.

5.1.5 Toxicity Assessment

The objective of the toxicity assessment is to weigh available evidence regarding the potential for particular chemicals to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects. For humans, USEPA has conducted numerous toxicity assessments which have undergone extensive review within the scientific community. Chemical Abstract Service (CAS) numbers and the toxicity classifications for all chemicals of concern at the site are presented in Table 5.16.

The types of EPA toxicity values used in risk assessment include oral reference doses (RfDs), inhalation reference concentrations (RfCs), oral slope factors (SFs), and inhalation and oral unit risk factors (URFs). RfDs and RfCs are used to evaluate noncarcinogenic effects. SFs and URFs are used to evaluate carcinogenic effects. Toxicity values for the chemicals of concern are presented in Tables 5.17 through 5.20. Additionally, these tables list the critical effects, target organs, or tumor types. The "critical effects" are those effects on which the RfD and/or RfC are based. Likewise, the "target organ" or "tumor type" refers to the site of the lesion or type of tumor observed, on which the SF and/or URF are based.

The chronic RfD or RfC is ideally based on studies where either animal or human populations were exposed to a given chemical by a given route of exposure for a major portion of the life span (referred to as a chronic study). The RfD is an oral value which is derived by determining dose-specific effect levels from all the available quantitative studies, and applying uncertainty factors to the most appropriate effect level in order to determine a chronic RfD for humans. RfCs are inhalation values which are derived by determining concentration-specific effect levels from all of the available literature and transforming the most appropriate concentration to a human RfC. Transformation usually entails converting an animal concentration to a continuous 24-hour exposure, transforming the exposure-adjusted value to account for differences in animal and human inhalation, and then dividing the adjusted human concentration by uncertainty factors to arrive at an RfC.

RfDs are reported as doses in milligrams of chemical per kilogram body weight per day (mg/kg/day). RfCs are reported as concentrations in mg of chemical per cubic meter of air (mg/m³). RfDs and RfCs represent thresholds for toxicity. They are derived such that human lifetime exposure to a given chemical via a given route at a dose at or below the RfD or RfC should not result in adverse health effects, even for the most sensitive members of the population.

Carcinogenic slope factors and unit risk factors are route-specific values derived only for chemicals which have been shown to cause an increased incidence of tumors in either human or animal studies. Slope factors and unit risk factors are upper 95 percent confidence limits on lifetime risk and are determined by low-dose extrapolation from human or animal studies. When an animal study is used, the final slope factor or unit risk factor has been adjusted to account for extrapolation of animal data to humans. If the studies used to derive the slope factor or unit risk factor were conducted for less-than the life span of the test organism, the final slope factor has been adjusted to reflect risk associated with lifetime exposure. Slope factors are reported as risk per dose (mg/kg/day)⁻¹. Unit risk factors are reported as risk per unit concentration (μg/m³)⁻¹ or (μg/ml)⁻¹.

For carcinogens, EPA has developed weight-of-evidence classifications which are reported along with SFs and URFs. The weight-of-evidence classification developed by the USEPA reflects the likelihood that an agent is a human carcinogen based on available data. There are five groups into which chemicals may be classified with regard to carcinogenic potential:

- A - Human carcinogen.
- B1 or B2 - Probable human carcinogen. B1 indicates that limited human data are available. B2 indicates sufficient evidence in animals and inadequate or no evidence in humans.
- C - Possible human carcinogen.
- D - Not classifiable as to human carcinogenicity.
- E - Evidence of noncarcinogenicity for humans.

It should be noted that EPA has not derived toxicity values for all routes of exposure. Most of the available toxicity values are for oral exposure, and many inhalation values are available. No values are currently available for dermal exposure. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants. In addition, until recently, scientists have assumed that dermal exposures were minimal in comparison with oral exposure.

In the absence of dermal reference toxicity values, EPA has suggested (USEPA, 1989) that in some cases it may be appropriate to modify an oral reference toxicity value (RfD or slope factor) to reflect dermal absorption. This requires that the toxic endpoints observed are the same for both oral and dermal exposure, and that one have quantitative estimates of both dermal and oral absorption of the chemical. This information is generally not available for most priority pollutants, and oral toxicity values are nevertheless often used to quantify risks associated with dermal exposure.

As a consequence, any valuation of the contribution of dermal exposure to overall risk needs to be viewed as highly tentative at best.

Oral toxicity values are usually presented as administered-dose values. The calculation of hazards and risks via the dermal route requires the use of absorbed-dose values. Therefore, the administered-dose values must be converted to absorbed-dose values (Tables 5.21 and 5.22). To convert an administered-dose RfD to an absorbed-dose RfD, the administered-dose value must be multiplied by the appropriate oral absorption factor. To convert an administered-dose slope factor to an absorbed-dose slope factor, the administered-dose value must be divided by the appropriate oral absorption factor.

The oral absorption factors for the chemicals of concern were taken from the appropriate ATSDR Profiles (1989-1992), where possible. Absorption of chemicals through the gastrointestinal tract is dependent upon several factors: the vehicle in which the chemical is administered (e.g., chemicals are more readily absorbed in corn oil than in water); the nutritional status of the individual (e.g., chemicals are absorbed to a greater extent when the individual is fasting and when given with water as compared to food); the age of the individual (some chemicals are more readily absorbed in children than in adults); and the solubility of the chemical (e.g., water-soluble metals are more readily absorbed than insoluble metals). The absorption factors presented in Tables 5.21 and 5.22 represent conservative (health protective) estimates of oral absorption. When information on the extent of oral absorption was lacking, default values were used (Tables 5.21 and 5.22). The default values were determined by adopting absorption factors for similar chemicals. It should be noted that to assume 100 percent oral absorption in this case would be a non-conservative (non-health protective) approach.

The toxicity information used in this baseline human health evaluation was obtained from the USEPA Integrated Risk Information System (IRIS; USEPA, 1993b), if possible. If values were not available from IRIS, the USEPA Health Effects Assessment Summary Tables (HEAST; USEPA, 1993a) were used. For tetrachloroethene and trichloroethene another USEPA reference (USEPA, 1992d) was used.

5.1.6 Risk Characterization

To characterize potential noncarcinogenic effects, comparisons are made between projected intakes of substances and toxicity values. To characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and to the extent possible, estimates of the uncertainties embodied in the assessment are also presented.

As required by current USEPA guidance (1992b), the central tendency and high end portions of the hazard and risk distributions were quantified. For decision-making purposes, the high end values should be used (USEPA, 1992f).

5.1.6.1 Noncarcinogenic Effects

The potential for noncarcinogenic effects is evaluated by comparing an exposure level or intake (chronic daily intake or CDI) over a specified time period with a reference value derived for a similar exposure period. This ratio is termed the hazard quotient (HQ). In other words, the hazard quotient equals the intake divided by the reference value, or:

$$\text{oral HQ} = \frac{\text{exposure intake (administered dose)}}{\text{oral RfD (administered dose)}}$$

$$\text{dermal HQ} = \frac{\text{intake (absorbed dose)}}{\text{oral RfD (absorbed dose)}}$$

$$\text{inhalation HQ} = \frac{\text{exposure concentration}}{\text{RfC}}$$

The hazard quotient assumes that there is a level of exposure (i.e. the RfD or RfC) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level exceeds the threshold (i.e., if the HQ exceeds 1) there may be concern for potential noncancer effects.

To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach has been developed by the USEPA. This approach assumes that simultaneous subthreshold exposures to several chemicals could result in an adverse health effect. The hazard index is calculated as follows:

$$\text{hazard index} = \text{HQ}_1 + \text{HQ}_2 + \dots + \text{HQ}_i$$

where:

$$\text{HQ}_i = \text{the hazard quotient for the } i^{\text{th}} \text{ substance}$$

It should be noted that exposure intake is taken to mean "chronic" exposure. Chronic exposure is defined as exposure which occurs over the majority of a life span.

Calculation of a hazard index in excess of 1 (one) indicates the potential for adverse health effects. Indices greater than 1 will be generated anytime intake (oral or dermal exposure) or air concentration (inhalation exposure) for any of the chemicals of concern exceeds its RfD or RfC. However, if there are two or more chemicals involved, it is possible to generate a hazard index greater than 1 even if none of the individual chemical intakes or concentrations exceed their respective RfDs or RfCs.

Oral chronic daily intake (CDI) is calculated by multiplying the appropriate intake factor (Tables 5.10 and 5.13) by the corresponding exposure point concentration (Tables 5.2, and 5.4 through 5.6). Dermal CDI is calculated by multiplying the appropriate intake factor (Tables 5.11, 5.12, and 5.14) by the corresponding exposure point concentration and by the chemical-specific permeability coefficient (describes the rate of penetration through the skin of chemicals present in water, from Table 5.15) or absorption factor (for soil; see associated tables in Appendix L). Hazard quotients and indices have been calculated for all chemicals of concern for all pathways in Appendix L. Summaries of these indices by pathway may be found in Table 5.23.

The overall high end hazard index for current residents is 44 (Table 5.23), while that for hypothetical future residents is 68 (Table 5.23). The comparable central

tendency hazard indices are 5 and 24, respectively. These values substantially exceed the USEPA target hazard index of 1 (one). This finding indicates that adverse noncarcinogenic health effects may result from repeated, long-term exposure to site media. Ingestion of sediment poses the greatest noncarcinogenic health threat, followed by ingestion of soil. Other exposure pathways associated with potential adverse noncarcinogenic health effects include dermal contact with soil and sediment, as well as ingestion of and dermal contact with groundwater. The chemicals accounting for this health threat are: manganese, PCBs, arsenic, antimony, copper, and vanadium. Profiles of these and other potentially site-related chemicals may be found in Appendix M. These profiles include CAS Number, common synonyms, analytical classification, physical and chemical data, and information on half-lives (organics), background concentrations (inorganics), fate and transport, human toxicity, and ecological toxicity.

The results of the USEPA Lead Uptake Biokinetic (UBK) Model indicated that lead in soil at the site does not pose a significant threat to children, as the predicted blood lead concentrations for over 99 percent of the exposed population were below 10 µg/dL. The predicted blood lead concentrations (geometric means) of current and hypothetical future children were 4.39 µg/dL and 3.86 µg/dL, respectively. Appendix N contains the inputs and outputs for the Lead UBK Model.

5.1.6.2 Carcinogenic Effects

Carcinogenic risk is expressed as a probability of developing cancer as a result of lifetime exposure (lifetime average daily exposure or LADE for oral and dermal exposure). For a given chemical and route of exposure, carcinogenic risk is initially calculated as follows:

$$\text{oral risk} = \frac{\text{LADE (administered dose)} \times \text{oral slope factor}}{\text{(administered dose)}}$$

$$\text{dermal risk} = \frac{\text{LADE (absorbed dose)} \times \text{oral slope factor}}{\text{(absorbed dose)}}$$

$$\text{inhalation risk} = \text{exposure concentration} \times \text{unit risk factor}$$

However, if the oral or dermal risk is determined to be greater than or equal to 10^{-2} (1/100), then the following equation is used to make the final risk estimate:

$$\text{risk} = 1 - e^{-(\text{LADE} \times \text{slope factor})}$$

For simultaneous exposure to several carcinogens, USEPA assumes that the risks are additive. That is to say:

$$\text{risk}_T = \Sigma \text{risk}_1 + \text{risk}_2 + \dots + \text{risk}_i$$

where:

risk_T = the total cancer risk, expressed as a unitless probability, and

risk_i = the risk estimate for the i^{th} substance

Addition of the carcinogenic risks is valid when the following assumptions are met:

- doses are low;
- no synergistic or antagonistic interactions occur; and
- similar endpoints are evaluated.

USEPA's target range for carcinogenic risk associated with Superfund sites is 1 in 1,000,000 (10^{-6}) to 1 in 10,000 (10^{-4}). That is, the risks due to the site should not exceed this target range. If they do, the need for remediation is indicated. Note that although Superfund guidance is used here, the Napanoch Paper Mill Site is not on the National Priorities List (NPL).

Oral lifetime average daily exposure (LADE) is calculated by multiplying the appropriate intake factor (Tables 5.10 and 5.13) by the corresponding exposure point concentration (Tables 5.2, and 5.4 through 5.6). Dermal LADE is calculated by multiplying the appropriate intake factor (Tables 5.11, 5.12, and 5.14) by the corresponding exposure point concentration and by the permeability coefficient (from Table 5.15) or absorption factor (Appendix L). Risks have been calculated for all chemicals of concern for all pathways in Appendix L. Summaries of these risks by pathway may be found in Table 5.24.

The overall high end carcinogenic risk for both current and hypothetical future residents is about 6 in 10,000 (Table 5.24). This exceeds the USEPA target risk range of 1 in 10,000 to 1 in 1,000,000. All exposure pathways for both current and hypothetical future residents had associated risks exceeding the USEPA target range. The central tendency risks for current and hypothetical future residents are 4 in 100,000 and 5 in 100,000, respectively. The risks are due primarily to the presence of the following chemicals in one or more site media: PCBs, PAHs, arsenic, DDT analogs, vinyl chloride, tetrachloroethene, and dieldrin. Profiles of these and other potentially site-related chemicals may be found in Appendix M.

5.1.6.3 Uncertainty

There are several categories of uncertainties associated with site risk assessments. One is the initial selection of substances used to characterize exposures, noncarcinogenic hazards and carcinogenic risks on the basis of the sampling data and available toxicity information. Other sources of uncertainty are inherent in the toxicity values for each substance used to characterize hazards and risks. Additional uncertainties are inherent in the exposure assessment for individual substances and individual exposures. These uncertainties are driven by the degree of reliability of the chemical monitoring data, the models used to estimate exposure concentrations in the absence of monitoring data, and the population intake parameters. Finally, additional uncertainties are incorporated into the risk assessment when exposures to several substances across multiple pathways are summed.

Uncertainties in the Physical Setting

This HHE is based on an unrestricted current and future land use scenario where residents and persons working on site (the receptors) are assumed to receive a "reasonable maximum exposure" (RME). It should be noted that this is highly

conservative (health protective) in approach. The following major assumptions are made:

- The concentrations of chemicals present at the site will not diminish over the course of 30 years; and
- The receptor will be exposed to a greater-than-average concentration, usually the upper 95 percent confidence limit on the arithmetic mean concentration, or the maximum detected concentration, for the majority of the time.

In reality, the concentrations of many organic compounds present at the site, particularly volatiles, will significantly decline over time due to volatilization and/or various degradation processes such as biodegradation, and due to the continuous flushing of the site by normal precipitation and groundwater flow. Furthermore, people will not be exposed to the higher site concentrations for the majority of the time.

The noncarcinogenic health threat associated with the use of groundwater by current residents is somewhat uncertain because it is based on a single value from one residence. Although data for other downgradient or crossgradient residences were available, the maximum value detected was used, as actual receptors (as opposed to hypothetical receptors) are using this water. Ideally, several rounds of sampling over the course of at least a year would have increased the reliability of the hazard index calculated for current residents. Additionally, contaminants present in these wells may not be due to the site anyway, but may instead be due to an off-site source.

Uncertainties in Exposure Models

There is always some doubt as to how well an exposure model or its mathematical expression approximates the true relationships among site-specific conditions. Soil concentrations based on environmental sampling and analysis may overestimate or underestimate exposure. Further, a steady state condition was assumed which would tend to overestimate hazards and risks since concentrations of organic chemicals, at least, are expected to decrease over time.

Standard assumptions regarding body weight, period exposed, life expectancy, population characteristics, and lifestyle may not be representative of any actual exposure situation. Therefore, hazards and risks may be overestimated or underestimated.

Uncertainties in the Toxicity Assessment

Some uncertainty is inherent in the toxicity values for the duration of exposure assessed. These uncertainties are compounded under the assumption of dose additivity for multiple substance exposure. That assumption ignores possible synergisms or antagonisms among chemicals, and assumes similarity in mechanisms of action and metabolism. Another assumption is that all the toxicity values used have an equal degree of reliability, which in reality is not the case (see Tables 5.17 and 5.18). Overall, these assumptions would tend to overestimate hazards and risks. Because toxicity constants are generally based on the 95 percent confidence limit, hazards and risks tend to be overestimated.

On the other hand, it must also be emphasized that not all chemicals detected could be quantitatively evaluated for health effects since there are not toxicity values available for all chemicals. An example is 1,1,1-trichloroethane, for which the previously available RfD has been withdrawn. Lead also has no toxicity values, thus a hazard index or risk could not be calculated. Nevertheless, lead was evaluated using the USEPA Lead Uptake Biokinetic (UBK) Model (USEPA, 1993c).

5.2 HABITAT-BASED ASSESSMENT

A Phase I habitat-based assessment (HBA) was conducted to assess the potential effects of site-related contaminants detected in physical media at the Napanoch Paper Mill site, . The scope of the HBA was outlined as Task 2.6 in the RI/FS work plan (ES, 1992), and was designed to fulfill the requirements of the NYSDEC 1991 guidance, "Fish and Wildlife Impact Assessment for Inactive Hazardous Waste Sites." The 1991 document supersedes a draft version released in 1990. The draft memorandum was followed in the RI/FS work plan, and therefore, the organization of the HBA presented in this report varies from the Task 2.6 work plan organization. However, all major elements of the HBA requirements are the same in the draft and the final TAGM.

5.2.1 HBA Scope and Objectives

This Phase I HBA meets the requirements for Steps I and II as described in the NYSDEC (1991) document. The objectives of Step I, the Site Description, are 1) to identify if fish and wildlife resources potentially affected by site-related contaminants are present, and 2) if such resources are present, to provide adequate characterization of the resources and their habitats to allow assessment of site-related impacts (Step II). The scope of the Step I characterization is described in the RI/FS work plan as Task 2.6.1 (ES, 1992).

The Step I HBA includes discussion of physical and vegetation cover conditions present at the site (with supporting topographic and cover type maps); descriptions of fish and wildlife resources and their associated habitats; assessment of the values of the fish and wildlife resources and habitats; and identification of standards, criteria, and guidelines (SCGs) appropriate for assessing the impacts of site-related contaminants on the ecological resources present.

The objective of Step II, Contaminant-Specific Impact Analysis, is to determine the impacts of site-related contaminants on fish and wildlife resources (NYSDEC, 1991). The scope of Step II of the HBA is described in the RI/FS work plan as Tasks 2.6.2 and 2.6.3 (ES, 1992). Step II includes a pathways analysis; criteria-specific analyses for contaminants detected in media for which pathways to ecological receptors are complete; and an analysis of toxicological effects for contaminants that are retained following the criteria-specific analysis. The TAGM allows a choice in selection of receptors for the toxicological assessment. The indicator-species analytical approach was adopted for the toxicological analysis, pursuant to the HBA guidance memorandum (NYSDEC, 1991). The result of the toxicological analysis is a summary of the potential impacts posed by chemicals of concern in selected media to ecological receptors, a discussion of uncertainty factors associated with the analysis, and

recommendations for further Phase II HBA or remediation work at the site. The methodologies and results of Steps I and II of the Phase I HBA are presented in the following sections.

5.2.2 Site Habitat Characterization

The purposes of the Step I HBA are to develop a site description to address existing environmental conditions and to characterize ecological resources. This preliminary evaluation is based on the reported contaminant levels detected in various media at the site and the incidence of contaminants in habitats associated with resident wildlife.

Site-specific data do not exist for all the species found within the site subject area. Biological samples and inventories were not conducted for Phase I. All data and observations utilized in the site characterization were compiled from the site investigation, site reconnaissance, and the technical literature. Data were acquired for regulated wildlife game species present in NYSDEC Wildlife Management Unit (WMU) #39. Vegetative characterizations were based upon a compilation of regional and local information and by site inspection.

Information presented in this section was acquired by literature searches, telephone interviews, searches of agency file information, and site inspections. Information was obtained from the NYSDEC headquarters in Albany, NY, regional offices in New Paltz and Syracuse NY., and the Wildlife Resources Center in Latham, NY. Information was also obtained from the Albany headquarters of the New York State Department of Health (NYSDOH), the Village of Napanoch, Ulster County Environmental Management Council, State University of New York College of Environmental Science and Forestry (SUNY ESF), Cornell University, US Fish and Wildlife Service, and publications of the Society of American Foresters. Regional information was obtained from the USGS 7 1/2-minute topographic maps of Napanoch, Ellenville, Rondout, and Kerhonkson NY, New York State Freshwater Wetlands maps, US Fish and Wildlife Service National Wetlands Inventory, the USDA Soil Conservation Service, the NYSDOH Community Water Systems Atlas, and the US Commerce Dept. Climatic Atlas of the United States.

Site-specific data do not exist for all the types of habitats and wildlife species found in the site vicinity. Multiple site visits were conducted to evaluate the habitat conditions within a one-half mile radius of the site. Observations and evaluations were concentrated within this radius and on the undeveloped areas.

5.2.2.1 Terrestrial Physical Environment

The Napanoch Paper Mill Site is situated near Napanoch, NY in the southwest corner of Ulster County in the low-lying Rondout Creek valley between the Catskill mountains to the north, and the Shawangunk mountain ridge to the south. The site consists of 19 acres bordered by NY Route 55 on the north and by Rondout Creek on the south. The site elevation slopes from 417 feet AMSL, at the edge of NY Route 55, to 336 feet AMSL at the ponded area of Rondout Creek.

The site surface is an irregular composite of graded areas and old structures including abandoned penstocks and tailraces, power houses, hydropower dams, debris piles, storage tanks, bedrock outcrops, foundations and walls.

The soils of the site and local region consist of the Arnot-Lordstown rock outcrop complex (USSCS, 1979). This soil association consists of shallow, somewhat excessively drained, and moderately well-drained Arnot soils; moderately deep, well drained, Lordstown soils; and bedrock outcrops. The soils in the site vicinity comprise an intricate pattern of approximately 35% Arnot soils, 30% Lordstown soils, 20% rock outcrop, and 15% other soils. Permeability is moderate in both major soil types, acidity is moderately to extremely acidic, and run-off is very rapid. Boulders cover 0.1% to 3% of the surface of these soils.

5.2.2.2 Climate

The Catskill region has cold winters and moderately cool to warm summers. Average annual air temperature is 15 degrees Celsius (NOAA, 1985) The area has an average of 127 freeze-free days per year. In winter the average temperature is 26 degrees F and the average daily minimum temperature is 19 degrees. Prevailing winds are from the west-southwest with highest average wind speeds of 12 MPH typically occurring in March. Precipitation is well distributed throughout the year with 51% (24 inches) occurring in April through September. Average total annual precipitation is 48 inches. Average seasonal snowfall is 68 inches (USSCS, 1979).

5.2.2.3 Land Use and Vegetative Cover

The site lies at the fringe of the small rural community of Napanoch, NY in the southern Catskill Mountain region. Land use to the west and south of the site, in the Village of Napanoch, is medium-density residential. Areas north and east of the site are generally sparsely populated. Many educational/recreational camps are located throughout the area. The distance from the site boundary to the nearest active camp is at least four miles. Undeveloped private and state-owned forest lands are common throughout the region.

The site lies within the 2.5 million acre Catskill region of south central NY. Forests cover nearly 1,600,000 acres - approximately two thirds of the land area. The State of New York owns 234,000 acres of Catskill Forest Preserve and 50,000 acres of game management lands and reforestation areas in the region. The site lies within the area described in the "Atlas of Forestry in New York" as the 1 million acre Catskill High Peak sub-region (SAF, 1953). Rugged slopes and high ridges are completely forested and contain some red spruce and balsam fir. The valleys have variable forest cover depending on the extent of active farming. The predominant forest type of the region is northern hardwoods composed chiefly of sugar maple, white ash, and black cherry, and yellow birch at higher elevations. Hemlock was once plentiful but historic harvesting of this species for the tanbark industry heavily depleted this species (SAF, 1953). Oaks and white pine grow in association in the southern and eastern parts of the region. Abandoned crop and pasture land commonly is taken over by red maple stands and northern hardwoods.

Previously disturbed and vacant lands at the Napanoch Paper Mill site have been transformed into brushland or old-field communities that exhibit interspersed areas of shrubs, small trees, vines, and coarse herbs. A cover type map is provided as Figure 5.1. Sumac, aspens, brambles, gray dogwood, and black locust are common. Small linear meadows existing on former access roads support herbaceous species including timothy, chicory, Queen Anne's lace, and clover.

A dense, hemlock-dominated, bottomland forest exists beside the creek bend below the US Route 55 bridge. This cover type occupies all of the low-lying creekside area from the highway bridge to the site perimeter fence. Thin, moist, organic soils are present among numerous boulders/cobbles. Moss and many species of ferns are abundant. The irregular surface contains many small seasonal pools concentrated along the edge of Rondout Creek. Sycamores are common along the creek margin.

Forests canopy on the slopes south of Rondout Creek consists of a sugar maple/red oak association with many hickories, scattered white pine, white cedar, burr oak, swamp white oak, and hemlock. Much of the understory is dominated by saplings of these species. The understory of the upper slopes is dominated in many places by thick stands of mountain laurel.

5.2.2.4 Wildlife Resources

Wildlife species that utilize habitat in the vicinity of the site were determined from NYSDEC wildlife harvest statistics for the Town of Napanoch, and Wildlife Management Unit (WMU) #39, and published lists of resident species. Game harvest statistics are maintained by NYSDEC for Ulster County, the Town of Wawarsing, WMU #31, and Deer Management Unit (DMU) #46. While each of these areas include much more territory than the two-mile radius of concern for the Napanoch RI/FS site, they represent the most precise units for wildlife resource information that are available. The information available adequately describes representative species likely to be associated with habitats similar to those found on the Napanoch Paper Mill site.

Statistics for upland game birds and waterfowl were available for the 1989-1993 seasons in WMU #39. The 1993 pheasant harvest was reported as 30,979 birds. Stocked birds represent almost all of the reported take. Ruffed grouse harvests varied from 13,603 in 1990 to 12,512 in 1993. Woodcock harvests are reported as 2,816 in 1993. Harvest of ducks species ranged from 17,518 to 11,602 for the period 1989 through 1993.

Pelts of furbearers (those requiring possession seals) harvested in WMU #31 include beaver, bobcat, coyote, and otter. Harvest estimates for furbearing species include cottontail rabbit, grey squirrel, snowshoe hare, raccoon, red fox, grey fox, woodchuck, mink, skunk, opossum, and muskrat. All of the species represented in the harvest statistics have the potential to occur within a three-mile radius of the Napanoch Paper Mill Site.

During the site investigation activities conducted in the winter of 1992 and summer of 1993, several wildlife species were observed at the site.

White-tailed deer were observed browsing the vegetation on the IRM area. Many fresh tracks were observed near the NY Route 55 bridge, suggesting that deer frequently cross the roadway at this point. A deer carcass was observed in the creek at sediment sampling location SED #3 (Plate 3.1) during the fieldwork in 1992. The cause of death is unknown. There is no evidence of site-related contaminant impacts in the area where this carcass was observed and it is not considered a site-related mortality. Evidence of significant deer presence in the forests adjacent to the site was observed during the summer 1993 site visit. Numerous tracks and buck scrapes were found along an abandoned access road leading to a nearby overhead power line route. Deer habitat is widespread on the forested slopes to the south of the site.

Heavy beaver activity was noted along the banks of the lower ponded area and upstream along Rondout Creek. Many girdled and fallen trees occur all along the Rondout Creek banks along the site boundary. Most of the beaver activity did not appear recent, except in the lower ponded area. A beaver carcass was noted during 1992 fieldwork at sediment sampling station # 11. The cause of death was not investigated.

Common winter songbirds observed on-site included the blue jay, downy woodpecker, cardinal, junco, nuthatch, purple finch and mourning dove. Numerous robins were observed foraging on the site property in meadow areas among old facility ruins. Belted kingfishers were sighted hunting fry and minnows in the creek. Migratory waterfowl (pair of unidentified ducks) were observed upstream of the site at the NY Route 55 highway bridge. Since songbird distribution over the site was generally random, it is not possible to evaluate whether they frequent any areas exhibiting obvious signs of soil or surface water contamination.

5.2.2.5 Aquatic Environment

Physical Characteristics

The Napanoch Paper Mill Site occurs within the Rondout Creek watershed. Rondout Creek occurs directly adjacent to the Napanoch Paper Mill Site. The Rondout Creek, which is a perennial stream, flows south from the Rondout Reservoir, approximately 4.7 miles upstream of the site property, and follows the Shawangunk Mountain ridge northeast to discharge into the Hudson River at Kingston NY, approximately 25 miles downstream from the site (USGS, 1976).

Flooding of Rondout Creek is somewhat attenuated by the large holding capacity of the Rondout Reservoir and the Honk Lake impoundment approximately 1 mile upstream. However the steep gradient and low moisture holding capacity of the thin local soils provide conditions for very high flow rates during run-off periods. The occurrence of periodically swift flow rates combined with thin soils and boulder/bedrock outcrops produces a channel that has only isolated areas of significant sediment accumulation. Stream discharge hydrographs suggest sharp increases and steep recessions to base flow after storms (Murdoch, 1991). Flow rates have been recorded as 129 cubic feet/second (CFS) in March, 1991 and 15 CFS in July 1991. The highest recorded flow rate was 1570 CFS in May 1989 at a gauging station in Rosendale, NY. Near the Napanoch Paper Mill Site the creek drops from 430 to 340 feet in elevation over a boulder-strewn channel and two impoundments. The creek

dimensions vary from 3 feet deep and 30 ft. wide in a free-flowing stretch under the US Route 55 bridge, to 150 feet wide and generally 3 to 6 feet deep at the impoundment below the paper mill ruins (ES, 1992 & aerial photography, 1993)

Chemical Characteristics

Rondout Creek is classified as a NYS Class A water course and has been used as a drinking water supply (NYSDOH, 1982). A drinking water supply intake point is located one mile downstream of the site at the Eastern New York Correctional Facility. The surface water intake, along with groundwater wells, supplies approximately 700 people (NYSDOH, 1982).

Water quality parameters have been periodically monitored by the NYSDEC Rotating Intensive Basin Survey (RIBS) since 1984. Samples and data for this program are obtained upstream of the Napanoch Paper Mill site in Neversink, NY and downstream at Rosendale, NY. Analytical data from upstream samples indicate typical pH values ranging from 6.1 to 7.9. Alkalinity values range from 4 to 6 ppm, and dissolved oxygen ranges from 9 to 12 mg/L, representing saturation of from 90% to greater than 100%. Turbidity at the upstream station is typically 0.3 to 1 NTU. Analytical data from downstream samples indicate typical pH values ranging from 7.0 to 8.3, with a maximum of 9.0. Alkalinity values range from 16 to 49 ppm, and dissolved oxygen from 8.4 to 13.6 mg/L represents 90% to 100% saturation. Turbidity measurements at the downstream location typically range from 1 to 6.9 NTU (RIBS, 1993).

5.2.2.6 Aquatic Wildlife Resources

The Rondout Creek supports a relatively diverse and productive fishery. NYSDEC Division of Fish and Wildlife has conducted sampling of fish species downstream of the site near the confluence of Rondout Creek and Sandburg Creek. Species noted during this sampling include predatory species such as brown trout, smallmouth bass, largemouth bass, chain pickerel, and grass pickerel. The dominant forage fishes include fallfish, white sucker, cutlips minnow, and common shiner. Other common forage fish consist of blacknose dace, Johnny darter, shield darter, and satinfin shiner. Panfish species present include redbreast sunfish, brown bullhead, and rock bass (NYSDEC, 1993b). NYSDEC Catskill Fish Hatchery in DeBruce, NY, typically stocks the Rondout Creek, at the Route 209 bridge, with trout twice per year. Stocking usually takes place in April and May and consists of approximately 2500 individuals of both brown and rainbow trout (NYSDEC, 1993c). Records from 1980 to the present indicate that there are no reported fish kill episodes in Rondout Creek within the subject area (NYSDEC, 1993b).

Collections of resident fish in the pool above the lower dam were made by angling. Several individuals of pumpkinseed and bluegill sunfish (*Lepomis* sp.) were caught below the falls at the head of the lower pool. Bluegill sunfish and creek chubs (*Semotilus atromaculatus*) were caught from the lower dam. All individuals were released where captured. Creek chubs were also caught from smaller pools located upstream near the northern perimeter fence. None of the resident fish observed exhibited any obvious morphological deformities, lesions or noticeable abnormalities.

5.2.3 Special Ecological Resources

5.2.3.1 Endangered Species

The presence of rare, threatened, and endangered species in the vicinity of the Napanoch Paper Mill site was determined by reference to the NYSDEC Natural Heritage Program (NHP) database files.

The NHP files indicate the presence of eight areas supporting rare plants, animals or natural communities within a three-mile radius of the site. Information relating to these sites is considered sensitive and may not be released without permission of the New York Natural Heritage Program. As a result, detailed discussion of the nature of these areas is not presented in this report. Six of the areas occur along the nearby Shawangunk Ridge at elevations up to 400 feet higher than the site and are not considered to have any functional relationship to the Napanoch Paper Mill site (approximate locations within a three-mile radius of the site are presented in Figure 5.2). Another significant feature is located approximately two and a half miles southwest of Napanoch in the Town of Ellenville. Elevation, distance, and drainage patterns preclude any significant relationship between this area and the Napanoch Paper Mill site. The location of a plant species having a threatened status in New York state occurs within one mile west of the site. The exact location of this species has not been determined, however it is evidently higher in the Rondout Creek watershed than the paper mill site. An endangered raptor species, last observed in 1975, is documented to inhabit the Shawangunk ridge highlands.

There are no known federal or state designated threatened/endangered species occurring within a one-half mile radius of the Napanoch Paper Mill site.

5.2.3.2 Freshwater Wetlands

Review of the New York State Freshwater Wetlands maps quadrangles (1:24000 series) for Napanoch, Ellenville, Kerhonkson and Rondout NY indicate that there are no designated wetlands within a 2-mile radius of the site.

The US Fish and Wildlife Service National Wetlands Inventory does not currently include an evaluation of the site region.

Site investigation suggests that riparian wetland conditions may exist one mile downstream of the site at the confluence of the Rondout Creek and Sandburg Creek. The forest near the confluence of these creeks was observed to have several areas of standing water and is apparently flooded periodically. It is suspected that some of the area near the confluence exhibits wetland conditions, however no investigation was conducted to determine its nature or extent.

A dense, hemlock dominated, bottomland forest exists beside the creek bend below the Route #55 bridge. This cover type occupies all of the low-lying creekside area from the highway bridge to the site perimeter fence. Thin, moist, organic soils are present among numerous boulders/cobbles. Moss and many species of ferns are abundant. The irregular surface contains many small seasonal pools concentrated along the creek edge. This area is suspected to exhibit wetland characteristics.

5.2.4 Habitat Based Assessment

5.2.4.1 Habitat Values to Wildlife

The ecological values of the Napanoch Paper Mill site are numerous and diverse. The site and vicinity contain undeveloped lands that offer diverse cover types including fully-developed, mature forest cover, early successional forest types, open meadows, freshwater wetlands, creeks and ponds. The site is the observed habitat of transient species (migratory waterfowl, birds of prey, and songbirds,) and frequent occupants (white tailed deer) as well as permanent residents (beaver, creek chub, sunfish). The environments on the site property do not differ significantly from the surrounding area and generally do not appear to provide either unique or exceptionally valuable wildlife habitat. A possible exception to this assessment may be the attractiveness of the grasses and clover that were planted over the IRM area at the southeast end of the site. White-tailed deer may preferentially browse the vegetation in this area, especially when other food sources are scarce.

The site property is incompletely fenced. A six-foot chain link fence topped with two-strand barbed wire follows the north, east, and south site property boundary. The only restriction to access on the west side boundary of the site is the Rondout Creek. This pattern limits human access more than the movements of wildlife, which does not find the creek a significant barrier. Most deer access, for example, was observed to be from across the Rondout Creek. The site perimeter fence is likely not an obstacle to small mammals.

Ordinarily, human presence on the site is infrequent. While site investigation and remedial activities involve sporadic human presence, the frequency and intensity of these activities does not discourage the use of the site by wildlife.

5.2.4.2 Values of Resources to Humans

Documented wildlife utilization within a two-mile radius of the site consists of sport fishing for trout and other freshwater gamefish, small game and big game hunting, and trapping.

NYSDEC Catskill Fish Hatchery in DeBruce NY, typically stocks the Rondout Creek, at the Route 209 bridge, with trout twice per year with approximately 2500 individuals of both brown and rainbow trout (NYSDEC, 1993c). The recreational fishing pressure is estimated as moderate (approximately 300 hours per stream acre per year). Rondout Creek is considered a regionally important trout fishery.

Other consumptive use of wildlife within the subject area consists of small game hunting of furbearers, upland game birds and migratory waterfowl and big game hunting of white-tailed deer and black bear. Although regulated game species are likely present, it is not known to what extent hunters, trappers, and fishermen utilize specific wildlife resources within the subject area. No evidence of hunting activities such as spent casings, tree stands, blinds or trap lines were observed on-site or on the lands adjacent to the site.

Other resource utilization values involving non-consumptive outdoor recreation, and wildlife observation are difficult to quantify. No private nature reserves, wildlife

management areas or significant natural resources are known within the two-mile radius. Human utilization of undeveloped open-space environments within the subject area appears limited to occasional recreational use of a number of interconnecting foot trails leading to a set of waterfalls north of the Route 55 bridge.

5.2.5 Identification of Ecological SCGs

As part of Step I of the HBA, the NYSDEC (1991c) guidance document calls for identification of SCGs intended to be protective of ecological receptors potentially exposed to contaminated media at the site. For the Napanoch Paper Mill site, specific SCGs were identified for surface water, sediment, and shallow (0 to 2 feet deep) soils. Based on the pathway analysis (Section 5.5.3.1), pathways are not considered to be complete for groundwater, leachate, or subsurface (more than 2 feet deep) soils. Therefore, ecological SCGs were not identified for these media.

