Public Health and Environmental Risk Evaluation (PHERE)

Envirite Corporation
Thomaston, Connecticut

Prepared for:
Envirite Corporation
Blue Bell, Pennsylvania

Prepared by:
ENVIRON International Corporation
Groton, Massachusetts

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EXECUTIVE SUMMARY

Introduction

Envirite Corporation (Envirite) owns a former hazardous waste treatment facility and hazardous and solid waste disposal facility in Thomaston, Connecticut ("site"), which was operated from 1975 until 1990. In November 1990, Envirite and the United States Environmental Protection Agency (USEPA) Region I entered into a Consent Agreement issued under Section 3008(h) of the Resource Conservation and Recovery Act (RCRA). Under the terms of the Consent Agreement, Envirite was required to evaluate the nature and extent of any releases of hazardous waste or hazardous constituents from the solid waste management units at the facility.

A RCRA facility investigation (RFI) was conducted by GZA GeoEnvironmental, Inc. (GZA) to characterize the site and the surrounding area. To determine the nature, extent, and magnitude of chemicals present in various environmental media in the site vicinity, samples of soil, ground water, and soil gas were collected from the site. In addition, samples of surface water and sediment from Naugatuck River and Branch Brook were collected at locations both upstream and downstream of the site. ENVIRON Corporation (ENVIRON) was retained by Envirite to prepare a public health and environmental risk evaluation (PHERE) of the site. The purpose of the PHERE is to identify the human population and environmental systems that may be exposed to hazardous constituents released from the site, and to assess potential risks to currently exposed populations and potential future populations.

Site Description and Characterization

The site is located in the southern portion of the Town of Thomaston, Connecticut. The site consists of an approximately five-acre solid waste monofill, which includes a one-acre area technically considered hazardous although it contains the same material as the rest of the monofill. A former 12,000 square foot waste treatment and storage building was formerly centrally located at the property. From 1975 until 1990, the facility received acidic, alkaline, and neutral wastes from a variety of industrial clients. The wastes were batch treated on-site using cyanide destruction and hexavalent chromium reduction, followed by neutralization and precipitation. The treatment residues were deposited into a monofill, which forms a horseshoe-shaped ridge around the former building. The monofill ranges from 15 to 30 feet above grade in height and approximately 150 to 200 feet wide, and currently is completely vegetated.

A conceptual model of the site has been developed based on the field observations and subsurface boring data described in the RFI report and several additional studies of the site. The dominant geological feature of the site is a bedrock highland that is overlain by overburden composed of fine to coarse alluvial sands and gravels. Gravel and blast debris from the nearby construction of Route 8 have been placed as fill over most of the site.

The site is bounded on the west by Branch Brook and on the east by Naugatuck River. These streams merge approximately one half mile south of the site, and both are thought to recharge the unconfined overburden aquifer at least seasonally. The water table is generally located in the upper portion of the overburden or the lower portion of the fill. Ground water flow in the overburden aquifer generally flows to the south and southwest. Average horizontal linear ground water flow velocities in the overburden are estimated to be high, ranging from 5 to 35 feet per day. Although the available data are not conclusive, it seems likely that ground water flows off the site to the southwest, then moves downstream in the overburden under Branch Brook. This ground water would eventually discharge to Branch Brook or Naugatuck River some distance downstream from the site.

Prior to the construction of the Envirite facility in 1975, an investigation was conducted at the site, during which time an "oily sludge" material that contained volatile organic compounds (VOCs) was discovered. This material was determined as likely being waste material from a solvent recovery operation, Solvents Recovery Service Corporation, which operated a facility across from the site on the east bank of Naugatuck River from 1947 until 1955. Although the majority of this oily sludge ("Pre-Envirite Waste Material") reportedly was excavated and removed in 1975, similar waste material was discovered in 1981 in the same vicinity, approximately half of which is located off the Envirite property to the east. According to the RFI report, based on historical data, this Pre-Envirite Waste Material was determined to be unrelated to Envirite's post-1975 operations.

According to the RFI report, the Pre-Envirite Waste Material is believed to be the dominant source of organic constituents at the site. High concentrations of certain VOCs (e.g., tetrachloroethylene, trichloroethylene) were measured in samples collected from the Pre-Envirite Waste Material, on the order of several thousand parts per million. Based on these high concentrations, potential exposures resulting from exposure to this waste material would be expected to be significant. The highest concentrations of organic constituents in the ground water were found in monitoring wells immediately downgradient of the Pre-Envirite Waste Material.

Other potential sources of on-site contamination include two acid spills that occurred on-site in 1978 and 1983. These spills, particularly the 1983 spill, are believed to be the primary source of certain metals detected in environmental media. Concentrations of metals (e.g., copper, nickel, and zinc) are highest in well clusters along the southern boundary of the site, immediately downgradient of areas impacted by a 1983 on-site acid spill event. The spill is the likely source of these constituents in the wells since the observed metal constituents and depressed pH are typical of the composition of the material released, and constituent concentrations are decreasing over time.

Human Health Risk Assessment

In the human health risk assessment (HHRA), potential risks to human health associated with the site are quantitatively evaluated. First, potentially exposed populations and exposure

pathways are identified, and the magnitude of exposure to individuals in that population is quantified. These exposure doses subsequently are combined with available toxicological information to develop estimates of potential risks to human health. Risks were estimated for both carcinogenic and noncarcinogenic health effects, under both "central tendency" exposure (CTE) and "reasonable maximum" exposure (RME) conditions.

Estimates of human intake have been developed for populations potentially exposed under current or future land use conditions to on- and off-site media. The populations evaluated in the PHERE are:

- On-site workers (current and future land use)
- Trespassers (current and future land use)
- Off-site residents and workers (future land use)
- Recreational visitors (current and future land use)

In addition to these populations, a scenario involving a utility/construction worker and the Pre-Envirite Waste Material is evaluated under future land use conditions. The exposure pathways identified for quantitative evaluation in the PHERE include:

- Ingestion of on-site soil
- Industrial and residential use of off-site ground water
- Inhalation of chemicals volatilizing from soils into outdoor air
- Ingestion of surface water and sediment
- Dermal contact with surface water

In addition to the pathways listed above, exposures are assessed for a hypothetical utility/construction worker scenario via the ingestion of soil and the inhalation of volatile chemicals during excavation activities involving the Pre-Envirite Waste Material.

Based on an evaluation of the risk estimates from exposure to chemicals for each of the modeled populations, the major results of the HHRA are summarized below:

- For the populations modeled in the current use scenario, no excess cancer risks are above $1x10^{-6}$ with the exception of the on-site worker under the RME scenario. The cancer risk to the on-site worker under RME conditions is $2x10^{-6}$. This is at the lower end of the risk range judged to be acceptable by USEPA. In addition, no hazard index values are above one for any of the populations modeled in the current use scenario. This indicates that the concentration levels present in the study area are acceptable for the exposures assessed under the current use scenario.
- Excess cancer risks under the future use scenario for off-site residents are between $4x10^{-4}$ (CTE) and $1x10^{-3}$ (RME). Under this hypothetical future use scenario, the risks would exceed the upper end of the range of risk deemed acceptable by USEPA. The

cancer risks are primarily attributable to polychlorinated biphenyls (PCBs). While PCBs were detected in many on-site media, PCBs were also detected in background soil and upstream sediment samples, and is unlikely to be site-related. Furthermore, because this area currently is part of the Mattatuck State Forest, the actual use of this location for residential purposes in the future is unlikely. Therefore, this situation clearly is a worst case estimate and in no way implies that this scenario is remotely likely in the future.

- Excess cancer risks under the future use scenario for off-site workers are between $6x10^{-6}$ (CTE) and $4x10^{-5}$ (RME). Under this hypothetical future use scenario, the risks would be within the range of risk deemed acceptable by USEPA. These risks are attributable to the incidental ingestion of ground water by a worker situated adjacent to the southern edge of the site. These risks are primarily attributable to N-nitrosodimethylamine, the source of which is unclear.
- Excess cancer risks under the future use scenario for on-site excavation activities are between $8x10^{-5}$ (utility worker) and $2x10^{-4}$ (construction worker). Under this hypothetical future use scenario, the risks would exceed the range of risk deemed acceptable by USEPA. In addition to the cancer risks, noncancer risks associated with this scenario were determined to be high and unacceptable. These risks are attributable to the inhalation of chemicals volatilizing during the excavation of the Pre-Envirite Waste Material, which is situated over nine feet below ground level, for utility installation/maintenance or construction purposes.

Ecological Risk Assessment

The primary objectives of the ecological risk assessment were to: (1) determine the ecological resources present on the site and in adjacent water bodies; and (2) identify any potential risks or existing impacts to these resources from chemicals present at, or migrating from, the site.

The 13-acre site consists of a 5-acre solid was monofill around a former building. Most of the site is covered by mowed lawn. Branch Brook is the only wetland/water body which occurs on-site, flowing through the extreme western edge of the site. The Naugatuck River occurs about 100 feet east of the site. No special resources or significant habitats occur within the site vicinity, although a state forest borders the site to the west. Although the site and surrounding area is utilized by a variety of aquatic and wildlife species, there are no known occurrences of rare and endangered species on the site.

Exposure of ecological receptors to site-related chemicals was evaluated using data from the 1994 RFI sampling program pertaining to chemical concentrations in surface water, sediment, and surface soil. Data on benthic macroinvertebrate communities and fish populations were also collected in Branch Brook and the Naugatuck River during RFI studies. Based on a screening process using maximum measured concentrations and conservative toxicological benchmark values, eight inorganic and seven organic chemicals were retained for risk evaluation in surface soils and sediments; no chemicals were retained in surface water. The sediment chemicals were evaluated for potential impacts to lower trophic level aquatic biota using a comparison to toxicological benchmark values, the results of benthic macroinvertebrate

surveys, and the results of fish surveys in a weight-of-the-evidence approach. In addition, the surface soils chemicals were evaluated using a comparison to toxicological benchmark values and food chain modeling to determine if these chemicals pose a risk to terrestrial receptors.

Upper trophic level receptor species used in food chain modeling included the meadow vole, red fox, American robin, and red-tailed hawk. These receptor species represent the most likely and/or significant exposure groups and pathways that may be present in on-site habitats. Population-level risks to these receptors were characterized using the quotient method. Effects were evaluated through a comparison of chronic toxicological benchmark values obtained from the literature for each selected receptor species to conservatively-derived benchmarks for ingestion exposure.

Based on the assessment endpoints evaluated and the weight-of-the evidence approach utilized in this assessment, significant adverse ecological effects are not likely to occur in Branch Brook and the Naugatuck River from site-related exposures. Based on the available assessment endpoints, there may be the potential for adverse impacts to lower trophic level soil biota in on-site terrestrial habitats. These potential risks are likely to have low ecological significance due to the limited nature and low quality of the habitats present on the monofill. In addition, the vegetation on the monofill was not visibly stressed. The risk evaluation indicates a low likelihood of adverse effects to populations of upper trophic level wildlife that might consume soil invertebrates, plants, and soil from the site.

1 INTRODUCTION

1.1 Background

Envirite Corporation[1] (Envirite) owns a former hazardous waste treatment facility and hazardous and solid waste disposal facility in Thomaston, Connecticut ("site"), which was operated from 1975 until 1990. In November, 1990, Envirite and the United States Environmental Protection Agency (USEPA) Region I entered into a Consent Agreement issued under Section 3008(h) of the Resource Conservation and Recovery Act (RCRA). Under the terms of the Consent Agreement, Envirite was required to evaluate the nature and extent of any releases of hazardous waste or hazardous constituents from the solid waste management units at the facility.