5.2.5.1 Surface Water SCGs

For surface water, SCGs protective of aquatic organisms in freshwater under chronic exposure conditions were identified. The State of New York classifies Rondout Creek as a Class A stream suitable for fish propagation and survival [Title 6, Chapter V, Part 609 of the New York Codes, Rules and Regulations (6 NYCRR 609)]. Therefore, New York aquatic surface water quality standards for fresh Class A waters were identified as SCGs (6 NYCRR 703.5). USEPA (1991) aquatic life water quality criteria protective of the most sensitive aquatic freshwater organisms in a chronic exposure scenario were also identified as SCGs. Site-specific surface water criteria for certain water-hardness-dependent metals were developed by applying the average measured site water hardness value of 40 mg/L of calcium carbonate (CaCO_3) to state and federal formulas. Site-specific background concentrations of certain compounds were determined from one surface water sample collected in Rondout Creek upstream from the site. The background concentrations were reviewed for comparative purposes only, and were not considered SCGs for surface water.

5.2.5.2 Sediment SCGs

SCGs identified for sediment include the freshwater aquatic toxicity-basis sediment criteria developed by NYSDEC (1989) and interim USEPA (1991) sediment criteria. These criteria are intended to be protective of benthic and epibenthic aquatic organisms and for wildlife consuming fish and/or benthic macroinvertebrates exposed to contaminated sediments. The NYSDEC (1989) sediment criteria for non-polar organic compounds are based on total organic carbon (TOC) content in the sediments. Therefore, these criteria were adjusted for the average measured site TOC concentration of approximately 1 percent. Site-specific background concentrations of certain compounds were determined from three sediment samples collected in Rondout Creek upstream from the site. These background concentrations were reviewed for comparative purposes only, and were not considered SCGs for sediment.

5.2.5.3 Soil SCGs

SCGs for shallow soils were determined following NYSDEC (1992) TAGM HWR-92-4046 guidance. For organic compounds, soil cleanup objectives established by NYSDEC were identified as SCGs. For most inorganic compounds, average site-specific background concentrations were used as SCGs. The soil cleanup objectives were developed to "at a minimum, eliminate all significant threats to human health and/or the environment posed by the inactive hazardous waste site" (NYSDEC, 1992). For most detected metals, the average site-specific background values were calculated as the mean concentration for each metal based on five soil samples collected in the 0- to 2-foot depth interval upgradient/upwind at sampling locations approved by NYSDEC and thought to be outside the area of site influence (ES, 1992 - Work Plan). Mercury was detected in only two of the five soils background samples and calculation of the average yielded an inappropriately low value. Therefore, the proposed NYSDEC (1992) soil cleanup objective of 0.1 mg/kg was identified as the mercury SCG for soil.

5.2.5.4 Fish and Wildlife SCGs

Promulgated standards are available for limited sectors of the diverse biological environment. Federal and state standards, based on the Clean Water Act and reflecting acute and chronic aquatic life standards, are generally used to establish aquatic life protection requirements. Risks to the remaining biological groups are evaluated by comparing site chemical concentrations to toxicological response data derived from laboratory and field testing as reported in technical literature. In some situations, USEPA and a few states issue advisories or guidelines addressing acceptable concentrations of chemicals of concern in specific physical media. These recommendations are generally intended as interim planning or evaluation guidelines for avoiding or minimizing potential adverse effects from food chain biomagnification, bioaccumulation, or chronic exposures. These recommendations are usually chemical-specific.

Wildlife

There are no promulgated or established federal or State of New York standards relating specific chemical concentrations in sediments or surface waters directly to toxic effects on wildlife species. There are abundant toxicological testing data that relate known chemical dosages in either food or surface water to acute and chronic effects on specific species. These dosage values are important as reference points. However, dosage values cannot be used as absolute measurements of risk because other sophisticated site measurements required to credibly apply the dosage data (e.g., proportion of a species' annual diet derived from the site) involve analyses of food chain dynamics beyond the scope of this study.

For potential wildlife risk encountered through diet, toxic contaminant concentrations and resulting effects reported for laboratory animals such as ducks, rats, and mice are used as appropriate. This approach conservatively assumes that chemical concentrations are transferred from soil or sediment through direct ingestion or through vegetation at 100 percent of the reported amount.

Aquatic Life

Under the authority of the Clean Water Act, USEPA has developed federal water-quality criteria (WQC), including criteria for protection of aquatic life, for each of more than 120 inorganic and organic compounds. Numerical ambient WQC are provided to protect marine and freshwater animals and nonvascular plants from chronic and acute toxicities (USEPA, 1991a). These criteria, as well as analogous aquatic life protection criteria established by the state of New York (NYSDEC, 1991), are used as standards for receptors in the aquatic life group. In addition, median lethal dose or median lethal concentration (LD50 or LC50) toxicity data are used as guidelines for those chemicals of potential concern not addressed by either federal or state ambient water quality criteria. The LC50 values for aquatic life receptors were used to represent acute toxicity concentrations. If chronic toxicity values were unavailable, a chronic toxicity threshold was determined by using 10 percent of the acute LC50 value for the specific receptor species (NYSDEC, 1991c). Acute and chronic toxicity values were then used to evaluate the potential for risks to aquatic life.

5.3 RISK ASSESSMENT

Potential biological effects of contaminant releases into the environment are analyzed and described in this section. The assessment focuses on evaluating effects on vegetation, wildlife, and aquatic life.

The risk assessment determines which chemical contaminants found in physical media pose potential adverse risks to biological resources, identifies general categories of receptors, identifies exposure routes, and evaluates toxicological effects resulting from exposure. The assessment begins with identification of chemicals of potential environmental concern, proceeds through systematic evaluations of potential risks posed by these chemicals to major biological groups occurring on or near the sites, and concludes with determinations of those contaminants that represent potentially significant environmental risks to on-site and nearby biota.

5.3.1 Pathway Analysis

This section identifies potential exposure pathways for contaminants of potential concern to biota. The concepts of bioaccumulation and biomagnification are used throughout this report. Because these concepts have been historically applied in several ways, the following definitions describe their application in this study. Bioaccumulation is considered to be a process by which toxic substances are absorbed by organisms from the surrounding physical environment (e.g., fish absorbing mercury from water) or through consumption of another organism. Biomagnification refers to the resultant total process, by which tissue concentrations of bioaccumulated toxic substances increase as the substances pass up through two or more trophic levels (adapted from Brunge and Mount, 1978).

Chemical analyses of physical media samples suggest potential pathways exist between contaminant sources at the site and terrestrial and aquatic receptors. Ecological exposure pathways for biota may be direct or indirect. Direct exposure pathways include dermal contact, absorption, inhalation, and ingestion. Examples of direct exposure include animals incidentally ingesting contaminated soil, sediment, or

surface water. (e.g., during burrowing or dust-bathing activities), plants absorbing contaminants by uptake from contaminated sediments or soils, and dermal contact of aquatic organisms with contaminated surface water. Indirect exposure pathways for biota can occur when terrestrial or aquatic fauna consume previously-contaminated biota. Examples of indirect exposure include higher-order animals consuming plants or animals that bioaccumulate contaminants.

Contamination of biota could result from exposure to one or more chemicals of potential concern at the site. Chemical bioavailability is an important contaminant characteristic that regulates a receptor's reaction to contaminant exposure. Bioavailable chemicals are in a form that a receptor can accumulate and react to. Bioavailability, which is regulated by several physical and chemical environmental factors, is a concern with many inorganic chemicals, especially the metals. Pathway evaluations must account for this characteristic. In addition to bioavailability, exposure pathways for contaminants consist of four components: 1) source and mechanism of contaminant release, 2) transport medium, 3) potential receptors, and 4) exposure route. All components were evaluated during this study. If either contaminant bioavailability or the exposure pathway between contaminated media and the receptors are not complete, then contaminants in those media do not constitute an environmental risk at the site.

Contaminants have been documented in soils, groundwater, surface water, and sediments at the Napanoch Paper Mill site. Contaminants include VOCs, SVOCs, metals, organochlorine pesticides, and PCBs. Sources of the contaminants at the site include releases of paper milling and manufacturing chemicals and wastes into site soils and the on-site lower settling pond, and the leaching of chemicals in soils to form leachate which discharges to the surface at two seasonal seepage points. Past milling, processing, and waste management practices at the site appear to have resulted in widespread surface soil contamination, and localized contamination of pond sediments and leachate discharge. Deeper soils have been contaminated beneath the site through leaching and releases from USTs. Surface water flowing through Rondout Creek, which receives surface runoff and (historically) direct mill effluent discharges from the site, contains concentrations of lead in excess of the NYSDEC surface water standards.

5.3.1.1 Groundwater Exposure Pathway

Based on the depths to groundwater, and the absence of springs at the site, there is no apparent completed exposure pathway for wildlife or fish to contaminants in the groundwater. Moreover, any recharge of Rondout Creek from the groundwater would be addressed through the surface water exposure pathways. Ecological receptors are generally not exposed to contaminants in soils below the 2-foot depth. Therefore, pathways for exposure of these receptors to contaminants in subsurface soils at depths greater than 2 feet are not considered complete.

5.3.1.2 Surface Water Exposure Pathway

Surface water represents a potential transport medium for the chemicals of concern. Potential sources for contaminated surface water include contaminated soil and groundwater. The release mechanisms include surface runoff and groundwater seepage. Aquatic organisms and terrestrial wildlife may be exposed to contaminants in surface water. Fish and other aquatic animals may be exposed through respiration,

ingestion, and dermal contact with affected surface waters of Rondout Creek and the artificial site impoundments. Terrestrial wildlife may be exposed to these waters primarily through ingestion. There is no emergent vegetation associated with site surface waters, and therefore an exposure pathway from surface water to plants is not complete. Consumption by other animals in which contaminants have bioaccumulated constitutes a potential indirect exposure pathway for faunal receptors. Chemical bioavailability of some metals and other chemicals is controlled by water hardness and pH.

5.3.1.3 Sediment Exposure Pathway

Creek substrate is largely lacking on-site except in small pockets in the rocky stream channel and in the 3-to 6-foot deep impoundment behind the lower dam. Therefore, it is not considered likely that plants or terrestrial wildlife are exposed to contaminated sediments.

Sediment consists of materials precipitated or settled out of suspension in surface waters. Sediments in the lower ponded area represent a potential transport medium for contaminants from the site. Potential contaminant sources for sediment include buried waste, and contaminated surface water, groundwater, and soil. The release mechanisms include surface water run-off, airborne deposition, and groundwater discharge. Aquatic organisms such as fish and macroinvertebrates may be exposed to Rondout Creek and pond sediments through dermal contact, ingestion, and respiration. Indirect exposure pathways for sediment include consumption by other consumers in the food chain of plants or animals in which contaminants have bioaccumulated. Chemical bioavailability of many nonpolar organic compounds, including PCBs and pesticides, decreases with increasing concentrations of TOC in the sediment.

The potential for exposures to contaminants through sediment appears to be mostly associated with the lower ponded area and, to a lesser extent, with Rondout Creek sediments adjacent to the paper mill ruins and at the lower dam spillway.

An evaluation of the maximum concentrations of detected sediment contaminants indicates that the pond sediments along the old mill ruins exhibit the greatest contamination. The majority of samples exhibiting concentrations of metals and semivolatiles exceeding three times the background levels are located along the pond sample grid locations A1 through D1 and SED 12.

5.3.1.4 Soils Exposure Pathway

On-site soil represents a potential source and transport medium for the chemicals of concern. Potential sources include buried waste, deposition of airborne contaminants, and migrating contaminants in surface water or groundwater. The release mechanisms for contaminants in soil include surface runoff, tracking, groundwater contaminant plumes, and fugitive dust generation/deposition. Exposure routes include dermal contact by birds, mammals, and invertebrates; uptake by plants; and incidental ingestion or inhalation by birds and mammals while foraging and grooming. Consumption of contaminated biota by higher-order predators in the food chain can provide an indirect exposure pathway for some soil contaminants.

Soil exposure pathways are potentially important for terrestrial plants and wildlife at the site. Plants are directly exposed to contaminants in soil by absorption and assimilation of soluble chemical forms through the root system. This represents the primary exposure route for vegetation at the site. Chemicals may be accumulated in different plant tissues, at different rates, or not at all depending on the specific chemical and plant species involved and prevailing soil chemical and physical conditions. In addition, environmental conditions such as soil moisture, soil pH, and cation exchange capacities significantly influence whether potential soil contaminants remain chemically bound in the soil matrix or whether they can be chemically mobilized (in a bioavailable form) and released for plant absorption. Generally, neutral to alkaline soils (soil pH of 6.5 or greater) restrict the absorption of toxic metals, making pathway completion to plants difficult. Soils in the region of the site are moderately to extremely acidic (USGS, 1991) suggesting conditions which may facilitate mobilization of metals available for plant uptake.

5.3.1.5 Leachate Exposure Pathway

Leachate represents a potential transport medium for the chemicals of concern. Potential sources for contaminated leachate include contaminated soil and groundwater. The release mechanisms include surface runoff and groundwater seepage. Potential receptors of contaminated leachate include terrestrial fauna and flora. Exposure routes for contaminated leachate include dermal contact, ingestion, and absorption. Ingestion of contaminated leachate represents the specific exposure route to terrestrial fauna. Consumption by other animals of flora and fauna in which contaminants have bioaccumulated constitutes a potential indirect exposure pathway for faunal receptors. Chemical bioavailability of some metals and other chemicals is controlled by water hardness and pH.

The analytical data indicate that leachate sample locations SW-6 and SW-7 contain elevated concentrations of metals and Aroclors 1248 and 1254 at 1 and 2 ug/l, respectively. Leachate presence on the site is limited to these two locations.

Leachate discharges to the surface at two seepage points on the Napanoch Paper Mill site. These seeps flow only intermittently and are generated during periods of precipitation and soil saturation. Since they do not create standing pools of leachate, this medium does not provide aquatic habitat or direct exposure pathways to aquatic organisms. Leachate that migrates into Rondout Creek is quickly diluted, and any measurable leachate contributions to surface water contamination will be addressed by the surface water medium. The leachate seepage areas are generally devoid of vegetation due to site-related clearing and filling, and therefore completed pathways from leachate to plants are unlikely. Leachate could be contacted or ingested by terrestrial wildlife. However, the perennial nature and availability of Rondout Creek as a drinking water source, and the noted absence of wildlife use or activity around the seepage points suggest that completion of this pathway is unlikely. Moreover, contaminants detected in leachate were also detected in shallow soils at the site, and are evaluated via the incidental ingestion pathway for the soil medium.

In summary, pathways for exposure of ecological receptors to site-related contaminants are considered complete for the surface water, sediment, and shallow (0-

to 2-foot depth interval) soils media. Contaminants in these media include VOCs, SVOCs, metals, pesticides, and/or PCBs. Pathways to ecological receptors are considered incomplete for contaminants in groundwater, subsurface (deeper than 2 feet) soils, and leachate. The criteria-specific analyses were conducted only for the media where pathway completion is considered likely.

5.3.2 Criteria-Specific Analysis of Site Contaminants

Pursuant to Step II HBA requirements (NYSDEC, 1991c), a criteria-specific analysis of site contaminants was performed. The purpose of the analysis was to compare site chemical concentrations to numerical criteria selected from the SCGs identified in Section 5.2.5. Only chemicals detected in media for which the pathways to ecological receptors are complete (e.g., surface water, sediment, and shallow soils) were analyzed. Chemicals considered essential nutrients, including calcium, magnesium, potassium, and sodium, were deleted from the criteria-specific analyses for the media of ecological concern. Numerical criteria were not established for these chemicals, and they are not expected to represent toxicological risks to the biota at the Napanoch Paper Mill site.

The initial screening phase examined the representative concentrations of chemicals for comparison versus regulatory guidelines and/or criteria, toxic concentrations, expected concentrations, etc. Chemicals with representative concentrations exceeding any of the screening criteria were retained for detailed risk assessment. Chemicals for which no screening criteria were available, or those posing a biomagnification risk, were retained as well.

The selection of site-specific criteria for chemicals detected in each medium of concern, and the screening methods and rationale used to identify site-related chemicals of potential concern, are discussed in the following paragraphs. The discussions are organized by the media of ecological concern.

5.3.2.1 Chemicals of Potential Concern in Surface Water

The most conservative of the surface water SCGs identified in Section 5.2.5 were selected as site-specific criteria for each chemical detected in the four surface water samples (SW-2 through SW-5) collected in Rondout Creek at the mill site. For each detected analyte, the lesser of the 95-percent upper confidence limit (UCL) or the maximum concentration detected in the four site surface water samples was used as the site concentration for comparison to the site-specific numerical criterion. If the site concentration was equal to or greater than the numerical criterion, the chemical was retained for analysis of toxicological effects. Per HBA guidance (NYSDEC, 1991c), chemicals for which numerical SCGs were not identified were automatically carried forward for toxicological analysis.

Chemicals with site concentrations that were less than the numerical criteria were dropped from the HBA analysis and are not considered to pose risks to ecological receptors. All chemicals that were retained for further analysis after comparison to numerical criteria were considered chemicals of potential concern to ecological receptors exposed to surface water. The criteria-specific analysis for site-related contaminants detected in surface water is summarized in Table 5.25. As indicated on

the table, acetone, barium, lead, and manganese were determined to be chemicals of potential concern for this medium.

5.3.2.2 Chemicals of Potential Concern in Sediment

For the sediment screening, either maximum or 95% UCL values of each chemical were compared to values proposed as criteria. For chemicals in sediment for which there are no proposed criteria for protection of aquatic life and/or wildlife, direct comparisons of representative site concentrations to safe and/or toxic dietary levels for aquatic organisms and/or animals were made. For screening purposes, the conservative assumption that receptor species would ingest sediment as 100 percent of their diet and assimilate the maximum contaminant concentration was made to identify chemicals that warrant more detailed toxicological evaluations. If a chemical concentration was equal to or greater than the proposed criterion or the applicable dietary standard, the chemical was retained for further evaluation.

The most conservative of the sediment ecological SCGs identified in Section 5.2.5 were selected as site-specific criteria for each chemical detected in the 30 primary sediment samples collected on and around the site. To better evaluate site-related contamination, the 30 sediment samples were grouped by stream locations into five data subsets (see Figure 5.3). These sample subsets are defined below:

Upstream Background:	Samples SED-1, -2, P, and -3 (n=4)
On-site Stream Channel:	Samples SED-4 through SED-11 (n=8)
Lower Pond:	Samples SED-A1#26, -A5#29, -B1#25, -C1#24, -C1#27, -C3#23, -D1#22, -D1#28, -D3#21, SED-12 (n=10)
Downstream Segment 1:	Samples SED-13 through SED-16 (n=4)
Downstream Segment 2:	Samples SED-17 through SED-20 (n=4).

Only primary samples were screened during the criteria-specific sediment analysis; reanalysis and diluted sample results were excluded to minimize biasing the data. For each detected analyte in each data subset, the lesser of the 95-percent UCL or the maximum concentration detected in the samples of the subset was used as the concentration for comparison to the site-specific numerical criterion.

If the comparison concentration was equal to or greater than the numerical criterion, the chemical was retained for analysis of toxicological effects. Analytes for

which no sediment criterion was identified were automatically carried forward for further analysis. Chemicals with comparison concentrations below the criteria were dropped from further analysis. All chemicals retained for the toxicological analysis were considered chemicals of potential concern in sediment. The criteria-specific analyses for site-related contaminants in each of the four on-site and downstream sediment data subsets are summarized in Tables 5.27 through 5.30. Chemicals of potential concern in sediment for each stream segment affected by the site are as follow:

- On-site Stream Channel: Lead, manganese, PCBs,
- Lower Pond: PCBs, chlorobenzene,
1,2-dichlorobenzene,
bis(2-ethylhexyl)phthalate,
arsenic, copper, manganese,
mercury, nickel, zinc
- Downstream Segment 1: PCBs
- Downstream Segment 2: PCBs, copper, manganese, zinc

5.3.2.3 Chemicals of Potential Concern in Shallow Soil

The SCGs identified in Section 5.2.5 for organic and inorganic chemicals in soil were adopted as the site-specific numerical criteria for each analyte detected in the 35 on-site shallow (0 to 2 feet deep) soil samples. For each detected analyte, the lesser of the 95-percent UCL or the maximum concentration detected was used as the site concentration for comparison to the numerical criterion.

As for the other media, analytes with site concentrations that equalled or exceeded the numerical criterion, or for which no criterion was available, were retained for analysis of toxicological effects on ecological receptors exposed to this medium. Chemicals with comparison concentrations that did not exceed the criteria were deleted from the analysis as being below levels of concern. Chemicals that were retained after the criteria-specific analysis were considered chemicals of potential concern in shallow soils. Table 5.31 presents average background concentrations of inorganics in soils which were used for comparison to on-site concentrations. Table 5.32 summarizes the criteria-specific screening of site-related contaminants in shallow soil. Based on the screening, PAHs, semivolatiles, metals, PCBs and cyanide were determined to be chemicals of potential concern for this medium.

5.3.3 Analysis of Toxicological Effects

5.3.3.1 Selection of Indicator Species

To assess the toxicological effects of the chemicals of potential concern identified for each medium through the criteria-specific analysis (Section 5.2.3.2), the indicator species analytical approach was adopted, per the HBA document (NYSDEC, 1991c). Indicator species were selected for each medium of concern (i.e., surface water, sediment, and shallow soils), and are intended to be representative of species known or likely to be present in site habitats, special concern resources, a variety of trophic levels, and species with a high probability of exposure to contaminants in the affected

site media. Consideration of availability of toxicological data in the scientific literature was also given in the selection of indicator species.

Evaluation of ecological risks is inherently difficult and complex for several reasons. These include the large number of species typically present at a particular site, significant differences in biological reactions to the same contaminant concentration among different species, multiple factors regulating chemical bioavailability, and multiple levels of ecological organization (e.g., population or ecosystem) susceptible to contaminant effects.

The objective of this analysis phase was to select groups of receptors and risk evaluation endpoints to represent the focus of the site-specific assessment. The assessment of potential effects on receptors addresses potential contaminant effects on the selected receptors, and on the habitats of these organisms, as appropriate. Evaluating receptor species provides a practical alternative to evaluating all of the several hundred species that may be present on a site. In addition, evaluating a limited number of receptor species minimizes data interpretation difficulties created by the inherent differences in the ways various species react to the same contaminants. However, it is important that there be sufficient toxicological information available in the literature on the receptor species selected. The white-tailed deer was selected as a terrestrial indicator species potentially exposed to shallow soil and surface water contaminants. The deer was selected as representative of a resource of recreational importance. The deer mouse was selected as representative indicator of small terrestrial mammals in close association with shallow site soils.

For aquatic exposure pathways, the brook and rainbow trout were selected as carnivorous fish indicator species representing a recreationally importance resource. The bluegill sunfish was selected as a common water-column fish known to occur on-site and downstream in Rondout Creek. The crayfish was selected as a representative macroinvertebrate closely associated with stream and pond sediments. Though crayfish were not observed on-site by the ES field biologists, their presence is considered likely in the available habitat. This species commonly serves as a food source for terrestrial predators.

No specific indicator species for plants was selected due to a general lack of specific toxicity data in the literature. Rather, terrestrial plants were evaluated against available phytotoxicity values for soils to assess this potential pathway.

Table 5.33 summarizes chemicals of potential concern in each medium of concern, and the selected indicator species associated with the media.

Because there are no federal or state promulgated standards or criteria established to specifically protect wildlife species from contaminant exposures, the following evaluations use laboratory exposure and toxicity studies demonstrating acute and chronic toxic concentrations, and non-hazardous exposure recommendations by fish and wildlife toxicology authorities to establish quantitative risk determination criteria. The fundamental evaluation rationale applied for the wildlife risk analysis was that if contaminant concentrations were lower than acute and chronic toxic concentrations and lower than safe (i.e., no-effect) dietary concentration recommendations, then the receptor(s), and wildlife in general, were not considered at toxic risk from the specific

TABLE 5.33
CHEMICALS OF POTENTIAL CONCERN
TO ECOLOGICAL RECEPTORS
NAPANOCH PAPER MILL SITE, NEW YORK

Medium	Chemicals of Potential Concern	Potentially Exposed Indicator Species	Exposure Route
Surface Water	Acetone Metals PCBs	• White-tailed deer • Brook and rainbow trout • Bluegill sunfish	Ingestion Respiration/Absorption Absorption
Sediment	Metals PAHs PCBs	• Crayfish	Ingestion/Absorption
Shallow Soils	PCBs Metals PAHs	• White-tailed deer • Deer mouse • Terrestrial vegetation	Incidental ingestion Incidental ingestion Uptake through roots

contaminant. In comparing and using contaminant toxicity information, preference was given to compiling quantitative reference data that reflected dietary testing procedures in order to more accurately reflect field dose mechanisms. Because plant and animal tissue samples were not collected and chemically analyzed as part of this RI, inferences regarding wildlife toxicity were made from sediment, soil, and surface water chemical data. To establish worst-case analytical conditions, assumptions were made that wildlife ingested and assimilated 100 percent of the contaminant concentrations reported for the samples. The discussion focuses on the individual chemicals that required detailed evaluation to resolve potential toxicological impacts.

5.3.3.2 Contaminant Toxicity Evaluation

For the purposes of this risk analysis, a chemical of concern is defined as a substance that can cause adverse toxicological effects to plants or animals at concentrations recorded at a site. Chemicals of potential concern were identified through a criteria-specific analysis (Section 5.3.2). The screening process derives chemicals of potential concern through a series of systematic and quantitative steps to identify the chemicals of sufficient environmental concern to warrant detailed risk evaluations. This screening process was applied to the initial list of chemicals identified in Section 5.3.2 in one or more of the three media (soils, surface water, and sediment) examined during this investigation.

Pursuant to the HBA guidance document (NYSDEC, 1991c), exposure of indicator species to contaminants in affected media was assumed to be continuous and uniform for all individuals in all life stages. Effects of chemicals of potential concern in surface water, sediment, and shallow soils on growth, reproduction, and/or mortality were

considered during review of toxicological data in the literature. Although these assessment endpoints were considered, most available data were relevant only to the mortality endpoint. These data most often include median lethal doses (LD₅₀s) for the ingestion (i.e., dietary) exposure route, and median lethal concentrations (LC₅₀s) for the absorption/respiration exposure routes for aquatic organisms in surface water. When available, no observed effect levels (NOELs) and lowest observed effect levels (LOELs) were utilized in the toxicological analyses as a conservative measure. Chronic exposure was evaluated when possible. Acute LD₅₀ and LC₅₀ values were multiplied by 0.1 to derive estimated chronic values.

The quantity and quality of toxicological data available in the scientific literature varies widely by chemical, exposure medium, exposure route, and species. It was frequently necessary to extrapolate data available for species of similar physiological characteristics for use in evaluation of effects on the selected indicator species. For example, data on toxicity of chemicals in diet or drinking water to deer were not available. Therefore, data for cattle and other domestic ungulate species were substituted. Similarly, toxicological data for laboratory rat and mice species were extrapolated directly for deer mice. Another source of uncertainty in the toxicological analysis was the frequent lack of toxicity information for individual chemicals of potential concern. Whenever possible, classes of chemicals with similar physiochemical properties were grouped for discussion, and toxicity data available for members of the group were considered representative of toxic effects of the other group members. Examples of these groupings include PAHs, phenolic compounds, VOCs, PCBs, and isomers of certain pesticides.

The toxicity analyses are presented for chemicals of potential concern by affected media and selected indicator species in the following paragraphs. Table 5.33 provides a summary of the media, chemicals, and indicator species addressed.

Surface Water

Toxicological analyses were conducted for the following chemicals of potential concern in surface water; acetone, PCBs, barium, lead, and manganese. Of these, acetone, barium, and manganese were carried forward for further analysis because numerical criteria were not identified. Only lead was retained for further analysis because site concentrations exceeded the numerical criterion. Although not detected, PCBs were retained for further analysis because the criterion is below the detection limit of the analytical method and because PCBs are potential contaminants of concern in other media at the site. Toxicological data for indicator species potentially exposed to these contaminants in surface water were reviewed. The indicator species include white-tailed deer, rainbow and brook trout, and bluegill sunfish.

Volatiles

Acetone

Acetone, a readily-volatilized organic compound, is present in the environment from both natural and artificial sources including forest fires, plants and animals, automobile exhaust, and wood pulping processes (Howard, 1990). Deposition of atmospheric acetone onto soils and into surface waters occurs from rainfall. Biodegradation occurs in surface water, soils, and groundwater. In surface water, acetone volatilization is retarded by its miscibility. Adsorption from surface waters to sediments is not considered a significant fate process. The half-life of acetone in surface waters is reported as being from 20 hours (Howard, 1991) to 7 days (Micromedex, Inc., 1993).

A 96-hour LC₅₀ for rainbow trout (*Salmo gairdneri*) is reported as 5,540 mg/L (Jonhson and Finley, 1980; Micromedex, Inc. 1993). An acute LC₅₀ (96-hour) concentration for bluegill sunfish (*Lepomis macrochirus*) is reported as 8,300 mg/L. Chronic LC₅₀ values are estimated as 10 percent of reported acute LC₅₀ levels. Chronic LC₅₀ levels for these species are estimated at 554 to 830 mg/L. Bioconcentration in aquatic organisms is not considered significant.

Acetone was detected only in one surface water sample from the lower pond, at a concentration of 4 ug/L. The low concentrations detected at the site, the short half-life in surface water, and the lack of bioconcentration potential indicate that exposure of aquatic receptor species to the concentrations detected is not expected to result in any demonstrable impacts. Acetone is not considered a chemical of concern in surface water.

Semivolatiles

No semivolatile compounds were detected in Rondout Creek surface water samples. Semivolatiles did not present any potential for site-attributable impacts, via the surface water exposure pathways, upon indicator species.

PCBs and Pesticides

No PCB or pesticide compounds were detected in Rondout Creek surface water samples. No site-attributable impacts to aquatic indicator species via surface water exposure pathways can be confirmed. However, PCBs were detected at levels of

concern in pond and creek sediments at the site. Analytical detection limits for these chemicals in surface water are greater than the numerical criteria used in the criteria-specific analysis. Therefore, it is possible that these chemicals are present at undetected concentrations that could still pose risks to most sensitive aquatic species. These chemicals tend to have high bioconcentration factors (BCFs), and tend to biomagnify through the food chain. A residual PCB criterion of 0.1 mg/kg (fresh weight) in fish has been recommended by NYSDEC (Skinner and Jackling, 1990) for the protection of piscivorous wildlife. PCBs were retained as potential chemicals of concern based on concentrations reported from sediments.

Inorganics

Lead

Lead is ubiquitous in the environment and is a trace constituent in rocks, soils, water, plants, animals, and air. Environmental fate processes may transform one lead compound to another; however lead itself is not degraded. Anthropogenic sources of lead include storage batteries, gasoline additives, pigments, and ammunition. Lead concentrations are typically highest in ecosystems near lead mining, smelting, and refining facilities; urban areas; and vehicle high traffic areas. Lead reaches the aquatic environment through industrial and municipal discharges, atmospheric deposition, weathering processes in areas of natural lead mineralization, and highway runoff (Eisler, 1988).

Lead may bioaccumulate, but does not biomagnify in food chains. A 7-day exposure to media concentrations of tetramethyl lead at 3.5 ug/L exhibited a BCF of 726 in rainbow trout. Acute LC₅₀ value for tetramethyl lead in rainbow trout is reported as 3.5 ug/l (Eisler, 1988). Bluegill sunfish exhibited a lifetime maximum allowable toxicant concentration (MATC) of 70 to 120 ug/L at water hardness of 41 mg/L CaCO₃.

Concentrations of lead ore (galena) are known to occur in local bedrock in the Napanoch site vicinity. Lead mines dating to the early 1900s are common in bedrock formations in the site region (ES, 1993). Lead concentrations exceeding the numerical criterion for surface water were detected in upgradient as well as on-site surface waters. Lead was detected in the surface water background sample at 7.0 ug/L. The numerical site-specific lead criterion, adjusted for Rondout Creek water hardness, is 0.99 ug/L. Lead concentrations in all water samples for which lead was an analyte ranged from 7.0 to 17 ug/L. The maximum detected concentration of 17 ug/L is used as the representative site concentration. Concentrations of lead exceeded concentrations reported in the toxicological literature as causing adverse acute impacts to rainbow trout and brook trout and exceeded the safe drinking water levels for large mammals (e.g. white-tailed deer). Lead is considered a chemical of concern to these sensitive and/or recreationally important aquatic and terrestrial species.

Barium

Sedimentation of suspended solids removes a large portion of the barium from surface waters. Barium is considered to pose little hazard to receptors under natural conditions (Micromedex, 1993). Environmental fate processes may transform one

barium compound to another; however, barium itself is not degraded. In aquatic media, barium is likely to precipitate out of solution as an insoluble salt, making it unavailable for biological uptake. In most natural waters there is sufficient sulfate or carbonate available to precipitate soluble barium present in surface waters into an insoluble nontoxic compound (USEPA, 1993). Experimental data indicate that soluble barium concentrations would have to exceed 50,000 ug/L before toxic effects to aquatic life might be observed (CH2M Hill, 1989). Mckee and Wolf (1963) suggest a tentative limit for barium of 5,000 ug/L to be protective of fish. There are no known reports of barium toxicity to animals (Gough et al., 1979) Bioconcentration of barium in freshwater aquatic organisms is considered minimal.

The representative concentration of barium detected in surface waters at the site was 21 ug/L. The on-site levels are not expected to result in demonstrable impacts to indicator species due to the physiochemical fate processes operant on barium in surface waters. Therefore, barium in surface water is not considered a chemical of concern in surface water.

Manganese

Environmental fate processes may transform one manganese compound to another. The +2 valence state predominates in most waters, and usually combines with carbonate to form a compound of low solubility. Manganese is often transported in rivers attached to suspended sediments.

At low concentrations, manganese may be "fixed" by clays, and will not be readily released into solution. At higher concentrations, it may be desorbed by ion exchange. Manganese in water may be significantly bioconcentrated at lower trophic levels. Also, microorganisms may increase the mobility of manganese under some circumstances (ATSDR, 1990).

Manganese ions are rarely found at concentrations above 1 mg/L, so manganese is not considered to be a problem in freshwater systems (USEPA, 1976). Manganese toxicity to assorted freshwater fish has been demonstrated at concentrations from 2,420 to 3,450 mg/kg (Gough et al., 1979). Manganese has been shown to bioaccumulate in freshwater invertebrates (Snyder and Snyder, 1984). No data on toxic effects of manganese in the drinking water of animals were located.

The representative concentration of manganese in Rondout Creek is 29.1 ug/L. The site concentrations are considered to be significantly lower than those levels resulting in toxicity to aquatic life. Therefore, manganese is not considered a contaminant of concern to ecological receptors in surface water.

Surface Water Contaminant Summary

Of the five chemicals that survived the initial screening process, lead was the only potential chemical of concern present at toxic concentrations to aquatic life receptors or to wildlife receptors through the surface water ingestion pathway. Site concentrations exceeded acute toxic concentrations for trout. However, concentrations exceeding aquatic life protective standards were also identified for locations upgradient of the site and are probably the result of local ore deposits. It is not clear from the site sample data, what role site lead contributions play in aquatic and wildlife risks.

Soils

Soils at the site were evaluated through analysis of samples obtained from the 0-2 ft. depth interval collected both on-site and at representative background locations. While site-specific Ph data were not acquired for the site investigation, local soils are known to be moderately to highly acidic.

Toxicological analyses were conducted for di-n-butylphthalate, four PAHs, 18 metals, three PCB compounds, and cyanide in shallow soils. All of the organic compounds were carried forward for detailed analysis because they exceeded one or more of the SCGs identified for soils in Section 5.2.5.3. In the case of inorganics, metals were retained for further analysis if they exceeded the applicable SCGs, or exceeded a calculated background concentration or, in cases where neither of these was applicable, concentrations exceeded the contract required detection limit. Cyanide was retained due to lack of an applicable standard.

Toxicological data for indicator species potentially exposed to contaminants in surface soils were reviewed. The indicator species include white-tailed deer, deer mouse, and terrestrial vegetation.

Semivolatiles

Di-n-butylphthalate

Di-n-butylphthalate is a member of the phthalate ester group. Most information found in the technical literature deals with these compounds as a group (Autian (1973) suggests there is evidence that phthalate esters are metabolized by animals. As a result, phthalate esters are not likely to biomagnify. Di-n-butylphthalate has a very low volatility, is strongly adsorbed to soil, and has a high potential for bioaccumulation (Arthur D. Little, Inc., 1985).

The rat acute LD₅₀ dietary value of di-n-butylphthalate is 24,000 mg/kg, and the calculated chronic LD₅₀ value is 2,400 mg/kg (Micromedex, Inc., 1993). Because di-n-butylphthalate is strongly sorbed to soils, it would be unavailable for plant uptake. Because the site 95-percent UCL concentration (385.3 mg/kg) is below the rat chronic toxicity value and the chemical is unavailable to plants, di-n-butylphthalate would not pose a risk to the indicator species. This compound is not considered a chemical of concern for ecological receptors.

PAHs

The PAHs benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenzo(a,h)-anthracene were retained for toxicological analysis because their site concentrations exceeded the respective NYSDEC soil cleanup objectives (Table 5.2.12). PAHs are ubiquitous in nature primarily as a result of natural processes such as forest fires, microbial and terrestrial vegetation synthesis, and volcanic activities (Eisler, 1987D). The molecular weight of the individual PAHs affects their mobility and solubility in the environment, with lower-weight compounds (acenaphthene, acenaphthylene, anthracene, fluorene, phenanthrene, fluoranthene, and pyrene) of more concern because they are generally more volatile and soluble than higher-weight compounds (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene,

benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene), which have strong sorption properties. PAHs show little tendency for bioconcentration in mammals probably because most PAHs are rapidly metabolized (Eisler, 1987D). Vegetation can absorb lower weight PAHs through their roots and translocate them to other plant parts, however PAH-induced phytotoxic effects are rare (Eisler, 1987D).