A RCRA facility investigation (RFI) was conducted by GZA GeoEnvironmental, Inc. (GZA) to characterize the site and the surrounding area. Field investigation activities conducted as part of the RFI included geophysical investigations, monitoring well drilling and installation, and aquifer testing. To determine the nature, extent, and magnitude of chemicals present in various environmental media in the site vicinity, samples from on-site soil borings, on-site and off-site ground water wells, and on-site soil gas were collected and analyzed. In addition, a sampling program for the Naugatuck River and Branch Brook, the main surface water bodies receiving runoff from the site, was completed. This program included the analysis of samples collected from surface water and sediment at locations along the rivers both upstream and downstream of the site. Full descriptions of the field investigation activities and sampling programs are presented in the RFI report (GZA 1995) and the RFI Supplement.

ENVIRON Corporation (ENVIRON) was retained by Envirite to prepare a public health and environmental risk evaluation (PHERE) of the site. The purpose of the PHERE is to identify the human population and environmental systems that may be exposed to hazardous constituents released from the site, and to assess potential risks to currently exposed populations and potential future populations. The previous version of the PHERE was submitted to USEPA on May 30, 1997. This version of the PHERE incorporates draft comments dated December 2, 1997 by USEPA on the 1997 PHERE that were provided to Envirite.

This report is based on the results of the RFI activities conducted by GZA (1995) and ENVIRON (1996), as well as subsequent work conducted by the University of Connecticut Environmental Research Institute (ERI) (Envirite 1998) and Xpert Design and Diagnostics, LLC (XDD 1999). While ENVIRON made reasonable efforts to verify independently the information contained in the RFI report, this report is complete and accurate only to the extent that the information provided to ENVIRON is complete and accurate.

[1]Envirite Corporation was formerly known as Liqwacon Corporation. Liqwacon Corporation changed its name to Envirite Corporation in 1982.

1.2 The Risk Assessment Process

To understand whether chemical releases can result in a significant public health and environmental risk, it is not sufficient simply to determine whether a particular substance is "toxic" or "non-toxic," or whether some potential exposure may or may not have occurred. Almost all substances, even those that people consume in high amounts on a daily basis, can produce a toxic response under some conditions of exposure. Conversely, almost all substances, even those generally considered to be "toxic," are tolerated by humans in certain limited quantities. To determine that a health risk exists, it must be established that a chemical to which exposure occurred (or may have occurred) can produce a specific type of health damage, and that exposures were sufficient to cause that health damage. Risk assessment is a systematic process by which both the toxicity of the chemicals to which exposure may have occurred and the extent of exposure to those chemicals are characterized.

The basic process of quantitative human health risk assessment has been described by the National Academy of Sciences (NAS) in its landmark report *Risk Assessment in the Federal Government: Managing the Process* (NRC 1983). According to NAS, the risk assessment process consists of four steps:

- **Hazard Identification**, in which it is determined whether exposure to a chemical can cause an increased incidence of an adverse health effect, and the nature and strength of the evidence for causation is characterized.
- **Dose-Response Assessment**, in which the relationship between the amount of chemical exposure (or dose) and the incidence and severity of the resulting adverse health effect is characterized. Dose-response assessment can also involve extrapolation of high-dose responses to low-dose responses, as well as extrapolation of responses in animals to humans. The Hazard Identification and Dose-Response Assessment steps are sometimes combined and referred to as the Toxicological Assessment.
- **Exposure Assessment**, in which the intensity, frequency, and duration of actual or hypothetical exposures are determined. Measures of chemical exposure (e.g., dose or concentration in an environmental medium) are typically estimated for each relevant pathway of exposure, based on various assumptions about and characteristics of the exposed population.
- **Risk Characterization**, in which the outcomes of the Toxicological Assessment and the Exposure Assessment are combined to establish the probability of harm occurring from exposure to a chemical.

The human health risk assessment methods described in this report are based primarily on USEPA's *Risk Assessment Guidance for Superfund* (RAGS) (USEPA 1989a) and other guidelines provided by USEPA (e.g., USEPA 1992b, 1995a, 1996a). Additional guidance developed by USEPA Region I was also used (e.g., USEPA 1992c, 1994, 1995b, 1996b, 1996c). The foundation for this guidance comes from established chemical risk assessment principles and procedures developed from the regulation of environmental contaminants (NRC

1983; OSTP 1985; NRC 1994) and other USEPA guidelines (e.g., USEPA 1986). The ecological risk assessment is based on current national and Region I USEPA guidance (e.g., USEPA 1989b, 1989c, 1989d, 1992a, 1993, 1996d, 1996e, 1996f).

Application of these guidelines and principles has provided a consistent process for evaluating and documenting potential health risks associated with environmental exposures. As emphasized by the Office of Science and Technology Policy (OSTP 1985) and USEPA (1986) with respect to carcinogenic risk assessments, these assessments also involve a number of assumptions and forms of extrapolation that have not been verified by traditional scientific means. This approach has arisen because of the need, as perceived by regulatory officials, to act in the absence of complete experimental information by adopting a series of conservative assumptions to ensure maximum health protection. Risk assessments performed in this manner are designed to place an upper bound on risk.

Similarly, risk assessment methods developed for estimation of the potential noncarcinogenic effects of chemicals incorporate various conservative (i.e., health protective) assumptions. Noncarcinogenic risk assessment is not intended to provide a demarcation between "safe" and "unsafe" levels of exposure. A substantial margin of safety is built into noncarcinogenic toxicity values, thereby providing a high degree of certainty that the levels derived as "acceptable" according to methods developed by regulatory agencies will cause no adverse health effects in the potentially exposed population. Consequently, exposures may even exceed the estimated acceptable dose level without a significant risk arising.

It must be emphasized that the potential risks estimated using these risk assessment methods are not actuarial, i.e., the risk estimates cannot be used to predict the actual number of individuals who might experience health consequences as a result of exposure. Actual health risks are almost certainly less than those estimated using the methods of risk assessment. Furthermore, the risk estimates developed herein do not relate to absolute individual risks. Many individual risk factors - such as exposures to other environmental agents, occupational exposures, smoking, age, diet, and inherent susceptibility - influence the probability of developing a specific disease.

Although current risk assessment approaches generally overstate risk, they nevertheless provide a systematic approach that allows public health policy makers to establish the relative risks posed by various environmental substances and potential exposure pathways. A further discussion of uncertainties in the risk assessment process and the conservative assumptions adopted in light of these uncertainties is presented in Chapter 4.6 (Uncertainties and Limitations).

1.3 Report Organization

This report is divided into six chapters, as follows:

Chapter 1. Introduction, in which background on the project, a discussion of the risk assessment process, and the report organization are presented.

Chapter 2. Site Description and History, in which the description and history of the site relevant to the assessment of human health and environmental risks are summarized.

Chapter 3. Site Characterization, in which the sampling data collected during the RFI process are summarized, and a conceptual model of the site hydrogeology is described. The environmental data contained in this chapter are based solely on soil, surface water, ground water, sediment, and soil gas sampling results collected during the RFI process and subsequent investigations. The results of these sampling investigations are presented in various reports (GZA 1995; Envirite 1996a, 1996b; ENVIRON 1996; Envirite 1998; XDD 1999) and the RFI Supplement.

Chapter 4. Human Health Risk Assessment, in which the numerical estimates of carcinogenic and noncarcinogenic risks are calculated for each chemical of potential concern for each potential route of exposure using toxicity information for the chemicals and estimates of human intake.

Chapter 5. Ecological Risk Assessment, in which the principles of risk assessment are used to evaluate the potential effects on the off-site local flora and fauna.

Chapter 6. Media Protection Standard, in which protection standards are developed to be used for measuring the necessity for and/or the degree of protection afforded by the corrective measures.

In addition, technical appendices to the report are included that provide the necessary documentation of data and methods relied upon to perform the analyses.

1.4 References

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2 SITE DESCRIPTION AND HISTORY

2.1 Introduction

This chapter summarizes the portions of the site description and history that are relevant to the assessment of human health and ecological risks. More detailed descriptions of site activities are presented in the RFI report (GZA 1995).

2.2 Site Description

The site is located in the southern portion of the Town of Thomaston, Connecticut in Litchfield County (Figure II-1). The southwestern portion of the site is located in the Town of Watertown. The site consists of an approximately five-acre solid waste monofill, which includes a one-acre area technically considered hazardous although it contains the same material as the rest of the monofill (Figure II-2). The monofill forms a horseshoe-shaped ridge around the former building, ranging from 15 to 30 feet above grade in height and approximately 150 to 200 feet wide. The monofill surface currently is completely vegetated. A former 12,000 square foot waste treatment and storage building was dismantled in 2008. The site is situated in a valley, approximately one half mile north of the confluence of Branch Brook and Naugatuck River. Branch Brook flows along the western edge of the site, and Old Waterbury Road is situated to the east. The Naugatuck River is located immediately east of Old Waterbury Road. The site vicinity is primarily industrial. The Thomaston Publicly Owned Treatment Works (POTW) and transfer station are situated adjacent to the southern edge of the site.

The area within a one half mile radius of the site contains three major land uses. The area to the west and south is mostly part of the Mattatuck State Forest. This area is heavily wooded, with no commercial or residential activity. The Thomaston dog pound, the POTW, and a mixed solid waste transfer station are situated south of the site. To the east, north, and northwest, land use is a mix of industrial and residential. The properties north of the site along Old Waterbury Road contain a number of light industries, including Summit Metals, Eyelets for Industry, and the T.A.D. Corporation. Across from the site on the eastern bank of the Naugatuck River lies a major metal plating operation (Whyco Chromium Company) and sporadic residential uses.

The general topography of the site vicinity consists of rolling hills with occasional steep valleys associated with the Naugatuck River and its tributaries. In general, site conditions include a bedrock highland that outcrops along the northern end of the site and a sand and gravel aquifer that thickens from the bedrock outcrops in the north to sixty feet thick in the south and southeast portions of the site. Surface water flow is from north to south, and stream flux measurements indicate the brook and river are likely recharging the aquifer (at least seasonally) adjacent to the site (GZA 1995). According to the RFI report, ground water in the overburden aquifer in the vicinity of the former treatment building flows to the west towards Branch Brook; overburden ground water at the rest of the site flows to the south and southwest. Flow directions in the bedrock are also generally to the south and southwest.

2.3 Site History

The site history summarized below is based primarily on information presented in the RFI report (GZA 1995).

2.3.1 Previous Uses and Pre-Existing Contamination

From approximately 1955 until 1975, the site reportedly was used as a source of sand and gravel by Savin Brothers, a local construction contractor. The site was also used to dispose of debris produced by the construction of Route 8, which runs parallel to the site to the west. The debris consisted mostly of blast rubble that contained boulders and rock pieces (3 to 5 feet in diameter), and reportedly covered 85-90 percent of the site.

In 1975, the site was purchased from Savin Brothers by the Connecticut Development Authority (CDA), who financed the construction of the Envirite facility through the issuance of industrial development bonds. CDA held title to the property as security from 1975 until November 1994, at which time ownership transferred to Envirite.

Prior to the construction of the facility, Envirite retained Minges Associates (Minges) to investigate the suitability of the site as a solid waste disposal area.[2] As part of its investigation, Minges completed a seepage test pit in the northeast portion of the site to assess subsurface drainage, during which time a material described as an oily sludge (Pre-Envirite Waste Material\ or PEWM) that apparently contained volatile organic compounds (VOCs) was discovered. Subsequent test pits determined the material to be approximately 2.5 to 4 feet thick.[3] The upper limit of the waste material found beneath the monofill residues (PEWM-L) ranges from 15 to 25.5 feet below ground surface (bgs). Based on a review of Figure 6-3 from the RFI, this PEWM-L covers an area of approximately 30 feet by 40 feet.

This material was determined as likely being waste material from a solvent recovery operation, Solvents Recovery Service Corporation, which operated a facility across from the site on the east bank of the Naugatuck River from 1947 until 1955. Historical records and aerial photographs reportedly indicate that a bridge across the Naugatuck River was located directly across from Envirite's northern property line during this time, which could have facilitated transport and disposal from across the river. The majority of this oily sludge reportedly was excavated and removed in 1975 by CDA.