PAH toxicity studies for wildlife are mostly confined to laboratory experiments and the toxicity values vary widely. The available mammal toxicity information for PAHs that may be applicable to the deer mouse indicator species is listed below:

- Benzo(a)pyrene - Rat acute LD₅₀ dietary value is 20,000 mg/kg, while the calculated chronic LD₅₀ value is 2,000 mg/kg (Micromedex, Inc., 1993).
- Dibenzo(a,h)anthracene - Mouse acute LD₅₀ dietary value is 16 mg/kg, while the calculated chronic LD₅₀ value is 1.6 mg/kg (Micromedex, Inc., 1993).

The four PAHs with elevated site concentrations are all of the higher-molecular-weight class. The limited toxicity data available for benzo(a)pyrene indicate that site soil concentrations are considerably lower than dietary levels known to cause toxic effects in small mammals. The site concentrations for benzo(a)anthracene and chrysene are of the same order of magnitude as the soil cleanup goals for these compounds. These relationships of site concentrations to the cleanup goals, site concentrations to and toxicity data, considered in conjunction with the extremely conservative assumption that site animals would ingest 100 percent of the site concentration as their diet, suggest that chrysene, benzo(a)pyrene, and benzo(a)anthracene do not pose significant risk to the indicator species. The dibenzo(a,h)anthracene site concentration of 549 mg/kg significantly exceeds the acute mouse LD₅₀ of 1.6 mg/kg. Despite the conservative soil ingestion assumption it appears possible that site soil concentrations could be posing risks to small rodents likely to be incidentally ingesting soil. However, as PAHs do not tend to bioconcentrate in mammals, risks to higher-order predators of deer mice are not considered to be at risk.

For the purposes of this HBA, dibenzo(a,h)anthracene is considered a chemical of concern for small mammals on the site. The other three PAHs are not considered chemicals of ecological concern.

Inorganics

Aluminum

Aluminum is abundant in most soils and makes up 2 to 12 percent (20,000 to 120,000 mg/kg) of soils (Jackson, 1964). Toxicity of aluminum is largely dependent on the exchangeable amounts present due to low soil pH. Only small quantities of soluble aluminum were found in soils that had pH values between 4.7 and 7.8 (Gough et al., 1979). There are no reports in the technical literature of mammal toxicity attributed to naturally-occurring aluminum in the environment. It seems unlikely that grazing animals could achieve toxic concentrations naturally (Gough et al., 1979). An acute toxic dietary concentration of 20,000 mg/kg for the rat was reported by Gough et al. (1979). NAS/NAE (1972) reported that a level of 4,000 mg/kg of aluminum in the

diet of chicks caused phosphorus deficiency. USEPA (1983) reports a phytotoxic concentration for vegetation from soluble aluminum of 2 to 14 mg/kg.

Insufficient site-specific data relating to soil acidity are available to quantify the amount of soluble aluminum that is bioavailable. A total aluminum concentration of 11,500 mg/kg was determined to be representative of site conditions. This level is lower than acute dietary levels for the rat, and the available aluminum levels, although unknown, are considered significantly lower still. Soluble aluminum is not considered present at the site in concentrations sufficient to produce acute or chronic effects in wildlife receptor species.

Antimony

Antimony in soil usually occurs in the +3 or +5 valence (Overcash and Pal, 1979). Antimony is considered nonessential for plants and animals. Very high concentrations of antimony may present a hazard to plants and animals, though little or no information was available in the technical literature. Because of the low concentrations of antimony believed generally to occur in plants, toxicity to animals from plant sources is unlikely (Gough et al., 1979).

Antimony was retained for toxicological analysis due to the lack of applicable standards and data on background concentrations. A CRDL of 0.6 mg/kg served as the only screening criteria. The representative site concentration for antimony was determined to be 9 mg/kg. It is considered unlikely that concentrations detected at the site will exhibit either acute or chronic effects on wildlife receptors or phytotoxic effects. Therefore, antimony is not considered a chemical of ecological concern in soil.

Arsenic

Arsenic is a relatively common element that occurs in air, water, soil, plants, and all living tissue. Arsenic exists in four oxidation states, as inorganic and organic forms. Inorganic arsenic compounds are more toxic than organic compounds, and trivalent forms (arsenites) are more toxic than pentavalent forms (arsenates) (Eisler, 1988A). In most soil systems, arsenic becomes arsenate (Woolson, 1975). The arsenic in normal soils ranges from < 1 to 40 mg/kg (Gough et al., 1979). It is shown in the technical literature that arsenic toxicity varies greatly among species, and that effects are significantly altered by numerous physical, chemical, and biological modifiers (Eisler, 1988A).

Arsenic poisoning in most animals is usually manifested by acute or subacute signs; chronic poisoning is infrequently seen (NAS, 1977). The probability of chronic arsenic poisoning from continuous ingestion of small doses is rare, because detoxification and excretion are rapid (Woolson, 1975). Arsenic is bioconcentrated by organisms, but is not biomagnified in the food chain (Eisler, 1988A). The acute LD₅₀ dietary value for the rat from arsenate is 112 mg/kg (Gough et al., 1979). USEPA (1983) reports a total arsenic soil guideline of 300 mg/kg to protect plants. USEPA (1983) also reports total arsenic phytotoxic concentrations for sensitive plants between 25 and 85 mg/kg.

The representative concentration of arsenic in on-site soils (39 mg/kg) falls within the range of normal soil concentrations reported in the literature and is below both the rat LD₅₀ dietary value and the USEPA phytotoxicity guidelines. Therefore, arsenic is not considered a chemical of concern at the site.

Barium

Barium compounds are generally insoluble, making them relatively unavailable for biological uptake (CH2M Hill, Inc., 1989). The higher the level of organic matter in the soil, the greater the adsorption of barium. Barium is considered a nonessential element for mammals or plants. Soluble barium compounds are highly toxic to animals when ingested (US Fish and Wildlife, 1978), although it is unlikely that suitable conditions would exist under natural conditions to accommodate exposure to these compounds. There are no reports of barium toxicity to wildlife under natural conditions.

There are very few reports of barium toxicity to plants, except under conditions of acidic soils. Some authors report that concentrations of barium need to be extreme before phytotoxicity occurs. Barium accumulation in plants is unusual except when the barium concentration exceeds calcium and magnesium concentrations in the soil (USEPA, 1983).

Barium was retained as a chemical of potential concern because it exceeded the NYSDEC soil cleanup objective. Barium is present at the site at a representative concentration of 159 mg/kg. Due to the generally insoluble nature of barium, and its unavailability under natural conditions, it is not considered a chemical of concern at the site.

Beryllium

Beryllium is strongly adsorbed to most types of soils and, consequently, has limited mobility in soil. It acts similar to aluminum (USEPA, 1983). Beryllium has a long biological half-life and therefore tends to accumulate in animal tissues, particularly in bone (Gough et al., 1979).

There are no reports of beryllium toxicity to animals grazing on native vegetation. The beryllium acute LD₅₀ dietary value for the rat is reported as 1,720 mg/kg, while the calculated chronic LD₅₀ value is 172 mg/kg (Micromedex, Inc., 1993). Gough et al. (1979) report that soil phytotoxic concentrations of beryllium ranged from > 2 to 16 mg/kg in sensitive plants. USEPA (1983) suggests a soil guideline of 50 mg/kg to protect plants.

Beryllium was carried forward in the contamination evaluation due to the lack of cleanup objectives or background concentrations. Representative concentrations of 1 mg/kg are considered too low to exhibit toxicological effects upon wildlife and vegetation receptors. Therefore, beryllium is not considered a chemical of ecological concern.

Cadmium

Cadmium is relatively mobile in the environment compared to most other heavy metals. The soil chemistry of bioavailable cadmium is controlled by pH and is usually

more available in acidic conditions. Cadmium occurs naturally in close association with zinc, usually in concentrations directly related to zinc levels (US Fish and Wildlife Service, 1978). Its cumulative nature in organisms and its high toxicity makes it an extremely dangerous poison to most animals. Cadmium is accumulated through the food chain in sufficient quantities to be harmful to higher trophic levels (Thomann et al., 1974). However, no evidence was found of biomagnification of this element through the trophic levels.

Mammals have no effective mechanism for the elimination of ingested cadmium; therefore cadmium tends to accumulate in the liver and kidneys, causing chronic poisoning (USEPA, 1973). CH2M Hill, Inc. (1989) report a NOEL for cadmium in the diets of rats at 20 mg/kg, while slight toxic effects occurred after 6 months at 45 mg/kg (Gough et al., 1979). USEPA (1983) suggests a soil guideline of 3 mg/kg of cadmium for the protection of plants, but phytotoxicity can occur between 2.5 and 5 mg/kg (Eisler, 1985).

Cadmium was carried forward in the contamination evaluation because the site concentration exceeded the background concentration. The representative concentration of 2 mg/kg is considered lower than those known to exhibit toxicological effects upon wildlife and vegetation receptors. Therefore, cadmium is not considered a chemical of concern in soil.

Chromium

Chromium usually exists in soils in insoluble oxides, which are largely unavailable at pHs greater than 4.0 (US Fish and Wildlife Service, 1978). The hexavalent form of chromium may be 100 times more toxic than the trivalent form; however, both are relatively nontoxic to mammals (Gough et al., 1979). Most mammals can tolerate up to 1,000 mg/kg of chromium in their diets (USEPA, 1983). A concentration of 500 mg/kg in the diet of rats caused acute toxic effects (Gough et al., 1979). No biomagnification of chromium has been observed in food chains, and concentrations are usually highest at the lowest trophic levels (Eisler, 1986A). USEPA (1983) suggests a soil guideline of 1,000 mg/kg for chromium to protect plants. However, USEPA (1983) also shows sensitive plant phytotoxicity occurring between 100 and 500 mg/kg of chromium in the soil.

The representative concentration of chromium at the site is 26 mg/kg which exceeds the NYSDEC soil cleanup objective of 7.76 mg/kg. However, chromium is not present in concentrations that exhibit acute toxicity to wildlife receptors or phytotoxicity. Therefore, chromium is not a chemical of concern in soil.

USEPA (1983) suggests a soil guideline of 1,000 mg/kg for chromium to protect plants. However, USEPA (1983) also shows sensitive plant phytotoxicity occurring between 100 and 500 mg/kg of chromium in the soil.

The representative concentration of chromium at the site is 26 mg/kg which exceeds the NYSDEC soil cleanup objective of 7.76 mg/kg. However, chromium is not present in concentrations that exhibit acute toxicity to wildlife receptors or phytotoxicity. Therefore, chromium is not a chemical of concern in soil.

Copper

Generally, copper is considered to be among the more mobile of the heavy metals in the environment. The persistence of copper in soil depends on pH and organic content. Copper is bound more securely to soils at a pH range of 7.0 to 8.0 (US Fish and Wildlife Service, 1978). In soils of high organic content, copper may be immobilized in the form of various inorganic complexes. Copper is accumulated by all animals and plants, but it has very little, if any, potential for biomagnification through the food chain (USEPA, 1979).

Copper is an essential trace element for animals and plants. However, excessive amounts of the element are toxic (Snyder and Snyder, 1984). Sheep have died after consuming plants and soils containing 15 mg/kg copper (dry weight) (Hemkes and Hartman, 1973). However, copper toxicity in other mammals and birds is of little significance because they possess barriers to copper absorption (Gough et al., 1979). The rat acute LD₅₀ dietary level for copper is 2,400 mg/kg, while a calculated chronic LD₅₀ is 240 mg/kg (CH2M Hill, 1989). Phytotoxic concentration of copper to vegetation ranges from about 70 to 640 mg/kg in the soil for most plants (USEPA, 1983). USEPA (1983) suggests a copper soil guideline of 250 mg/kg for the protection of plants.

Copper concentrations at the site (939 mg/kg) exceed the soil cleanup objective of 5.3 mg/kg. Copper is considered to be present in site soils in sufficient concentrations to present the risk of chronic effects to wildlife receptors and exceeds the USEPA guideline for protection of plants. Therefore, this chemical is considered to be of ecological concern.

Iron

Jackson (1964) states that iron makes up 1 to 6 percent (10,000 to 60,000 mg/kg) of soils. Iron is an essential nutrient to wildlife and vegetation. There is little information on iron in the technical literature. The acute LD₅₀ dietary value for the rat from total iron is 600,000 mg/kg, while the calculated chronic LD₅₀ value is 60,000 mg/kg (Micromedex, Inc., 1993). NAS/NAE (1972) reports that iron salts added at a level of 9,000 mg/kg in the diet of chicks caused phosphate deficiency. No data on phytotoxicity to plants were available.

A representative concentration of 42,800 mg/kg exceeds the NYSDEC soil cleanup objectives but is considered to fall within the range for naturally-occurring soils. Iron is not considered a chemical of concern in surface soils.

Lead

Lead is extremely persistent and occurs in relatively immobile forms in soil. Environmental fate processes may transform one lead compound to another; however, lead itself is not degraded. The tendency for lead to form complexes with naturally-occurring organic material increases its adsorption and decreases its bioavailability, except under acidic soil conditions. Lead is generally considered a highly toxic contaminant because it is not an essential nutrient to either animals or plants. It can bioaccumulate, but it does not biomagnify in terrestrial food chains (Golder Associates, Inc., 1991).

Lead adversely affects survival, growth, reproduction, development, and metabolism of most species under controlled conditions, but its effects are substantially modified by numerous physical, chemical, and biological compounds (Eisler, 1988). Lead toxicity information for mammals is limited. The acute LD₅₀ dietary value for the rat from lead is 1,600 mg/kg, while the calculated chronic LD₅₀ value is 160 mg/kg (Micromedex, Inc., 1993).

Uptake of lead by vegetation is limited by the low availability of lead in soils; however, adverse effects seem to occur only at total concentrations of several hundred mg/kg in soil (Eisler, 1988). USEPA (1983) reported a soil guideline for lead of 1,000 mg/kg to protect plants, while phytotoxic concentrations for sensitive plants range from 150 to 1,000 mg/kg.

Lead concentrations at the site (457 mg/kg) occur above concentrations suspected to produce chronic effects in wildlife receptors and phytotoxicity to plants and is considered a contaminant of concern in site soils.

Manganese

Manganese is an essential trace element for animals and plants. Manganese does not occur naturally as a metal, but is found in various salts and minerals, frequently in association with iron compounds (Snyder and Snyder, 1984). The divalent form of manganese has a low order of toxicity to biota, especially to vertebrate animals. The hexavalent form is highly toxic, but does not occur in nature. Manganese readily bioaccumulates in plants and animals, but does not biomagnify in food chains.

Toxic concentrations of divalent manganese are reported in the diets of the following species: birds, 4,800 mg/kg; rats, >2,000 mg/kg; rabbits, 1,250 to 6,000 mg/kg; and lambs, 5,000 mg/kg (Gough et al., 1979). Toxic levels of manganese in mammals can cause decreased food intake, decreased growth, reduced hemoglobin, and even death.

At soil pH values of 5.0 or less, manganese is rendered very soluble and excessive accumulation in plants can result (USEPA, 1983). USEPA (1983) reported a soil guideline for manganese of 1,000 mg/kg to protect plants, while phytotoxicity in sensitive plants occurs at >500 mg/kg.

The representative concentration of manganese at the site is 925 mg/kg. There is no cleanup objective specified for manganese. Background concentrations at the site average 199.3 mg/kg. However, the site concentration is within the normal range of magnesium in background soils, and is below concentrations considered toxic to mammals or plants. Therefore, manganese in soil is not a chemical of ecological concern.

Mercury

Methylmercury and other organomercury compounds are the most toxic forms of mercury to mammals (Bradbury et al., 1993). Given the relative values of water solubility and vapor pressure, mercury should be expected to be a fairly mobile material. Mercury biomagnifies through the food chain, usually increasing by a factor of three to five at each higher trophic level (Leland et al., 1979).

Mercury in mammals can adversely affect reproduction, growth and development, behavior, blood chemistry, coordination, vision, hearing, and metabolism (CH2M Hill, 1989). Bowen (1966) reported that a dietary intake of 800 ppm mercury (as Hg^{+2}) was lethal to rats (test duration not given), but 100 mg/kg was considered a NOEL.

Most vascular plants are resistant to mercury poisoning, although they may accumulate high concentrations of mercury in their tissues (Gough et al., 1979). There are no reports in the technical literature of toxicity resulting from animals grazing on normal vegetation; it is likely that the small amounts present in the plants are well within the elimination rates of animals (Gough et al., 1979).

Mercury is present at the site at representative concentration of 1 mg/kg. The NYSDEC soil cleanup objective is 0.1 mg/kg. Mercury is present well below concentrations expected to produce either acute or chronic effects on wildlife receptors. Therefore, at the representative site concentration, mercury in soil is not considered a chemical of ecological concern.

Nickel

Nickel is extremely persistent in soil. It is reasonably mobile in low pH and low cation exchange capacity mineral soils, but less mobile in basic mineral soils and soils with high organic content. Some vegetation can accumulate nickel.

Allaway (1968) reports that nickel toxicity in animals was moderate to low, and toxicity to grazing animals seemed unlikely. A mechanism in mammals appears to limit its intestinal absorption (Gough et al., 1979). Underwood (1971) reported that 700 mg/kg of nickel in the diet of chicks depressed growth; 1,600 mg/kg depressed growth in young mice; and 1,000 mg/kg had no apparent toxic effect on rats. Phytotoxic levels of nickel in soils range from 50 to 500 mg/kg, while the USEPA (1983) suggests a nickel soil guideline of 100 mg/kg to protect plants.

The representative concentration of nickel at the site is 49 mg/kg. The NYSDEC soil cleanup objective is 12.69 mg/kg. Nickel is not considered to be a contaminant of concern at the site because it occurs below reported toxic effects levels in receptor species and is below the USEPA plant protection guidelines.

Selenium

The behavior of selenium in soils is dependent on its oxidation state and different chemical compounds formed as a result of the oxidation states. Acidic soil conditions favor the predominance of selenides which are insoluble and immobile in the soils. Neutral to alkaline soil conditions favor the predominance of selenates which are very mobile in soils. Selenium is considered a nonessential trace element for most plants and a required trace element for most animals. Recent studies suggest that selenium biomagnifies in terrestrial food chains (Lemly and Smith, 1987).

Selenium protects mammals and some birds against the toxic effects of mercury, cadmium, arsenic, thallium, and the herbicide paraquat (Eisler, 1985). There is a danger of selenium toxicity in the diets of terrestrial animals at concentrations in excess of 5 ppm (USEPA, 1983). Signs of chronic poisoning are common in rats given diets containing 5 to 10 ppm selenium, and at 20 ppm, there is complete refusal of food and

death in a short time (Gough et al, 1979). Forage with selenium concentrations of 10 to 30 ppm was considered capable of producing toxicity symptoms in cattle (Gough et al., 1979). USEPA (1983) suggests a selenium soil guideline of 5 mg/kg to protect plants and animals.

Selenium was detected on site at concentration of 1 mg/kg. Only the CRDL for selenium (0.05 mg/kg) was available as a screening criteria. Selenium occurs at concentrations less than the chronic poisoning levels of wildlife receptors and is not considered a contaminant of concern at the site.

Silver

The mobility of silver through soil is influenced by the drainage rate of the soil (silver is readily leached from well-drained soils); the pH of the soil, which affects the ability of manganese and iron (among others) to immobilize silver; and organic matter, which tends to form complexes with silver. Silver tends to be retained in surface soils at a pH greater than 4, especially in soil with high concentrations of organic matter. Many of silver's salts, such as silver chloride, sulfide, and arsenate, are insoluble (Snyder and Snyder, 1984). Plants account for another mechanism of silver removal from soils, as plants will uptake silver from soils into the root system. Silver is not considered an essential element for animals or plants. It is bioconcentrated by animals and plants, but does not seem to biomagnify in the food chain.

No references have been found which discuss or report toxic effects of silver on wildlife under natural conditions. USEPA (1983) reports soil phytotoxic concentrations in vegetation between 25 and 50 mg/kg.

No SCGs are available for silver in soils. Silver was retained through the screening process only due to the lack of applicable standards or background values. Representative concentrations of 2 mg/kg in site soils are not considered to exhibit phytotoxicity or chronic toxic effects to receptor species.

Vanadium

Allaway (1968) and Zoller et al. (1973) do not consider vanadium to be a serious hazard to plant or animal life. Plants normally retain vanadium in their roots, thereby providing an effective barrier to food chain transfer. Animals tend to concentrate vanadium in their bones, which leaves their flesh relatively free of vanadium, thus reducing the potential for transfer into predators.

Vanadium toxicity is dependent on pH levels in the soils and absorption properties in wildlife. In general, the pH determines the valence state of vanadium (+2, +3, +4, or +5). Soils at the site are acidic, which would cause vanadium to be in the lower valence states for soils; these forms are less toxic than the higher valence states. Vanadium is also poorly absorbed from dietary intake into an animal's system. Friberg et al. (1986) states that the absorption of soluble vanadium compounds is estimated at 2 percent in one study and equal to or less than 1 percent in another study.

Micromedex, Inc. (1993) listed the oral LD₅₀ for the rat to different forms of vanadium as: 10-100 ppm for V₂O₅; 540 ppm for V⁺²; 350 ppm for V⁺³; 160 ppm for V⁺⁴; and 98 ppm for V⁺⁵. The acute oral LD₅₀ for the mouse is 130 ppm for V⁺³

and 75 ppm for V⁺⁵, while the calculated chronic LD₅₀ values are 13 ppm for V⁺³ and 7.5. Vanadium was toxic to rats at 25 ppm dry weight (Gough et al., 1979). USEPA (1983) reports a soil guideline for vanadium of 500 mg/kg to protect plants; phytotoxicity occurred at 500 to 1,000 mg/kg.

Vanadium is present at the site in sufficient concentration (102 mg/kg) to be considered a contaminant of concern based on comparison to documented acute and chronic toxicity to receptor species. Vanadium is not expected to exhibit phytotoxicity at concentrations encountered at the site.

Zinc

Zinc is an essential trace element for animals and plants. It is moderately mobile in soil/water systems. Zinc is bioaccumulated by all organisms, but it does not biomagnify in terrestrial food chains. Animals are generally protected from zinc poisoning through plant consumption because high concentrations of zinc are phytotoxic before they accumulate in toxic concentrations in plant tissues eaten by animals (USEPA, 1983). The phytotoxic level of zinc in soils range from 500 to 2,000 mg/kg, with toxicity being enhanced under acidic conditions (USEPA, 1983).

Zinc compounds are relatively nontoxic to mammals because mammals can physiologically regulate the adsorption and excretion of this metal. For example, a dietary intake of 2,500 ppm zinc produced no discernible effects in rats, while 10,000 ppm was required to induce high mortality (US Fish and Wildlife Service, 1978). The safe dietary concentrations of zinc for rats is 2,500 mg/kg; for growing cattle, 500 mg/kg; and for mature cattle, 1,000 mg/kg (Taylor and Demayo, 1980).

The representative concentration of 997 mg/kg at the site is below the proposed site soil cleanup objective of 24,000 mg/kg. Zinc occurs at the site at concentrations below those exhibiting discernable effects to receptor species and is not considered a contaminant of concern to wildlife receptors or plants.

Cyanide

Many chemical forms of cyanide are present in the environment, and the most common form is free cyanide. Only free cyanide is considered to be a biologically meaningful expression of cyanide toxicity. Cyanide seldom remains bioavailable in soils because it is either complexed by trace metals, metabolized by various microorganisms, or lost through volatilization (Eisler, 1991). Cyanide ions are not strongly adsorbed to or retained in soils, and leaching into the surrounding groundwater will probably occur. Cyanide was not accumulated or stored in any mammal studied, and biomagnification has not been reported, possibly due to rapid detoxification of sublethal doses in most species, and death at higher doses (Eisler, 1991).

Cyanide has an unusually low chronic toxicity, but chronic intoxication exists. Despite the high lethality of large single doses, repeated sublethal doses seldom result in cumulative adverse effects, and intermittent doses can be tolerated by many species for long periods of time, perhaps indefinitely (Eisler, 1991 and USEPA, 1980). The rat acute LD₅₀ dietary value for cyanide is 60 to 80 mg/kg (CH2M Hill, Inc., 1989).

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Vanadium is present at the site in sufficient concentration (102 mg/kg) to be considered a contaminant of concern based on comparison to documented acute and chronic toxicity to receptor species. Vanadium is not expected to exhibit phytotoxicity at concentrations encountered at the site.

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The representative concentration of 997 mg/kg at the site exceeds the NYSDEC soil cleanup objective of 35.8 mg/kg. Zinc occurs at the site at concentrations below those exhibiting discernable effects to receptor species and is not considered a contaminant of concern to wildlife receptors or plants.

Cyanide

Many chemical forms of cyanide are present in the environment, and the most common form is free cyanide. Only free cyanide is considered to be a biologically meaningful expression of cyanide toxicity. Cyanide seldom remains bioavailable in soils because it is either complexed by trace metals, metabolized by various microorganisms, or lost through volatilization (Eisler, 1991). Cyanide ions are not strongly adsorbed to or retained in soils, and leaching into the surrounding groundwater will probably occur. Cyanide was not accumulated or stored in any mammal studied, and biomagnification has not been reported, possibly due to rapid detoxification of sublethal doses in most species, and death at higher doses (Eisler, 1991).

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Cyanide was carried through the screening process due to the lack of applicable criteria and background concentrations to compare against site concentrations. Five mg/kg was determined representative of site concentrations. Cyanide is not considered to exhibit toxicological effects at the concentrations encountered at the site.

PCBs

As a class of compounds, PCBs exhibit a tendency to sorb strongly to soils. PCBs are expected to show very limited mobility and present only a slight danger of leaching to unprotected groundwaters. Environmental persistence of PCBs is determined by the degree of chlorination. Higher chlorobiphenyls (i.e., Aroclors 1254 and 1260) are more persistent in the environment, making them among the most stable compounds in the chemical class (Eisler, 1986).

PCBs have a significant environmental toxicity to mammals and birds. PCB toxicity is further enhanced by their ability to bioaccumulate and biomagnify in the food chain (Eisler, 1986). Three primary effects of PCB exposure on terrestrial wildlife are mortality, decreased reproductive success, and behavioral modifications.

Linzey (1988) reported poor reproductive success and growth among white-footed mice (*Peromyscus leucopus*) chronically exposed to Aroclor 1254 in the diet at a level of 10 ppm. Aroclor 1260 has relatively low oral toxicity to rats. Micromedex, Inc. (1993) cites several studies in which laboratory rats fed Aroclor 1260 at concentrations of 100 to 1,250 ppm in the diet for periods ranging from 2 to 21 months. Although sublethal effects such as reduced reproductive success, liver tumors, and retarded growth were noted, these concentrations did not cause large-scale mortality. LD₅₀ data for dietary intake of Aroclor 1254 as summarized in Eisler (1986) and Micromedex, Inc. (1993) are presented below:

White-footed mouse	> 100 mg/kg for 3 weeks
Mouse, PCB-resistant	> 250 mg/kg for 18 weeks
Norway rat	> 75 mg/kg for 6 days
Raccoon	> 50 mg/kg for 8 days
Cottontail rabbit	> 10 mg/kg for 12 weeks

PCBs are not very toxic to terrestrial vegetation. Eisler (1986) reported a soil phytotoxic concentration of 26 mg/kg for total PCBs. PCBs have been shown to bioconcentrate in vegetation. Although tissue concentrations of PCBs may not be toxic to the plants, they could be important as sources of PCBs for higher trophic levels.

Representative soil concentrations of the three PCB Aroclors detected on-site range from 349-750 ug/kg. Each of the Aroclors are present in concentrations exceeding the reported LD₅₀ for wildlife receptor species and are known to biomagnify.

Soils Contaminant Summary

Surface soil contaminants determined to be of concern to ecological receptors are based upon review of the toxicological information and comparison of effects levels to concentrations detected at the site. Compounds exhibiting on-site concentrations observed to produce chronic effects in wildlife receptor species include dibenzo(a,h)anthracene, copper, lead, and PCBs. The latter three of these chemicals

also produce phytotoxic effects at site concentrations. No compounds were detected in surface soils at concentrations associated with acute toxicity effects.

Sediments

Volatiles

Six VOCs (acetone, 2-butanone, chlorobenzene, methyl chloride, toluene, and xylenes) were retained for toxicological analysis. Of these, criteria for protecting benthic species from sediment contamination were not established for five. Only chlorobenzene exceeded its criterion for sediment. However, none of the VOCs are anticipated to cause toxic effects in benthic species because these compounds typically volatilize and degrade rapidly in aquatic environments. VOCs typically induce limited aquatic life toxicities. Because chlorobenzene exceeded the criterion, it is considered a contaminant of concern in on-site pond sediments.

Semivolatiles

Carbazole

Carbazole was retained for toxicological analysis because no criterion was established. Carbazole is not likely to volatilize from soil and water. Information regarding biodegradation, toxicity, and bioconcentration of carbazole in aquatic environments was not located in the technical literature. Due to lack of a standard and adequate toxicological information, as well as the low concentration (37 ug/kg) detected in on-site pond sediments, carbazole is not considered a contaminant of concern.

1,2-Dichlorobenzene

1,2-Dichlorobenzene (1,2-DCB) has a high affinity for lipophilic materials and has reported to have a relatively low vapor pressure and low aqueous solubility at ambient temperatures. Consequently, sorption to sediments, bioaccumulation, and volatilization are expected to be the competing fate processes (Callahan et al., 1979). Sediment sorption of 1,2-DCB is the major environmental fate process. There is some indication that 1,2-DCB is very persistent in sediments (Micromedex, Inc., 1993). No information was located in the technical literature to indicate toxicity to benthic organisms. The representative concentration of this compound (380 ug/kg) exceeded the NYSDEC Aquatic Toxicity Sediment Criterion of 120 ug/kg. Because no information was available relating to toxicity and the compound exceeds the criterion, it is considered to be a contaminant of concern in on-site pond sediments.

Phthalates

Four phthalate esters (bis(2-ethylhexyl)phthalate, butylbenzylphthalate, diethylphthalate, and di-n-butylphthalate) were retained for toxicological analysis. Of these, only bis(2-ethylhexyl)phthalate exceeded its criterion. The other three compounds were retained because there were no criteria identified. Most information reported in the technical literature deals with phthalate esters as a group. Autian (1973) suggests there is evidence that phthalate esters are metabolized by aquatic life. As a result, phthalate esters are not likely to biomagnify. Phthalate esters are nonvolatile and strongly adsorb to sediments.

Bis(2-ethylhexyl)phthalate, which exceeded its sediment criterion, also had the highest site-related concentration of the detected phthalates. Limited toxicological information was available for the phthalates. Studies indicate that there is little or no cumulative toxic effect to aquatic species from phthalates (Johnson and Finley, 1980). Invertebrates accumulate bis(2-ethylhexyl)phthalate up to 13,400 times when exposed to water concentrations ranging from 0.08 to 0.3 $\mu\text{g/L}$. However, 90 percent of the residues were lost within 10 days (Johnson and Finley, 1980).

Bis (2-ethylhexyl)phthalate was detected at 7300 ug/kg in upgradient sediments and 3236 ug/kg in on-site pond sediments. The source of high concentrations in background samples is unknown. The representative concentration of this compound is 81 ug/kg in stream channel sediments, and was not detected downstream of the site. The on-site pond concentration exceeded the NYSDEC Aquatic Toxicity Sediment Criterion of 1197 ug/kg . Because little information was available relating to toxicity and the compound exceeds the criterion, it is considered to be a contaminant of concern in on-site pond sediments.

PAHs

PAHs are ubiquitous in nature primarily as a result of natural processes such as forest fires, microbial and terrestrial vegetation synthesis, and volcanic activities (Eisler, 1987). The molecular weight of the individual PAHs affects their mobility and solubility in the environment, with lower-weight compounds (acenaphthene, acenaphthylene, anthracene, fluorene, phenanthrene, fluoranthene, 2-methylnaphthalene, and pyrene) of more concern because they are generally more volatile and soluble than higher-weight compounds (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene), which have strong sorption properties. In aquatic environments, PAH partitioning in sediments occurs in an equilibrium partitioning process, with a potential for localized occurrences of high levels of dissolved PAHs (Edwards, 1983). PAHs will adsorb strongly onto suspended particulates and biota. The ultimate fate of those which have accumulated in the sediment is believed to be biodegraded and biotransformed by benthic organisms (USEPA, 1980).

PAHs, as a group, exhibit similar toxicological properties. There is a general lack of evidence suggesting severe toxic effects on benthic biota. Sediment-associated PAHs have accounted for up to 77 percent of the steady-state body burden in benthic amphipods (Eisler, 1987). Little potential for biomagnification through aquatic food chains exists, and BCFs range widely.

Fluoranthene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)pyrene, chrysene, benzo(a)anthracene, and bis (2-ethylhexyl)phthalate (as described in the preceding section) were all detected in upgradient sediment samples suggesting an upgradient source of these compounds. The site facility was destroyed by fires, which could be a potential source for distribution and deposition of PAHs at upgradient locations. NYSDEC Aquatic Toxicity Sediment Criterion are available only for fluoranthene and phenanthrene. On-site concentrations do not exceed these criteria. Criteria are not available for many of the PAH compounds detected on-site or

downstream. Because of a lack of evidence suggesting severe toxic effects, the lack of sediment criteria for most of the PAHs detected, and the magnitude of upgradient concentrations, PAHs are not considered be a contaminant of concern in sediments at the site.

Metals

Aluminum

Aluminum was retained for toxicological analysis because no criterion was established. The mobility of aluminum in sediments is dependent upon the solubility of the aluminum compound and upon the pH of the medium. The range of concentrations of aluminum acutely toxic to freshwater invertebrate species is about the same as the range of concentrations toxic to fish (USEPA, 1988). No data are available concerning the effects of pH on toxicity of aluminum to invertebrates. Aluminum was detected only in upgradient sediments at a concentration of 3750 mg/kg. Aluminum is not considered to be a contaminant of concern in the site sediments.

Arsenic

Arsenic is extremely persistent in sediments. The bioavailability of arsenic tends to dramatically decrease at water pH 7.5 or higher as metal solubilities rapidly decrease, especially under conditions of readily available colloidal humic materials and high aluminum, iron, and calcium concentration (USEPA, 1983). Bioconcentration of arsenic occurs in aquatic organisms, primarily in algae and lower invertebrates. Biomagnification in aquatic food chains does not appear to be significant, although some fish and invertebrates contain high levels of arsenic compounds which are relatively inert toxicologically.

No significant difference has been demonstrated to indicate that hardness had any effect on arsenic toxicity to aquatic species (USEPA, 1980). Virtually no data on chronic effects of arsenic on fish and invertebrate species exist. USEPA (1980) indicated that arsenic toxicity to aquatic life was increased with increased duration of exposure.

The NYSDEC Aquatic Toxicity Sediment criterion (adjusted for organic carbon content) for arsenic is 5 mg/kg. The representative concentration for on-site pond sediments is 19.2 mg/kg. Arsenic exceeded the NYSDEC Aquatic Toxicity Criterion in on-site pond sediments only. It is considered a contaminant of concern for this area only.

Barium

Barium was retained for toxicological analysis because no criterion was established. In aquatic media, barium is likely to precipitate out of solution as an insoluble salt, or adsorb to suspended particulate matter. Sedimentation of suspended solids removes a large portion of the barium from surface waters. Barium in sediments is found largely in the form of barium sulfate. Bioconcentration in freshwater aquatic species is minimal.

Barium represents little hazard to aquatic life under natural conditions. Due to lack of an applicable standard and the minimal hazards associated with barium, it is not considered a contaminant of concern in on-site or downstream sediment.

Chromium

Chromium occurs in nature primarily as the trivalent (III) ion and secondarily in its hexavalent (VI) form. Chromium VI is the more biologically active form and is generally more toxic to aquatic life receptors (Eisler, 1986). Most of chromium III is expected to precipitate in sediments. There is little evidence of bioconcentration or biomagnification of chromium through the food chains. Benthic invertebrates have only a limited ability to accumulate chromium from sediments and clays (Neff et al., 1978).

The NYSDEC Aquatic Toxicity Criterion for chromium of 26 mg/kg was exceeded only in the on-site pond sediments. The representative site concentration is 39.8 mg/kg. Due to the limited toxicity characteristics described in the literature chromium is not considered to be a contaminant of concern at the site in the detected concentrations.

Copper

The toxicity of copper to aquatic life is largely dependent on water alkalinity, pH, and temperature. At lower alkalinity, pH, and temperature, copper is generally more toxic to aquatic life (USEPA, 1983). Copper is bioconcentrated by all aquatic life, but it has very little if any potential for biomagnification. Concentrations of 0.015 mg/L produced sublethal effects in crayfish and a 4-day LC₅₀ of 3 mg/L of copper is reported (Snyder and Snyder, 1984).

Representative copper concentrations in the on-site pond (155.7 mg/kg) exceed the applicable criteria of 19 mg/kg and exceed the levels described in the literature as having toxicological effects. Copper is considered a contaminant of concern in both on-site pond and downstream sediments.

Lead

Lead is extremely persistent in sediments. Lead is generally more toxic to animals in soft water than in hard water. Lead is also more mobile in acidic waters than in high pH waters. Because lead is slightly soluble and easily complexed, most lead is found in bottom sediments (McKee and Wolf, 1963). Lead can be bioaccumulated, but it does not biomagnify in aquatic food chains. Benthic microbes can transform methylate lead to tetramethyl lead, which is volatile and more toxic than inorganic lead (CH2M Hill, Inc., 1989).