In 1981, during a hydrogeologic study, a one foot layer of rubbery "dried paint" material (PEWM-R) was encountered at a depth of 14 feet while an off-site monitoring well (MW-31) was being installed near the northern gate. This material was outside of the limits of the waste material delineated by Minges, and was assumed by ENVIRON to be a separate area from the Pre-

[2]The report from the assessment conducted by Minges is included as Appendix A in the RFI Report (GZA 1995).

[3]Subsequent samples of the Pre-Envirite Waste Material collected by GZA during the RFI activities found the waste material thickness to range from 2 to 8.5 feet (GZA 1995).

Envirite Waste Material found beneath the monofill residues (PEWM-L).[4] Based on soil boring results, GZA (1995) determined that the upper limit of this waste material is 9 to 11.5 feet bgs and 55 percent of the known volume of the PEWM-R material is located off the Envirite property to the east. Based on a review of Figure 6-3 from the RFI, the PEWM-R up to the edge of Old Waterbury Road covers an area of approximately 40 feet by 60 feet (i.e., 223 m^2). According to the RFI report (GZA 1995), based on historical data, both areas of Pre-Envirite Waste Material were determined to be unrelated to Envirite's post-1975 operations.

2.3.2 Waste Treatment and Disposal Operations

Following the construction of the facility, Envirite (then Liqwacon Corporation) began accepting acidic, alkaline, and neutral wastes from a variety of industrial clients, including electroplaters, electroless platers, surface finishers, steel producers, nonferrous metals manufacturers, and automobile, aircraft, hardware, jewelry, and electronics manufacturers. In general, the facility received liquid wastes and pumpable slurries that contained metals and cyanides.

The waste treatment process consisted of a batch process using cyanide destruction and hexavalent chromium reduction, followed by neutralization and precipitation. The treatment process produced a slurry with high water content that contained mostly insoluble metal-sulfide complexes. This slurry was filtered, with the filtrate discharged to the sanitary sewer system (under a CTDEP permit) for treatment at the adjacent Thomaston POTW. The filtered residues were placed in a permitted on-site monofill. The portions of the monofill used initially were located north of the former building (Cells 1, 2, and 3) (see Figure II-2). A description of the sections of the monofill, the materials disposed, and periods of usage are provided in Table II-1. In 1980, the monofill area was expanded to the west of the former building (Cell 4) to accommodate the volume of treatment residues being produced.

Following the effective date of the first RCRA regulations (i.e., November 1980), the waste residues being produced at the site were considered hazardous because they were derived from listed hazardous wastes, and were required to be managed as such. The treatment residues that had been placed in Cell 4 prior to November 1980 ("pre-RCRA residues") were removed and placed on top of the existing material in Cells 1, 2, and 3 as overfill, and Envirite began managing Cell 4 as a RCRA-regulated hazardous waste unit. RCRA-regulated residues were placed in a well defined area of the monofill separate from the nonhazardous pre-RCRA residues.

Because Envirite determined the treatment residues themselves were not hazardous, Envirite submitted a petition to USEPA in June 1981 asking that the residues produced at the site be delisted, or classified as nonhazardous wastes. On December 16, 1981, USEPA granted Envirite a conditional temporary exclusion for the residues; a final exclusion was granted on

[4]Throughout this PHERE, the PEWM present beneath the landfill residues will be referred to as "PEWM-L" and the PEWM present near the property boundary and roadway will be referred to as "PEWM-R."

November 14, 1982. In December 1982, the portion of Cell 4 containing hazardous wastes was capped with a one foot gravel blanket, and delisted nonhazardous wastes were placed over the gravel. In November 1985, Envirite submitted a final petition to USEPA for the exclusion of its treatment residues, which was granted on November 14, 1986.

Cell 4 continued to be used for delisted nonhazardous wastes until December 1985. Use of Cell 5 began after it was permitted by CTDEP in October 1984, and continued until May 1989, when the solid waste disposal capacity of the site was reached. Wastes continued to be received and treated by the facility; treatment residues were transported to the Envirite facility in York, Pennsylvania for disposal. In May 1990, Envirite suspended all commercial treatment of hazardous wastes at the site. In December 1990, Envirite submitted a notice of closure for the storage and treatment building to USEPA. The building subsequently was used solely for treatability demonstrations and was dismantled in 2008.

On May 10, 1996, Envirite sold to Pure-Etch Company of Connecticut a 1.9-acre portion of the site, which included the 12,000 ft^2 treatment and storage building and essentially all of the paved area surrounding the building. Two underground storage tanks that were excavated by Envirite in November 1996 were included in this parcel.

In correspondence dated December 12, 1996, Envirite apprised USEPA Region I of its plans to reorganize its legal and corporate structure such that the monofill property would be owned by a subsidiary wholly owned by a holding company which, in turn, would be wholly owned by Envirite Corporation.[5] In its correspondence to Region I on February 24, 1997, Envirite confirmed its understanding that it continues to be bound by the Consent Order between Envirite Corporation and USEPA, which was finalized in November 1990 (RCRA Docket I-90-1032) (discussed below).

2.3.3 Permitting and Monitoring Activities

In October 1982, Envirite filed a RCRA Part A application with CTDEP and USEPA, which listed the site as a treatment and storage facility, and a RCRA Part B application was submitted in 1983. In 1982, Envirite submitted a ground water monitoring program to CTDEP and USEPA, which was designed to monitor releases from the portion of the monofill that was being managed as a RCRA-regulated hazardous waste unit (i.e., Cell 4). Four monitoring wells were used for this program, in which statistically significant increases in certain parameters were detected. As a result, Envirite submitted a ground water quality assessment plan to USEPA in November 1986, which was designed to determine the rate, degree, and extent of ground water contamination. This plan was implemented in 1987 and has been maintained continuously thereafter.

[5]The subsidiary was eventually named "Thomaston Enterprises."

Envirite submitted a series of closure and post-closure plans for the RCRA-regulated hazardous waste portion of the monofill (Cell 4) from 1983 through 1987, which were approved by CTDEP and USEPA on September 23, 1987. Closure of Cell 4 was completed in accordance with the approved plan in the summer of 1988, and closure was certified in December 28, 1988.

2.3.4 RCRA Facility Investigation

In November 1990,[6] Envirite and USEPA Region I entered into a Consent Agreement under which Envirite was required to evaluate the nature and extent of any releases of hazardous waste or hazardous constituents from the solid waste management units (SWMUs) at the facility. Envirite submitted a RCRA Facility Investigation Proposal (RFI Report Proposal) that presented the scope of work for Phase I of the RFI in January 1991 (Fuss & O'Neill 1991), which was approved by USEPA on September 30, 1991. The RFI Report Proposal was subsequently modified in a March 22, 1994 submittal (Modified RFI Report Proposal) (GZA 1994), and work was initiated in April 1994. Monthly reports were submitted to USEPA documenting all investigation activities. Phase I field investigation activities conducted by GZA as part of the RFI included:

- Soil borings and bedrock coring;
- Monitoring well installations and sampling;
- Hydraulic tests;
- Stream measurements and surface water sampling;
- Sediment profiling and sampling;
- Biological survey of Branch Brook and Naugatuck River;
- Soil, treatment residue, and Pre-Envirite Waste Material sampling; and
- Soil gas sampling.

These Phase I activities were completed in December 1994, and results were described in a report prepared by GZA (1995) and submitted to USEPA Region I. In response to comments from USEPA regarding the soil gas sampling results presented in the RFI, ENVIRON conducted a limited soil gas survey in August 1996 to supplement the results of the RFI. The results of this soil gas survey were submitted to USEPA Region I in October 1996 (ENVIRON 1996).

Phase II activities consisted primarily of additional soil sampling in the vicinity of two underground spill containment tanks. These tanks were used from 1975 to 1978 to collect spills from the acid and alkaline unloading pads on the south side of the former treatment building. These tanks were removed by Envirite in November 1996, and soil sampling was conducted in this area by GZA (Envirite 1996a, 1996b).

[6]The final Consent Order was signed by Envirite on October 22, 1990 and by USEPA on November 8, 1990.

2.3.5 Landfill Treatment Residue (LTR) Study

Additional sampling and analytical activities were conducted by ERI between November 1997 and May 1998 to assess potential impacts to ground water from metals and volatile organic compounds (VOCs) in the monofill. The extent of, or potential for, ground water contact with the LTR was evaluated by measuring the elevation of both the monofill's base and ground water. The relative concentration and distribution of VOCs in the monofill was evaluated through the collection of soil core and soil gas samples from the monofill. The results of this study were submitted to USEPA Region I in December 1998 (Envirite 1998).

2.4 References

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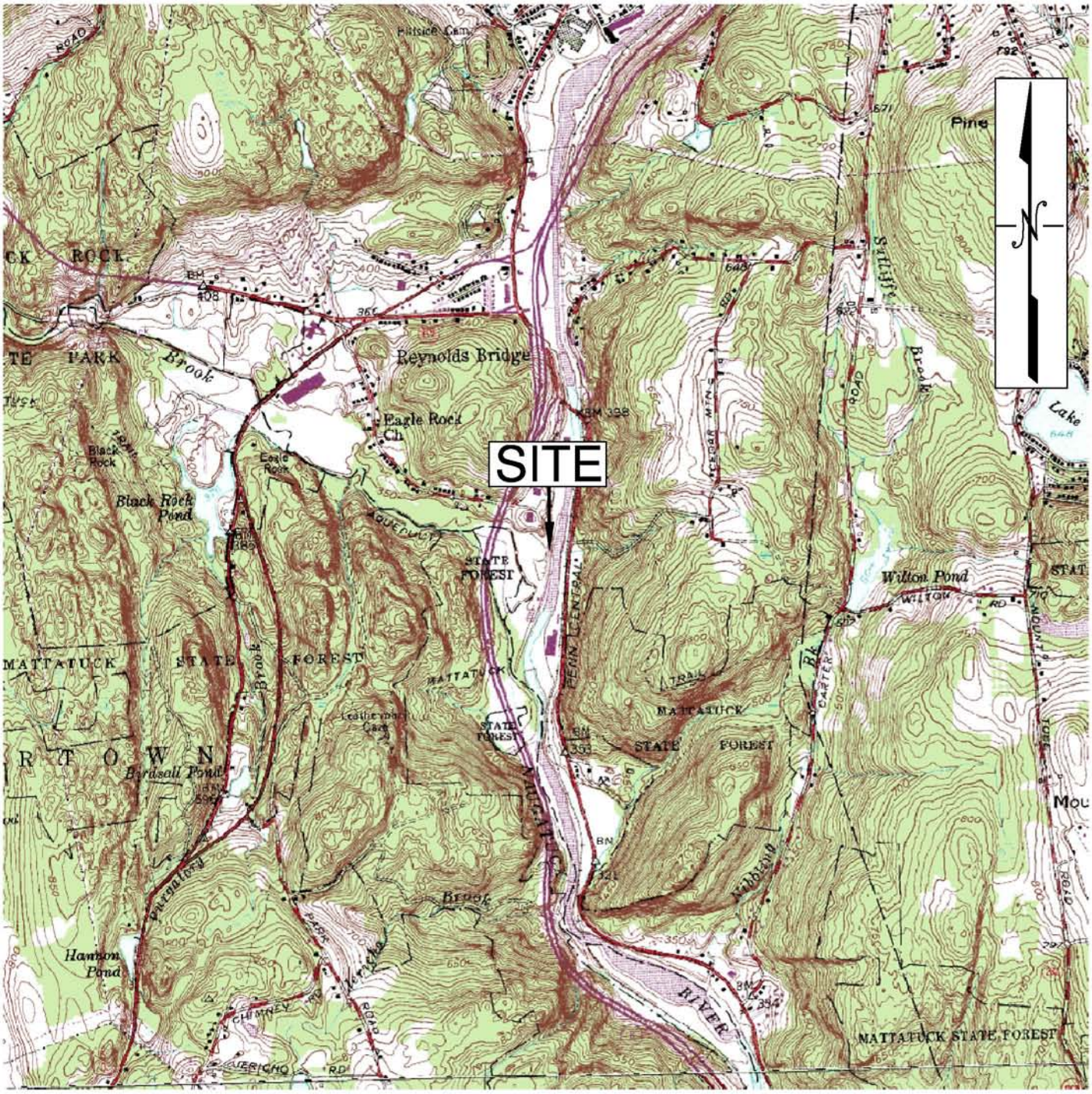
TABLE II-1

Description of Monofill Cells, Envirite Corporation, Thomaston, Connecticut

Cell	Dimensions	Regulatory Status of Contents	Fill Dates	Method of Closure	Volume of Residues
1	170'x130'	Nonregulated (pre-RCRA)	11/76 - 8/79 overfill added 10/80[a]	1' gravel drainage layer; 6" loam and seeded.	5,100 c.y. to grade 5,000 c.y. overfill
2	165'x130'	Nonregulated (pre-RCRA)	11/76 - 8/79 overfill added 10/80[a]	1' gravel drainage layer; 6" loam and seeded.	6,300 c.y. to grade 6,000 c.y. overfill
3	155'x140'	Nonregulated (pre-RCRA)	11/76 - 8/79 overfill added 10/80[a]	1' gravel drainage layer; 6" loam and seeded.	6,300 c.y. overfill
4[a]	250'x180'	Hazardous	11/80 - 11/82	Hazardous waste capped with 1' gravel drainage layer. Residues placed above cap. Cell capped with 30 mil PVC liner, drainage net, 42" cover, 6" loam and seeded.	19,000 c.y.
	550'x170'	Nonregulated (delisted)	11/82 - 6/87		47,600 c.y.
5	400'x165'	Nonregulated (delisted)	6/87 - 5/89	30 mil PVC liner, drainage net, 24" cover, 6" loam and seeded.	21,000 c.y.

Source: Fuss & O=Neill (1989)

a Envirite began placing nonregulated pre-RCRA waste treatment residues in Cell 4 in August 1979. In October 1980, prior to the effective date of the first RCRA regulations (i.e., November 1980), these materials were removed from Cell 4 and placed on top of the existing material in Cells 1, 2, and 3 as overfill. Following the removal of these wastes, Cell 4 began being used for RCRA hazardous wastes.



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Scale in Feet

SOURCE: WWW.TOPOZONE.COM; MAPS A LA CARTE, INC.

ENVIRON

SITE LOCATION MAP
ENVIRITE CORPORATION
THOMASTON, CONNECTICUT

Figure
1

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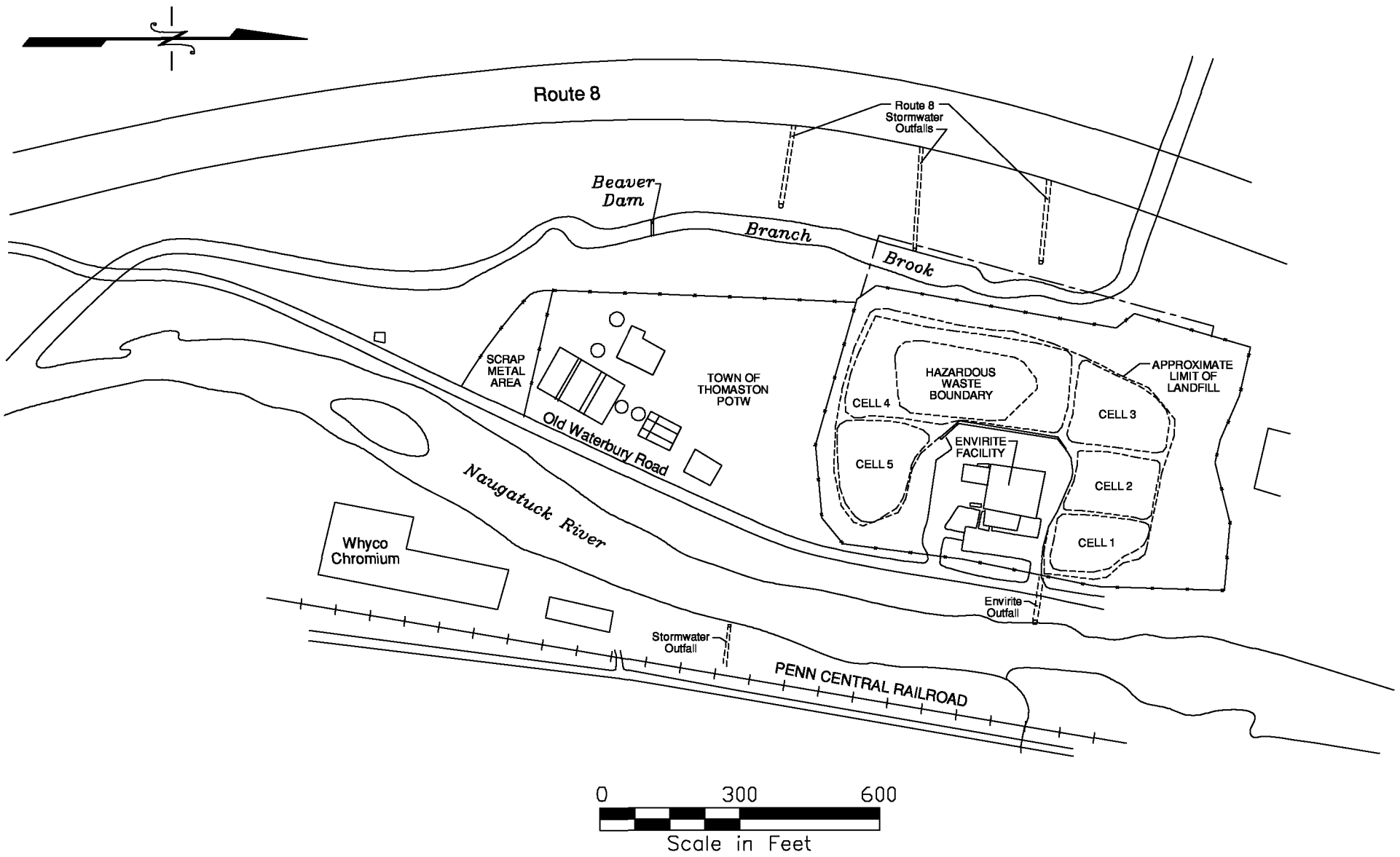

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SITE PLAN
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
II-2

3 SITE CHARACTERIZATION

3.1 Introduction

GZA and ENVIRON have conducted site characterization work on behalf of Envirite as part of the RFI process (GZA 1995; ENVIRON 1996). Additional soil sampling has been conducted by Envirite following the removal of the underground spill containment tanks (Envirite 1996a, 1996b). The design and implementation of these investigative studies have been approved by USEPA Region I. These data form the basis for evaluating potential exposures to chemicals detected at the site. This chapter summarizes the steps followed to organize the data into a form appropriate for the PHERE, and presents a conceptual model of the site hydrogeology.

3.2 Organization of Chemical Data

Samples from the various environmental media present - including surface water, ground water, sediment, soil, and soil gas - were submitted to various analytical laboratories for analysis. Data from these analyses were independently validated. Data validation procedures ultimately confirm each sample concentration to be either unqualified (i.e., identity and concentration of the constituents are certain) or qualified (i.e., the concentration, or possibly also the identity, of the constituent is estimated or not reliable). The various data qualifiers and the appropriate use of qualified data in risk assessment are addressed in USEPA guidance documents (USEPA 1989, 1990). Validated data from the RFI were subsequently provided by GZA to ENVIRON.

Unqualified chemical concentrations were used in the risk assessment without modification. For risk assessment purposes, qualified data were handled by ENVIRON in the following manner, in accordance with USEPA guidance (USEPA 1989, 1990):

- For a given sample, substances that were also detected in various blank samples (marked with a B-qualifier) were not considered to be native unless the sample concentration exceeded by five times or more the level in the blank(s). For common laboratory contaminants (i.e., acetone, 2-butanone [or methyl ethyl ketone], phthalate esters, methylene chloride, and toluene), the sample concentration had to exceed the concentration in the blank(s) by ten times or more to be considered native to the samples. Aqueous and solid sample results within five or ten times the level in the blanks of a similar matrix (viz., aqueous or solid blank) were qualified as “not detected.” Solid sample results within five or ten times the level in aqueous field blanks were qualified as “qualitatively suspect,” and treated as if they were not detected.
- Qualified data marked with a D-qualifier, indicating a compound identified in an analysis at a secondary dilution factor, were treated the same as unqualified data.
- Qualified data marked with an E-qualifier, indicating an exceedance of the linear calibration limit, were treated the same as unqualified data.

- Data marked with a J-qualifier, indicating that the concentrations were estimated, were treated the same as unqualified data.

Based on the available data, 142 chemicals were detected at least once in the sampled media, as summarized in Table III-1. Sampling locations are shown in Figures III-1 through III-6. Summary statistics - including frequency of detection, minimum and maximum detected levels, the range of reported quantitation limits for each chemical that was detected in the sampled media, the mean concentration, and the 95 percent upper confidence limit on the mean concentration (95% UCL) - are presented in Tables III-2 through III-33. These include data for:

- On-site and background ground water (Tables III-2 to III-5);
- On-site and background soil borings, collected from the general facility grounds, monofill perimeter, and the adjacent roadway (Old Waterbury Road) (Tables III-6 to III-8);
- Landfill treatment residue (LTR) samples (Table III-9);
- On-site leachate, extracted from the soil samples using the synthetic precipitation leaching procedure (SPLP) (Tables III-10);
- Surface water samples from Naugatuck River and Branch Brook (Table III-11 to III-18);
- Sediment samples from Naugatuck River and Branch Brook (Table III-19 to III-22);
- Off-site piezometer measurements (Table III-23 to III-26).
- Pre-Envirite Waste Material (Tables III-27 and III-28) and leachate (Tables III-29 and III-30); and
- On-site soil gas (Table III-31).

In addition, subsets of the on-site soil data used for the ecological risk assessment are presented in Tables III-32 and III-33; these tables are discussed in Chapter 5. The locations of the maximum concentrations for certain key chemicals of potential concern are shown in Figures III-7 through III-12.

In developing these summary statistics, when duplicate or replicate samples were encountered, the highest of two or more reported concentrations rather than their average concentration was used for the purpose of determining minimum and maximum detected levels and average concentrations. Frequency of detection was determined based only on the number of primary samples (i.e., duplicate and replicate samples were not included in the number of samples). Where multiple samples were taken at a single location, but in different depth strata, each depth was treated as a discrete sample in calculating summary statistics.

In Tables III-2 through III-33, the UCL concentration was represented by either the highest observed (detected) concentration or the 95 percent upper confidence limit on the mean concentration (95% UCL), whichever is lower, in accordance with USEPA guidance (USEPA 1989, 1992b, 1994a). For the purposes of the PHERE, ENVIRON generally assumed that all of the environmental data sets collected during the RFI were lognormally distributed based on USEPA experience that most large or “complete” environmental contamination data sets are

lognormally distributed rather than normally distributed (USEPA 1992b). Because of the limited amount of soil gas and ground water used in the PHERE, the maximum detected concentrations in these media were used to represent UCL concentrations.

For lognormal distributions, the 95% UCL was calculated using the H-statistic developed by Land (1975), which was described in recent USEPA guidance (USEPA 1992b).[7] In calculating the arithmetic mean and the 95% UCL, for those substances where a non-detect value was reported for a given sample, it was assumed that the actual sample concentration was one-half of the sample quantitation limit.