Sediments are not only sinks for lead, but act as a source of lead to aquatic biota after contamination from the original source has subsided (Knowlton et al. 1983). The uptake of lead from sediments was recorded in the exoskeleton of crayfish. Accumulation of lead in crayfish was primarily through adsorption; most was lost through molting, though some internal uptake and elimination occurred without molting (Knowlton et al., 1983). In all aquatic species, lead effects were most pronounced at

elevated temperatures and reduced pH, in comparatively soft waters, in younger life forms, and after long exposures (Eisler, 1988).

The NYSDEC lead criterion of 27 mg/kg was exceeded in background, on-site, and downstream samples. Upgradient sediments exhibited representative concentrations of 3.9 mg/kg, on-site sediments a concentration of 32.7 (stream channel) and 155.7 mg/kg (pond), and downstream sediments 45.5 mg/kg. Upstream concentrations exceeding the criteria may be, in part, attributable to the presence of lead ore (galena) deposits in local bedrock and may represent elevated natural background conditions. Due to the toxic effects demonstrated by lead and the presence of this metal in excess of the applicable criterion it is considered a contaminant of concern at the site.

Manganese

The bioavailability of manganese tends to dramatically decrease at water pH 7.5 or higher as metal solubilities rapidly decrease, especially under conditions of readily available colloidal humic materials and high aluminum, iron, and calcium concentrations (USEPA, 1983). Manganese has been shown to bioaccumulate in freshwater invertebrates (Snyder and Snyder, 1984). Upstream concentrations exceeding the criteria may be, in part, attributable to elevated natural background conditions. Representative manganese concentrations are 624 mg/kg in upgradient sediments, 1010 mg/kg in on-site stream sediments, 2630 mg/kg in on-site pond sediments, and 586 mg/kg in downstream sediments. All exceed the aquatic toxicity criteria of 428 mg/kg. Manganese is therefore considered a contaminant of concern in down stream and on-site sediments.

Mercury

Elemental and inorganic mercury compounds are generally susceptible to gravitational deposition in sediments of aqueous environments because of their high specific gravity/density values. The bioavailability of mercury tends to dramatically decrease at water pH of 7.5 or higher, as metal solubilities rapidly decrease, especially under conditions of readily available colloidal humic materials and high aluminum, iron, and calcium concentration (USEPA, 1983). Mercury bioaccumulates and biomagnifies in virtually all forms of aquatic life (USEPA, 1976). Mercury biomagnifies through the food chain, usually increasing by a factor of three to five at each higher level (Leland et al., 1979).

Mercury at comparatively low concentrations adversely affects the reproduction, growth, behavior, metabolism, blood chemistry, and oxygen exchange of aquatic organisms (Eisler, 1987). It is emphasized that organomercury compounds, especially methylmercury, were significantly more effective than inorganic mercury compounds in producing adverse effects and accumulations (Eisler, 1987).

Mercury was not detected in upgradient sediments, on-site stream sediment samples, or downstream sediments. Mercury concentrations of 1.0 mg/kg in the on-site pond were found to exceed the NYSDEC Aquatic Toxicity criterion of 0.1 mg/kg. Mercury is considered a contaminant of concern in on-site pond sediments only.

Nickel

Nickel tends to precipitate or be sorbed in aquatic systems, leading to decreased mobility and bioavailability. The toxicity of nickel to fish decreases as hardness and alkalinity increase (McKee and Wolf, 1963). Many aquatic organisms have the capability of bioaccumulating nickel, but biomagnification does not occur. Nickel appears to be less toxic to fish and river crabs than copper, zinc, and iron (McKee and Wolf, 1963).

Nickel was detected in upgradient sediments, on-site stream sediment samples, and downstream sediments at concentrations below the applicable criteria. Nickel concentrations of 41.1 mg/kg in the on-site pond were found to exceed the NYSDEC Aquatic Toxicity criterion of 22 mg/kg. Due to the lack of literature detailing toxic effects levels and the exceedance of the criterion, nickel is considered a contaminant of concern in on-site pond sediments.

Vanadium

Vanadium was retained for toxicological analysis because a criterion was not identified. The degree of vanadium toxicity depends largely on the dispersion and solubility. Toxicity also depends on the valence; it increases with increasing valence, with pentavalent vanadium being more toxic (Micromedex, Inc., 1993). The partitioning of vanadium from water to sediments is strongly influenced by the presence of particulates in the water. No toxicological or bioaccumulation information were available in the technical literature. Due to the lack of a standard and toxicological information vanadium is not considered a contaminant of concern at the site.

Zinc

Most of the zinc introduced into the aquatic environment is partitioned into the sediment by sorption onto hydrous iron and manganese oxides, clay materials, and organic materials. The acute lethal toxicity of zinc is greatly affected by water hardness, with soft water being more toxic than hard water. Zinc is bioaccumulated by all organisms, but it does not biomagnify in the aquatic food chain. The distribution of zinc through a river system in Illinois affected by industrial effluents showed that high concentrations of zinc were present in the sediments and the benthic organisms contained more zinc than the fish (Taylor and Demayo, 1980).

Zinc was determined present at elevated concentrations of 427 mg/kg and 91.9 mg/kg in on-site pond sediments and downstream sediments, respectively. Both values exceed the applicable standards of 85 mg/kg. Due to the lack of quantitative information on zinc toxicity and the exceedance of the applicable criteria, zinc is considered a contaminant of concern in on-site pond and downstream sediments.

Pesticides and PCBs

There were three pesticides (delta-BHC, endrin, and methoxychlor) retained because concentrations exceeded sediment guidelines. Organochlorine pesticides will strongly adsorb to sediments/solids in water. They have a high environmental toxicity for invertebrates, show strong tendencies for bioaccumulation (on the order of 10,000 in invertebrates and fish), and biomagnify in the aquatic food chains (USEPA, 1979). Effects of pH and water hardness on toxicity were of no concern. Toxicity information for each of the pesticides, if available, are presented below.

Although it is a member of the organochlorine class of compounds, BHC has a somewhat lower environmental toxicity to invertebrates and fish than many other compounds in this class. Delta-BHC is the only isomer of BHC that was retained for toxicological analysis. Most toxicological information deals with the gamma-BHC (lindane) isomer. USEPA (1976) reports that increased resistance to lindane toxicity has been documented among fish and invertebrates experiencing previous exposure to the chemical. BCFs are lower concern for BHC than most other organochlorines and range from 100 to 1,000 for invertebrates and fish (Micromedex, Inc, 1993).

Endrin is highly toxic to fish, but less toxic to invertebrates. There is little difference between the acute and chronic toxicity of endrin to aquatic species (USEPA, 1991). The acute LC₅₀ values for invertebrates range from 0.08 to 64 µg/L, with most values between 1 and 10 µg/L (Micromedex, Inc., 1993). BCFs of fish and invertebrates are on the order of 10,000 (USEPA, 1979).

Methoxychlor has a reported LC₅₀ of 0.5 µg/L for crayfish (Johnson and Finley, 1980). Studies cited by Micromedex, Inc. (1993) list acute LC₅₀ values for invertebrates ranging from 0.5 to 34 µg/L, with most values at less than 2 µg/L. Sax (1987) cites bioconcentration factors for aquatic species ranging from 200 to 800. However, methoxychlor is rapidly excreted by almost all aquatic life forms when exposure is terminated and is soon eliminated from body tissues (USEPA, 1987).

Based on the relative toxicities of these insecticide to aquatic life (as indicated by sediment guidelines, water quality standards, and water-column toxicity data), and the biomagnification potential and persistence in the environment, it appears that these chemicals in sediments pose toxic hazards to aquatic receptors in the lower pond (methoxychlor) and downstream of the site (endrin and delta-BHC).

PCBs

The only PCB that was retained for toxicological analysis was Aroclor-1242. In general, the more highly chlorinated compounds (e.g., Aroclors 1254 and 1260) are less water soluble, less biodegradable, and more difficult for organisms to metabolize than lower chlorinated compounds (e.g., Aroclors 1216 and 1242). PCBs tend to accumulate in freshwater sediments, where they can remain available for resuspension in surface water for at least 8 to 15 years (Eisler, 1986).

Little toxic information exists on a sediment level that may cause an effect on benthic organisms, but sediment-exposure toxicity would presumably be higher than surface-water toxicity. The U.S. Army Engineer Waterways Experiment Station (1988) conducted studies to assess the effects of PCBs in sediments on adult fathead minnow. Test populations were exposed to sediments containing 0.82, 14.0, and 27.0 ppm of Aroclor 1254 (equivalent) for 16 weeks. Reproduction was significantly impaired in the minnows exposed to the two higher sediment concentrations. The chronic (7-day) LC₅₀ for crayfish is 30 µg/L for total PCBs (Eisler, 1986). Invertebrates showed magnification of Aroclor-1254 up to 6,300 times within 21 days (Johnson and Finley, 1980).

PCBs are considered contaminants of concern in on-site pond sediments due to exceedance of criteria. Additionally, due to their fate and transport characteristics,

PCBs are considered contaminants of concern where detected below the applicable criterion but in exceedance of the detection limit. All stream segments sediments contained detectable concentrations of PCB and they are considered a site-wide contaminant of concern.

Sediment Contamination Summary

Sediment contaminants determined to be of concern to aquatic ecological receptors are based upon review of the toxicological information and comparison of effects levels to concentrations detected at the site. Stream segments were established and evaluated separately in order to address contaminants observed in particular locations. Widespread contaminants (those that are of equal concern in all stream segments) include PCBs, lead, and manganese. Other sediment contaminants of concern in the on-site pond consist of 1,2-dichlorobenzene, bis(2-ethylhexyl)phthalate, arsenic, copper, mercury, nickel, and zinc. Additional contaminants of concern in downstream sediments are copper and zinc.

5.3.4 Risk Characterization

In this section, chemicals of concern and the risks they pose to ecological receptors are first reviewed by affected medium. As appropriate, exposure pathway considerations are discussed, and general risk levels are summarized. A concluding subsection integrates the risk characterization of the site as a whole.

5.3.4.1 Surface Water

Lead in surface water was present at levels reported to cause toxic effects in rainbow and brook trout and exceeded safe drinking water concentrations for large mammals. However, these toxicity thresholds were also exceeded in the upgradient surface water sample, suggesting that toxic lead levels are not strictly site-related. As the chemical form of lead in Rondout Creek was not determined, toxicities and bioavailability of lead are not clear. Trout are known to survive after stocking downstream of the site, suggesting that lethal concentrations of lead apparently do not persist, though sub-lethal concentrations may be present. The more tolerant blue gills were observed on-site. As lead does not biomagnify, risks to consumers of fish from lead are probably not a concern.

5.3.4.2 Sediment

The pattern of concentration buildup in the pond sediments, suggests that the pond functions as a settling basin for contaminants. Chemicals of concern in sediment included PCBs, lead, manganese in the pond and all stream segments; 1,2-dichlorobenzene, bis(2-ethylhexyl)phthalate, arsenic, copper, mercury, nickel, and zinc in the pond; and zinc and copper downstream of the site. After evaluating the spatial distribution and sediment concentrations of these contaminants, it appears that the former site facilities may be sources of PCBs, lead, manganese, and copper contamination.

Maximum or 95% UCL sediment concentrations of these contaminants in the pond were higher than sample concentrations of sediment upstream and downstream of the pond. At least one concentration either the maximum or 95% UCL) of copper, lead,

and manganese exceeded the limit of tolerance for aquatic macroinvertebrates, which suggests that contaminant concentrations could be great enough to constrain and adversely affect the aquatic invertebrate population. Concentrations of arsenic, mercury, nickel, 1,2-dichlorobenzene, and zinc exceeded the sediment guidelines, which are protective of the most sensitive species. These findings suggest that sensitive species might be present in reduced numbers in the pond.

The maximum and/or 95% UCL concentrations of endrin and delta-BHC were present at concentrations that exceeded sediment guidelines in downstream segments 1 and 2 respectively. However, because neither contaminant was reported from on-site sediment samples, it was concluded that these contaminants may be derived from other sources not related to the site facilities. Methoxychlor was reported from the on-site pond and the downstream segment 2 station at a maximum or 95% UCL concentrations that exceeded the guidelines. It is not possible to determine whether these concentrations represent potential aquatic risks to aquatic life populations or communities because the data set was too small to warrant any confident estimates of site-induced risks.

5.3.4.3 Soils

One PAH, two metals, and three PCB Aroclors are considered chemicals of concern to ecological receptors ingesting shallow site soils. A summary of these chemicals is presented below:

Chemical	Site* Concentration (mg/kg)	Acute LD ₅₀ (mg/kg) Species	Phytotoxic Range (mg/kg)
Dibenzo(a,h)anthracene	549	16 Rat	Not Available
Copper	939	2,400 Rat	70-640
Lead	457	1,600 Rat	150-100
Aroclor-1242	750	Not Available	Not Available
Aroclor-1248	349	Not Available	Not Available
Aroclor-1254	475	> 100 White-footed mouse	Not Available
Total PCBs	1574	Not Available	26

* Site concentration equals the 95% UCL.

The copper and lead site concentrations exceed phytotoxic levels and exceed site background concentrations by one to two orders of magnitude (Table 5.32). However, the site concentrations for these two metals are below the acute LD₅₀ values for the rat (extrapolated for the deer mouse indicator species). Only when applying the 10-percent factor to estimate a chronic LD₅₀ do the site 95-percent UCLs appear to exceed these values. Neither copper nor lead magnify through the food chain and therefore likely do not pose risks to predators. The assumption that terrestrial wildlife are consuming 100 percent of site soil concentrations is extremely conservative, and incidental ingestion

rates are likely to be far lower. Given the ingestion assumption and the uncertainty of calculating a chronic toxicity value, the risks of terrestrial wildlife receptors exposed to shallow site soils contaminated with lead and copper are probably low. The absence of any evidence of vegetative stress on-site further suggests that concentrations of these metals are not inducing toxic effects in terrestrial plants present on-site.

The concentration of dibenzo(a,h)anthracene on-site is dramatically higher than the available literature toxicity value for the rat, suggesting that even incidental ingestion would pose a risk to small mammals on the site. However, PAHs tend to be rapidly metabolized and show little tendency for bioconcentration in mammals, thereby minimizing risks to higher-order predators. Vegetation may absorb more soluble PAHs through their roots, but phytotoxic effects due to PAH intake are rare (Eisler, 1987). Therefore, the consequences to the site environment due to evaluated dibenzo(a,h)anthracene concentrations in shallow soils appears limited to terrestrial wildlife ingesting the soils directly. Large-scale habitat effects are not considered likely, though individual and population level effects on certain species (e.g. small mammals) may be induced by the site concentrations of dibenzo(a,h)anthracene.

Three Aroclors, 1242, 1248, and 1254, were detected at concentrations of concern in shallow soils.

The combined PCB site concentration of 1,574 mg/kg significantly exceeds the phytotoxic concentration of 26 mg/kg (Eisler, 1986). Moreover, PCBs can accumulate in plant tissues, which may then provide another source of PCBs to wildlife herbivores. Even allowing for reduced exposure through only incidental soil ingestion, the concentrations of PCBs in shallow site soils pose unacceptable risks to terrestrial receptors at all trophic levels. Surface runoff over PCB-laden soils can add to the PCB concentrations in surface water and sediments.

5.3.5 Risk Characterization Conclusions

It is difficult to draw firm conclusions regarding the potential ecological risks of the contaminant concentrations reported from soil, surface water, and sediments. The primary constraints lie in the sampling and analytical designs used for the site. Because a consistent list of analytes was not systematically investigated in all media at all sampling locations, it is difficult to confidently establish exposure pathway relationships.

Although elevated concentrations of contaminants show up in surface water, sediments, and soils, there is no clear pattern that suggests widespread contamination from one or more potential chemicals of concern. The presence of elevated concentrations of some potential chemicals of concern in the upgradient or background station (e.g., lead and manganese) suggests naturally elevated concentrations which makes the assessment of site influences difficult using only a small sample data base.

It is clear that PCB concentrations are elevated in the site soils and sediments and at stream segments downstream of the site. These contaminants pose a potential risk to terrestrial aquatic animal species associated with the sediments and soils. The most prominent risk from PCB assimilation is impaired reproductive failure, which reduces

population productivity. There are inadequate data from this study to determine whether this potential risk is realized at the site or its surroundings.

Moreover, dibenzo(a,h)anthracene in shallow soil may pose risk to individuals, and possibly at the population level, for small mammal species on the site. However, widespread habitat and food chain effects are not considered likely for this PAH compound in soils.

5.3.6 Uncertainty Assessment

The assessment of ecological impacts is an inherently complex task. Several factors influence the accuracy of and confidence in the analysis of impacts at the Napanoch Paper Mill site. The uncertainties evident in this evaluation are associated with the quality and quantity of the data, the fate and transport model assumptions, the assumptions used in developing exposure scenarios, and extrapolation of toxicological information.

Sampling and Measurement Uncertainties

Uncertainties are common to any sampling and measurement routine and are associated with the representativeness of the samples collected. Factors that contribute to uncertainty for this analysis include the small number of data sets collected, and the lack of multiple rounds of sampling which detect temporal variations in contaminant concentrations and distribution, and inconsistent analytical parameters for samples within data sets.

The presence of contaminants of concern (particularly PCBs) below the analytical method detection limits is another area of uncertainty. The high bioconcentration factor of PCBs in tissues at levels below the detection limit was considered during the assessment. As a result, PCBs were retained for impact analysis in surface waters, even though they were reported as non-detected in the laboratory analysis.

The spatial distribution of sediment samples in downstream segments 1 and 2 was inadequate to evaluate whether other off-site sources are contributing to downstream sediment/surface water contamination.

Uncertainty was also associated with the availability of contaminants detected. Bioavailability of certain contaminants in soils is a function of pH and total organic content. No pH or TOC data were collected for soils. Also, the valence state or isomer of certain chemicals can affect toxicity, but only total fractions were measured.

No sampling and analysis of biological tissues was conducted. A basis of comparison of upstream background fish tissues concentrations with samples of fish tissues collected by NYSDEC downstream of the site in Rondout Creek in 1989 was not possible. Without tissues samples, the completion of particular exposure pathways from media to specific receptors can only be surmised and the contribution of contaminants attributable to the site cannot be evaluated.

Exposure scenarios

The exposure scenario for terrestrial receptors assumes that 100 percent of their diet consists of soils containing the detected contaminant concentrations. No evaluation was conducted to determine exposure frequency, duration, or intake rates of receptor

species. This conservative assumption tends to bias the analysis of potential dietary impacts to terrestrial receptors. The evaluation of impact does not consider exposures to multiple chemicals via multiple pathways.

Toxicological Data

Applicable criteria are not available for many of the compounds detected in site media. Additionally, many of the contaminants are not addressed in the toxicological literature in sufficient detail to make an exposure/impact scenario possible. PAHs, for example, were evaluated as a class exhibiting similar fate and transport mechanisms and effects levels.

Toxicological data on biological effects levels are extrapolated from laboratory animals to feral populations.

TABLE 5.1
COMPARISON OF MAXIMUM BACKGROUND
AND ON-SITE INORGANIC DATA (1)

Chemical	Groundwater (µg/L)		Surface Water (µg/L)		Soil (mg/kg)		Sediment (mg/kg)	
	Maximum Bkgd (2)	Maximum On Site (3)	Maximum Bkgd (2)	Maximum On Site (3)	Maximum Bkgd (2)	Maximum On Site (3)	Maximum Bkgd (2)	Maximum On Site (3)
Antimony	5.0 U	ND	5.0 U	ND	9.1 U	57.3	11.3 U	ND
Arsenic	10	ND	4.0 U	ND	6.8	619	3.9	24.1
Barium	35.3	239	22.7	111	56.9	670	67.1	276
Chromium	10 U	ND	10 U	ND	7.8	84.3	2.8 U	48.9
Cobalt	20.0 U	53.9	20.0 U	ND	6.2	136	5.6 U	7.2
Copper	10 U	40	10 U	7.5	8.3	84,000	14.5	201
Lead	3.0 U	ND	7.0	17.0	126	2,100	27.8	535
Manganese	300	13,100	21.0	345	509	2,850	612	4,960
Mercury	0.49	ND	0.20 U	ND	0.2	17	0.14 U	1
Nickel	20.0 U	150	20.0 U	ND	19.8	308	9.6	83.3
Silver	10 U	ND	1.0 U	ND	0.13	12	0.28 U	ND
Vanadium	20.0 U	ND	20.0 U	ND	72.8	504	5.6 U	65.2
Zinc	12.0	118	10 U	83.5	49.5	10,400	46.5	427
Cyanide	44.8	ND	10 U	ND	1.3 U	61	1.5 U	2.6

- (1) The chemicals presented were detected in one or more media. A "U" indicates that the chemical was not detected in any sample at or above the sample quantitation limit (SQL) presented. Other qualifiers not presented; see appendices. ND = not detected.
- (2) Maximum background value detected upgradient or off site.
- (3) Maximum detected on site or downgradient. A shaded value is at least three times the comparable upgradient value or SQL (if undetected).

TABLE 5.2
GROUNDWATER DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/L) (2)	Range of Detected Concentrations (mg/L)	Frequency of Detection	Average Concentration (mg/L) (3)	Standard Deviation (mg/L)	Representative Concentration (mg/L) (4)	Value of H or Other (5)
Volatiles							
Chlorobenzene	0.005 – 0.02	0.02 – 0.036	2 / 24	5.43E-03	2.32E-03	1.25E-02	2.321
Tetrachloroethene	0.005 – 0.01	0.01 – 0.012	2 / 24	3.77E-03	1.60E-03	6.33E-03	1.945
Trichloroethene	0.005 – 0.01	0.002 – 0.004	5 / 24	3.43E-03	1.46E-03	4.00E-03 **	NA
Vinyl chloride	0.005 – 0.01	0.003 – 0.009	3 / 24	3.45E-03	1.48E-03	5.51E-03	1.882
Semivolatiles							
Butylbenzylphthalate	0.01 – 0.01	0.0008 – 0.001	4 / 11	2.65E-03	2.42E-03	1.00E-03 **	NA
Chrysene	0.01 – 0.01	0.001 – 0.001	1 / 11	4.32E-03	1.62E-03	1.00E-03 **	NA
Di-n-butylphthalate	0.01 – 0.01	0.0007 – 0.001	5 / 11	2.24E-03	2.53E-03	1.00E-03 **	NA
Diethylphthalate	0.01 – 0.01	0.0007 – 0.002	7 / 11	2.24E-03	2.07E-03	2.00E-03 **	NA
Pesticides/PCBs							
None retained							
Inorganics							
Barium	–	0.0386 – 0.289	22 / 22	1.00E-01	2.00E-03	2.05E-01	2.171
Copper	0.005 – 0.01	0.0065 – 0.04	8 / 22	5.50E-03	2.10E-03	1.18E-02	2.227
Manganese	–	0.462 – 13.1	22 / 22	1.92E+00	2.59E-03	5.19E+00	2.484
Nickel	0.02 – 0.03	0.0211 – 0.16	15 / 22	3.37E-02	2.29E-03	7.88E-02	2.33
Zinc	0.01 – 0.01	0.0111 – 0.118	16 / 22	1.55E-02	2.44E-03	3.90E-02	2.4

Footnotes for Table 5.2

- (1) All organics detected on site or downgradient in at least 5 % of the samples are presented. Inorganics present in at least 5 % of the samples and present in at least one sample at $\geq$ three times the maximum upgradient value are presented. NA = not applicable.
- (2) For nondetects. If the analyte was detected in all samples, or was not analyzed in this medium, quantitation limits are not presented.
- (3) Arithmetic average concentration. Usually the data are known or assumed to be lognormally distributed, and have been transformed. In this case, the average, standard deviation, and 95 % upper confidence limit (UCL) are calculated based on the transformed data. An asterisk (**) indicates that the data were judged to be normally distributed, and the average, standard deviation, and 95 % UCL are based on untransformed data.
- (4) The 95% upper confidence limit (UCL) on the arithmetic mean. A double asterisk (**) indicates that the value is the maximum concentration, rather than the 95% UCL. This is appropriate when the maximum value detected is less than the 95% UCL.
- (5) The "H" statistic used to calculate the 95 % UCL on transformed data. "Other" refers to the Student's t value ($n < 30$) or z value ($n \geq 30$). The t or z values are used to calculate the 95 % UCL on untransformed data, where appropriate.

TABLE 5.3
SURFACE WATER DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/L) (2)	Range of Detected Concentrations (mg/L)	Frequency of Detection	Average Concentration (mg/L) (3)	Standard Deviation (mg/L)	Representative Concentration (mg/L) (4)	Value of H or Other (5)
<u>Volatiles</u>							
None retained							
<u>Semivolatiles</u>							
None retained							
<u>Pesticides/PCBs</u>							
Aroclor-1248	0.00001 - 0.001	0.00055 - 0.001	1 / 6	1.78E-04	2.69E-04	4.00E-04	2.015
Aroclor-1254	0.00001 - 0.001	0.0017 - 0.002	1 / 6	3.70E-04	6.81E-04	9.30E-04	2.015
<u>Inorganics</u>							
None retained							

(1) NA = not applicable.

(2) For nondetects. If the analyte was detected in all samples, or was not analyzed in this medium, quantitation limits are not presented.

(3) Arithmetic average concentration. Usually the data are known or assumed to be lognormally distributed, and have been transformed.

In this case, the average, standard deviation, and 95 % upper confidence limit (UCL) are calculated based on the transformed data.

An asterisk (***) indicates that the data were judged to be normally distributed, and the average, standard deviation, and 95 % UCL are based on untransformed data.

(4) The 95% upper confidence limit (UCL) on the arithmetic mean. A double asterisk (**) indicates that the value is the maximum concentration, rather than the 95% UCL. This is appropriate when the maximum value detected is less than the 95% UCL.

(5) The "H" statistic used to calculate the 95 % UCL on transformed data. "Other" refers to the Student's t value ($n < 30$) or z value ($n \geq 30$). The t or z values are used to calculate the 95 % UCL on untransformed data, where appropriate.

TABLE 5.4
SURFACE SOIL DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Volatiles							
Acetone	0.01 - 0.023	0.021 - 8.7	7 / 31	1.32E-02	5.04E-03	8.85E-02	3.250
2-Butanone	0.01 - 0.027	0.046 - 1.1	2 / 31	8.10E-03	2.71E-03	2.07E-02	2.423
Methylene chloride	0.01 - 0.04	0.0005 - 0.003	3 / 31	5.66E-03	1.95E-03	3.00E-03 **	NA
Tetrachloroethene	0.01 - 0.04	0.0007 - 0.048	10 / 31	5.78E-03	2.53E-03	1.37E-02	2.344
Toluene	0.01 - 0.04	0.0005 - 0.41	4 / 31	7.04E-03	2.54E-03	1.67E-02	2.344
1,1,1-Trichloroethane	0.01 - 0.04	0.002 - 0.12	2 / 31	7.04E-03	1.91E-03	1.27E-02	2.056
Trichloroethene	0.01 - 0.027	0.0007 - 0.002	3 / 31	5.47E-03	1.81E-03	2.00E-03 **	NA
Semivolatiles							
Acenaphthene	0.32 - 1.1	0.002 - 1.4	9 / 35	1.58E-01	3.63E-03	5.83E-01	2.756
Acenaphthylene	0.32 - 3.4	0.01 - 1.8	11 / 35	1.57E-01	3.15E-03	4.70E-01	2.581
Anthracene	0.32 - 1.1	0.01 - 11	12 / 35	1.84E-01	3.67E-03	6.90E-01	2.769
Benzo(a)anthracene	0.32 - 3.4	0.033 - 18	21 / 35	2.56E-01	3.79E-03	1.01E+00	2.809
Benzo(a)pyrene	0.32 - 3.4	0.013 - 17	19 / 35	2.54E-01	4.00E-03	1.09E+00	2.889
Benzo(b)fluoranthene	0.32 - 3.4	0.015 - 20	22 / 35	3.01E-01	4.10E-03	1.34E+00	2.915
Benzo(g,h,i)perylene	0.32 - 3.4	0.018 - 7.8	19 / 35	2.05E-01	3.45E-03	7.01E-01	2.691
Benzo(k)fluoranthene	0.32 - 3.4	0.021 - 12	18 / 35	2.45E-01	3.48E-03	8.47E-01	2.703
Bis(2-ethylhexyl)phthalate	0.4 - 3.4	0.017 - 7.2	27 / 31	4.72E-01	4.40E-03	2.47E+00	3.050
Butylbenzylphthalate	0.32 - 3.4	0.038 - 2.4	5 / 31	2.31E-01	2.17E-03	4.64E-01	2.172
Carbazole	0.32 - 3.4	0.005 - 0.99	14 / 31	9.85E-02	5.07E-03	6.23E-01	2.875
Chrysene	0.32 - 3.4	0.04 - 21	23 / 35	2.64E-01	3.91E-03	1.09E+00	2.849
Dibenzo(a,h)anthracene	0.32 - 3.4	0.015 - 7.9	12 / 35	1.97E-01	3.20E-03	6.04E-01	2.593
Dibenzofuran	0.32 - 3.4	0.036 - 0.61	5 / 31	2.06E-01	2.06E-03	3.94E-01	2.122
Di-n-butylphthalate	0.32 - 3.4	0.037 - 1.5	4 / 31	2.34E-01	1.98E-03	4.32E-01	2.084
Di-n-octylphthalate	0.32 - 3.4	0.17 - 0.29	2 / 30	2.35E-01	1.61E-03	2.90E-01 **	NA
Fluoranthene	0.32 - 3.4	0.059 - 42	23 / 35	3.70E-01	4.30E-03	1.79E+00	2.982

TABLE 5.4
SURFACE SOIL DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Semivolatiles (cont'd)							
Fluorene	0.32 - 1.1	0.011 - 4.2	6 / 35	2.27E-01	2.34E-03	4.78E-01	2.236
Indeno(1,2,3-cd)pyrene	0.32 - 3.4	0.064 - 10	11 / 31	2.57E-01	2.51E-03	6.01E-01	2.333
2-Methylnaphthalene	0.32 - 1.1	0.009 - 7.4	15 / 31	1.05E-01	4.02E-03	4.69E-01	2.927
Naphthalene	0.32 - 1.1	0.008 - 1	14 / 35	1.42E-01	2.77E-03	3.60E-01	2.422
Pentachlorophenol	0.77 - 8.2	0.058 - 0.42	3 / 31	4.99E-01	2.05E-03	4.20E-01 **	NA
Phenanthrene	0.35 - 3.4	0.01 - 21	28 / 35	1.79E-01	5.26E-03	1.24E+00	3.260
Pyrene	0.32 - 3.4	0.067 - 45	19 / 35	4.12E-01	3.87E-03	1.67E+00	2.836
Pesticides/PCBs							
Aroclor-1242	0.02 - 6.6	0.045 - 42	12 / 48	1.14E-01	7.40E-03	1.42E+00	3.572
Aroclor-1248	0.02 - 11.2	0.016 - 130	10 / 48	9.94E-02	1.32E-02	5.23E+00	4.395
Aroclor-1254	0.02 - 6.6	0.031 - 20	8 / 48	9.41E-02	6.38E-03	8.55E-01	3.369
4,4'-DDD	0.007 - 1.12	0.00087 - 0.026	8 / 34	1.16E-02	4.79E-03	2.60E-02 **	NA
4,4'-DDE	0.007 - 1.12	0.0006 - 0.12	10 / 34	1.47E-02	4.48E-03	7.67E-02	3.045
4,4'-DDT	0.007 - 1.12	0.0006 - 0.77	11 / 34	2.01E-02	5.17E-03	1.36E-01	3.243
Dieldrin	0.0045 - 1.12	0.0037 - 0.004	2 / 34	1.21E-02	4.15E-03	4.30E-03 **	NA
Endosulfan I	0.0023 - 0.58	0.0011 - 0.014	3 / 34	6.39E-03	4.16E-03	1.40E-02 **	NA
Endosulfan II	0.0047 - 1.12	0.00071 - 0.034	6 / 34	1.07E-02	4.88E-03	3.40E-02 **	NA
Endrin	0.0045 - 1.12	0.0039 - 0.022	3 / 34	1.25E-02	4.08E-03	2.20E-02 **	NA
Heptachlor epoxide	0.0023 - 0.58	0.00084 - 0.008	3 / 34	6.10E-03	4.30E-03	7.50E-03 **	NA
Methoxychlor	0.036 - 5.8	0.0026 - 0.021	3 / 34	5.92E-02	4.82E-03	2.10E-02 **	NA
Inorganics							
Antimony	1.92 - 48.8	1.3 - 37	6 / 35	2.54E+00	3.50E+00	8.85E+00	2.703
Arsenic	1.54 - 1.62	1.8 - 619	33 / 35	9.82E+00	3.82E+00	3.92E+01	2.823
Barium	-	11.1 - 350	35 / 35	8.37E+01	2.11E+00	1.59E+02	2.135

TABLE 5.4
SURFACE SOIL DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Chromium	-	4.3 - 64	35 / 35	1.45E+01	1.98E+00	2.61E+01	2.068
Cobalt	5.7 - 26.8	5.1 - 135	28 / 35	1.11E+01	2.17E+00	2.17E+01	2.164
Copper	4 - 4	1.7 - 84,000	34 / 35	5.02E+01	8.36E+00	9.39E+02	3.934
Lead	-	7 - 2,100	35 / 35	1.06E+02	4.02E+00	4.57E+02	2.889
Manganese	682 - 682	8.1 - 2,850	34 / 35	2.59E+02	3.56E+00	9.25E+02	2.730
Mercury	0.11 - 0.62	0.11 - 17	21 / 35	2.61E-01	3.48E+00	9.02E-01	2.703
Nickel	11.8 - 12	13.9 - 308	33 / 35	2.60E+01	2.09E+00	4.91E+01	2.125
Silver	0.16 - 3	0.08 - 12	17 / 35	2.99E-01	4.80E+00	1.75E+00	3.133
Vanadium	8 - 8.4	8.9 - 504	32 / 35	2.89E+01	3.52E+00	1.02E+02	2.716
Zinc	-	23.8 - 10,400	35 / 35	2.05E+02	4.32E+00	9.97E+02	2.982
Cyanide	1.4 - 2.4	1.1 - 51	9 / 29	1.63E+00	2.98E+00	4.80E+00	2.565

- (1) Surface soil is ≤ 2 feet deep. All organics detected on site or downgradient in at least 5 % of the samples are presented. Inorganics present in at least 5 % of the samples and present in at least one sample at $\geq$ three times the maximum upgradient value are presented. NA = not applicable. Includes a concrete sample and samples from rolls of paper.
- (2) For nondetects. If the analyte was detected in all samples, or was not analyzed in this medium, quantitation limits are not presented.
- (3) Arithmetic average concentration. Usually the data are known or assumed to be lognormally distributed, and have been transformed. In this case, the average, standard deviation, and 95 % upper confidence limit (UCL) are calculated based on the transformed data. An asterisk (**) indicates that the data were judged to be normally distributed, and the average, standard deviation, and 95 % UCL are based on untransformed data.
- (4) The 95% upper confidence limit (UCL) on the arithmetic mean. A double asterisk (**) indicates that the value is the maximum concentration, rather than the 95% UCL. This is appropriate when the maximum value detected is less than the 95% UCL.
- (5) The "H" statistic used to calculate the 95 % UCL on transformed data. "Other" refers to the Student's t value ($n < 30$) or z value ($n \geq 30$). The t or z values are used to calculate the 95 % UCL on untransformed data, where appropriate.