3.3 Comparison of Site Data With Potentially Applicable Standards

In addition to the summary statistics for the samples of environmental media collected during the RFI, Tables III-2 through III-31 list the potentially applicable regulatory standards for Connecticut. These standards are primarily based on Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

3.3.1 Soil and Pre-Envirite Waste Material

Organic constituents in surficial soil samples were compared to the more stringent of the Direct Exposure Criteria (DEC) for industrial/commercial sites[8] and the Pollutant Mobility Criteria (PMC) for Class GB areas.[9] The DEC are risk-based criteria developed to protect against potential risks associated with ingestion of soil. The PMC have been developed to protect against potential leaching of soil contaminants into ground water. Because both standards potentially apply to on-site soils, the more stringent of the two was selected for each chemical for comparison with the data. For inorganic constituents in soil, the leachate extract from the SPLP analysis was compared to the PMC for Class GB areas, as required by the CTDEP regulations.

The Pre-Envirite Waste Material is located at depths exceeding nine feet, and is considered "inaccessible soil" by CTDEP. Inaccessible soil is defined as soil greater than four feet below ground surface, soil greater than two feet below paved surface, or soil beneath an existing

[7] Because the number of samples taken within a specific exposure study area is generally limited, a particular data set could theoretically be statistically evaluated as being both normally and lognormally distributed. Because calculation of the 95% UCL for lognormal distributions using the H-statistic typically provides a more conservative estimate of the RME concentration than the Student-t statistic, the data were assumed to be lognormally distributed. The H-statistic gives an exact 95% UCL for the population mean only if the underlying distribution is lognormal. It should be noted that in order to accurately obtain the H-statistic used in the Land (1975) equation, a cubic interpolation (four-point Lagrangian interpolation) is required. Because the number of data points is generally small, a linear interpolation was assumed to provide a reasonable approximation of the H-statistic.

[8] Appendix A to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

[9] Appendix B to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

building or structure.[10] DEC standards do not apply to inaccessible soil. Therefore, the Pre-Envirite Waste Material was compared to the PMC for Class GB areas.

3.3.2 Soil Gas and Ground Water

CTDEP has developed volatilization criteria for soil gas, which protect against risks associated with the diffusion of soil gas constituents into industrial or residential buildings.[11] The soil gas data collected by GZA (1995) and ENVIRON (1996) were compared to these criteria.

To protect against the potential volatilization of ground water constituents into soil gas, CTDEP has also developed volatilization criteria for ground water.[12] Ground water that discharges to surface water must also meet Surface Water Protection Criteria (SWPC).[13] Because both ground water criteria potentially apply to the on-site ground water, the more stringent of the two was selected for each chemical for comparison. Since the ground water is not currently used for drinking or other domestic purposes, the Ground Water Protection Criteria do not apply.[14]

3.3.3 Surface Water and Sediment

CTDEP has developed Water Quality Criteria (WQC) for both aquatic life and human health criteria.[15] The aquatic life criteria include acute and chronic standards for freshwater and saltwater. The human health criteria include standards for the consumption of water (i.e., for drinking water purposes) and organisms (e.g., fish) and consumption of organisms only. For aquatic life criteria, the chronic standards for freshwater were selected because they are more stringent than the acute standards. The Naugatuck River is classified as a Class B surface water, while Branch Brook is classified as a Class B/A surface water. Designated uses of Class B waters are recreational use, fish and wildlife, fish and wildlife habitat, agricultural and industrial supply, and other legitimate uses (including navigation). Thus, only the consumption of organisms standards are required for human health criteria. Class B/A waters are those that may not be meeting Class A WQC, but have designated Class A criteria as a water quality goal. Designated uses of Class A waters are the same as Class B with the addition of potential drinking water supply. Because Branch Brook is classified as a B/A water, it is required to meet Class A WQC. Thus, the consumption of water and organisms standards apply for human health. The more stringent of the human health and aquatic life criteria were selected for each chemical for comparison.

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[10]Section 22a-133k-1(a)(28) of the Regulations of Connecticut State Agencies.

[11]Appendix F to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

[12]Appendix E to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

[13]Appendix D to Sections 22a-133-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

[14]Appendix C to Sections 22a-133-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

[15]Appendix D of Connecticut=s Surface Water Quality Standards (CTDEP 1997), effective April 8, 1997.

No criteria exist for sediment, so no comparisons were made between the sediment samples and any remediation standards.

A summary of the samples that exceed any potentially applicable Connecticut standards and their locations is presented in Tables III-34 and III-35. Compliance with these standards is determined by (1) comparing the 95% UCL to the standard (Table III-34) and (2) comparing each individual sample to two times the standard (Table III-35).[16] Based on these results, exceedances of the potentially applicable criteria occur for ground water, soil, surface water, and the Pre-Envirite Waste Material. All of the chemicals that were detected in these media either at 95% UCL levels that exceed the standards or in individual samples that exceed two times the standards have been included for evaluation in the PHERE.

3.4 Site Conceptual Model

A conceptual model of the site has been developed based on the field observations and subsurface boring data described in the RFI report (GZA 1995) and additional analyses conducted by ERI (Envirite 1998) and XDD (1999). The conceptual model addresses the geology, hydrology, and fate and transport of chemicals of concern.

3.4.1 Geology and Hydrology of the Site

According to the RFI report (GZA 1995), the dominant geological feature of the site is a bedrock highland that outcrops along the northern end of the site and generally dips to the southwest to a maximum depth on-site of approximately 70 feet. The bedrock is overlain by overburden composed of fine to coarse alluvial sands and gravels ranging in thickness from zero feet near the bedrock outcrop to 60 feet in the south and southeast portions of the site. Gravel and blast debris from the nearby construction of Route 8 have been placed as fill (10 to 20 feet thick) over most of the site. Geologic cross-sections are presented in Figures 2-1 through 2-4 of the RFI report.

The site is bounded on the west by Branch Brook and on the east by the Naugatuck River. These streams merge approximately one half mile south of the site, and both are thought to recharge the unconfined overburden aquifer at least seasonally. The water table is generally located in the upper portion of the overburden or the lower portion of the fill. There does not appear to be any confining or retarding layer separating the bedrock from the overburden, and the bedrock is thought to be essentially impermeable with the exception of the weathered zone that may be as much as 5 to 20 feet thick.

The predominant direction of flow over the site in both the overburden and the bedrock appears to be from the north and east (where the aquifer is recharged by the Naugatuck River) to the south-southwest. Based on site-wide water table elevation data for 1993 and 1994, the south-

[16]Sections 22a-133-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

southwest flow direction occurs from late spring (May) through early winter (December). Ground water flow in the overburden aquifer generally flows to the south and southwest. Flow directions in the bedrock are also generally to the south and southwest. Ground water flow in the northern portion of the site is primarily horizontal. There is a downward component of flow in the southern portion of the site in both the overburden and the bedrock. This component is most pronounced along the southwestern boundary, suggesting significant recharge from Branch Brook. The hydraulic conductivity of the bedrock is significantly lower than that of the overburden, in which the average horizontal linear ground water flow velocities are estimated to be 5 to 35 feet per day.

According to XDD (1999), Branch Brook (which is located along the site's western boundary) is a losing stream[17] throughout the entire year, while the Naugatuck River (which runs parallel and proximate to the site's eastern boundary) is a losing stream for the period when the ground water flow direction through the site is south-southwest (i.e., May through December). The 1993-94 data indicate that from mid-winter (January) through early spring (April), a mound in the water table level develops in the northeast corner of the site, which creates an easterly ground water flow in the northern half (upgradient of the former building) of the site. The Naugatuck River experiences high water conditions during the winter (January) and early spring (April), and is a losing stream along three fourths of the site's eastern boundary (running north to south). Consequently, the high water flow conditions in the Naugatuck River mitigate the easterly component of ground water flow across the northern part of the site, ultimately causing ground water to flow south-southeast as it approaches the Naugatuck River, as illustrated in Figure III-13. XDD (1999) indicates that the ground water flow direction along the southern quarter of the site's eastern boundary near the Naugatuck River may range from south-southeast to south-southwest during the January-April time frame as the river becomes slightly gaining.

The RFI report (GZA 1995) indicates that Branch Brook intercepts and communicates with the upper regions of the shallow overburden aquifer, and that the overburden aquifer is recharged by Branch Brook at least seasonally, but does not provide potentiometric head data for locations to the west of Branch Brook. Although the available data are not conclusive, it seems likely that ground water flows off the site to the southwest, then moves downstream in the overburden under Branch Brook. This ground water would eventually discharge to Branch Brook or the Naugatuck River some distance downstream from the site. Flow patterns in the bedrock are more speculative, but may follow a similar pattern. However, insufficient data have been collected to determine whether ground water from the site may migrate under Branch Brook at some depths and times.

[17]Throughout this document, the term "losing stream" is meant to convey the notion that water migrates from the streambed into the aquifer.

3.4.2 Sources and Migration of Chemicals

3.4.2.1 Pre-Envirite Waste Material

According to the RFI report (GZA 1995), the dominant source of organic constituents at the site is believed to be the two below-ground deposits of Pre-Envirite Waste Material (see Figure II-2). As discussed in Chapter 2.3, Pre-Envirite Waste Material has likely been situated on the eastern portion of the site and the adjacent town property since 1947-55. High concentrations of organic compounds were measured in samples collected from the Pre-Envirite Waste Material, for example:

2-Butanone (methyl ethyl ketone)	2,100 mg/kg
Ethylbenzene	3,100 mg/kg
Tetrachloroethylene	3,100 mg/kg
Toluene	15,000 mg/kg
Trichloroethylene	3,300 mg/kg
Xylene	16,000 mg/kg

Based on these high concentrations, potential exposures resulting from exposure to this waste material would be expected to be significant. Potential migration pathways include the following:

- **Ground Water**

  It is likely that waste constituents have leached into the ground water. As described in the RFI report (GZA 1995), the highest concentrations of organic constituents in the ground water were found in monitoring well MW-30 and well cluster MW-31 (GZA 1995). These wells are located immediately downgradient of the Pre-Envirite Waste Material. Organic chemicals of concern have also been detected at lower levels in the deep overburden and bedrock wells at cluster MW-44 (located in the southwest corner of the site). This observation is consistent with the apparent source of these chemicals and the dominant direction of ground water flow, which is to the south and southwest. For example, the concentration of tetrachloroethylene decreases from 330 µg/L in MW-31 to 74 µg/L in MW-44 to 2 µg/L in MW-37 (which is located on the other side of Branch Brook). The concentration of vinyl chloride decreases from 610 µg/L in MW-31 to 66 µg/L in MW-44 to <10 µg/L in MW-37.

  The detection of organic chemicals of concern at low levels in the deep overburden and bedrock wells at cluster MW-37 (which is located west of Branch Brook) indicates that Branch Brook does not always act as a barrier to ground water migration. The available data are not sufficient to determine the importance of this potential migration pathway. There is reason, however, to believe that the low levels of chemicals of concern found to date on the western side of Branch Brook will not increase. The ground water flow rates in the overburden aquifer are quite high (estimated at 5 to 35 feet per day), and the chemicals of concern were apparently released many years ago (the Pre-Envirite Waste Material has apparently been on-site for at least 40 years, and the acid spill occurred in

1983). In light of these facts, it is reasonable to assume that the concentrations of chemicals dissolved in the ground water immediately downgradient of the site have reached or passed their maximum levels.

- **Surface Water**

  Although the available data indicate that Branch Brook recharges the overburden aquifer at some times, the detection of some organic chemicals at low levels in the shallow overburden well at MW-44 suggests that migration to the surface water in this area may occur at some times. The higher concentrations in the deeper wells at MW-44 suggest that chemicals of concern may be transported downstream under Branch Brook and eventually discharged to Branch Brook or the Naugatuck River. This discharge could occur over a considerable distance and would not be likely to result in significant concentrations in surface water. As part of the RFI activities, GZA collected samples of surface water from several locations both upstream and downstream of the site. Only two organic compounds (trichloroethylene and dibutyl phthalate) were detected in more than ten percent of the surface water samples. However, these chemicals were detected in both upstream and downstream surface water samples, and their presence is not considered to be site-related.