TABLE 5.5
ALL SOIL DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Volatiles							
Acetone	0.01 - 0.023	0.021 - 8.7	9 / 48	1.09E-02	4.10E-03	4.44E-02	2.798
2-Butanone	0.01 - 0.027	0.011 - 1.1	3 / 48	7.27E-03	2.27E-03	1.39E-02	2.144
Methylene chloride	0.01 - 0.04	0.0005 - 0.003	3 / 48	7.34E-03	1.90E-03	3.00E-03 **	NA
Tetrachloroethene	0.01 - 0.04	0.0007 - 0.048	10 / 48	7.44E-03	2.28E-03	1.43E-02	2.144
Toluene	0.01 - 0.04	0.0005 - 0.41	6 / 48	6.66E-03	2.34E-03	1.31E-02	2.173
Trichloroethene	0.01 - 0.027	0.0007 - 0.002	4 / 48	5.42E-03	1.72E-03	2.00E-03 **	NA
Semivolatiles							
Acenaphthene	0.32 - 1.1	0.002 - 1.4	13 / 52	1.50E-01	3.08E-03	3.97E-01	2.435
Acenaphthylene	0.32 - 3.4	0.005 - 1.8	17 / 52	1.57E-01	2.99E-03	4.01E-01	2.402
Anthracene	0.32 - 1.1	0.01 - 11	18 / 52	1.74E-01	3.06E-03	4.58E-01	2.435
Benzo(a)anthracene	0.32 - 3.4	0.022 - 18	33 / 52	2.32E-01	3.90E-03	8.57E-01	2.709
Benzo(a)pyrene	0.17 - 3.4	0.013 - 17	28 / 52	2.34E-01	4.03E-03	9.07E-01	2.746
Benzo(b)fluoranthene	0.27 - 3.4	0.015 - 20	35 / 52	2.89E-01	4.11E-03	1.15E+00	2.770
Benzo(g,h,i)perylene	0.32 - 3.4	0.018 - 7.8	24 / 52	2.11E-01	2.94E-03	5.29E-01	2.391
Benzo(k)fluoranthene	0.1 - 3.4	0.017 - 12	31 / 52	2.19E-01	3.77E-03	7.69E-01	2.673
Bis(2-ethylhexyl)phthalate	0.17 - 3.4	0.017 - 7.2	43 / 48	4.73E-01	4.37E-03	2.13E+00	2.871
Butylbenzylphthalate	0.32 - 3.4	0.038 - 2.4	5 / 48	2.15E-01	1.88E-03	3.49E-01	1.955
Carbazole	0.32 - 3.4	0.005 - 0.99	20 / 48	1.06E-01	4.05E-03	4.24E-01	2.786
Chrysene	0.32 - 3.4	0.031 - 21	37 / 52	2.47E-01	3.94E-03	9.23E-01	2.721
Dibenzo(a,h)anthracene	0.32 - 3.4	0.013 - 7.9	17 / 52	1.81E-01	2.85E-03	4.35E-01	2.359
Dibenzofuran	0.32 - 3.4	0.007 - 0.61	9 / 48	1.71E-01	2.30E-03	3.31E-01	2.154
Di-n-butylphthalate	0.32 - 3.4	0.01 - 1.5	9 / 48	1.68E-01	2.64E-03	3.76E-01	2.292
Di-n-octylphthalate	0.32 - 3.4	0.03 - 0.29	3 / 47	2.09E-01	1.63E-03	2.90E-01 **	NA
Fluoranthene	0.32 - 3.4	0.04 - 42	38 / 52	3.36E-01	4.10E-03	1.34E+00	2.770
Fluorene	0.32 - 1.1	0.011 - 4.2	10 / 52	2.06E-01	2.07E-03	3.57E-01	2.050

TABLE 5.5
ALL SOIL DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Semivolatiles (cont'd)							
Indeno(1,2,3-cd)pyrene	0.32 - 3.4	0.064 - 10	16 / 48	2.56E-01	2.36E-03	5.09E-01	2.183
2-Methylnaphthalene	0.062 - 1.1	0.009 - 7.4	19 / 48	1.09E-01	3.37E-03	3.30E-01	2.557
Naphthalene	0.32 - 1.1	0.008 - 1	19 / 52	1.32E-01	2.66E-03	2.93E-01	2.284
Pentachlorophenol	0.77 - 8.2	0.058 - 0.42	3 / 31	4.99E-01	2.05E-03	4.20E-01 **	NA
Phenanthrene	0.35 - 3.4	0.01 - 21	43 / 52	1.72E-01	4.83E-03	9.01E-01	2.967
Pyrene	0.32 - 3.4	0.041 - 45	33 / 52	3.94E-01	4.09E-03	1.57E+00	2.770
Pesticides/PCBs							
Aroclor-1242	0.02 - 6.6	0.045 - 42	12 / 48	1.14E-01	7.40E-03	1.42E+00	3.572
Aroclor-1248	0.02 - 11.2	0.016 - 130	16 / 71	7.31E-02	9.43E-03	1.42E+00	3.758
Aroclor-1254	0.02 - 6.6	0.031 - 20	10 / 71	6.38E-02	5.25E-03	3.61E-01	3.009
gamma-Chlordane	0.0018 - 0.58	0.0014 - 0.007	3 / 57	3.72E-03	4.25E-03	6.70E-03 **	NA
4,4'-DDD	0.0034 - 1.12	0.00064 - 0.026	19 / 57	6.99E-03	4.34E-03	2.60E-02 **	NA
4,4'-DDE	0.0034 - 1.12	0.0006 - 0.12	25 / 57	8.83E-03	4.15E-03	3.52E-02	2.766
4,4'-DDT	0.0034 - 1.12	0.0006 - 0.77	26 / 57	1.39E-02	5.09E-03	7.81E-02	3.025
Dieldrin	0.0034 - 1.12	0.0013 - 0.026	4 / 57	6.71E-03	4.02E-03	2.54E-02	2.730
Endosulfan I	0.0018 - 0.58	0.0011 - 0.014	3 / 57	3.37E-03	4.01E-03	1.27E-02	2.730
Endosulfan II	0.0034 - 1.12	0.00047 - 0.034	13 / 57	5.45E-03	4.52E-03	2.49E-02	2.874
Endrin	0.0034 - 1.12	0.0039 - 0.022	4 / 57	6.66E-03	3.98E-03	2.20E-02 **	NA
Heptachlor epoxide	0.0018 - 0.58	0.00084 - 0.008	4 / 57	3.24E-03	4.05E-03	7.50E-03 **	NA
Methoxychlor	0.0029 - 5.8	0.00072 - 0.021	6 / 57	2.85E-02	5.08E-03	2.10E-02 **	NA
Inorganics							
Antimony	1.92 - 48.8	1.3 - 37.3	6 / 35	2.54E+00	3.50E+00	8.85E+00	2.703
Arsenic	1.54 - 1.62	1.8 - 619	50 / 52	7.82E+00	3.27E+00	2.24E+01	2.501
Barium	-	11.1 - 870	52 / 52	7.86E+01	2.16E+00	1.42E+02	2.084

TABLE 5.5
ALL SOIL DATA SUMMARY (1)
CHEMICALS OF POTENTIAL CONCERN

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Chromium	-	4.3 - 64.3	52 / 52	1.29E+01	1.86E+00	2.07E+01	1.961
Cobalt	5.7 - 26.8	5.1 - 135	28 / 35	1.11E+01	2.17E+00	2.17E+01	2.164
Copper	4 - 4	1.7 - 84000	51 / 52	3.52E+01	6.58E+00	3.33E+02	3.369
Lead	-	7 - 2100	52 / 52	8.90E+01	3.83E+00	3.19E+02	2.685
Manganese	682 - 682	8.1 - 2850	34 / 35	2.59E+02	3.56E+00	9.25E+02	2.730
Mercury	0.09 - 11	0.11 - 17	24 / 52	2.12E-01	4.07E+00	8.34E-01	2.758
Nickel	7.3 - 12	7.7 - 308	49 / 52	2.00E+01	2.11E+00	3.53E+01	2.067
Silver	0.16 - 3	0.08 - 11.6	18 / 52	4.52E-01	4.29E+00	1.94E+00	2.830
Vanadium	8 - 8.4	7.4 - 504	49 / 52	2.25E+01	3.07E+00	5.94E+01	2.435
Zinc	-	22.4 - 10400	52 / 52	1.64E+02	3.81E+00	5.86E+02	2.685
Cyanide	1.1 - 2.4	1.1 - 50.5	13 / 37	1.44E+00	2.70E+00	3.52E+00	2.386

- (1) Includes surface and subsurface soil. All organics detected on site or downgradient in at least 5 % of the samples are presented. Inorganics present in at least 5 % of the samples and present in at least one sample at $\geq$ three times the maximum upgradient value are presented. NA = not applicable.
- (2) For nondetects. If the analyte was detected in all samples, or was not analyzed in this medium, quantitation limits are not presented.
- (3) Arithmetic average concentration. Usually the data are known or assumed to be lognormally distributed, and have been transformed. In this case, the average, standard deviation, and 95 % upper confidence limit (UCL) are calculated based on the transformed data. An asterisk (**) indicates that the data were judged to be normally distributed, and the average, standard deviation, and 95 % UCL are based on untransformed data.
- (4) The 95% upper confidence limit (UCL) on the arithmetic mean. A double asterisk (**) indicates that the value is the maximum concentration, rather than the 95% UCL. This is appropriate when the maximum value detected is less than the 95% UCL.
- (5) The "H" statistic used to calculate the 95 % UCL on transformed data. "Other" refers to the Student's t value ($n < 30$) or z value ($n \geq 30$). The t or z values are used to calculate the 95 % UCL on untransformed data, where appropriate.

TABLE 5.6
SEDIMENT DATA SUMMARY (1)

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Volatiles							
Acetone	0.012 – 0.11	0.22 – 0.22	1 / 10	1.45E-02	3.22E-03	1.69E-01	5.324
2-Butanone	0.012 – 0.11	0.072 – 0.072	1 / 10	1.29E-02	2.47E-03	5.12E-02	2.902
Chlorobenzene	0.012 – 0.11	0.002 – 0.17	2 / 10	1.22E-02	3.53E-03	9.15E-02	3.662
Methylene chloride	0.012 – 0.11	0.0007 – 0.001	2 / 10	8.13E-03	4.24E-03	1.00E-03 **	NA
Toluene	0.012 – 0.11	0.001 – 0.002	2 / 10	8.61E-03	3.58E-03	2.00E-03 **	NA
Xylenes	0.012 – 0.11	0.005 – 0.005	1 / 10	9.90E-03	2.04E-03	5.00E-03 **	NA
Semivolatiles							
Acenaphthene	0.35 – 2.9	0.035 – 0.035	1 / 15	2.79E-01	2.19E-03	3.50E-02 **	NA
Acenaphthylene	0.35 – 2.9	0.034 – 0.11	2 / 15	2.65E-01	2.28E-03	1.10E-01 **	NA
Anthracene	0.35 – 2.9	0.066 – 0.085	3 / 15	2.35E-01	2.20E-03	8.50E-02 **	NA
Benzo(a)anthracene	0.35 – 2.9	0.043 – 0.77	9 / 14	1.84E-01	2.64E-03	6.34E-01	2.752
Benzo(a)pyrene	0.35 – 2.9	0.041 – 0.1	2 / 13	2.46E-01	2.25E-03	1.00E-01 **	NA
Benzo(b)fluoranthene	0.35 – 0.73	0.04 – 1.2	7 / 13	2.07E-01	2.50E-03	6.91E-01	2.722
Benzo(g,h,i)perylene	0.35 – 2.9	0.011 – 0.14	2 / 13	2.32E-01	2.92E-03	1.40E-01 **	NA
Benzo(k)fluoranthene	0.35 – 0.73	0.016 – 0.58	6 / 13	1.43E-01	3.27E-03	5.80E-01 **	NA
Bis(2-ethylhexyl)phthalate	0.48 – 0.99	0.063 – 16	10 / 15	7.27E-01	6.05E-03	1.12E+01	4.178
Butylbenzylphthalate	0.35 – 2.9	0.025 – 1.9	4 / 15	3.02E-01	2.64E-03	9.93E-01	2.698
Carbazole	0.35 – 2.9	0.007 – 0.037	8 / 15	6.36E-02	5.22E-03	3.70E-02 **	NA
Chrysene	0.41 – 0.72	0.046 – 0.61	13 / 15	2.01E-01	2.35E-03	5.66E-01	2.516
Di-n-butylphthalate	0.35 – 2.9	0.047 – 0.88	7 / 15	3.07E-01	2.41E-03	8.80E-01 **	NA
1,2-Dichlorobenzene	0.35 – 2.9	0.38 – 0.38	1 / 15	3.17E-01	1.67E-03	3.80E-01 **	NA
Diethylphthalate	0.35 – 2.9	0.015 – 0.19	4 / 15	1.75E-01	3.45E-03	1.90E-01 **	NA
Fluoranthene	0.35 – 0.72	0.08 – 0.87	11 / 15	2.77E-01	1.89E-03	6.14E-01	2.223
Fluorene	0.35 – 2.9	0.025 – 0.098	5 / 15	1.60E-01	2.95E-03	9.80E-02 **	2.878

TABLE 5.6
SEDIMENT DATA SUMMARY (1)

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Semivolatiles (cont'd)							
Indeno(1,2,3-cd)pyrene	0.35 - 2.9	0.016 - 0.23	2 / 13	2.48E-01	2.64E-03	2.30E-01 **	2.806
2-Methylnaphthalene	0.35 - 2.9	0.033 - 0.062	2 / 15	2.48E-01	2.41E-03	6.20E-02 **	2.560
Naphthalene	0.39 - 2.9	0.01 - 0.59	9 / 15	1.20E-01	3.88E-03	5.90E-01 **	3.361
Phenanthrene	0.41 - 2.9	0.012 - 0.42	12 / 15	1.53E-01	2.93E-03	4.20E-01 **	2.744
Pyrene	0.35 - 1.2	0.069 - 1.8	6 / 15	3.00E-01	2.21E-03	7.87E-01	2.429
Pesticides/PCBs							
Aroclor-1242	0.035 - 0.3	0.26 - 22	7 / 25	1.32E-01	1.01E-02	4.86E+00	4.533
Aroclor-1248	0.04 - 1.2	0.028 - 0.47	6 / 25	7.39E-02	3.20E-03	2.53E-01	2.722
Aroclor-1254	0.035 - 1.2	0.011 - 0.19	4 / 25	6.42E-02	3.28E-03	1.90E-01 **	NA
4,4'-DDD	0.004 - 0.03	0.0067 - 0.19	13 / 25	5.84E-03	3.74E-03	2.54E-02	2.947
4,4'-DDE	0.0035 - 0.12	0.0082 - 0.009	7 / 25	5.70E-03	3.29E-03	9.40E-03 **	NA
4,4'-DDT	0.0035 - 0.12	0.0056 - 0.007	10 / 25	5.03E-03	3.68E-03	7.00E-03 **	NA
Endrin	0.0035 - 0.12	0.0017 - 0.012	2 / 25	6.18E-03	3.26E-03	1.20E-02 **	NA
Methoxychlor	0.02 - 0.62	0.0083 - 0.018	6 / 25	2.26E-02	4.22E-03	1.80E-02 **	NA
Inorganics							
Arsenic	1.1 - 1.1	0.58 - 24.1	15 / 16	3.72E+00	2.78E+00	1.27E+01	2.746
Barium	-	39.8 - 276	16 / 16	7.66E+01	1.68E+00	1.50E+02	2.077
Chromium	20.5 - 20.5	4.8 - 48.9	15 / 16	1.22E+01	1.73E+00	2.45E+01	2.110
Copper	-	5.8 - 201	16 / 16	3.16E+01	2.59E+00	9.80E+01	2.638
Lead	-	8.4 - 335	16 / 16	5.78E+01	2.68E+00	1.89E+02	2.698
Manganese	403 - 403	188 - 4960	15 / 16	7.12E+02	2.85E+00	2.53E+03	2.795
Mercury	0.11 - 1.1	0.22 - 1	7 / 16	2.02E-01	3.11E+00	8.19E-01	2.926

TABLE 5.6
SEDIMENT DATA SUMMARY (1)

Chemical	Range of Sample Quantitation Limits (mg/kg) (2)	Range of Detected Concentrations (mg/kg)	Frequency of Detection	Average Concentration (mg/kg) (3)	Standard Deviation (mg/kg)	Representative Concentration (mg/kg) (4)	Value of H or Other (5)
Inorganics (cont'd)							
Nickel	-	12 - 83.3	16 / 16	2.27E+01	1.63E+00	4.34E+01	2.044
Vanadium	41 - 41	5.1 - 65.2	15 / 16	1.67E+01	2.03E+00	3.86E+01	2.286
Zinc	-	51.1 - 427	16 / 16	1.26E+02	2.01E+00	2.90E+02	2.286

(1) ND = chemical not detected in this medium; NA = not applicable.

(2) For nondetects. If the analyte was detected in all samples, or was not analyzed in this medium, quantitation limits are not presented.

(3) Arithmetic average concentration. Usually the data are known or assumed to be lognormally distributed, and have been transformed.

In this case, the average, standard deviation, and 95 % upper confidence limit (UCL) are calculated based on the transformed data.

An asterisk (**) indicates that the data were judged to be normally distributed, and the average, standard deviation, and 95 % UCL are based on untransformed data.

(4) The 95% upper confidence limit (UCL) on the arithmetic mean. A double asterisk (**) indicates that the value is the maximum concentration, rather than the 95% UCL. This is appropriate when the maximum value detected is less than the 95% UCL.

(5) The "H" statistic used to calculate the 95 % UCL on transformed data. "Other" refers to the Student's t value ($n < 30$) or z value ($n \geq 30$). The t or z values are used to calculate the 95 % UCL on untransformed data, where appropriate.

TABLE 5.7
MATRIX OF POTENTIAL EXPOSURE PATHWAYS
NAPANOCH PAPER MILL SITE
NAPANOCH, NEW YORK

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Current Land Use		Reason for Selection or Exclusion
		Ingestion of or dermal contact with crossgradient groundwater in home	Pathway Evaluated	
Residents			Yes	Manganese was detected in four cross-gradient residential wells at concentrations greater than upgradient residential wells. Currently, contaminants are probably not migrating from the site to these wells; however, different hydrological conditions may have existed previously.
Residents	Inhalation of volatiles from downgradient groundwater in home		No	Volatiles were not detected in residential wells at concentrations of concern.
Residents	Ingestion of, or dermal contact with surface water		Yes	No chemicals were detected at levels of concern in Rondout Creek water. However, PCBs were detected in one sample of on-site seep water near the creek. Ingestion is likely to be insignificant, but dermal contact could be significant.

TABLE 5.7 (CONTINUED)
MATRIX OF POTENTIAL EXPOSURE PATHWAYS
NAPANOCH PAPER MILL SITE
NAPANOCH, NEW YORK

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Current Land Use	Pathway Evaluated	Reason for Selection or Exclusion
Residents	Ingestion of, or dermal contact with surface soils on site	Yes	Yes	Contaminants were detected in site surface soils, and access is not restricted.
Residents	Ingestion of, or dermal contact with sediments in Rondout Creek	Yes	Yes	Contaminants were detected in sediments, and the creek is used recreationally.
Residents	Inhalation of volatiles and dust at the site via outdoor air	No	No	Concentrations of volatiles in soils are low. Routine air monitoring in breathing zone did not detect concentrations above 1 ppm. The site is almost entirely covered by vegetation, pavement, and old building foundations. The probability of incurring significant risks via this pathway is very low.

TABLE 5.7 (CONTINUED)
MATRIX OF POTENTIAL EXPOSURE PATHWAYS
NAPANOCH PAPER MILL SITE
NAPANOCH, NEW YORK

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Evaluated	Reason for Selection or Exclusion	
			Current Land Use	Future Land Use
Residents	Ingestion of fish from Rondout Creek	No	Contaminants in fish were not detected at concentrations exceeding appropriate FDA and USEPA action levels.	
		Yes	Chemicals were detected in on-site and downgradient wells at concentrations greater than or equal to three times the concentrations detected upgradient.	
Residents	Inhalation of volatiles from downgradient groundwater in home	Yes	Volatiles were detected in on-site and downgradient wells at concentrations greater than or equal to three times the concentrations detected upgradient.	

TABLE 5.7 (CONTINUED)
MATRIX OF POTENTIAL EXPOSURE PATHWAYS
NAPANOCH PAPER MILL SITE
NAPANOCH, NEW YORK

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	<u>Future Land Use</u>	Pathway Evaluated	Reason for Selection or Exclusion
Residents	Ingestion of, or dermal contact with surface water	Yes		No chemicals were detected at levels of concern in Rondout Creek water. However, PCBs were detected in one sample of on-site seep water near the creek. Ingestion is likely to be insignificant, but dermal contact could be significant.
Residents	Ingestion of, or dermal contact with surface and subsurface soils on site		Yes	Contaminants were detected in site surface and subsurface soils. Future excavation could bring subsurface contamination to the surface.
Residents	Ingestion of, or dermal contact with sediments in Rondout Creek		Yes	Contaminants were detected in sediments and the creek is used recreationally.

TABLE 5.7 (CONTINUED)
MATRIX OF POTENTIAL EXPOSURE PATHWAYS
NAPANOCH PAPER MILL SITE
NAPANOCH, NEW YORK

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Future Land Use		Reason for Selection or Exclusion
			Pathway Evaluated	
Residents	Inhalation of volatiles and dust at the site via outdoor air	No		Concentrations of volatiles in soils are low. Routine air monitoring in breathing zone did not detect concentrations above 1 ppm. The site is almost entirely covered by vegetation, pavement, and old building foundations. The probability of incurring significant risks via this pathway is very low, even in the case of hypothetical soil disturbances.
Residents	Ingestion of fish from Rondout Creek	No		Contaminants in fish were not detected at concentrations exceeding appropriate FDA and USEPA action levels.

TABLE 5.8
CONCENTRATIONS OF PCBs AND PESTICIDES
IN FISH SAMPLES FROM RONDOUT CREEK (1)

Chemical	Number of Fish Analyzed	Maximum Concentration in Fish Tissue (ppm) (2)	Action Level (ppm) (3)	Source	Exceeds Action Level?
PCBs	117	0.55	2	FDA	No
DDT	117	0.77	5	USEPA	No
Dieldrin	117	0.01	0.3	FDA	No
Endrin	117	ND	—	—	—
HCB	117	ND	—	—	—
Lindane	117	ND	—	—	—
Mirex	117	ND	—	—	—
Chlordane	117	0.04	0.3	FDA	No
Heptachlor epoxide	117	0.01	0.3	FDA	No

- (1) Samples collected by NYSDEC during July and October 1989 (NYSDEC, 1989). Most or all fish were taken from downstream of the site. Species sampled included smallmouth bass, brown trout, bluegill, redear sunfish, rock bass, brown bullhead, American eel, largemouth bass, rainbow trout, white sucker, yellow bullhead, and pumpkinseed. A dash ("—") indicates that the item is not applicable.
- (2) Either flesh or lipid. In some cases whole fish were analyzed, and in other cases a standard fillet was analyzed.
- (3) From ATSDR, 1989–1992.

TABLE 5.10
INTAKE VARIABLES FOR
INGESTION OF WATER USED FOR DOMESTIC PURPOSES (1)

Effect of Concern	IR (L/d)	EF (d/yr)	ED (yr)	BW (kg)	AT (d)	Intake Factor (L/kg/d)
<u>Central Tendency</u>						
Noncarcinogenic	1.4	350	9	70	3,285	1.92E-02
Carcinogenic	1.4	350	9	70	25,550	2.47E-03
<u>High End</u>						
Noncarcinogenic	2.0	350	30	70	10,950	2.74E-02
Carcinogenic	2.0	350	30	70	25,550	1.17E-02

(1) Intake Factor = $(IR \times EF \times ED) / (BW \times AT)$ (modified from USEPA, 1989, 1990, and 1991)

where:

IR	=	Ingestion rate (mean and 90th percentile values)
EF	=	Exposure frequency (50 weeks/year)
ED	=	Exposure duration (50th and 90th percentiles)
BW	=	Body weight (mean adult body weight)
AT	=	Averaging time (equals ED for noncarcinogenic effects, or 70 year lifetime for carcinogenic effects)

TABLE 5.11
INTAKE VARIABLES FOR
DERMAL CONTACT WITH WATER USED FOR DOMESTIC PURPOSES (1)

Effect of Concern	SA (cm ²)	ET (hr/d)	EF (d/yr)	ED (yr)	CF (L/cm ³)	BW (kg)	AT (d)	Intake Factor (2)
<u>Central Tendency</u>								
Noncarcinogenic	20,000	0.12	350	9	0.001	70	3,285	3.29E-02
Carcinogenic	20,000	0.12	350	9	0.001	70	25,550	4.23E-03
<u>High End</u>								
Noncarcinogenic	23,000	0.20	350	30	0.001	70	10,950	6.30E-02
Carcinogenic	23,000	0.20	350	30	0.001	70	25,550	2.70E-02

(1) Intake Factor = $(SA \times PC \times ET \times EF \times ED \times CF) / (BW \times AT)$ (Modified from USEPA, 1989, 1990 and 1992a)

where:

- SA = Skin surface area (USEPA, 1992)
- ET = Exposure time (median and 90th percentile)
- EF = Exposure frequency (50 weeks/year)
- ED = Exposure duration (50th and 90th percentiles)
- CF = Conversion factor (1 liter/1,000 cm³)
- BW = Body weight (mean adult body weight)
- AT = Averaging time (equals ED for noncarcinogenic effects, or 70 year lifetime for carcinogenic effects)

(2) Intake factor units = (hr-L)/(kg-d-cm)

TABLE 5.12
INTAKE VARIABLES FOR
DERMAL CONTACT WITH SURFACE WATER (1)

Effect of Concern	SA (cm ²)	ET (hr/d)	EF (d/yr)	ED (yr)	CF (L/cm ³)	BW (kg)	AT (d)	Intake Factor
<u>Central Tendency</u>								
Noncarcinogenic	5,000	0.5	5	9	0.001	70	10,950	1.47E-04
Carcinogenic	5,000	0.5	5	9	0.001	70	25,550	6.29E-05
<u>High End</u>								
Noncarcinogenic	5,800	1.0	150	30	0.001	70	10,950	3.41E-02
Carcinogenic	5,800	1.0	150	30	0.001	70	25,550	1.46E-02

(1) Intake Factor = (SA x PC x ET x EF x ED x CF)/(BW x AT); units = (hr-L)/kg-d-cm

where:

- SA = Skin surface area (25 % exposure, mean and 95th percentile, adult male)
- ET = Exposure time (central and upper for swimming)
- EF = Exposure frequency (central and upper for swimming)
- ED = Exposure duration (50th and 90th percentiles at one residence)
- CF = Conversion factor (1 liter/1,000 cm³)
- BW = Body weight (mean for adult male)
- AT = Averaging time (equals ED for noncarcinogenic effects, or 70 year lifetime for carcinogenic effects)

Equation adapted from USEPA, 1989. All intake variables are from USEPA, 1989 and 1992.

TABLE 5.13
INTAKE VARIABLES FOR
INGESTION OF SOIL AND SEDIMENT (1)

Effect of Concern	IR (mg/d)	CF (kg/mg)	FI (d/yr)	EF (yr)	BW (kg)	AT (d)	Intake Factor (kg/kg/d)
<u>Central Tendency</u>							
Noncarcinogenic	200	1.00E-06	1.0	65	6	15	2.37E-06
Carcinogenic	200	1.00E-06	1.0	65	6	15	1.39E-07
	100	1.00E-06	1.0	65	3	70	25,550
<u>High End</u>							
Noncarcinogenic	800	1.00E-06	1.0	175	6	15	2.56E-05
Carcinogenic	800	1.00E-06	1.0	175	6	15	25,550
	100	1.00E-06	1.0	175	24	70	6.26E-07

(1) Intake Factor = $(IR \times CF \times FI \times EF \times ED) / (BW \times AT)$ (Modified from USEPA, 1989 and 1991). Intake factors time-weighted, based on exposure durations.

where:

- IR = Ingestion rate (central from USEPA, 1991; high end from USEPA, 1990)
- CF = Conversion factor (1×10^{-6} kg/mg)
- FI = Fraction ingested (default)
- EF = Exposure frequency (USEPA, 1992)
- ED = Exposure duration (6 years = time as a child; 9 years = 50th percentile; 30 years = 90th percentile)
- BW = Body weight (mean body weights for children and adults)
- AT = Averaging time (equals ED for noncarcinogenic effects, or 70 year lifetime for carcinogenic effects)

The overall assumption is that receptors will be exposed to soil half of the time, and to sediment half of the time.

TABLE 5.14
INTAKE VARIABLES FOR
DERMAL CONTACT WITH SOIL AND SEDIMENT (1)

Effect of Concern	CF (kg/mg)	SA (cm ²)	AF (mg/cm ²)	EF (d/yr)	ED (yr)	BW (kg)	AT (d)	Intake Factor (kg/kg/d)
<u>Central Tendency</u>								
Noncarcinogenic	1.00E-06	5,000	0.2	65	9	70	3,285	2.54E-06
Carcinogenic	1.00E-06	5,000	0.2	65	9	70	25,550	3.27E-07
<u>High End</u>								
Noncarcinogenic	1.00E-06	5,800	1	175	30	70	10,950	3.97E-05
Carcinogenic	1.00E-06	5,800	1	175	30	70	25,550	1.70E-05

(1) Intake Factor = $(CF \times SA \times AF \times EF \times ED) / (BW \times AT)$ (Modified from USEPA, 1989 and 1992a)

where:

CF	=	Conversion factor (1 x 10 kg/mg)
SA	=	Skin surface area (USEPA, 1992a)
AF	=	Soil to skin adherence factor (USEPA, 1992a)
EF	=	Exposure frequency (USEPA, 1992a)
ED	=	Exposure duration (50th and 90th percentiles)
BW	=	Body weight (mean adult body weight)
AT	=	Averaging time (equals ED for noncarcinogenic effects, or 70 year lifetime for carcinogenic effects)

The overall assumption is that receptors will be exposed to soil half of the time, and to sediment half of the time.

TABLE 5.15
PERMEABILITY COEFFICIENTS FOR
THE CHEMICALS OF CONCERN (1)

Chemical	Permeability Coefficient (cm/hr)	Chemical	Permeability Coefficient (cm/hr)
Volatiles		Pesticides/PCBs	
Acetone	3.1E-04 *	Aroclor-1242	7.1E-01 (4)
Benzene	2.1E-02	Aroclor-1248	7.1E-01 (4)
2-Butanone	1.1E-03	Aroclor-1254	7.1E-01 (4)
Chlorobenzene	4.1E-02	alpha-BHC	1.4E-02 (5)
1,1-Dichloroethane	8.9E-03	delta-BHC	1.4E-02 (5)
trans-1,2-Dichloroethene	1.0E-02	alpha-Chlordane	4.6E-02
Methylene chloride	4.5E-03	gamma-Chlordane	4.6E-02
Tetrachloroethene	3.7E-01	4,4'-DDD	2.8E-01
Toluene	4.5E-02	4,4'-DDE	2.4E-01
1,1,1-Trichloroethane	1.7E-02	4,4'-DDT	4.3E-01
Trichloroethene	1.6E-02	Dieldrin	1.6E-02
Vinyl chloride	7.3E-03	Endosulfan I	2.1E-03 *
Xylenes	8.0E-02	Endosulfan II	2.0E-03 *
		Endrin	1.6E-02
Semivolatiles		Heptachlor epoxide	5.5E-02 *
Acenaphthene	1.5E-01 *	Methoxychlor	6.0E-02 *
Acenaphthylene	9.6E-02 *		
Anthracene	2.2E-01 *	Inorganics	
Benzo(a)anthracene	8.1E-01	Antimony	1.0E-03
Benzo(a)pyrene	1.2E+00	Arsenic	1.0E-03
Benzo(b)fluoranthene	1.2E+00	Barium	1.0E-03
Benzo(g,h,i)perylene	1.6E+00 *	Chromium	1.0E-03
Benzo(k)fluoranthene	1.1E+00 *	Cobalt	1.0E-03
Bis(2-ethylhexyl)phthalate	3.3E-02	Copper	1.0E-03
Butylbenzylphthalate	7.3E-02 *	Lead	1.0E-03
Carbazole	3.9E-02 *	Manganese	1.0E-03
Chrysene	8.1E-01	Mercury	1.0E-03
Dibenzo(a,h)anthracene	2.7E+00	Nickel	1.0E-03
Dibenzofuran	6.9E-02 (2)	Silver	1.0E-03
Di-n-butylphthalate	3.3E-02	Vanadium	1.0E-03
1,2-Dichlorobenzene	6.1E-02	Zinc	1.0E-03
Diethylphthalate	4.8E-03	Cyanide	1.0E-03
Di-n-octylphthalate	3.3E-02 (3)		
2,4-Dimethylphenol	1.1E-01		
Fluoranthene	3.6E-01		
Fluorene	1.7E-01 *		
Indeno(1,2,3-cd)pyrene	1.9E+00		
2-Methylnaphthalene	6.9E-02 (2)		
Naphthalene	6.9E-02		
Pentachlorophenol	6.5E-01		
Phenanthrene	2.3E-01		
Pyrene	3.4E-01 *		

(1) USEPA, 1992a. An asterisk ("*") indicates a value calculated using the following formula:

$$\text{Log Kp} = -2.72 + 0.71 \log \text{Kow} - 0.0061 \text{ MW}$$

Where: Kp = permeability coefficient

Kow = octanol/water partition coefficient

MW = molecular weight

Kow and MW obtained from Howard, 1990, 1991; ATSDR, 1989-1991; Verschuieren, 1983.

(2) Value listed for naphthalene.

(3) Value listed for dibutylphthalate.

(4) Value listed for PCB-hexachlorobiphenyl.

(5) Value listed for Lindane.

TABLE 5.16
CAS NUMBERS AND TOXICITY CLASSIFICATION (1)

CAS No.	Chemical	Toxicity Class (2)	CAG Group (3)
	<u>Volatiles</u>		
67-64-1	Acetone	NC	D
71-43-2	Benzene	C	A
78-93-3	2-Butanone	NC	D
108-90-7	Chlorobenzene	NC	D
75-34-3	1,1-Dichloroethane	C	C
156-59-2	1,2-Dichloroethene	NC	D
75-09-2	Methylene chloride	C	B2
127-18-4	Tetrachloroethene	C	NR
108-88-3	Toluene	NC	D
71-55-6	1,1,1-Trichloroethane	NC	D
79-01-6	Trichloroethene	C	NR
75-01-4	Vinyl chloride	C	A
1330-20-7	Xylenes	NC	D
	<u>Semivolatiles</u>		
83-32-9	Acenaphthene	NC	NR
208-96-8	Acenaphthylene	NC	D
120-12-7	Anthracene	NC	D
56-55-3	Benzo(a)anthracene	C	B2
50-32-8	Benzo(a)pyrene	C	B2
205-99-2	Benzo(b)fluoranthene	C	B2
191-24-2	Benzo(g,h,i)perylene	NC	D
207-08-9	Benzo(k)fluoranthene	C	B2
117-81-7	Bis(2-ethylhexyl)phthalate	C	B2
85-68-7	Butylbenzylphthalate	C	C
86-74-8	Carbazole	C	B2
218-01-9	Chrysene	C	B2
53-70-3	Dibenzo(a,h)anthracene	C	B2
132-64-9	Dibenzofuran	NC	D
84-74-2	Di-n-butylphthalate	NC	D
95-50-1	1,2-Dichlorobenzene	NC	D
84-66-2	Diethylphthalate	NC	D
117-84-0	Di-n-octylphthalate	NC	NR
105-67-9	2,4-Dimethylphenol	NC	NR

TABLE 5.16
CAS NUMBERS AND TOXICITY CLASSIFICATION (1)

CAS No.	Chemical	Toxicity Class (2)	CAG Group (3)
206-44-0	Fluoranthene	NC	D
86-73-7	Fluorene	NC	D
193-39-5	Indeno(1,2,3-cd)pyrene	C	B2
91-57-6	2-Methylnaphthalene	U	NR
91-20-3	Naphthalene	NC	D
87-86-5	Pentachlorophenol	C	B2
85-01-8	Phenanthrene	NC	D
129-00-0	Pyrene	NC	D
	<u>Pesticides/PCBs</u>		
53469-21-9	Aroclor-1242	C	B2
12672-29-6	Aroclor-1248	C	B2
11097-69-1	Aroclor-1254	C	B2
319-84-6	alpha-BHC	C	B2
319-86-8	delta-BHC	NC	D
5103-74-2	alpha-Chlordane	C	B2
5103-74-2	gamma-Chlordane	C	B2
72-54-8	4,4'-DDD	C	B2
72-55-9	4,4'-DDE	C	B2
50-29-3	4,4'-DDT	C	B2
60-57-1	Dieldrin	C	B2
959-98-8	Endosulfan I	NC	NR
33213-65-9	Endosulfan II	NC	NR
72-20-8	Endrin	NC	D
1024-57-3	Heptachlor epoxide	C	B2
72-43-5	Methoxychlor	NC	D
	<u>Inorganics</u>		
7440-36-0	Antimony	NC	NR
7440-38-2	Arsenic	C	A
7440-39-3	Barium	NC	NR
7440-47-3	Chromium (VI)	C	A
7440-48-4	Cobalt	NC	NR
7440-50-8	Copper	NC	D
7439-92-1	Lead	C	B2

TABLE 5.16
CAS NUMBERS AND TOXICITY CLASSIFICATION (1)

CAS No.	Chemical	Toxicity Class (2)	CAG Group (3)
7439-95-4	Magnesium	U	NR
7439-96-5	Manganese	NC	D
7439-97-6	Mercury	NC	D
7440-02-0	Nickel	NC	NR
7440-22-4	Silver	NC	D
7440-62-2	Vanadium	NC	NR
7440-66-6	Zinc	NC	D
57-12-5	Cyanide	NC	D

(1) IRIS (USEPA, 1993b) and HEAST (USEPA, 1993a).

(2) NC = noncarcinogen; C = carcinogen; U = unable to assess carcinogenic potential

(3) CAG = USEPA Carcinogen Assessment Group. A = human carcinogen, B1 = probable human carcinogen (some human data), B2 = probable human carcinogen (inadequate human data), C = possible human carcinogen, D = not classifiable as to human carcinogenicity, E = evidence of noncarcinogenicity in humans, NR = not reported.

TABLE 5.17
REFERENCE DOSES AND CRITICAL EFFECTS FOR THE CHEMICALS OF CONCERN (1)

Chemical	RfD (mg/kg-d)	Level of Conf (2)	Critical Effect
Volatiles			
Acetone	1.00E-01	Low	Increased liver and kidney weights and nephrotoxicity
Benzene	UR	-	-
2-Butanone	6.00E-01	Low	Decreased fetal birth weight
Chlorobenzene	2.00E-02	Med	Histopathologic changes in liver
1,1-Dichloroethane	1.00E-01 *	-	No observed effects
1,2-Dichloroethene	1.00E-02 *	-	Decreased hematocrit and hemoglobin
Methylene chloride	6.00E-02	Med	Liver toxicity
Tetrachloroethene	1.00E-02	Med	Hepatotoxicity in mice, decreased weight gain in rats
Toluene	2.00E-01	Med	Changes in liver and kidney weights
1,1,1-Trichloroethane	UR	-	-
Trichloroethene	UR	-	-
Vinyl chloride	NR	-	-
Xylenes	2.00E+00	Med	Hyperactivity, decreased body weight and increased mortality (males)
Semivolatiles			
Acenaphthene	6.00E-02	Low	Hepatotoxicity
Acenaphthylene	UR	-	-
Anthracene	3.00E-01	Low	No observed effects
Benzo(a)anthracene	NR	-	-
Benzo(a)pyrene	NR	-	-
Benzo(b)fluoranthene	NR	-	-
Benzo(g,h,i)perylene	NR	-	-
Benzo(k)fluoranthene	NR	-	-
Bis(2-ethylhexyl)phthalate	2.00E-02	Med	Increased relative liver weight

TABLE 5.17
REFERENCE DOSES AND CRITICAL EFFECTS FOR THE CHEMICALS OF CONCERN (1)

Chemical	RfD (mg/kg-d)	Level of Conf (2)	Critical Effect
Butylbenzylphthalate	2.00E-01	Low	Increased liver --to-- body weight and liver --to-- brain weight ratios
Carbazole	NR	-	-
Chrysene	NR	-	-
Dibenzo(a,h)anthracene	NR	-	-
Dibenzofuran	NR	-	-
Di-n-butylphthalate	1.00E-01	Low	Increased mortality
1,2-Dichlorobenzene	9.00E-02	Low	No adverse effects
Diethylphthalate	8.00E-01	Low	Decreased growth/ altered organ weight
Di-n-octylphthalate	2.00E-02 *	-	Increased kidney and liver weights, and increased liver enzyme activity
2,4-Dimethylphenol	2.00E-02	Low	Clinical signs and hematological changes
Fluoranthene	4.00E-02	Low	Nephropathy, increased liver weights, hematological alterations, clin. effects.
Fluorene	4.00E-02	Low	Decreased RBC, packed cell volume and hemoglobin
Indeno(1,2,3-cd)pyrene	NR	-	-
2-Methylnaphthalene	NR	-	-
Naphthalene	4.00E-02 **	-	Decreased weight
Pentachlorophenol	3.00E-02	Med	Liver and kidney pathology
Phenanthrene	NR	-	-
Pyrene	3.00E-02	Low	Kidney effects (renal tubular pathology, decreased kidney weights)
<u>Pesticides/PCBs</u>			
Aroclor - 1242	7.00E-05 (3)	Med	Reduced birth rates
Aroclor - 1248	7.00E-05 (3)	Med	Reduced birth rates
Aroclor - 1254	7.00E-05 (3)	Med	Reduced birth rates
alpha-BHC	NR	-	-
delta-BHC	NR	-	-

TABLE 5.17
REFERENCE DOSES AND CRITICAL EFFECTS FOR THE CHEMICALS OF CONCERN (1)

Chemical	RfD (mg/kg-d)	Level of Conf (2)	Critical Effect
alpha-Chlordane	6.00E-05 (4)	Low	Regional liver hypertrophy
gamma-Chlordane	6.00E-05 (4)	Low	Regional liver hypertrophy
4,4'-DDD	5.00E-04 (5)	-	-
4,4'-DDE	5.00E-04 (5)	-	-
4,4'-DDT	5.00E-04	Med	Liver lesions
Dieldrin	5.00E-05	Med	Liver lesions
Endosulfan I	UR	-	-
Endosulfan II	UR	-	-
Endrin	3.00E-04	Med	Mild histological lesions in liver, occasional convulsions
Heptachlor epoxide	1.30E-05	Low	Increased liver-to-body weight ratio
Methoxychlor	5.00E-03	Low	Excessive loss of litters
<u>Inorganics</u>			
Antimony	4.00E-04	Low	Longevity, changes in blood glucose, and cholesterol decreased
Arsenic	3.00E-04	Med	Hyperpigmentation, keratosis and possible vascular complications
Barium	7.00E-02	Med	Increased blood pressure
Chromium (VI)	5.00E-03	Low	No observed effects
Cobalt	UR	-	-
Copper	4.00E-02 (6)*	-	Gastrointestinal irritation
Lead	NR	-	-
Manganese	5.00E-03 (7)	Med/Low	Central nervous system effects
Mercury	3.00E-04 *	-	Kidney effects
Nickel	2.00E-02	Med	Decreased body and organ weights
Silver	5.00E-03	Low	Argyria (grey or blue discoloration of the skin)
Vanadium	7.00E-03 *	-	No observed effects

TABLE 5.17
REFERENCE DOSES AND CRITICAL EFFECTS FOR THE CHEMICALS OF CONCERN (1)

Chemical	RfD (mg/kg-d)	Level of Conf (2)	Critical Effect
Zinc	3.00E-01	Med	Red blood cell effects
Cyanide	2.00E-02	Med	Weight loss, thyroid effects and myelin degeneration

- (1) From IRIS (USEPA, 1993b). When IRIS values were unavailable, HEAST (** for USEPA, 1992c or *** for USEPA, 1993a) was used. RfD = reference dose, NR = not reported, UR = under review, NV = non-verifiable. A dash ('-') indicates that this item is not applicable, or that there is no entry in either IRIS or HEAST.
- (2) USEPA-assigned level of confidence in toxicity value. Not available for values obtained from HEAST. Med = medium.
- (3) Value for Aroclor - 1016 (CAS No. 12674 - 11 - 2).
- (4) Value for chlordane (CAS No. 57 - 74 - 9).
- (5) Value for 4,4' - DDT (CAS No. 50 - 29 - 3).
- (6) The RfD for copper was calculated from a value of 1.3 ug/L, cited in HEAST.
- (7) Two RfD values are available for manganese and the most conservative is presented.

TABLE 5.18
REFERENCE CONCENTRATIONS AND CRITICAL EFFECTS FOR THE CHEMICALS OF CONCERN (1)

Chemical	RfC (mg/m ³)	Level of Conf (2)	Critical Effect
Volatiles			
Acetone	NR	—	—
Benzene	UR	—	—
2-Butanone	1.00E+00	Low	Decreased fetal birth weight
Chlorobenzene	2.00E-02 *	—	Liver and kidney effects
1,1-Dichloroethane	5.00E-01 *	—	Kidney damage
1,2-Dichloroethene	NR	—	—
Methylene chloride	3.00E+00 *	—	Liver toxicity
Tetrachloroethene	NR	—	—
Toluene	4.00E-01	—	Neurological Effects
1,1,1-Trichloroethane	UR	—	—
Trichloroethene	UR	—	—
Vinyl chloride	NR	—	—
Xylenes	NV *	—	—

(1) From IRIS (USEPA, 1993b). When IRIS values were unavailable, HEAST (USEPA, 1993a) was used. An asterisk ("*") indicates that the values were taken from HEAST. RfD = reference dose, NR = not reported, UR = under review, NV = non-verifiable. A dash ("—") indicates that this item is not applicable, or that there is no entry in either IRIS or HEAST.

(2) USEPA—assigned level of confidence in toxicity value. Not available for values obtained from HEAST. Med = medium.

TABLE 5.19
ORAL SLOPE FACTORS AND TARGET ORGANS FOR THE CHEMICALS OF CONCERN (1)

Chemical	CAG Group (2)	SF (mg/kg-d) ⁻¹	Target Organ (Tumor Type)
Volatiles			
Acetone	D	—	—
Benzene	A	2.90E-02	Blood (Leukemia)
2-Butanone	D	—	—
Chlorobenzene	D	—	—
1,1-Dichloroethane	C	NR	—
1,2-Dichloroethane	D	—	—
Methylene chloride	B2	7.50E-03	Liver (adenomas and carcinomas)
Tetrachloroethene	NR	5.20E-02 **	Liver (carcinoma)
Toluene	D	—	—
1,1,1-Trichloroethane	D	—	—
Trichloroethene	NR	1.10E-02 **	Liver, Kidney, Lung (NR)
Vinyl chloride	A	1.90E+00 *	Liver/Lung (NR)
Xylenes	D	—	—
Semivolatiles			
Acenaphthene	NR	—	—
Acenaphthylene	D	—	—
Anthracene	D	—	—
Benzo(a)anthracene	B2	1.06E+00 (3)	Forestomach (NR)
Benzo(a)pyrene	B2	7.30E+00	Forestomach (NR)
Benzo(b)fluoranthene	B2	1.02E+00 (3)	Forestomach (NR)
Benzo(g,h,i)perylene	D	—	—
Benzo(k)fluoranthene	B2	4.82E-01 (3)	Forestomach (NR)

TABLE 5.19
ORAL SLOPE FACTORS AND TARGET ORGANS FOR THE CHEMICALS OF CONCERN (1)

Chemical	CAG Group (2)	SF (mg/kg-d) ⁻¹	Target Organ (Tumor Type)
Bis(2-ethylhexyl)phthalate	B2	1.40E-02	Liver (adenoma and carcinoma)
Butylbenzylphthalate	C	-	-
Carbazole	B2	2.00E-02 *	Liver (NR)
Chrysene	B2	3.21E-02 (3)	Forestomach (NR)
Dibenzo(a,h)anthracene	B2	8.10E+00 (3)	Forestomach (NR)
Dibenzofuran	D	-	-
Di-n-butylphthalate	D	-	-
1,2-Dichlorobenzene	D	-	-
Diethylphthalate	D	-	-
Di-n-octylphthalate	NR	-	-
2,4-Dimethylphenol	NR	-	-
Fluoranthene	D	-	-
Fluorene	D	-	-
Indeno(1,2,3-cd)pyrene	B2	1.69E+00 (3)	Forestomach (NR)
2-Methylnaphthalene	NR	-	-
Naphthalene	D	-	-
Pentachlorophenol	B2	1.20E-01	Blood vessels (hemangiosarcomas)
Phenanthrene	D	-	-
Pyrene	D	-	-
Pesticides/PCBs			
Aroclor - 1242 (4)	B2	7.70E+00	Liver (carcinoma)
Aroclor - 1248 (4)	B2	7.70E+00	Liver (carcinoma)
Aroclor - 1254 (4)	B2	7.70E+00	Liver (carcinoma)

TABLE 5.19
ORAL SLOPE FACTORS AND TARGET ORGANS FOR THE CHEMICALS OF CONCERN (1)

Chemical	CAG Group (2)	SF (mg/kg-d) ⁻¹	Target Organ (Tumor Type)
alpha-BHC	B2	6.30E+00	Liver (carcinoma)
delta-BHC	D	—	—
alpha-Chlordane (5)	B2	1.30E+00	Liver (carcinoma)
gamma-Chlordane (5)	B2	1.30E+00	Liver (carcinoma)
4,4'-DDD	B2	2.40E-01	Liver (carcinoma)
4,4'-DDE	B2	3.40E-01	Liver (carcinoma)
4,4'-DDT	B2	3.40E-01	Liver (adenoma and carcinoma)
Dieldrin	B2	1.60E+01	Liver (carcinoma)
Endosulfan I (6)	NR	—	—
Endosulfan II (6)	NR	—	—
Endrin	D	—	—
Heptachlor epoxide	B2	9.10E+00	Liver (carcinoma)
Methoxychlor	D	—	—
Inorganics			
Antimony	NR	—	—
Arsenic	A	1.75E+00 (7)	Skin (carcinoma)
Barium	NR	—	—
Chromium (VI)	A	—	—
Cobalt	NR	—	—
Copper	D	—	—
Lead	B2	—	—
Manganese	D	—	—
Mercury	D	—	—

TABLE 5.19
ORAL SLOPE FACTORS AND TARGET ORGANS FOR THE CHEMICALS OF CONCERN (1)

Chemical	CAG Group (2)	SF (mg/kg-d) ⁻¹	Target Organ (Tumor Type)
Nickel	NR	-	-
Silver	D	-	-
Vanadium	NR	-	-
Zinc	D	-	-
Cyanide	D	-	-

- (1) From IRIS (USEPA, 1993b). When IRIS values were unavailable, HEAST (USEPA, 1993a) was used. An asterisk ("*") indicates that the values were taken from HEAST. SF = slope factor, NR = not reported. A dash ("-") indicates that this item is not applicable, or that there is no entry in either IRIS or HEAST. A double asterisk ("**") indicates values from USEPA, 1992c.
- (2) CAG = USEPA Carcinogen Assessment Group.
- (3) The slope factors for the carcinogenic PAHs were derived by multiplying the slope factor for benzo(a)pyrene by the following toxicity equivalency factors: 0.145 for benzo(a)anthracene, 0.14 for benzo(b)fluoranthene, 0.66 for benzo(k)fluoranthene, 1.11 for dibenz(a,h)anthracene, 0.0044 for chrysene and 0.232 for indeno(1,2,3-cd)pyrene.
- (4) The toxicity values are for PCBs (CAS No. 1336-36-3).
- (5) The toxicity values are for Chlordane (CAS No. 57-74-9).
- (6) The toxicity values are for Endosulfan (CAS No. 115-29-7).
- (7) The slope factor for arsenic was calculated from an oral unit risk of 5E-05 (L/ug).

TABLE 5.20
INHALATION UNIT RISKS AND TARGET ORGANS
FOR THE CHEMICALS OF CONCERN (1)

Chemical	CAG Group (2)	Unit Risk ($\mu\text{g}/\text{m}^3$) ⁻¹	Target Organ (Tumor Type)
Volatiles			
Acetone	D	—	—
Benzene	A	8.30E-06	Blood (leukemia)
2-Butanone	D	—	—
Chlorobenzene	D	—	—
1,1-Dichloroethane	C	NR	—
1,2-Dichloroethene	D	—	—
Methylene chloride	B2	4.70E-07	Liver (adenomas and carcinoma)
Tetrachloroethene	NR	5.80E-07 **	Liver (carcinoma)
Toluene	D	—	—
1,1,1-Trichloroethane	D	—	—
Trichloroethene	NR	1.70E-06 **	Liver, kidney, lung (NR)
Vinyl chloride	A	8.40E-05 *	Kidney (NR)
Xylenes	D	—	—

- (1) From IRIS (USEPA, 1993). When IRIS values were unavailable, HEAST (USEPA, 1992c) was used. An asterisk ("*") indicates that the values were taken from HEAST. NR = not reported. A dash ("—") indicates that this item is not applicable, or that there is no entry in either IRIS or HEAST. A double asterisk ("**") indicates values from USEPA, 1992d.
- (2) CAG = USEPA Carcinogen Assessment Group.

TABLE 5.21
ABSORBED-DOSE ORAL REFERENCE DOSES (RfDs) FOR
USE IN DERMAL RISK ASSESSMENT

Chemical	Oral Absorption Factor (1)	Absorbed-Dose Oral RfD (mg/kg-d) (2)
Volatiles		
Acetone	0.9 #	9.00E-02
Benzene	0.95	-
2-Butanone	0.9 #	5.40E-01
Chlorobenzene	0.3	6.00E-03
1,1-Dichloroethane	0.9 #	9.00E-02
1,2-Dichloroethene	0.9 #	9.00E-03
Methylene chloride	0.98	5.88E-02
Tetrachloroethene	0.9	9.00E-03
Toluene	0.9 #	1.80E-01
1,1,1-Trichloroethane	0.9 #	-
Trichloroethene	0.9	-
Vinyl chloride	0.9	-
Xylenes	0.9	1.80E+00
Semivolatiles		
Acenaphthene	0.2 #	1.20E-02
Acenaphthylene	0.2 #	-
Anthracene	0.2 #	6.00E-02
Benzo(a)anthracene	0.2 #	-
Benzo(a)pyrene	0.2	-
Benzo(b)fluoranthene	0.2 #	-
Benzo(g,h,i)perylene	0.2 #	-
Benzo(k)fluoranthene	0.2 #	-
Bis(2-ethylhexyl)phthalate	0.5	1.00E-02
Butylbenzylphthalate	0.5 #	1.00E-01
Carbazole	0.2 #	-
Chrysene	0.6	-
Dibenzo(a,h)anthracene	0.2 #	-
Dibenzofuran	0.5 #	-
Di-n-butylphthalate	0.9	9.00E-02
1,2-Dichlorobenzene	0.5 #	4.50E-02
Diethylphthalate	0.5 #	4.00E-01
Di-n-octylphthalate	0.5 #	1.00E-02
2,4-Dimethylphenol	0.9 #	1.80E-02
Fluoranthene	0.2 #	8.00E-03
Fluorene	0.2 #	8.00E-03
Indeno(1,2,3-cd)pyrene	0.2 #	-
2-Methylnaphthalene	0.2 #	-
Naphthalene	0.2 #	8.00E-03
Pentachlorophenol	1	3.00E-02
Phenanthrene	0.2 #	-
Pyrene	0.2 #	6.00E-03

TABLE 5.21
ABSORBED-DOSE ORAL REFERENCE DOSES (RfDs) FOR
USE IN DERMAL RISK ASSESSMENT

Chemical	Oral Absorption Factor (1)	Absorbed-Dose Oral RfD (mg/kg-d) (2)
Pesticides/PCBs		
Aroclor-1242	0.9	6.30E-05
Aroclor-1248	0.9	6.30E-05
Aroclor-1254	0.9	6.30E-05
alpha-BHC	0.92 #	-
delta-BHC	0.92	-
alpha-Chlordane	0.5	3.00E-05
gamma-Chlordane	0.5	3.00E-05
4,4'-DDD	0.2	1.00E-04
4,4'-DDE	0.2	1.00E-04
4,4'-DDT	0.2	1.00E-04
Dieldrin	0.5	2.50E-05
Endosulfan I	0.85	-
Endosulfan II	0.85	-
Endrin	0.5 #	1.50E-04
Heptachlor epoxide	0.4	5.20E-06
Methoxychlor	0.2 #	1.00E-03
Inorganics		
Antimony	0.01	4.00E-06
Arsenic	0.8	2.40E-04
Barium	0.05	3.50E-03
Chromium (VI)	0.02	1.00E-04
Cobalt	0.05	-
Copper	0.6	2.40E-02
Lead	0.15	-
Manganese	0.03	1.50E-04
Mercury	0.01	3.00E-06
Nickel	0.04	8.00E-04
Silver	0.2	1.00E-03
Vanadium	0.01	7.00E-05
Zinc	0.25	7.50E-02
Cyanide	0.5	1.00E-02

- (1) The absorption factors were cited in the appropriate ATSDR Profiles. The pound sign ("#") indicates that ATSDR Profiles were not available and default values were used (the use of default values is explained in the text).
- (2) Absorbed-dose RfD = administered-dose RfD x oral absorption factor.
Administered-dose RfDs from Table 5.14.

TABLE 5.22
ABSORBED–DOSE ORAL CANCER SLOPE FACTORS FOR USE
IN DERMAL RISK ASSESSMENT

Chemical	Oral Absorption Factor (1)	Absorbed–Dose Oral SF (mg/kg–d) ⁻¹ (2)
Volatiles		
Acetone	0.9 #	–
Benzene	0.95	3.05E–02
2–Butanone	0.9 #	–
Chlorobenzene	0.3	–
1,1–Dichloroethane	0.9 #	–
1,2–Dichloroethene	0.9 #	–
Methylene chloride	0.98	7.65E–03
Tetrachloroethene	0.9	5.78E–02
Toluene	0.9 #	–
1,1,1–Trichloroethane	0.9 #	–
Trichloroethene	0.9	1.22E–02
Vinyl chloride	0.9	2.11E+00
Xylenes	0.9	–
Semivolatiles		
Acenaphthene	0.2 #	–
Acenaphthylene	0.2 #	–
Anthracene	0.2 #	–
Benzo(a)anthracene	0.2 #	5.30E+00
Benzo(a)pyrene	0.2	3.65E+01
Benzo(b)fluoranthene	0.2 #	5.10E+00
Benzo(g,h,i)perylene	0.2 #	–
Benzo(k)fluoranthene	0.2 #	2.41E+00
Bis(2–ethylhexyl)phthalate	0.5	2.80E–02
Butylbenzylphthalate	0.5 #	–
Carbazole	0.2 #	1.00E–01
Chrysene	0.6	5.35E–02
Dibenzo(a,h)anthracene	0.2 #	4.05E+01
Dibenzofuran	0.5 #	–
Di–n–butylphthalate	0.9	–
1,2–Dichlorobenzene	0.5 #	–
Diethylphthalate	0.5 #	–
Di–n–octylphthalate	0.5 #	–
2,4–Dimethylphenol	0.9 #	–
Fluoranthene	0.2 #	–
Fluorene	0.2 #	–
Indeno(1,2,3–cd)pyrene	0.2 #	8.45E+00
2–Methylnaphthalene	0.2 #	–
Naphthalene	0.2 #	–
Pentachlorophenol	1	1.20E–01
Phenanthrene	0.2 #	–
Pyrene	0.2 #	–

TABLE 5.22
ABSORBED–DOSE ORAL CANCER SLOPE FACTORS FOR USE
IN DERMAL RISK ASSESSMENT

Chemical	Oral Absorption Factor (1)	Absorbed–Dose Oral SF (mg/kg–d) ⁻¹ (2)
Pesticides/PCBs		
Aroclor–1242	0.9	8.56E+00
Aroclor–1248	0.9	8.56E+00
Aroclor–1254	0.9	8.56E+00
alpha–BHC	0.92 #	6.85E+00
delta–BHC	0.92	–
alpha–Chlordane	0.5	2.60E+00
gamma–Chlordane	0.5	2.60E+00
4,4'–DDD	0.2	1.20E+00
4,4'–DDE	0.2	1.70E+00
4,4'–DDT	0.2	1.70E+00
Dieldrin	0.5	3.20E+01
Endosulfan I	0.85	–
Endosulfan II	0.85	–
Endrin	0.5 #	–
Heptachlor epoxide	0.4	2.28E+01
Methoxychlor	0.2 #	–
Inorganics		
Antimony	0.01	–
Arsenic	0.8	2.19E+00
Barium	0.05	–
Chromium (VI)	0.02	–
Cobalt	0.05	–
Copper	0.6	–
Lead	0.15	–
Manganese	0.03	–
Mercury	0.01	–
Nickel	0.04	–
Silver	0.2	–
Vanadium	0.01	–
Zinc	0.25	–
Cyanide	0.5	–

- (1) The absorption factors were cited in the appropriate ATSDR Profiles. The pound sign ("#") indicates that ATSDR Profiles were not available and default values were used (the use of default values is explained in the text).
- (2) SF = slope factor. Absorbed–Dose SF = administered–dose SF/oral absorption factor. Administered–dose SFs from Table 5.16.

Table 5.23
SUMMARY OF NONCARCINOGENIC HAZARDS
FOR CURRENT AND HYPOTHETICAL FUTURE RESIDENTS

Exposure Pathway	Pathway Hazard Index		Primary Source(s) of Hazard ¹
	Central	High	
	Tendency	End	
<u>Current Residents</u>			
Ingestion of groundwater ²	1.5	2.1	Manganese
Dermal contact with groundwater ²	0.084	0.16	
Dermal contact with surface water	0.0022	0.51	
Ingestion of surface soil	1.2	13	Manganese, arsenic, PCBs, copper, antimony, vanadium
Dermal contact with surface soil	0.29	4.6	Manganese, antimony, vanadium
Ingestion of sediment	1.5	17	Manganese, Aroclor-1242, arsenic
Dermal contact with sediment	0.46	7.2	Manganese
TOTAL RECEPTOR HAZARD INDEX	5.0	44	
<u>Hypothetical Future Residents</u>			
Ingestion of groundwater	20	29	Manganese
Inhalation of volatiles during showering	0.00091	0.0021	
Dermal contact with groundwater	1.2	2.2	Manganese
Dermal contact with surface water	0.0022	0.51	
Ingestion of surface/subsurface soil	0.85	9.2	Manganese, arsenic, PCBs, antimony
Dermal contact with surface/subsurface soil	0.26	4.1	Manganese, antimony
Ingestion of sediment	1.5	17	Manganese, Aroclor-1242, arsenic
Dermal contact with sediment	0.46	7.2	Manganese
TOTAL RECEPTOR HAZARD INDEX	24	68	

1. Those chemicals causing the associated high end pathway hazard index to exceed 1.
2. Based on the maximum concentration of manganese detected in a residential well (382 µg/L).

Table 5.24
SUMMARY OF CARCINOGENIC RISKS
FOR CURRENT AND HYPOTHETICAL FUTURE RESIDENTS

Exposure Pathway	Pathway Risk		Primary Source(s) of Risk ¹
	Central Tendency	High End	
<u>Current Residents</u>			
Dermal contact with surface water	5.08E-07	1.18E-04	PCBs ²
Ingestion of surface soil	2.00E-05	8.98E-05	Arsenic, PCBs, PAHs
Dermal contact with surface soil	4.34E-06	2.26E-04	PAHs, PCBs, arsenic, DDT, DDE, DDD
Ingestion of sediment	9.20E-06	4.13E-05	PCBs, arsenic, PAHs
Dermal contact with sediment	1.45E-06	7.56E-05	PCBs, PAHs, arsenic
TOTAL RECEPTOR RISK	4E-05	6E-04	
<u>Hypothetical Future Residents</u>			
Ingestion of groundwater	2.68E-05	1.28E-04	Vinyl chloride, tetrachloroethene
Inhalation of volatiles during showering	2.74E-07	2.13E-06	Vinyl chloride
Dermal contact with groundwater	1.12E-06	7.14E-06	Tetrachloroethene, vinyl chloride, chrysene
Dermal contact with surface water	5.08E-07	1.18E-04	PCBs ²
Ingestion of surface/subsurface soil	1.09E-05	4.88E-05	Arsenic, PCBs, PAHs
Dermal contact with surface/subsurface soil	2.97E-06	1.54E-04	PAHs, PCBs, arsenic, dieldrin, DDD, DDE, DDT
Ingestion of sediment	9.20E-06	4.13E-05	PCBs, arsenic, PAHs
Dermal contact with sediment	1.45E-06	7.56E-05	PCBs, PAHs, arsenic
TOTAL RECEPTOR RISK	5E-05	6E-04	

1. Those chemicals causing the associated high end pathway risk to exceed 1×10^{-6} .

2. PCBs were detected in water from a seep, not in Rondout Creek water.

TABLE 5.25
CRITERIA SPECIFIC ANALYSIS OF
DETECTED COMPOUNDS IN SURFACE WATER

CHEMICALS DETECTED	NYSDEC CLASS A SURFACE WATER STANDARD	USEPA CHRONIC EXPOSURE CRITERIA	PROPOSED SITE-SPECIFIC CRITERIA (a)	SITE CONCENTRATION (b)	CHEMICAL RETAINED FOR FURTHER ANALYSIS (Yes/No)
<u>Volatiles (ug/L)</u>					
Acetone	NS (c)	NS	NS	4	Yes
Chloroform	NS	1240 (d)	1240	0.5	No
<u>Semivolatiles</u>					
None detected	NA (c)	NA	NA	ND (f)	No
<u>Pesticides/PCBs (ug/L)</u>					
None detected	0.001	0.014	0.001	ND	Yes (g)
<u>Inorganics (ug/L)</u>					
Barium-total	NS	NS	NS	21	Yes
Lead-total	1 (h)	0.99 (h)	0.99 (h)	17	Yes
Manganese-total	NS	NS	NS	29.1	Yes

(a) Proposed criteria equal to the lowest applicable standard.

(b) Site concentrations equals the lesser of the 95% UCL or the maximum detected concentration. (N=4)

(c) NS= No standard identified

(d) Lowest observed effect level (LOEL).

(e) NA= Not applicable

(f) ND= Not detected in any sample above the quantitation limit

(g) PCB's were retained for further evaluation because the detection limit was greater than the site-specific criterion, these compounds tend to biomagnify and elevated concentrations were reported in sediment samples.

(h) Hardness dependent standard calculated using average detected hardness value of 40mg/l CaCO₃.

TABLE 5.26
UPGRADIENT SEDIMENT (a)
DETECTED COMPOUND SUMMARY

Chemical	NYSDEC Aquatic Toxicity Sediment Criterion (b)	Representative Background Concentration (c)
Volatiles (ug/Kg)		
Methylene Chloride	NS (d)	0.9
Semivolatiles (ug/Kg)		
Benzo(a)anthracene	NS	180
Benzo(a)pyrene	NS	16
Benzo(b)fluoranthene	NS	220
Benzo(k)fluoranthene	NS	95
Bis(2-ethylhexyl)phthalate	1197	7300
Chrysene	NS	27
Fluoranthene	10200 (e)	300
Pesticides/PCBs (ug/KG)		
4,4' -DDE	500	5.5
4,4' -DDT	500	5.3
Inorganics (mg/KG)		
Aluminum	NS	3750
Arsenic	5	3.9
Barium	NS	67.1
Chromium	26	4.8
Copper	19	14.5
Iron	24000	8800
Lead	27	32.7
Magnesium	NS	1460
Manganese	428	624
Nickel	22	13.6
Vanadium	NS	5.1
Zinc	85	46.5

(a) Sediment samples SED-1, SED-2, SED-3.

(b) Criteria for organic compounds are adjusted for 1% organic carbon.

(c) Background concentration equals the lesser of the 95% UCL or the maximum detected concentration.

(d) NS= No standard established.

(e) USEPA (1991) proposed interim sediment criterion.

TABLE 5.27
CRITERIA—SPECIFIC ANALYSIS FOR
CHEMICALS DETECTED IN ON—SITE
STREAM CHANNEL SEDIMENTS (a)

Chemical	NYSDEC Aquatic Toxicity Sediment Criterion (b)	Representative On—site stream Concentration (c)	Compound Retained for Further Analysis
Semivolatiles (ug/KG)			
Benzo(a)pyrene	NS (d)	41	YES
Benzo(b)fluoranthene	NS	52	YES
Benzo(g,h,i)perylene	NS	11	YES
Benzo(k)fluoranthene	NS	22	YES
Bis(2—ethylhexyl)phthalate	1197	81	NO
Chrysene	NS	76	YES
Indeno(1,2,3—cd)pyrene	NS	16	YES
Phenanthrene	1390	60	NO
Pyrene	NS	120	YES
Pesticides/PCBs (ug/KG)			
4,4'—DDE	500	5	NO
4,4'—DDT	500	1.2	NO
Inorganics (mg/KG)			
Arsenic	5	1.3	NO
Barium	NS	48.2	YES
Chromium	26	4.8	NO
Copper	19	8.2	NO
Lead	27	32.7	YES
Manganese	428	1010	YES
Nickel	22	17.6	NO
Vanadium	NS	5.1	YES
Zinc	85	51.1	NO

(a) Sediment samples SED—4, SED—5, SED—6, SED—7, SED—8, SED—9, SED—10, SED—11.

(b) Criteria for organic compounds are adjusted for an average of 1% organic carbon

(c) Representative concentrations equals the lesser of the 95% UCL or the maximum

(d) NS= No standard identified

TABLE 5.28
CRITERIA-SPECIFIC ANALYSIS FOR
CHEMICALS DETECTED IN
ON-SITE POND SEDIMENTS (a)

Chemical	NYSDEC Aquatic Toxicity Sediment Criterion (b)	Representative Site Concentration (c)	Compound Retained for Further Analysis
Volatiles (ug/Kg)			
Acetone	NS (d)	220	YES
2-Butanone	NS	72	YES
Chlorobenzene	35	170	YES
Toluene	NS	2	YES
Xylenes	NS	5	YES
Semivolatiles (ug/Kg)			
Acenaphthylene	NS	110	YES
Anthracene	NS	85	YES
Benzo(a)anthracene	NS	770	YES
Benzo(b)fluoranthene	NS	1200	YES
Benzo(k)fluoranthene	NS	580	YES
Bis(2-ethylhexyl)phthalate	1197	3236	YES
Butylbenzylphthalate	NS	1900	YES
Carbazole	NS	37	YES
Chrysene	NS	610	YES
Di-n-butylphthalate	NS	700	YES
1,2-Dichlorobenzene	120	380	YES
Diethylphthalate	NS	190	YES
Fluoranthene	10200 (e)	870	NO
Fluorene	NS	98	YES
2-Methylnaphthalene	NS	33	YES
Naphthalene	NS	590	YES
Phenanthrene	1390	420	NO
Pyrene	NS	130	YES
Pesticides/PCBs (ug/Kg)			
Aroclor-1242	1000	10000	YES
4,4'-DDD	500	190.0	NO
Methoxychlor	6	8.1	YES
Inorganics (mg/Kg)			
Arsenic	5	19.2	YES
Barium	NS	152.0	YES
Chromium	26	39.8	YES
Copper	19	155.7	YES
Lead	27	315.4	YES
Manganese	428	2630.0	YES
Mercury	0.11	1.0	YES
Nickel	22	41.1	YES
Vanadium	NS	62.5	YES
Zinc	85	427.0	YES

(a) Pond sediment samples include SED-12, A1#26, A5#29, B1#25, C1#24, C1#27, C3#23, D1#22, D1#28, D3#21.

(b) Criteria for organic compounds are adjusted for an average of 1% TOC.

(c) Representative concentration equals the lesser of the 95% UCL or the maximum detected concentration.

(d) NS= No standard established

(e) USEPA (1991) Proposed interim sediment criterion.

TABLE 5.29
CRITERIA—SPECIFIC ANALYSIS FOR
CHEMICALS DETECTED IN
DOWNSTREAM SEGMENT 1 SEDIMENTS (a)

Chemical	NYSDEC Aquatic Toxicity Sediment Criterion (b)	Representative Concentration (c)	Compound Retained for Further Analysis
Pesticides/PCBs (ug/Kg)			
Aroclor—1248	500 (d)	470	NO
Aroclor—1254	500 (d)	190	NO
4,4'—DDD	500	13	NO
4,4'—DDE	500	5.7	NO
4,4'—DDT	500	6.6	NO
Endrin	10.4	12	YES

(a) Sediment samples SED—13, SED—14, SED—15, SED—16

(b) Criteria for organic compounds are adjusted for an average of 1% TOC.

(c) Representative concentration equals the lesser of the 95% UCL or the maximum detected concentration.

(d) The criterion of 1,000 ug/Kg for total PCBs was divided by the number of Aroclors detected in the data set to determine Aroclor specific criteria.

TABLE 5.30
CRITERIA–SPECIFIC ANALYSIS FOR
CHEMICALS DETECTED IN
DOWNSTREAM SEGMENT 2 SEDIMENTS (a)

Chemical	NYSDEC Aquatic Toxicity Sediment Criterion (b)	Representative Concentration	Compound Retained for Further Analysis
Volatiles (ug/Kg)			
Methylene chloride	NS (d)	1	YES
Toluene	NS	1	YES
Semivolatiles (ug/Kg)			
Benzo(a)anthracene	NS	130	YES
Benzo(a)pyrene	NS	100	YES
Benzo(b)fluoranthene	NS	150	YES
Benzo(k)fluoranthene	NS	69	YES
Chrysene	NS	140	YES
Fluoranthene	10200 (e)	230	NO
Pyrene	NS	250	YES
Pesticides/PCBs (ug/Kg)			
Aroclor – 1248	500 (f)	49	NO
Aroclor – 1254	500 (f)	11	NO
delta – BHC	0.6	0.98	YES
4,4' – DDD	500	16	NO
4,4' – DDE	500	2.8	NO
4,4' – DDT	500	4	NO
Methoxychlor	6	5.1	NO
Inorganics (mg/Kg)			
Arsenic	5	3.3	NO
Barium	NS	77.4	YES
Chromium	26	15.1	NO
Copper	19	19	YES
Lead	27	45.5	YES
Manganese	428	586	YES
Nickel	22	15.6	NO
Vanadium	NS	8.9	YES
Zinc	85	91.9	YES

(a) Sediment samples SED – 17, SED – 18, SED – 19, SED – 20.

(b) Criteria for organic compounds are adjusted for an average of 1% TOC.

(c) Representative concentration equals the lesser of the 95% UCL or the maximum detected concentration.

(d) NS= No standard identified

(e) USEPA (1991) Proposed interim sediment criterion

(f) The criterion of 1,000 ug/Kg for total PCBs was divided by the number of Aroclors detected in the data set to determine Aroclor specific criteria.

TABLE 5.31
AVERAGE CONCENTRATIONS OF METALS
DETECTED IN BACKGROUND SOILS

Inorganics (mg/Kg)	Average Concentration (a)
Aluminum	7140
Arsenic	4.3
Barium	38
Cadmium	0.14
Calcium	558.6
Chromium	7.76
Cobalt	5.1
Copper	5.3
Iron	11542
Lead	63.86
Manganese	199.32
Mercury	0.69
Nickel	12.69
Potassium	333.8
Silver	0.072
Vanadium	36.5
Zinc	35.8

(a) Arithmetic average concentration using detected values.
and 1/2 SQL for undetected values.