- **Ground Water Seeps**

  Based on a review of site diagrams, an outfall is located between the former treatment facility building and the western bank of the Naugatuck River. According to Envirite (2000), the outfall serviced an effluent pipe that formerly was used to convey noncontact cooling water from vacuum pumps. The effluent line consists of a six-inch diameter, vitreous clay pipe leading from the facility to the property boundary, where it connects with an eight-inch diameter, corrugated asphalt metal pipe that terminates at the Naugatuck River. The on-site portions of the pipe are all situated at elevations (333.60 to 334.67 ft MSL) several feet higher than the PEWM (upper bound of PEWM in the area is at elevation 330.58 ft MSL) and ground water (325 ft MSL). Thus, it is unlikely that this outfall serves as a conduit for ground water that may have contacted the PEWM.

- **Air**

  Chemicals present in the Pre-Envirite Waste Material may volatilize into the subsurface soil gas and subsequently into the air.

3.4.2.2 Landfill Treatment Residues (LTR)

Based on the type of waste treatment conducted on-site prior to disposal of treatment residues into the monofill, it is unlikely that the monofill is a significant source of metals. Because the facility generally accepted inorganic liquid wastes for treatment and disposal, it is unlikely that the monofill is a significant source of organic compounds. No polychlorinated biphenyls (PCBs) or pesticides are known to be associated with the wastes deposited in the monofill. In addition, based on a review of soil and ground water data, XDD (1999) concluded that “the water table elevations are consistently two feet or more below the LTR base elevations, based on annual

records of rainfall for the last 64 years." As such, ground water contact with the LTR is not considered as a potential exposure pathway. Issues associated with future leaching of LTR constituents in rainfall into the underlying aquifer will be addressed by Envirite in the future.

3.4.2.3 Other Potential Sources

Two acid spills have occurred on-site, one in 1978 and one in 1983. The areas potentially impacted by these spills are located in the vicinity of soil samples F-1 through F-11 (Figure III-1). These spills, particularly the 1983 spill, are believed to be the primary source of certain metals detected in environmental media (GZA 1995).

The first spill occurred on February 1, 1978 when a tank inside the former storage and treatment building suffered a total failure and caused two other tanks to develop major leaks of hydrochloric and nitric acids. The second spill occurred on January 30, 1983 when the bottom fell out of a tank storing nitric acid. The collapse of the tank bottom damaged the plumbing and valves of some other tanks, causing the contents of several other tanks containing nitric, sulfuric, and hydrochloric acids to spill onto the floor. Table III-36 summarizes the levels of certain metals that were measured in samples collected from the spill areas. Additional details on the spills are provided in the RFI report (GZA 1995).

Potential migration pathways associated with these spills are discussed below:

- **Ground Water**

  According to the RFI report (GZA 1995), concentrations of metals (e.g., copper, nickel, and zinc) are highest in well clusters along the southern boundary of the site (MW-42, MW-43, and MW-44), adjacent to the Thomaston POTW (see Figure III-3). These wells are located immediately downgradient of areas impacted by a 1983 on-site acid spill event. The spill is the likely source of these constituents in the wells since the observed metal constituents and depressed pH are typical of the composition of the material released (see Table III-36), and constituent concentrations are decreasing over time. This observation is also consistent with the apparent source of these chemicals and the dominant direction of ground water flow, which is to the south and southwest.

- **Surface Water**

  Based on samples of surface water collected by GZA from several locations both upstream and downstream of the site, the primary chemical constituents in the surface water are metals. Analyses of surface water samples collected from the Naugatuck River and Branch Brook at locations upstream and downstream of the site are compared in Tables III-37 and III-38. Based on the similarity between the upstream and downstream measurements in the metals detected, the frequency of detection, and the mean concentrations, there does not appear to be any impact from the site on surface water conditions.

- **Air**

  Due to the nonvolatile nature of most metals, migration to air is unlikely to have occurred.

3.5 References

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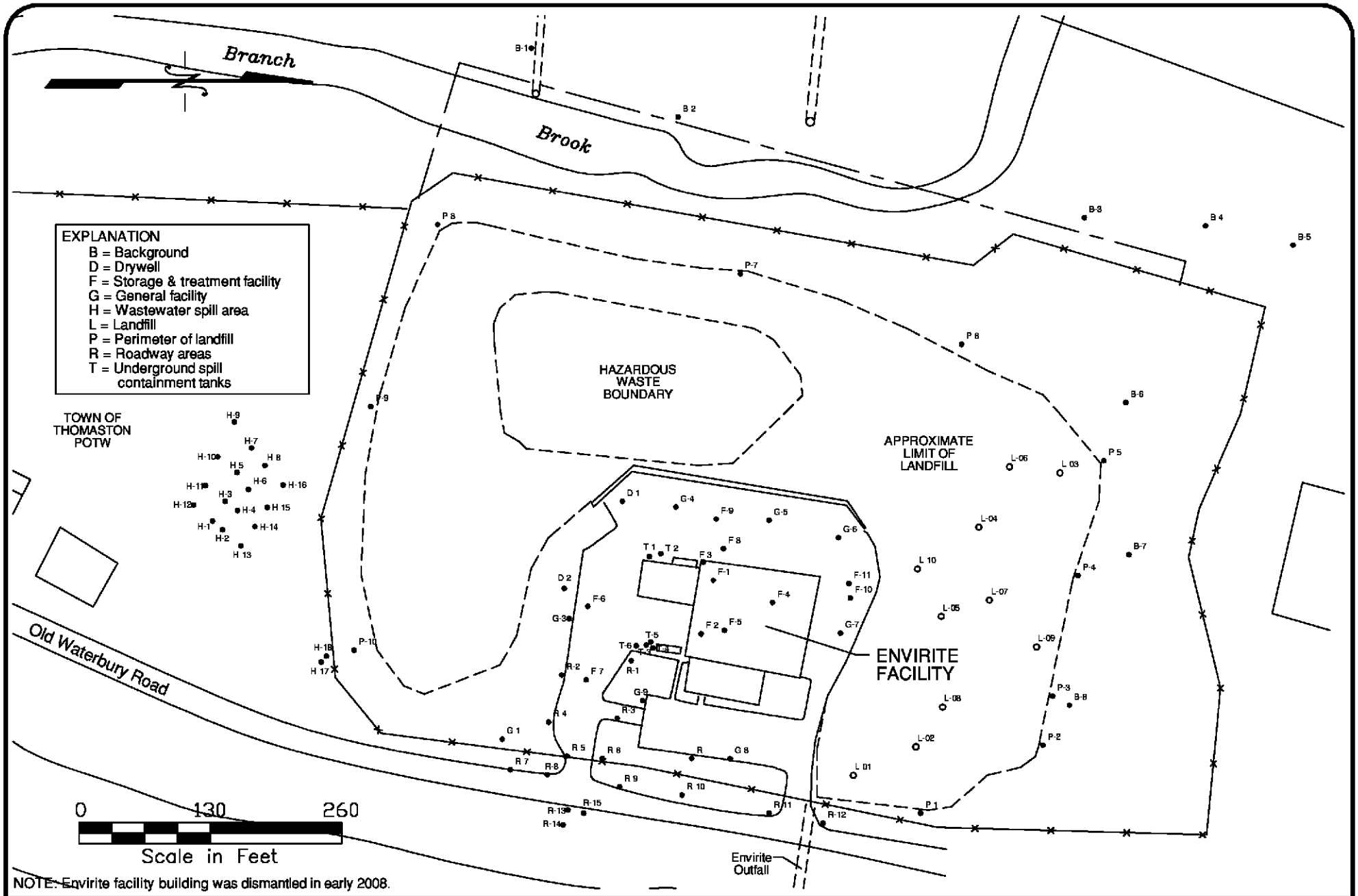

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SOIL SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-1

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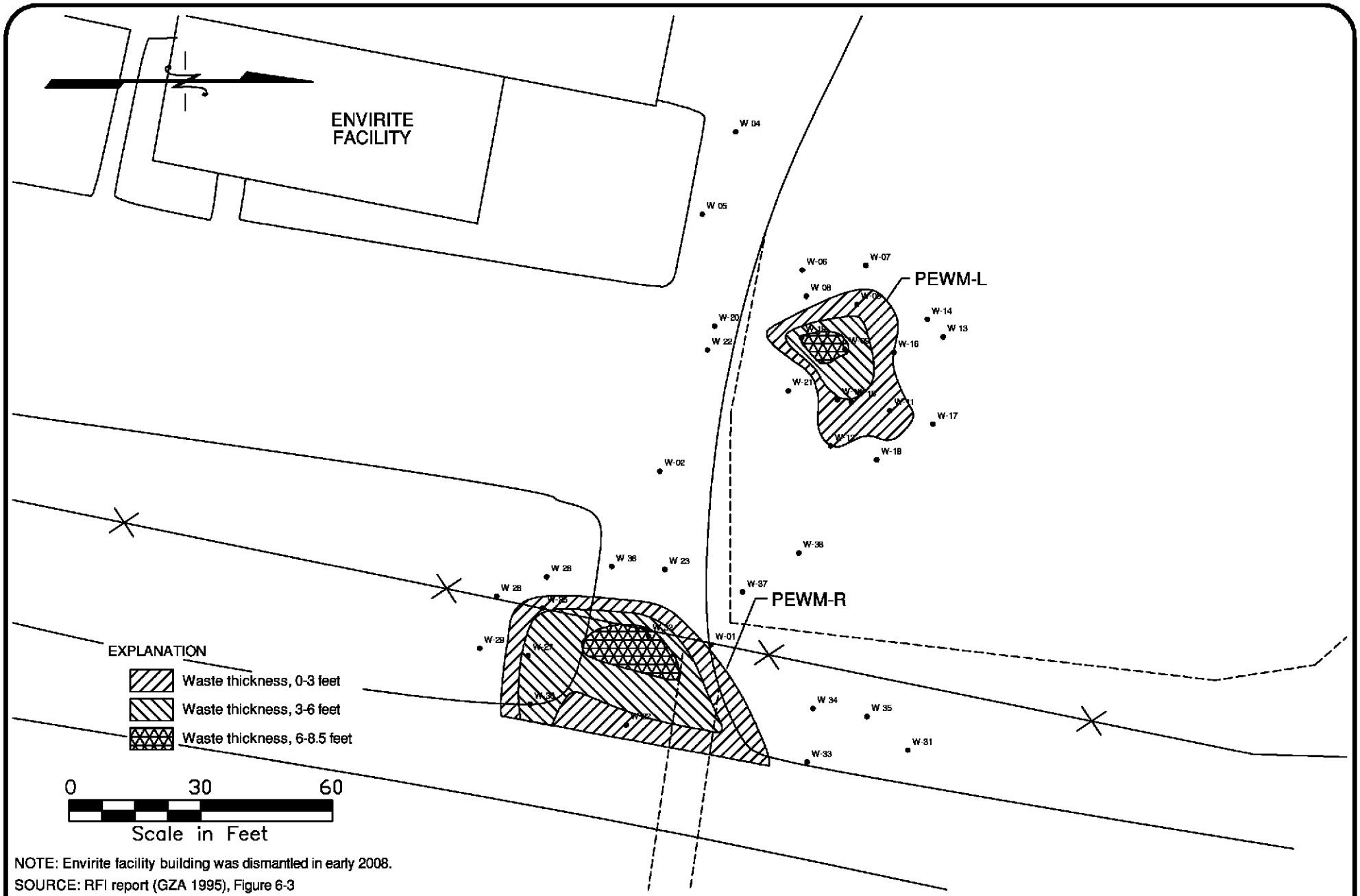

NOTE: Envirite facility building was dismantled in early 2008.