TABLE 5.32
CRITERIA-SPECIFIC ANALYSIS FOR
CHEMICALS DETECTED IN ON-SITE
SURFACE SOILS

Chemical	NYSDEC Soil Cleanup Objective	Representative Concentration (a)	Compound Retained for Further Analysis
Volatiles (ug/KG)			
Acetone	200	88.5	NO
2-Butanone	300	20.7	NO
Carbon disulfide	2700	11.9	NO
Ethyl benzene	5500	2.0	NO
Methylene chloride	100	3.0	NO
Tetrachloroethene	1400	13.7	NO
Toluene	1500	16.7	NO
1,1,1-Trichloroethane	800	12.7	NO
Trichloroethene	700	2.0	NO
Xylenes	1200	13.3	NO
Total VOCs	<10000	184.5	NO
Semivolatiles (ug/KG)			
Acenaphthene	50000	568.7	NO
Acenaphthylene	41000	407.9	NO
Anthracene	50000	695.6	NO
Benzo(a)anthracene	220	645.1	YES
Benzo(a)pyrene	61	706.5	YES
Benzo(b)fluoranthene	1100	858.8	NO
Benzo(g,h,i)perylene	50000	524.3	NO
Benzo(k)fluoranthene	1100	594.5	NO
Bis(2-ethylhexyl)phthalate	50000	2474.6	NO
Butylbenzylphthalate	50000	463.5	NO
Carbazole	50000	534.6	NO
Chrysene	400	675.9	YES
Dibenzo(a,h)anthracene	14	549.3	YES
Dibenzofuran	6200	372.6	NO
Di-n-butylphthalate	100	385.3	YES
Di-n-octylphthalate	50000	290.0	NO
2,4-Dimethylphenol	50000	45.0	NO
Fluoranthene	50000	994.0	NO
Fluorene	50000	443.0	NO
Indeno(1,2,3-cd)pyrene	3200	428.0	NO
2-Methylnaphthalene	36400	494.9	NO
Naphthalene	13000	315.4	NO
Pentachlorophenol	1000	420.0	NO
Phenanthrene	50000	672.3	NO
Pyrene	50000	950.0	NO
4-Methylphenol	900	180.0	NO
N-nitrosodiphenylamine	50000	110.0	NO
Total SVOCs	<500000	18117.0	NO
Pesticides/PCBs (ug/KG)			
Aroclor-1242	330 (b)	750.4	YES
Aroclor-1248	330 (b)	349.2	YES
Aroclor-1254	330 (b)	475.3	YES
beta-BHC	200	41.6	NO
delta-BHC	300	0.6	NO
4,4'-DDD	2900	26.0	NO

TABLE 5.32
CRITERIA—SPECIFIC ANALYSIS FOR
CHEMICALS DETECTED IN ON—SITE
SURFACE SOILS

Chemical	NYSDEC Soil Cleanup Objective	Representative Concentration (a)	Compound Retained for Further Analysis
4,4'—DDE	2100	44.3	NO
4,4'—DDT	2100	61.7	NO
Dieldrin	44	4.3	NO
Endosulfan I	900	14.0	NO
Endosulfan II	900	34.0	NO
Endosulfan sulfate	1000	9.2	NO
Endrin	100	22.0	NO
Endrin ketone	1.6 (c)	23.0	NO
Heptachlor epoxide	20	7.5	NO
Methoxychlor	10000	21.0	NO
Inorganics (mg/KG)			
Aluminum	7140 (c)	11500	YES
Antimony	<0.6 (d)	9	YES
Arsenic	4.3	39	YES
Barium	300	159	NO
Beryllium	1	1	YES
Cadmium	1	2	YES
Chromium	10	26	YES
Cobalt	30	22	NO
Copper	25	939	YES
Iron	2000	42800	YES
Lead	30	457	YES
Manganese	199.3 (c)	925	YES
Mercury	0.1	1	YES
Nickel	13	49	YES
Selenium	2	1	NO
Silver	0.072 (c)	2	YES
Vanadium	150	102	YES
Zinc	20	997	YES
Cyanide	NS	5	YES

- (a) Representative concentration equals the lesser of the 95% UCL or the maximum detected concentration.
- (b) The criterion of 1,000 ug/Kg for total PCBs was divided by the number of Aroclors detected in the data set to determine Aroclor specific criteria.
- (c) No soil cleanup objective is available for this compound. Value represents average concentration in site background samples.
- (d) No soil cleanup objective or background concentration is available for this compound. Value represents the CRDL.

SECTION 6

REMEDIAL INVESTIGATION SUMMARY AND CONCLUSIONS

6.1 REMEDIAL INVESTIGATION SUMMARY

The primary objective of the Remedial Investigation phase of the RI/FS was to define the extent, nature, and source(s) (if possible) of surface and subsurface contamination in soils, sediments, groundwater, and surface water. The Remedial Investigation undertaken to accomplish the objectives included the following elements:

- Performing a site-wide geologic investigation, consisting of soil borings and monitoring well installations;
- Conducting a groundwater investigation consisting of groundwater sampling and analysis of both on-site and nearby residential wells, and characterization of the site hydrogeology;
- Sampling of sediments in Rondout Creek upstream, downstream and adjacent to the site;
- Performing ecological and human health risk assessments;
- Excavating test pits to determine the presence or absence of buried waste materials;
- Performing extensive surface soil sampling and analysis throughout various areas of the site to define the nature and extent of contamination; and
- Sampling of other miscellaneous matrices such as concrete foundations, paper rolls, and leachate outbreaks.

6.1.1 Surface Soils

Surficial soils, defined as 0-2 feet below ground surface, were investigated through surface soil sampling, soil borings, and test pit excavations.

During the course of the investigation, PCBs in excess of 1.0 mg/kg were detected in surficial soils in several distinct areas of the site:

- Main Plant Ruins - three areas;
- Test Pit Area A;
- Areas 7 and 8;
- Area 9 - drainage ditch;
- Bank of Rondout Creek east of the Main Plant Ruins - three small areas.

Total PCB concentrations in these areas typically ranged from 1.0 to 10.0 mg/kg, with smaller subareas or pockets of contamination where levels exceeded 10 mg/kg. The highest concentrations were observed in Areas 7 and 8, the former process water lagoons. Concentrations in the vicinity of the former lagoons ranged as high as 160

mg/kg. One area measuring approximately 100 by 100 feet contained PCBs in excess of 50 mg/kg.

Metals were detected at concentrations above cleanup criteria in the majority of on-site sample locations. Thus, distinct areas of metals contamination were not defined. The most commonly occurring metals in concentrations above cleanup objectives were arsenic, chromium, lead, manganese, and mercury.

PAHs exceeding cleanup objectives were detected most frequently in the Main Plant Ruins, Test Pit Area B, and Area No. 9. The most commonly occurring PAHs exceeding cleanup objectives were benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene.

Pesticides and VOCs did not constitute a problem in surficial soils. Only a single pesticide, beta-BHC, was detected above soil cleanup objectives in one sample.

6.1.2 Subsurface Soils

Subsurface soils (greater than two feet) were determined not to be contaminated with respect to VOCs, PCBs/pesticides, and SVOCs. Three subsurface soil samples contained metals exceeding cleanup objectives.

6.1.3 Sediments

Three distinct areas of sediments were sampled during the RI and are discussed as follows: the ponded area, upstream of the ponded area, and downstream of the ponded area.

PAHs, PCBs, pesticides, and metals were detected above sediment cleanup criteria, particularly in the ponded area of Rondout Creek. PCBs in excess of 1.0 mg/kg were found in an area along the southern bank of the creek in the ponded area. Only a single pesticide, 4,4,-DDD, was found throughout the ponded area above the cleanup criterion. PAHs were detected at six of the seven sampling locations in the ponded area, but were distinctly higher in concentration and frequency of occurrence near the northern shoreline. Various metals were also detected above cleanup criteria at all seven sampling locations. This is consistent with the widespread distribution of metals throughout the site.

Upstream of the ponded area, PAHs were detected above criteria at SED-10 (200 feet upstream of the upper dam) and pesticides were found above criteria at SED-6 (approximately 170 feet southwest of the Main Plant Ruins on the southern shoreline). No PCBs were detected above the sediment cleanup criteria of 1.0 mg/kg.

Downstream of the ponded area, PCBs were not detected above the sediment cleanup criteria of 1.0 mg/kg. Four pesticides were detected in four downstream sediment samples above cleanup criteria (SED-14, 16, 19, and 20). PAHs and metals were detected above criteria only at SED-12, located immediately downstream of the lower dam, and SED-20, near the correctional facility.

6.1.4 Surface Water

In Rondout Creek, lead was detected above the NYSDEC Class A surface water standards both upstream of and within the ponded area. However, concentrations of

lead in three of the four samples located adjacent to and downstream of the site were equal to or less than the concentration in the upstream sample. This suggests that the lead found in the downstream samples was not site-related.

6.1.5 Groundwater

Organic compounds were detected in only five on-site monitoring wells, and at concentrations within one order of magnitude in excess of water quality standards. No plumes or areas of organic compound contamination were identified. No organic compounds were detected in the off-site residential wells.

Iron, manganese, and sodium were in excess of groundwater standards in on-site and residential wells. The source of the metals in the on-site wells is assumed to be the metallic debris throughout the plant area and Areas 7 and 8, the former lagoons.

It is not believed that metals detected above groundwater standards in the residential wells are site-related. Wells located near the eastern property boundary, including residential wells, are not hydraulically downgradient from on-site sources. Thus, metals above standards in these wells are suspected of originating from fill over a former axe-head manufacturing facility located in the vicinity of wells MW-7 and MW-9.

Variations in bedrock mineralogy across the site could be responsible for much of the spatial variation in water quality. Due to steeply dipping bedrock units, wells across the site do not penetrate the same stratigraphic units.

Although water quality standards have been exceeded for selected organics and metals, the threat of off-site migration is low due to groundwater flow patterns towards the creek. Groundwater contour maps and water level data suggest that groundwater does not flow from the site towards the residential wells.

Groundwater contour maps show that shallow groundwater from the site ultimately discharges to Rondout Creek. However, there is presently no impact on surface water quality that can be attributed to the site. With the exception of lead, the surface water in Rondout Creek contained no organic or inorganic compounds above surface water standards. As mentioned previously, the lead in the creek does not seem to be site-related.

6.1.6 Human Health Evaluation

A baseline human health evaluation (HHE) was conducted to assess the potential risks to human health which might be related to chemicals originating from the site. For noncarcinogenic effects, elevated hazard indices were computed for both current and hypothetical future residents. The elevated hazard indices, which indicate the likelihood of non-carcinogenic health effects, are due primarily to the presence of manganese in soil, sediments, and in a residential well; PCBs in soil and sediment; and other metals in soil and sediment.

With respect to carcinogenic effects, risks exceeding the USEPA target risk ranges (1 in 1,000,000 to 1 in 10,000) were calculated for both current and future hypothetical residents. These risks are due primarily to the presence of vinyl chloride in

groundwater; PCBs in a groundwater seep; PCBs, PAHs, and arsenic in soil and sediment; and pesticides in soil.

The calculated risks assume a repeated long-term exposure to the medium, such as dermal contact or ingestion of soil or groundwater. With the exception of manganese in one residential well, risks are associated with on-site contact of soil and groundwater, and contact with sediments in Rondout Creek.

6.1.7 Habitat-Based Assessment

To assess the potential effects of site-related contaminants detected in physical media at the Napanoch Paper Mill site, a Phase I habitat-based assessment (HBA) was conducted. The completed assessment fulfilled the requirements of the NSYDEC (1991) technical and administrative guidance memorandum (TAGM), Fish and Wildlife Impact Assessment for Inactive Hazardous Waste Sites.

During Step I (Site Description) Fish and wildlife resources potentially affected by site-related contaminants were identified. A characterization of the resources and their habitats was done to allow assessment of site-related impacts.

During Step II the Contaminant-Specific Impact Analysis, impacts of site-related contaminants on fish and wildlife resources (NYSDEC, 1991) were determined. Step II included a pathways analysis; criteria-specific analyses for contaminants detected in media for which pathways to ecological receptors are complete; and an analysis of toxicological effects for contaminants that are retained following the criteria-specific analysis.

PCB concentrations are elevated in the site soils and sediments and at stream segments downstream of the site. These contaminants pose a potential risk to terrestrial aquatic animal species associated with the sediments and soils. Also, dibenzo(a,h)anthracene in shallow soil may pose risks to individuals, and possibly at the population level, for small mammal species on the site.

6.2 CONCLUSIONS

The project objectives of the Remedial Investigation were as follows:

- To define the nature, extent, and source(s) of surface and subsurface contamination based on previously existing data and information obtained during the RI;
- To collect additional information needed to perform a risk assessment, both human health and ecological; and
- To evaluate impacts of the site on public health and the environment in the form of a health-based risk assessment and a habitat-based risk assessment.

The following subsections discuss the major conclusions with respect to each project objective.

6.2.1 Nature, Extent, And Sources Of Contamination

PCBs, metals, PAHs, and pesticides were detected above cleanup objectives or NYSDEC standards in various media, including surface soils, sediments, groundwater,

and surface water. Through extensive sample collection and analysis for a variety of parameter classes, this objective was accomplished for the Napanoch Paper Mill site. The nature and extent of contamination were described in detail in Section 4, and summarized in Section 6.1. Potential sources of contamination were proposed and are listed below:

- Surface Soils - site-wide occurrence of metallic debris, process lagoons, PCBs used in paper processing, organic solvent spills or disposal, PAHs from incomplete combustion of wood products during fires and from asphalt debris;
- Subsurface Soils - determined not to be contaminated with respect to VOCs, PCBs/pesticides, and SVOCs. Metals in three subsurface soil samples exceed cleanup objectives. A possible source is metallic debris in the surface soils.
- Sediments - PCBs, PAHs, and metals in site soils transported via runoff and through drainage ditch. Pesticides possibly originated from gypsy moth spraying in 1980s; PCBs may have originated from on-site soils;
- Groundwater - metals may have leached from on-site soils and metallic debris; VOCs may have originated in on-site soils;
- Surface Water - the presence of lead is assumed to be from an off-site source.

6.2.2 Human Health Risk Assessment

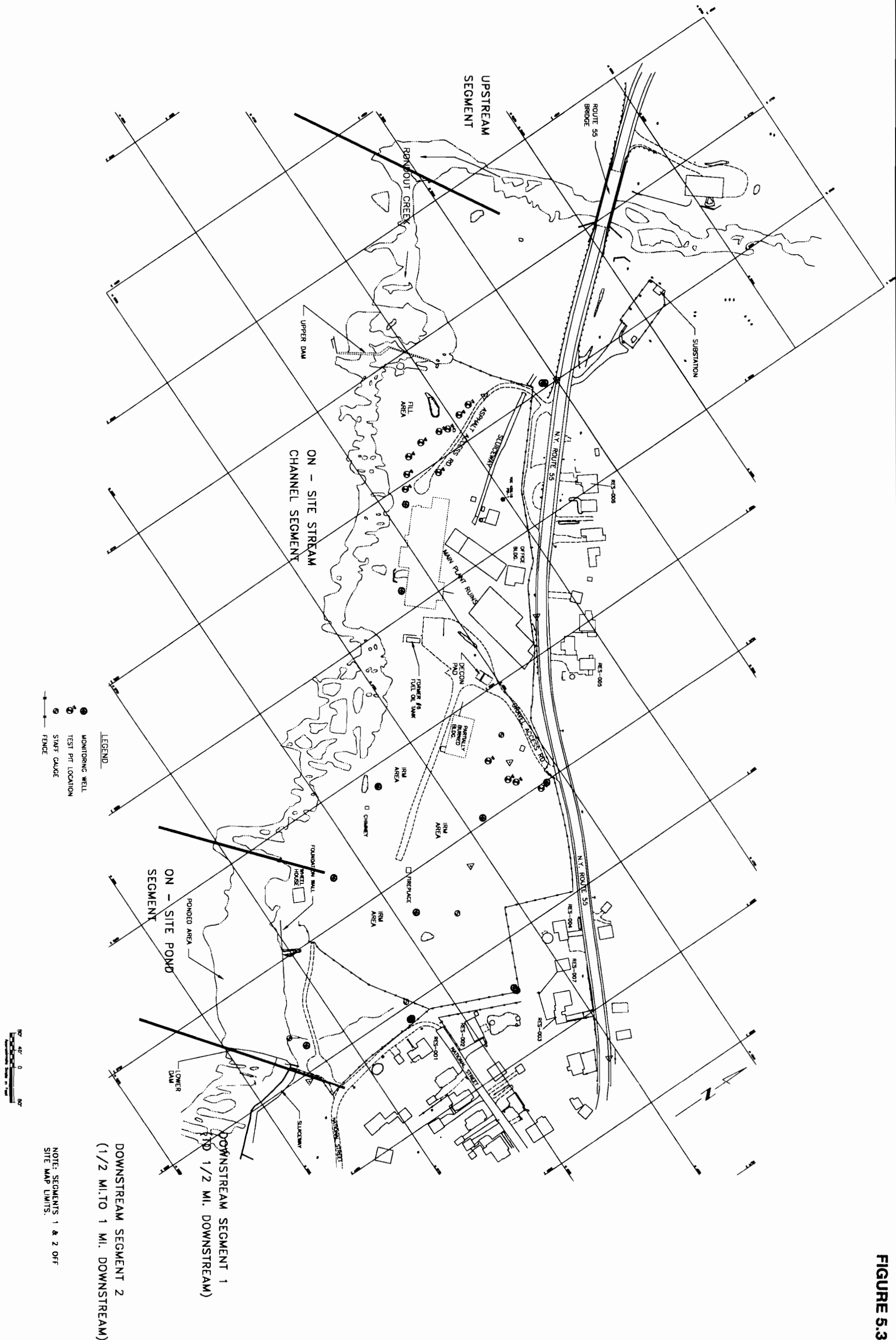
Results of the human health risk assessment indicated that adverse health effects due to contact with carcinogenic and noncarcinogenic chemicals may occur in both current and hypothetical future residents. If these adverse effects occur at all, they would likely result from repeated long-term exposure. The calculated risks assume a repeated long-term exposure to the medium, such as dermal contact or ingestion of soil or groundwater.

6.2.3 Ecological Risk Assessment

PCB concentrations are elevated in the site soils and sediments and at stream segments downstream of the site. These contaminants pose a potential risk to terrestrial aquatic animal species associated with the sediments and soils. The most prominent risk from PCB assimilation is impaired reproductive failure, which reduces population productivity. There are inadequate data from this study to determine whether the potential risk is realized at the site or its surroundings.

Moreover, dibenzo(a,h)anthracene in shallow soil may pose risks to individuals, and possibly at the population level, for small mammal species on the site. However, widespread habitat and food chain effects are not considered likely for this PAH compound in soil.

FIGURE 5.3



REVISION: 01/23/94 DOT/SDOT/1/23/94/WWP002.DWG									
5				PROJECT NO.	723192 DA.02	DATE	9/93	ENGINEERING-SCIENCE DESIGN * RESEARCH * PLANNING 290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NEW YORK 13088 • 315/451-9580 OFFICES IN PRINCIPAL CITIES	
4				DESIGNED BY	R.S. BOWMAN		9/93		
3				DRAWN BY	J.H. DOLYHART		9/93		
2				CHECKED BY	RSW/WWP/ML		11/20/93		
1				ENGINEER					
NO.	DATE			REVISIONS	BY	DATE		REMEDIAL INVESTIGATION/ FEASIBILITY STUDY	SCALE AS NOTED FIG./REV. NO.
								STREAM SEGMENT LOCATION MAP	FILE NO. 722292

FIGURE 5.2

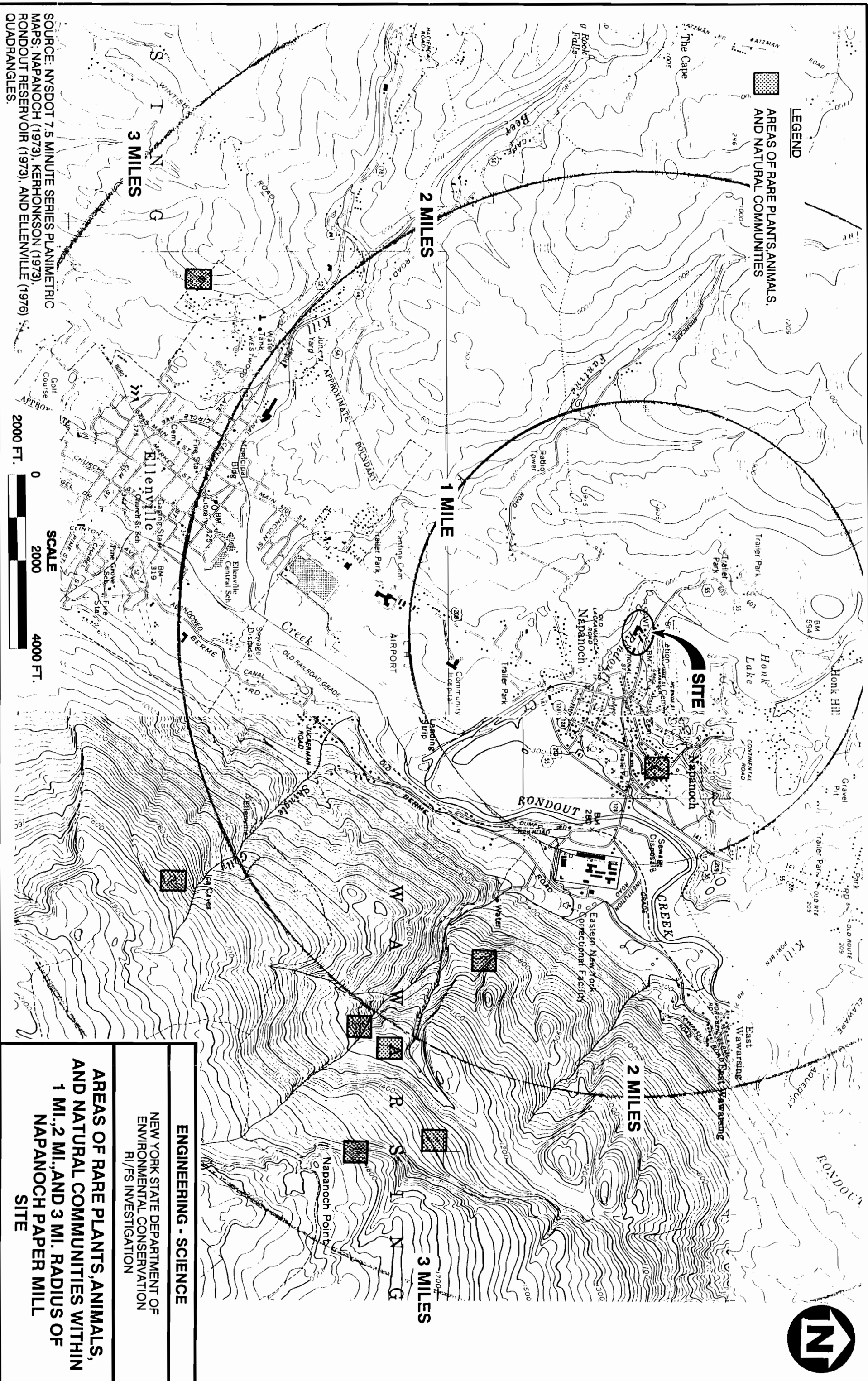
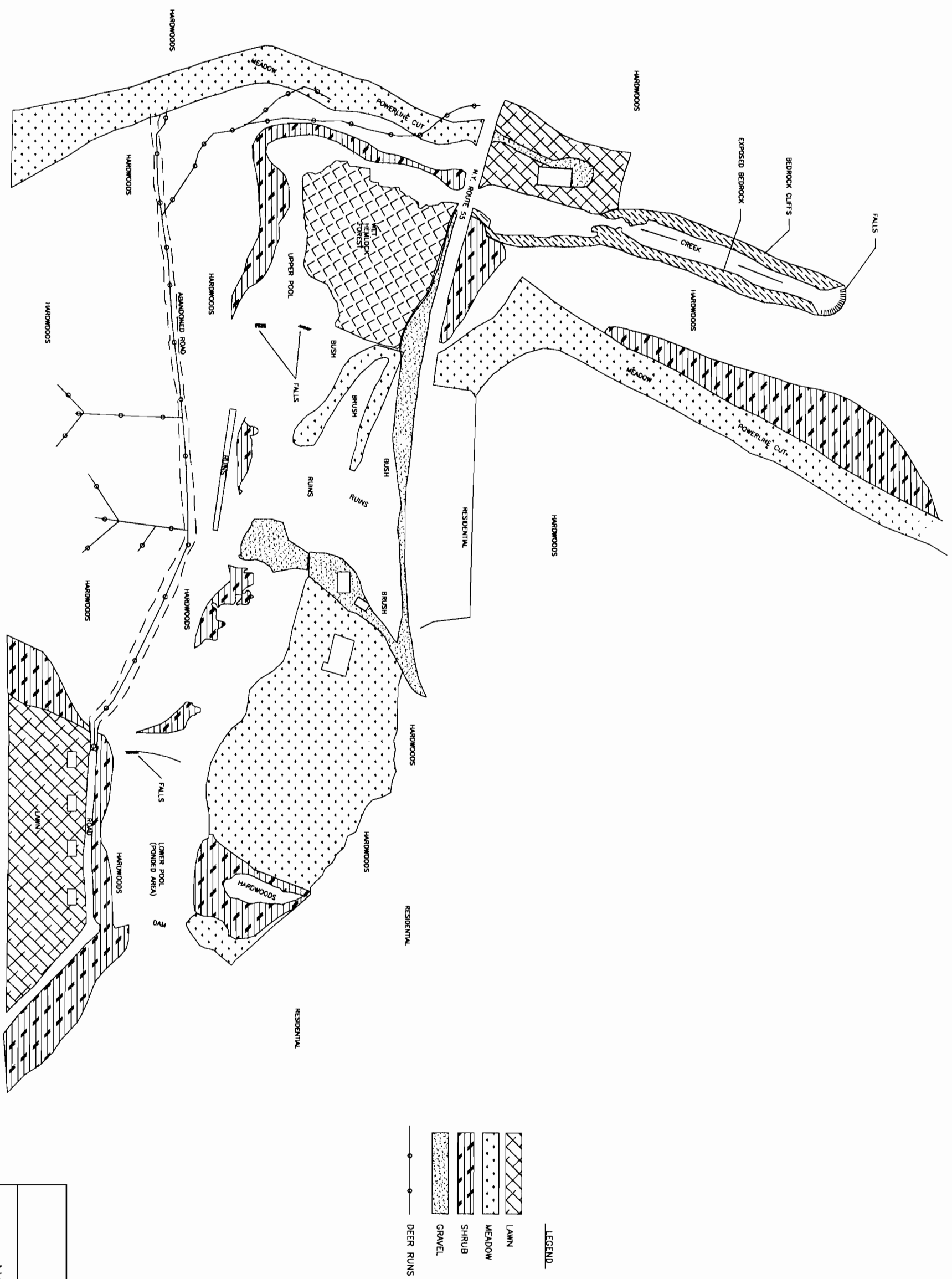


FIGURE 5.1



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RI/FS

NAPANOCH PAPER MILL SITE

AREA VEGETATION MAP

ENGINEERING—SCIENCE

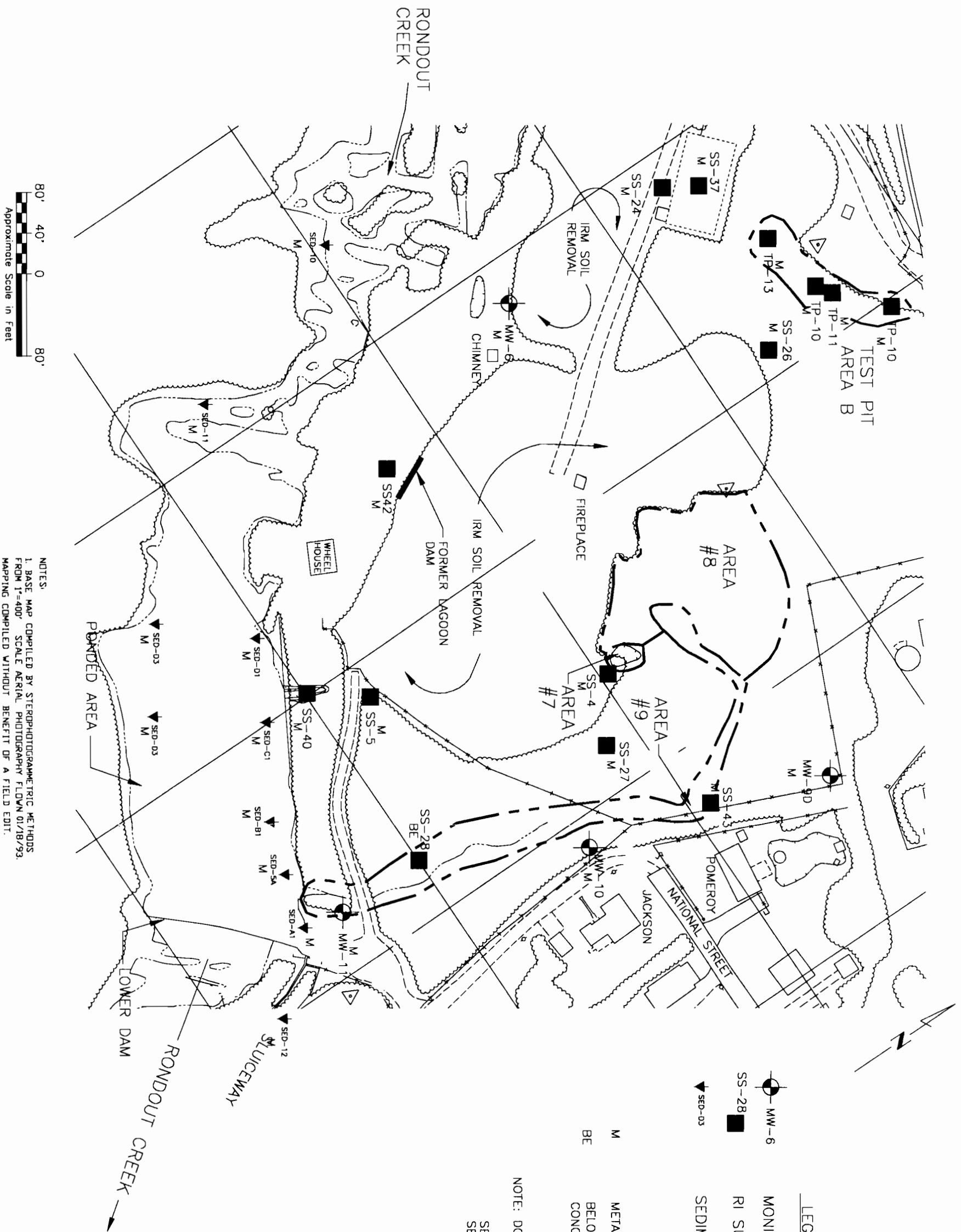
ENVIRONMENTAL SCIENCE
DESIGN • RESEARCH • PLANNING

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MS

NOT TO SCALE

FIGURE 4.4B



LEGEND

- MONITORING WELL/RESIDENTIAL WELL
- RI SURFACE SOIL SAMPLE
- SEDIMENT SAMPLE

METALS EXCEEDANCE LOCATION
BELOW METALS EXCEEDANCE
CONCENTRATIONS

NOTE: DOWNSTREAM SAMPLES:

- SED-17 BE
- SED-20 M

NOTES:
1. BASE MAP COMPILED BY STEREOPHOTOGRAHMETRIC METHODS FROM 1"=400' SCALE AERIAL PHOTOGRAPHY FLOWN 01/18/93. MAPING COMPILED WITHOUT BENEFIT OF A FIELD EDIT. AREAS OUTLINED AND NOTED INDICATE AREAS OF DOUBTFUL ACCURACY.
2. SAMPLE LOCATIONS ARE APPROXIMATE.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

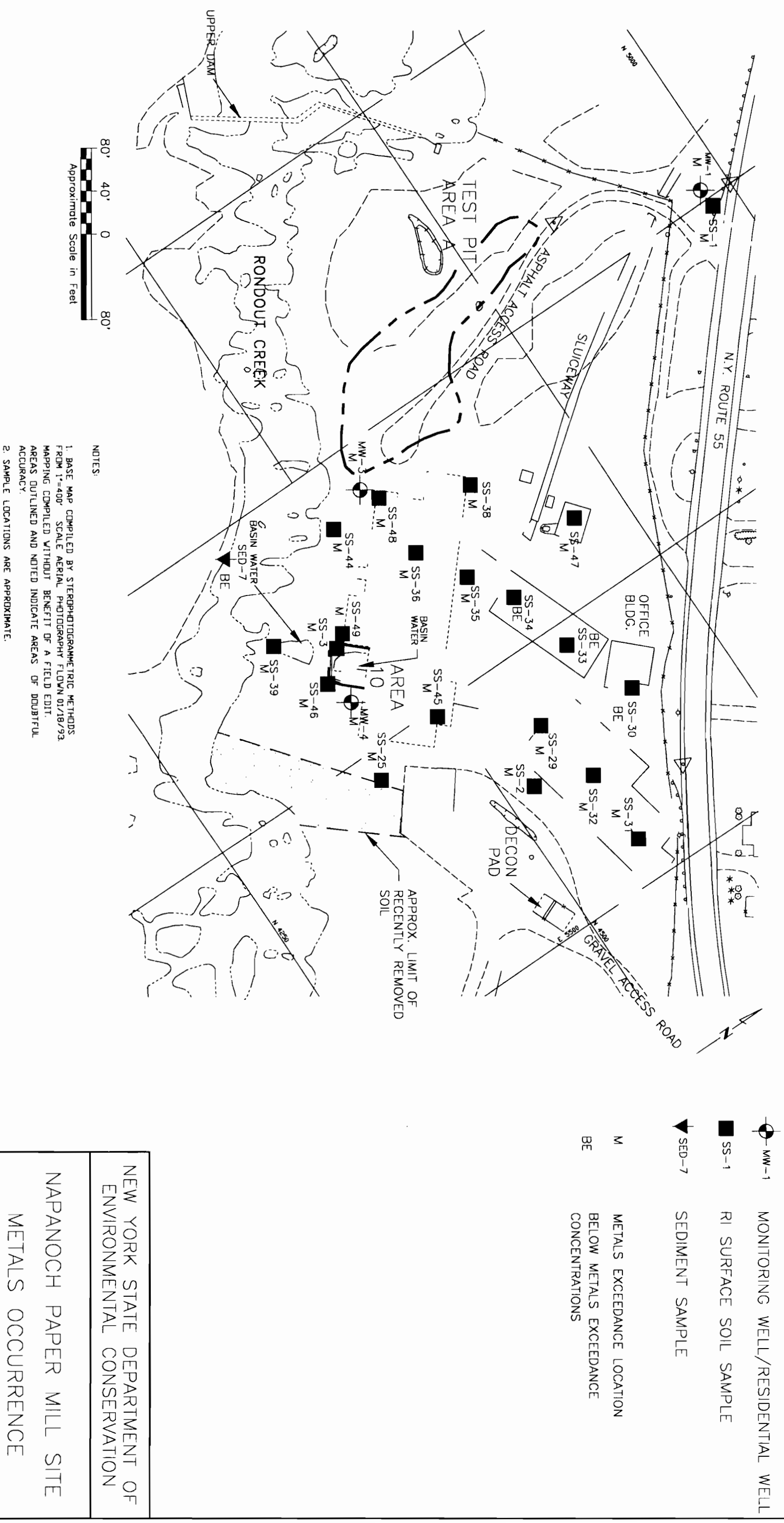
NAPANOCH PAPER MILL SITE

METALS OCCURRENCE LOCATION MAP – ZONE II

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FIGURE 4.4A



NEW YORK STATE DEPARTMENT OF
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NAPANOCH PAPER MILL SITE
METALS OCCURRENCE
LOCATION MAP - ZONE 1

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280 LINDO DAVIS ROAD • LIVERPOOL, NEW YORK 13088 • 313/431-9900
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ES

MS

FIGURE 4.5B

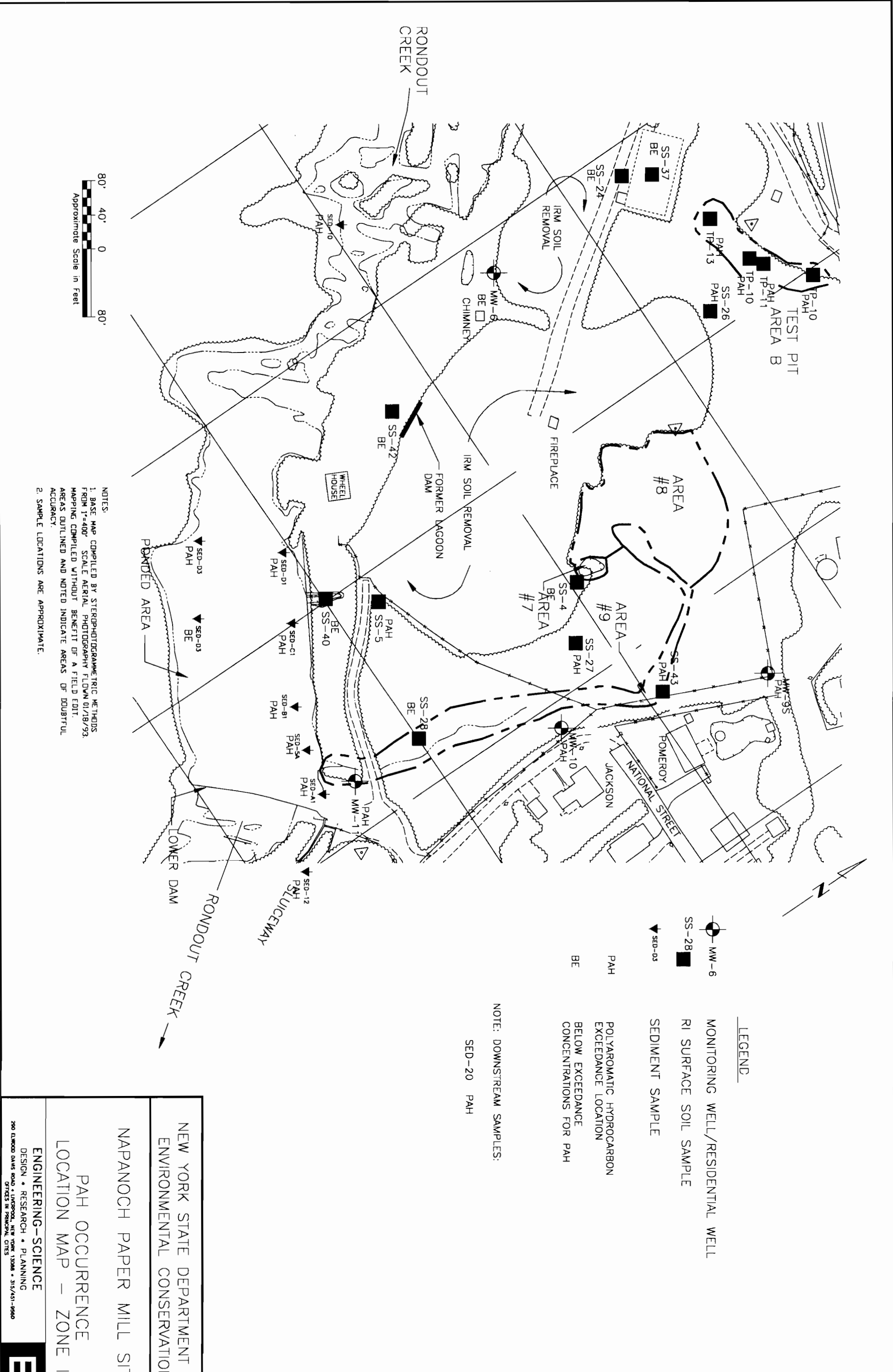


FIGURE 4.3A

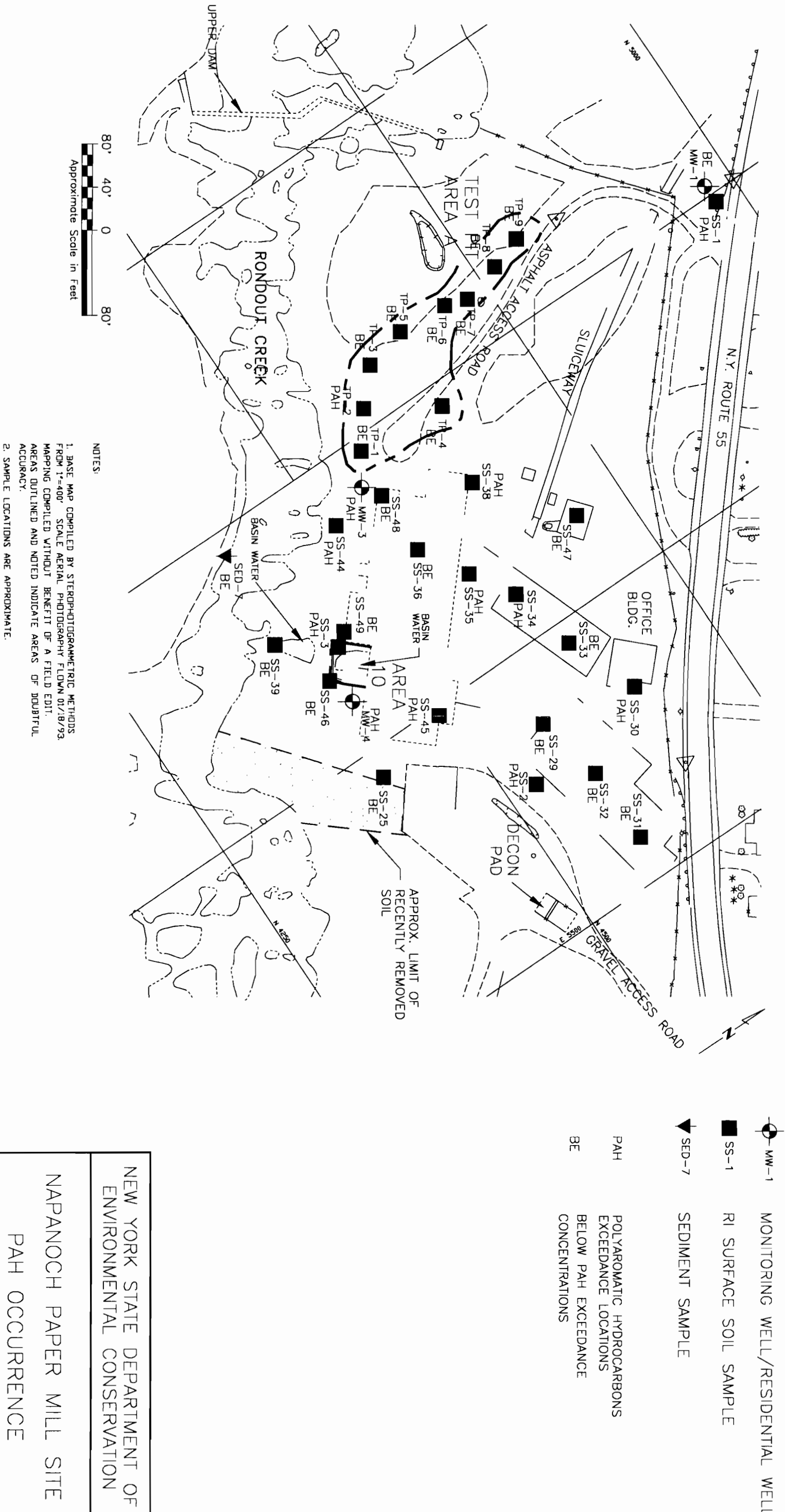


FIGURE 4.2B

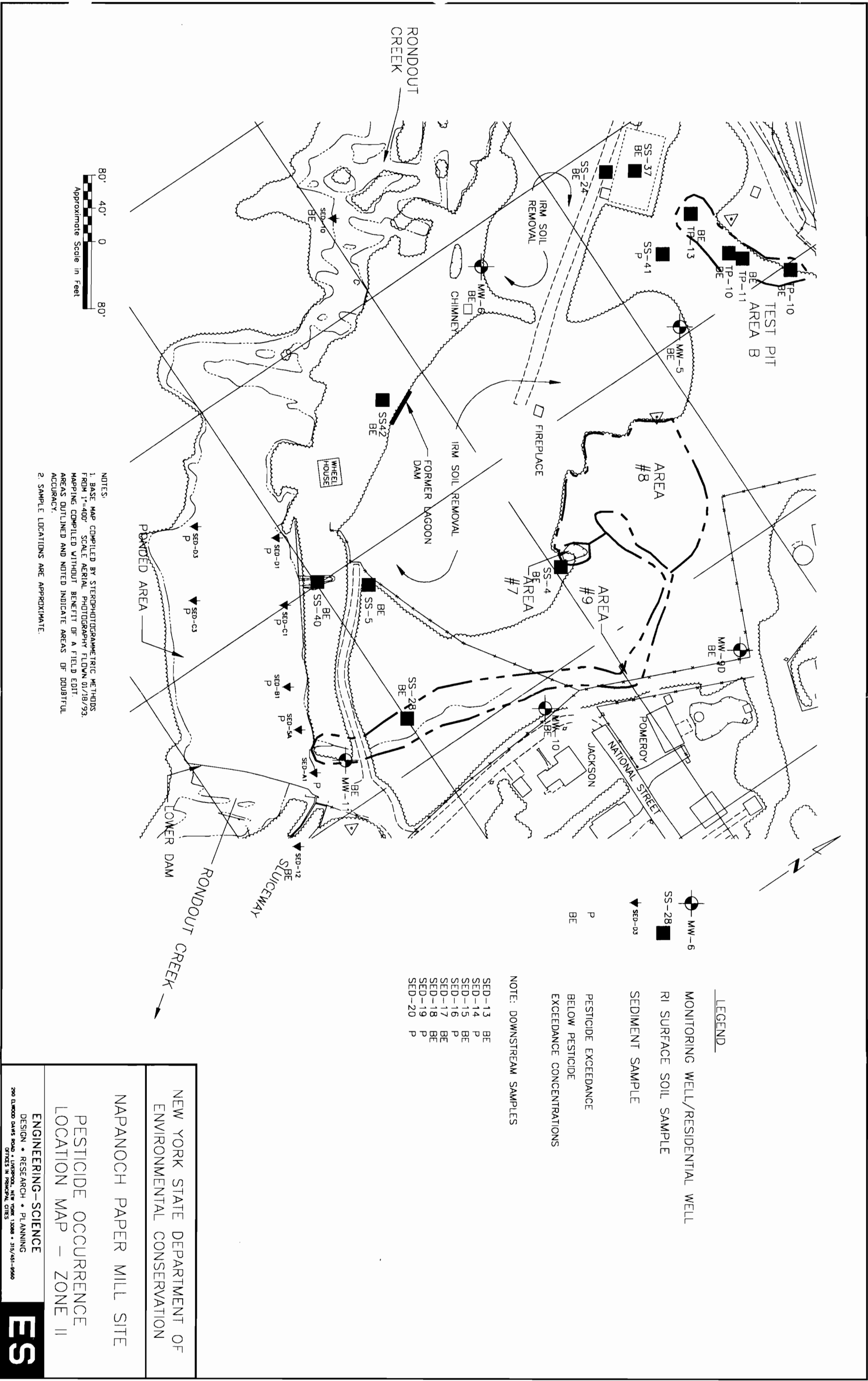
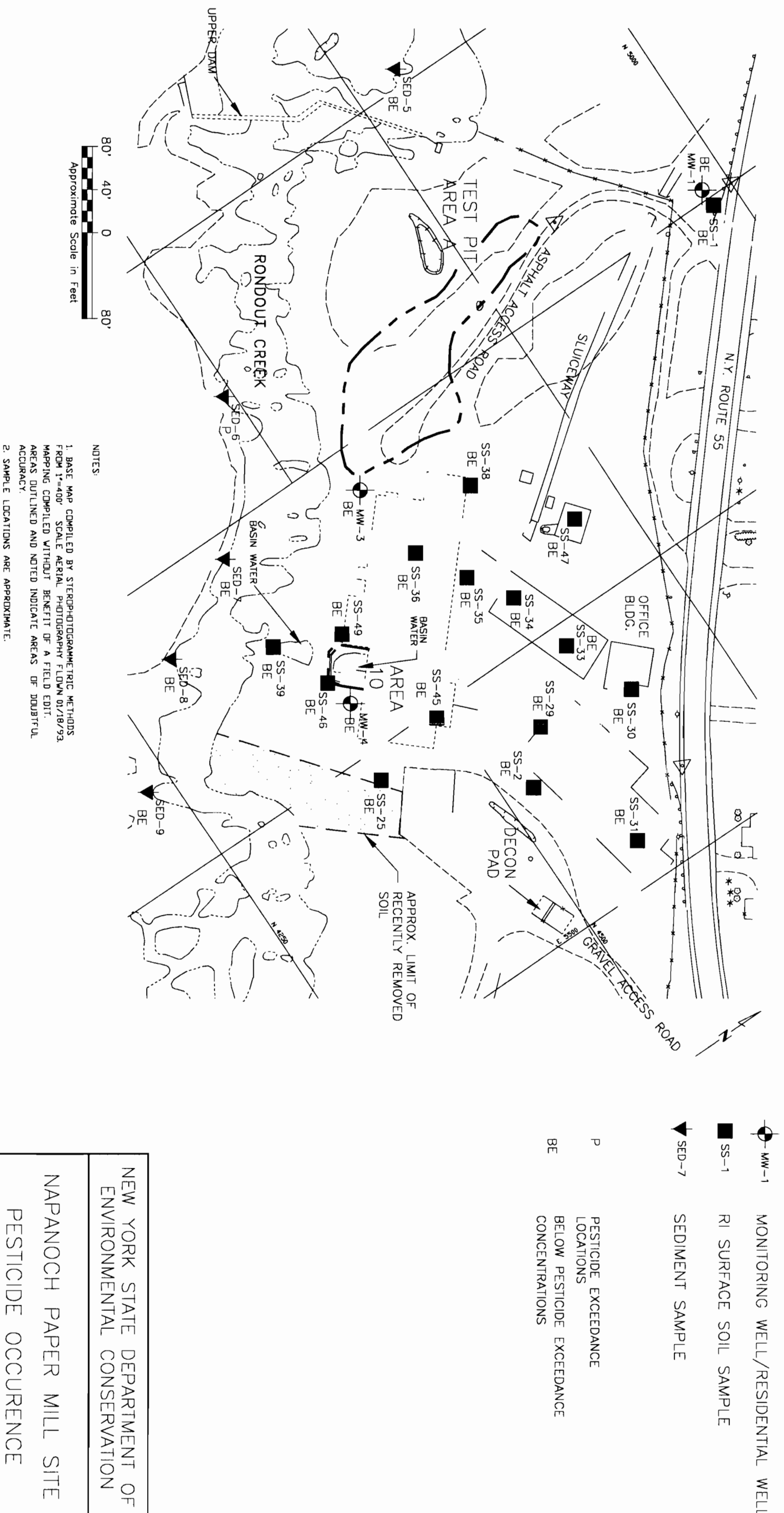


FIGURE 4.2A

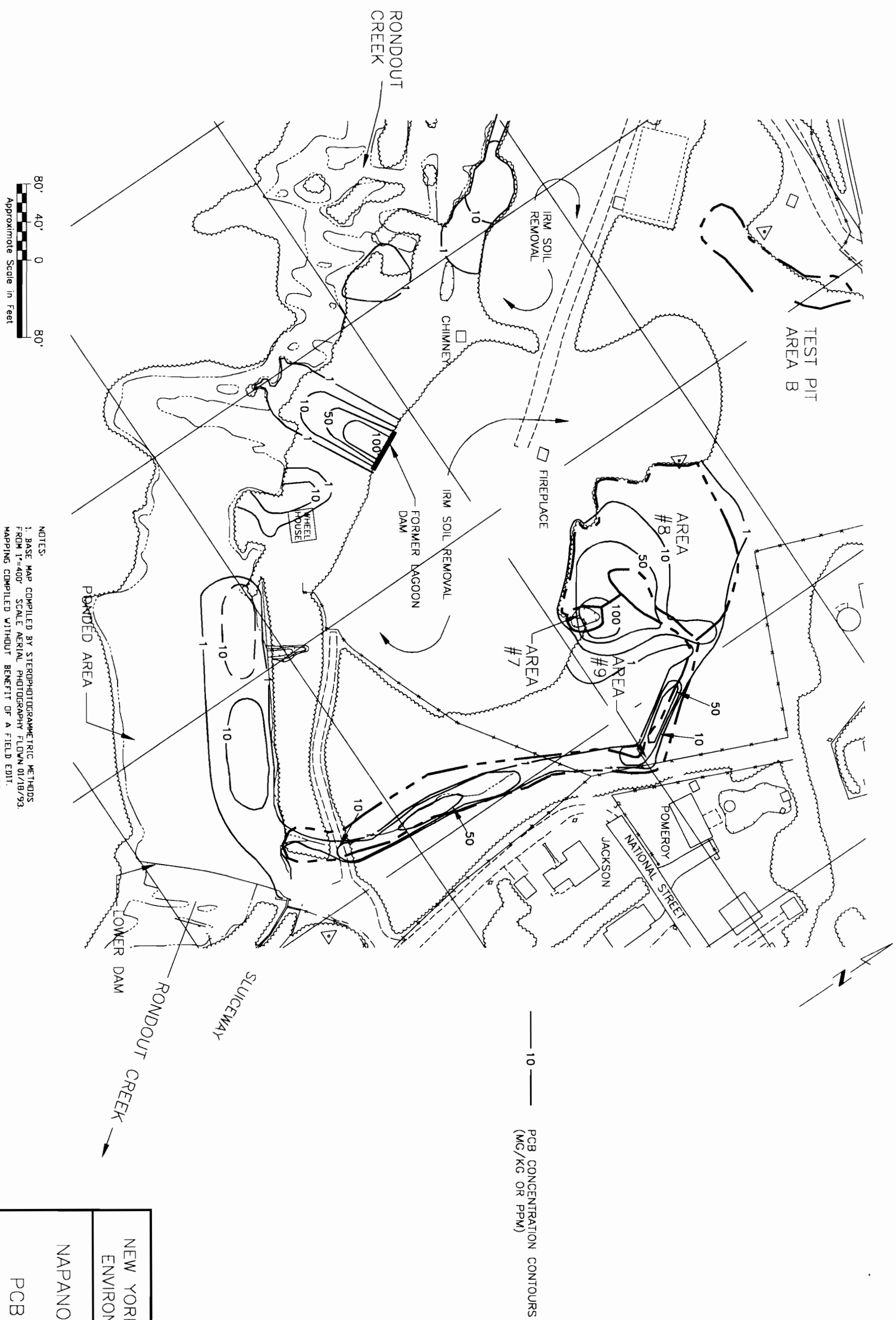


NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

NAPANOCH PAPER MILL SITE
PESTICIDE OCCURRENCE
LOCATION MAP – ZONE I

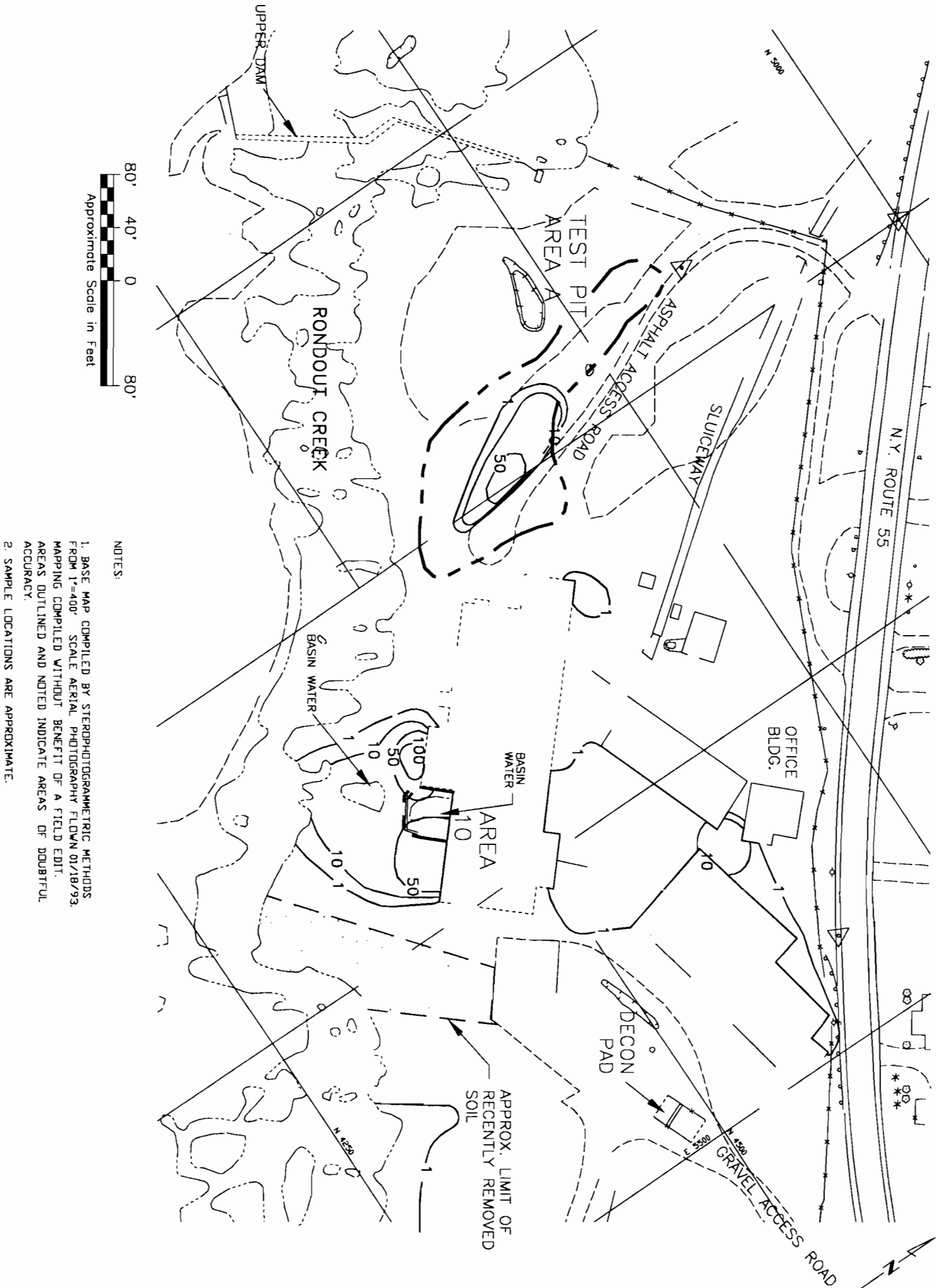
ENGINEERING—SCIENCE
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • LIVERPOOL, NEW YORK 13088 • 315/431-1900
OFFICES IN PRINCIPAL CITIES

FIGURE 4.1B



NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION	
NAPANOCH PAPER MILL SITE	
PCB CONCENTRATIONS ZONE II	
ENGINEERING—SCIENCE DESIGN • RESEARCH • PLANNING 200 LINDOOD DAMS ROAD • LINGENPOOL, NEW YORK 13088 • 315/451-9600 OFFICES IN PRINCIPAL CITIES	ES

FIGURE 4.1A



50
PCB CONCENTRATION CONTOURS
(MG/KG OR PPM)

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

NAPANOCH PAPER MILL SITE
PCB CONCENTRATION MAP
ZONE 1

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ES

FIGURE 2.2

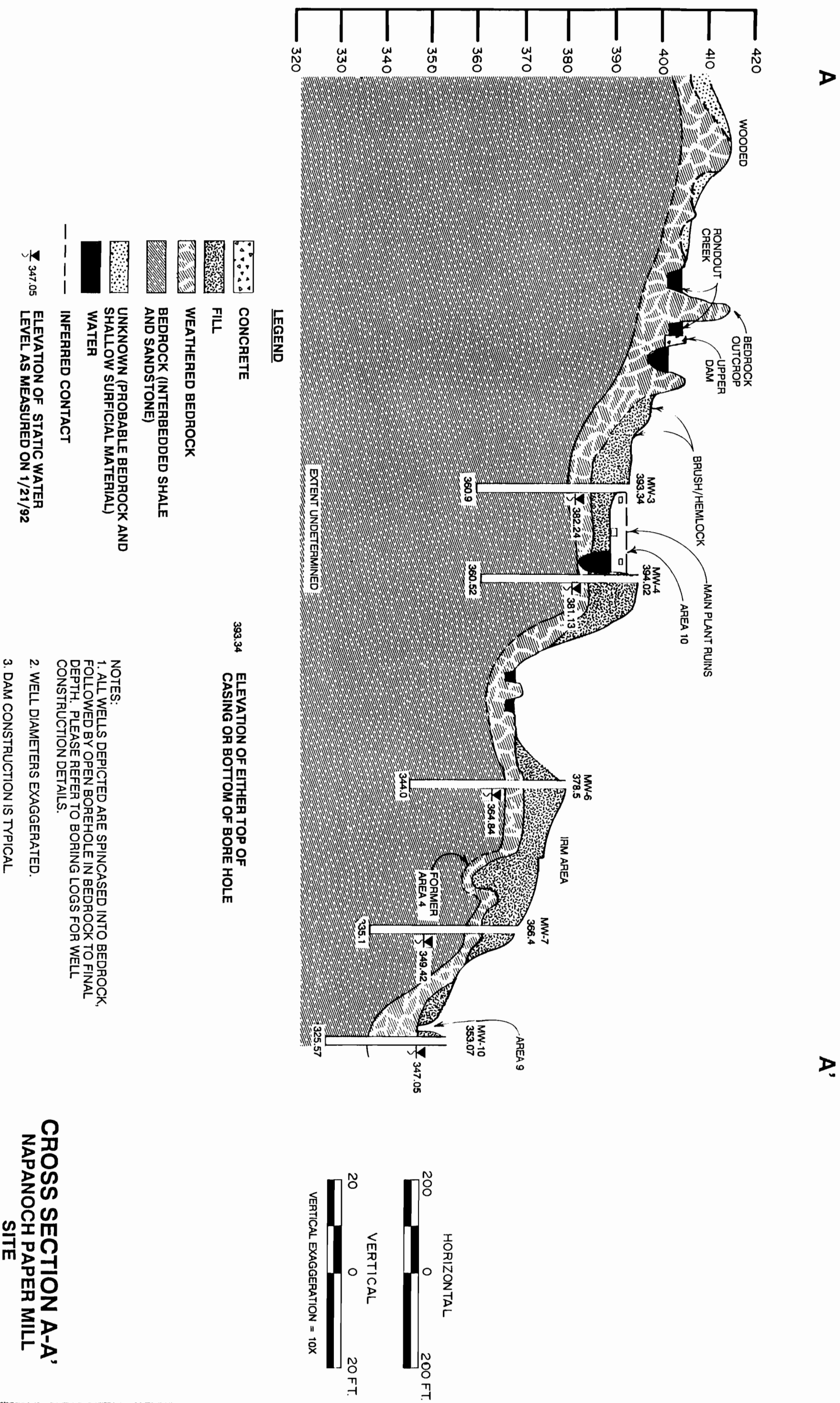
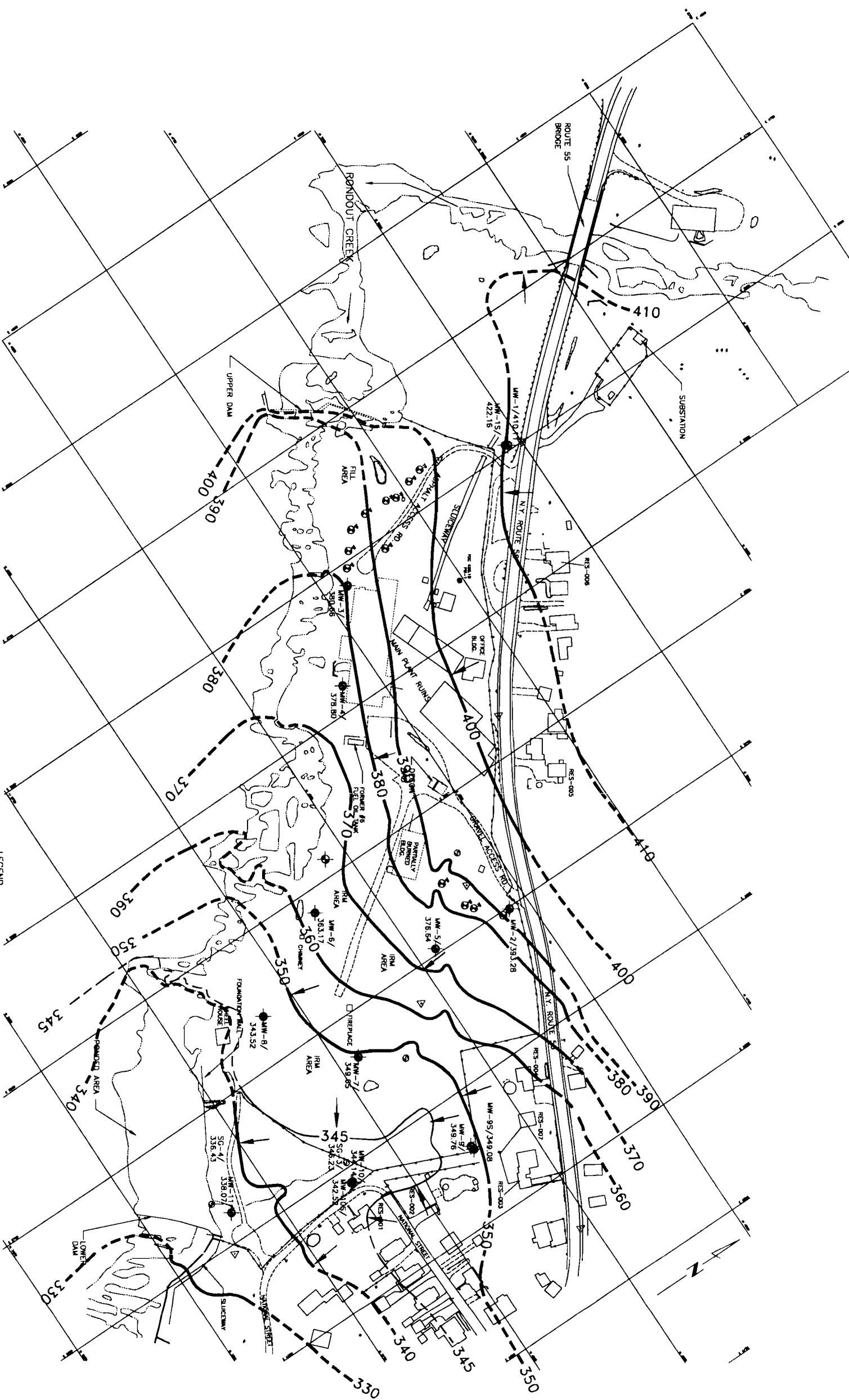
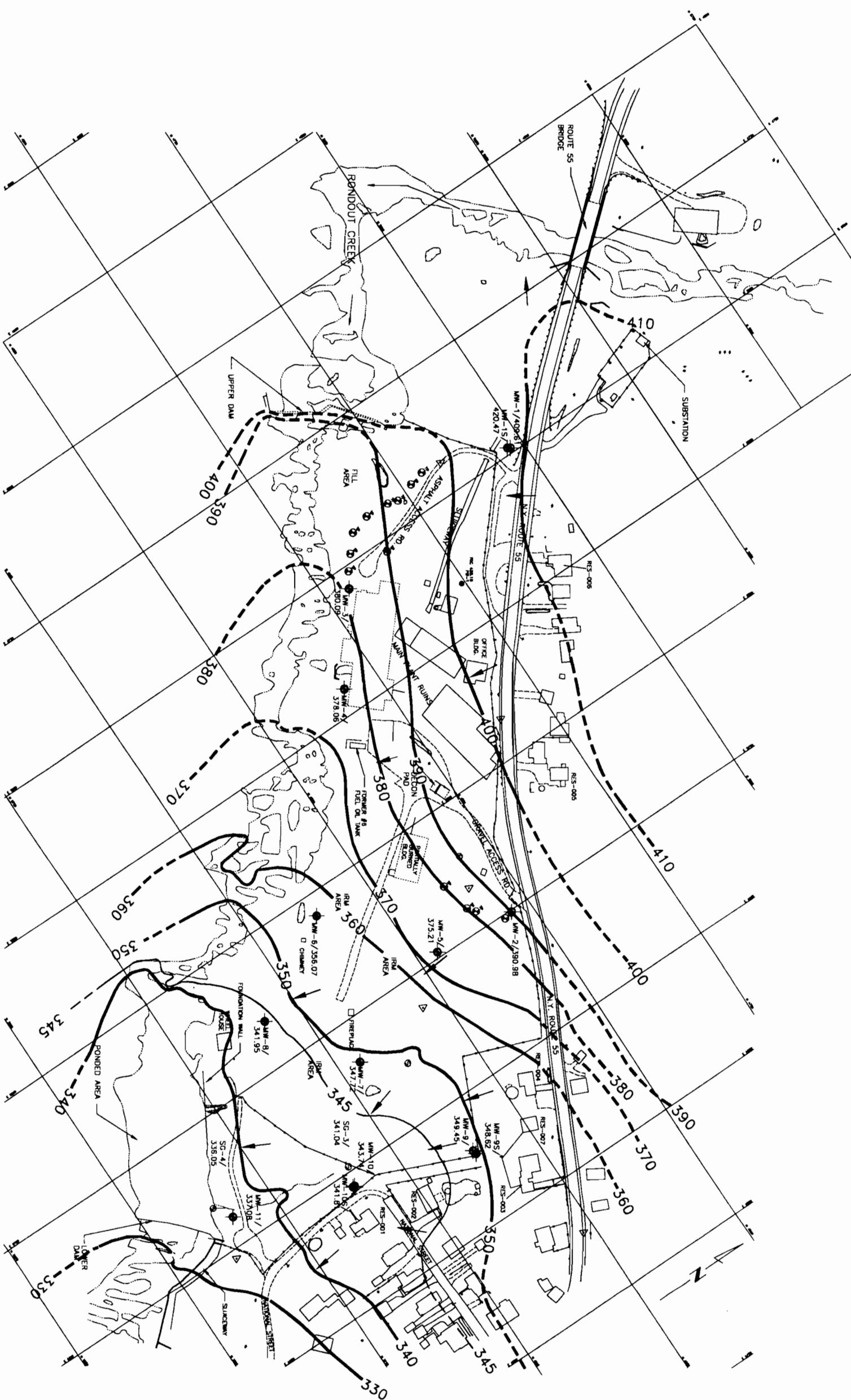


FIGURE 2.3A



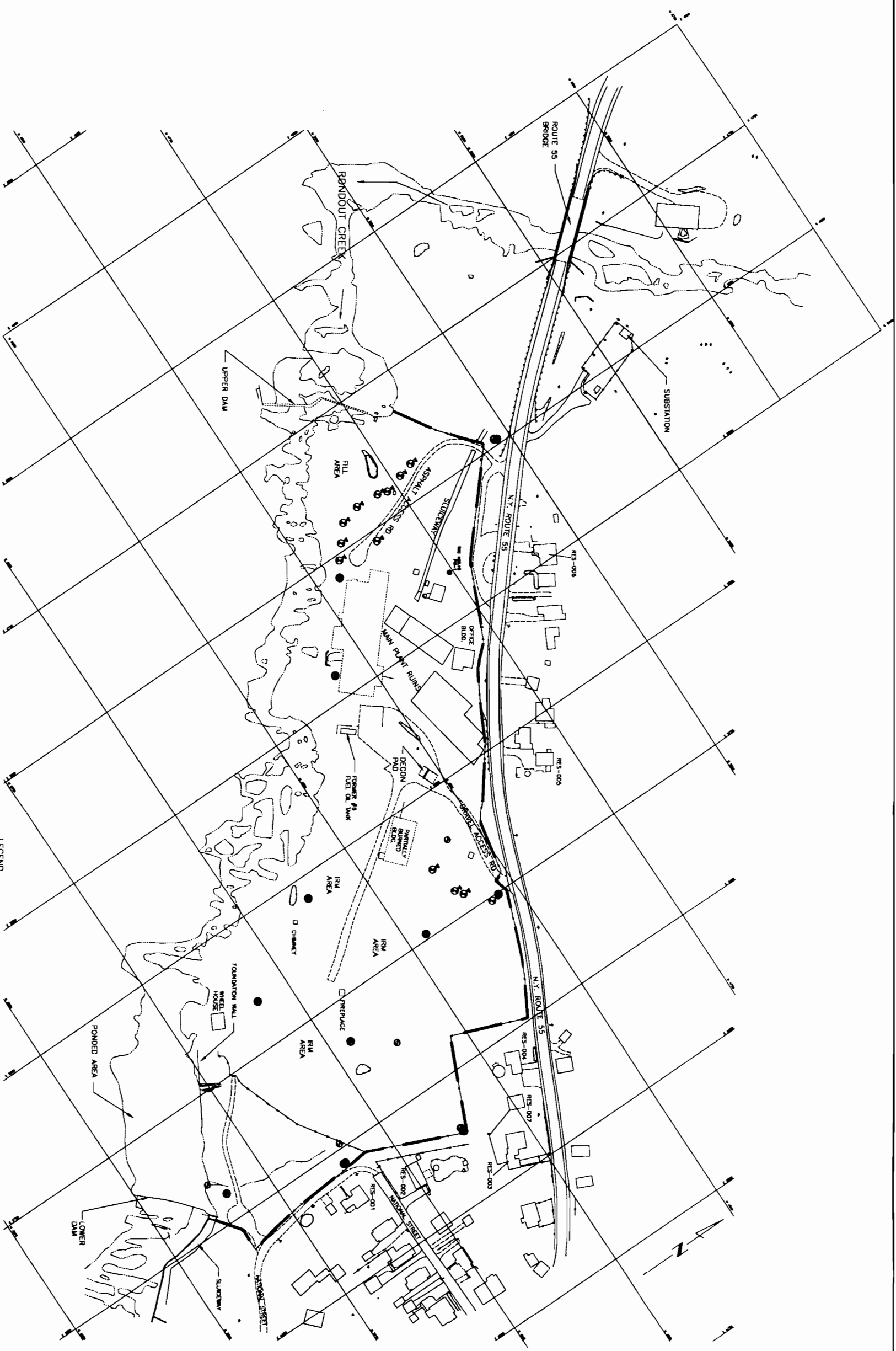
REVISION: 01/23/94 00115003\7237787\WMA0002.DWG			
5		PROJECT NO.	7237787-24-02
4		DESIGNED BY	R.S. MORANETC
3		DRAWN BY	J.H. COLLETT/MAT
2		CHECKED BY	RSW/PAW/WR
1		DATE	11/7/93/7/3
		REVISIONS	
		NO.	DATE
		BY	
		REGISTRATION NO.	
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NEW YORK 13088 • 315/451-8580 OFFICES IN PRINCIPAL CITIES			
ENGINEERING-SCIENCE DESIGN • RESEARCH • PLANNING		ES REMEDIAL INVESTIGATION/ FEASIBILITY STUDY	
		NAPANOCH PAPER MILL SITE GROUNDWATER ELEVATION MAP JANUARY 1993	
		SCALE AS NOTED FIGURE NO. 2.3A FILE NO. 7237787-	

FIGURE 2.3B



5		PRODUCT NO.	723792.DA.D2	DATE	
4		DESIGNED BY	H.S. WOODRICK	9/8/93	
3		DRAWN BY	J.H. GOLDTHAMPT	9/8/93	
2		CHECKED BY	NSM/WW/TML	11/26/93	
1		DRAWN BY			
DATE		NO.		BY	
		REVISIONS		DATE	
ENGINEERING—SCIENCE DESIGN * RESEARCH * PLANNING 290 ELWOOD DAVIS ROAD * SUITE 312 * LIVERPOOL, NEW YORK 13088 * 315/451-9580 OFFICES IN PRINCIPAL CITIES					
ES					
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY					
NAPANOCH PAPER MILL SITE GROUNDWATER ELEVATION MAP JULY 1993					
				SCALE	AS NOTED
				FILE NO.	2.38
				FILE NO.	723792

FIGURE 1.2



5		PRODUCT NO.	5713104-02	DATE	
4		DESIGNED BY	R.S. LUDWIG	9/9/83	
3		DRAWN BY	J.H. GOLDENHART	9/9/83	
2		CHECKED BY	RMH/MP/TM	11/20/83	
1		DRAWN			
	REVISIONS	NO.		DATE	
		BY			
		REGISTRATION NO.			

ENGINEERING—SCIENCE

DESIGN * RESEARCH * PLANNING

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OFFICES IN PRINCIPAL CITIES

ES

REMEDIATION INVESTIGATION / FEASIBILITY STUDY

NAPANOCH PAPER MILL SITE

SITE MAP

SCALE AS NOTED
PLATE NO.
FILE NO.