SOURCE: RFI report (GZA 1995), Figure 6-3

ENVIRON

PRE-ENVIRITE WASTE MATERIAL SAMPLING LOCATIONS
AND APPROXIMATE WASTE LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-2

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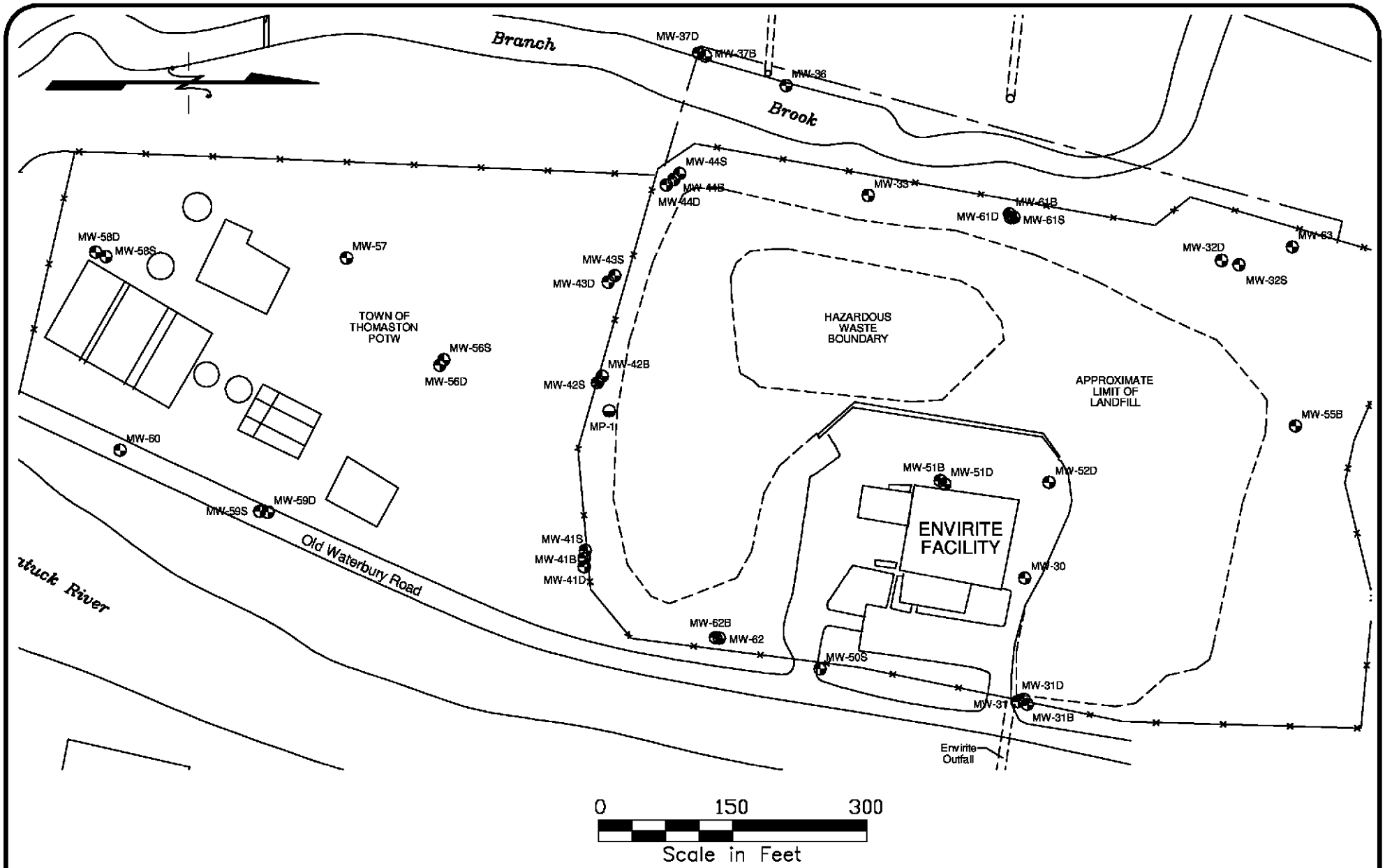

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

GROUND WATER SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-3

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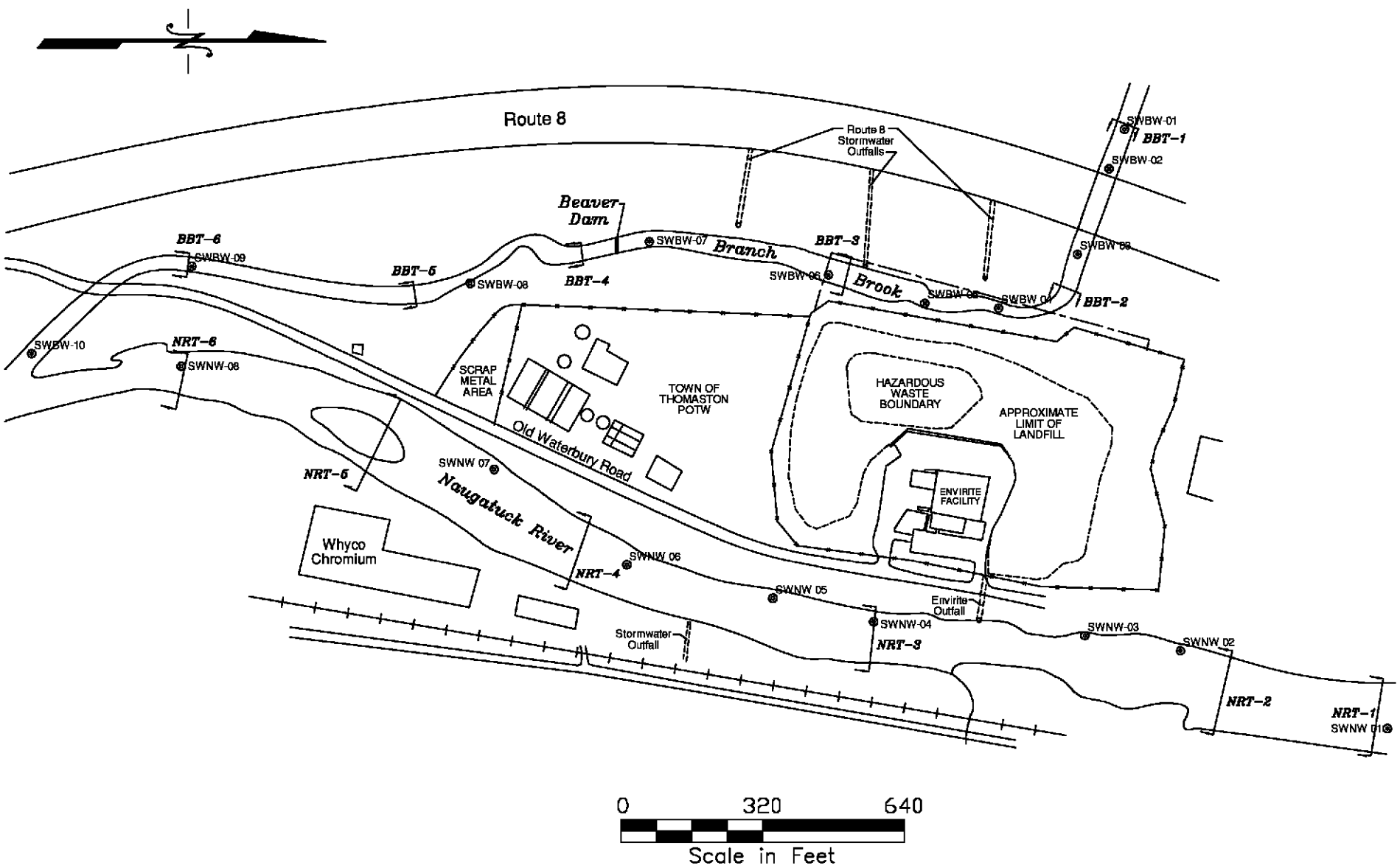

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SURFACE WATER SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-4

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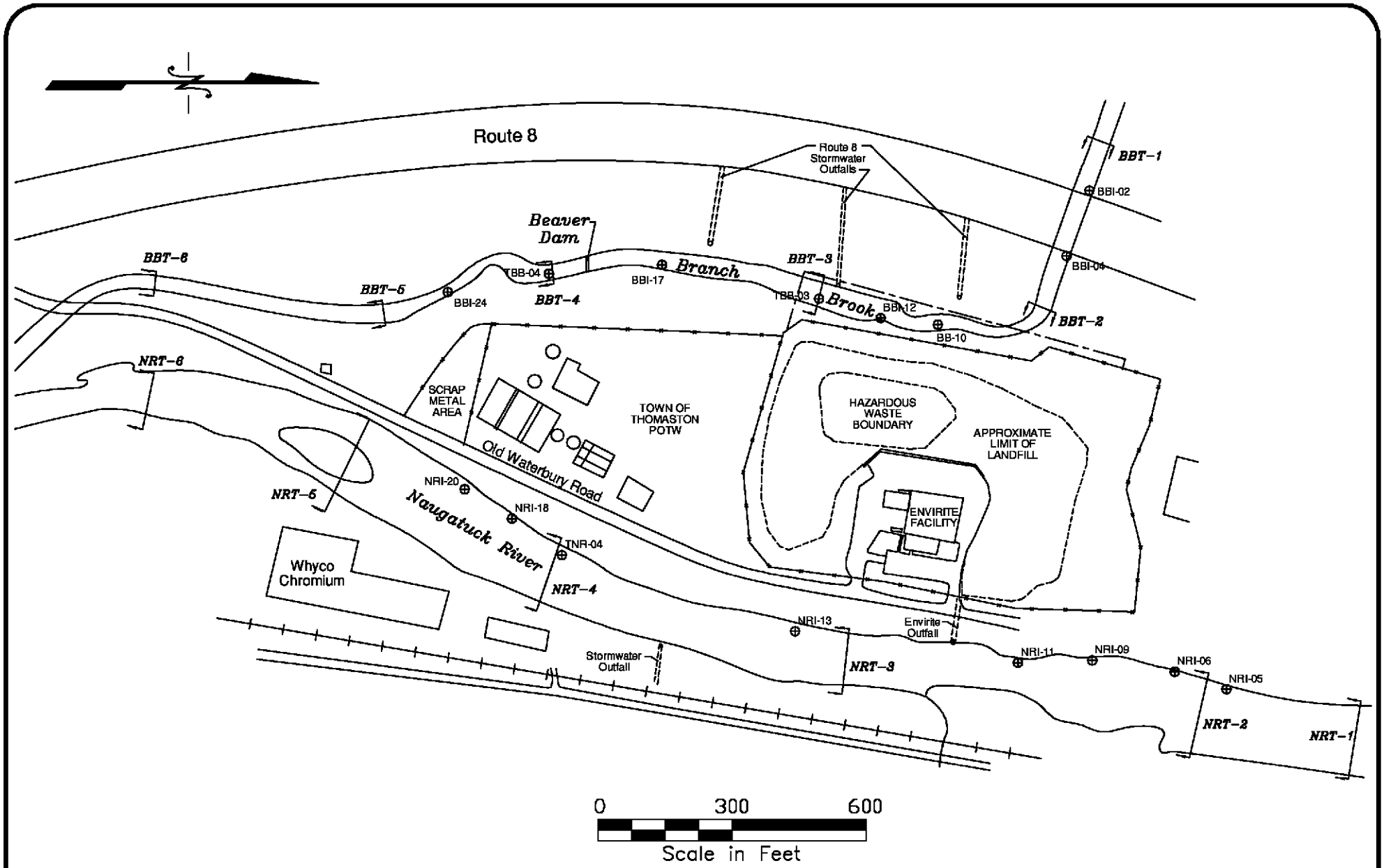
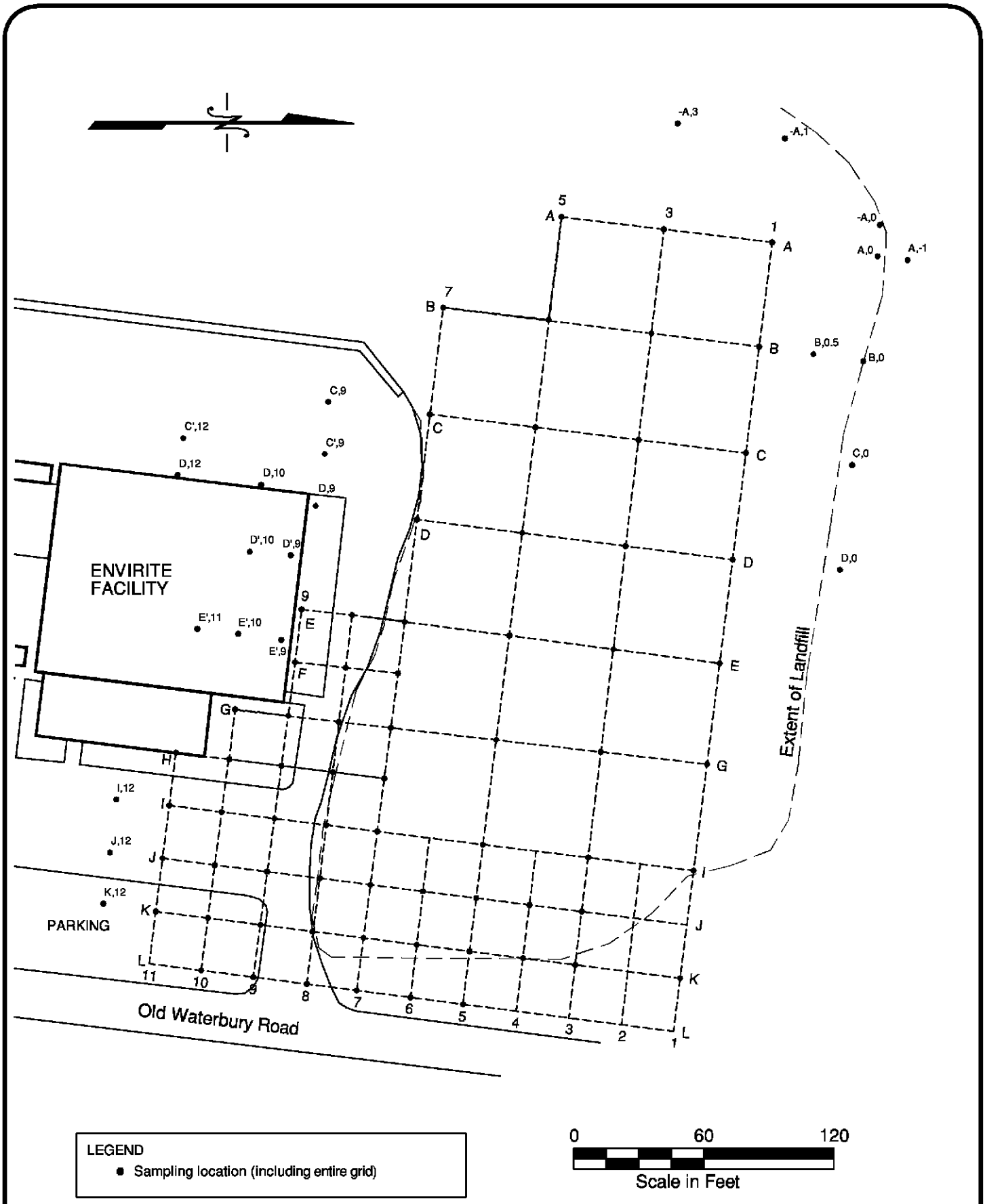


NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SEDIMENT SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-5



NOTE: Envirite facility building was dismantled in early 2008.

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ENVIRON

SOIL GAS SAMPLING LOCATIONS
ENVIRITE CORPORATION
THOMASTON, CONNECTICUT

Figure
III-6

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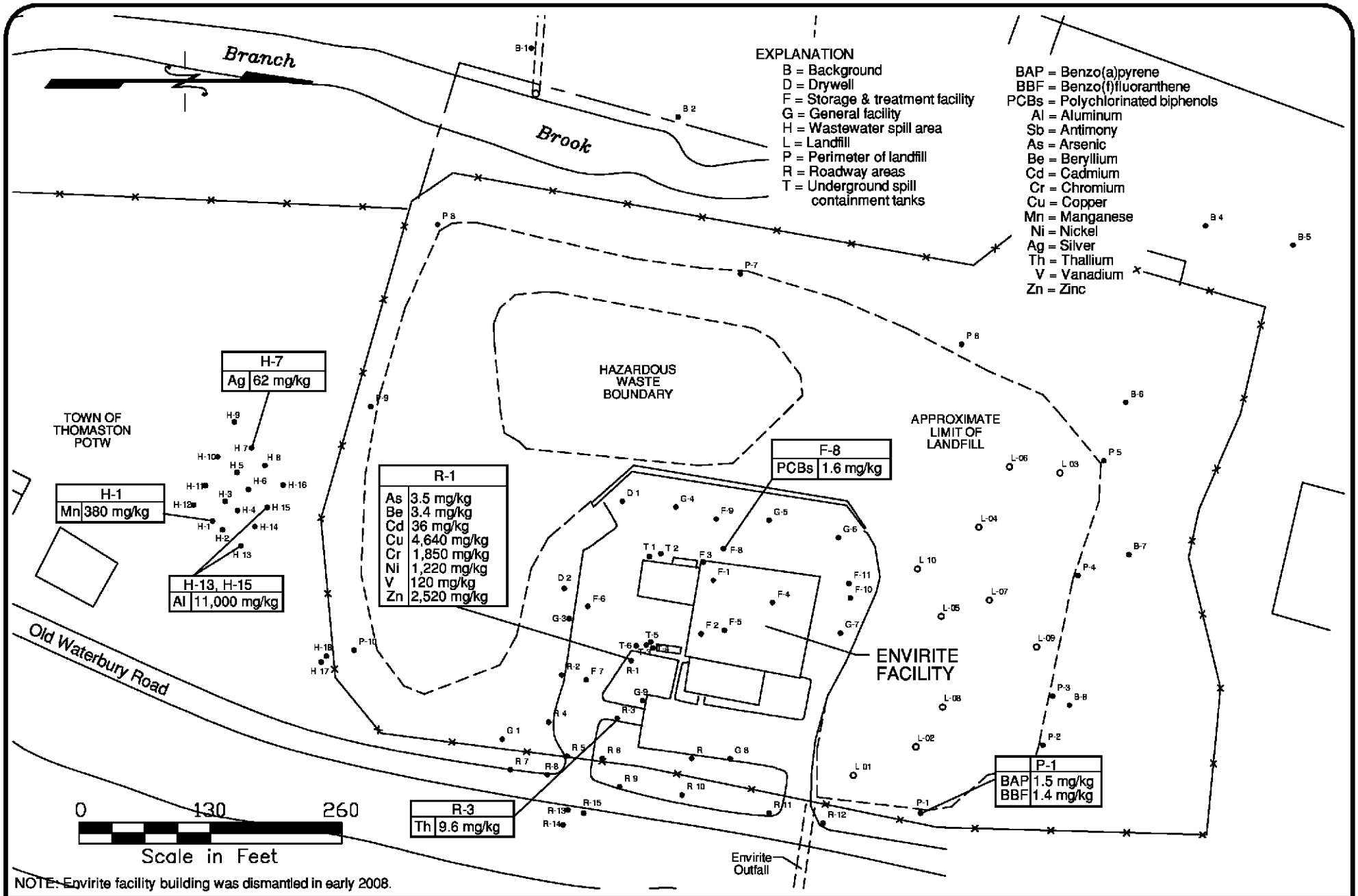

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

MAXIMUM CHEMICAL CONCENTRATIONS DETECTED IN SURFICIAL SOIL
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-7

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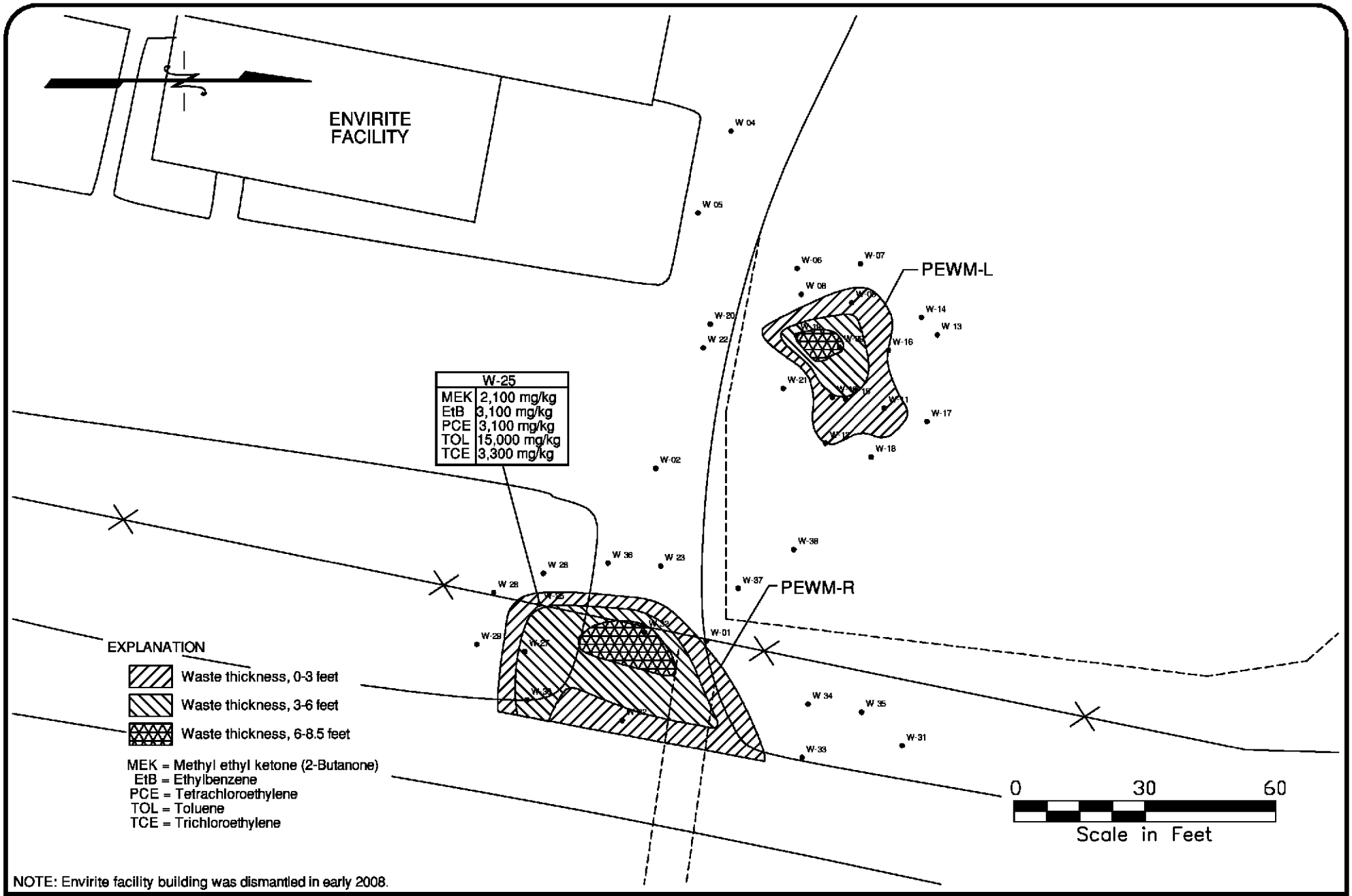

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

MAXIMUM CHEMICAL CONCENTRATIONS DETECTED IN PRE-ENVIRITE WASTE MATERIAL
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure III-8

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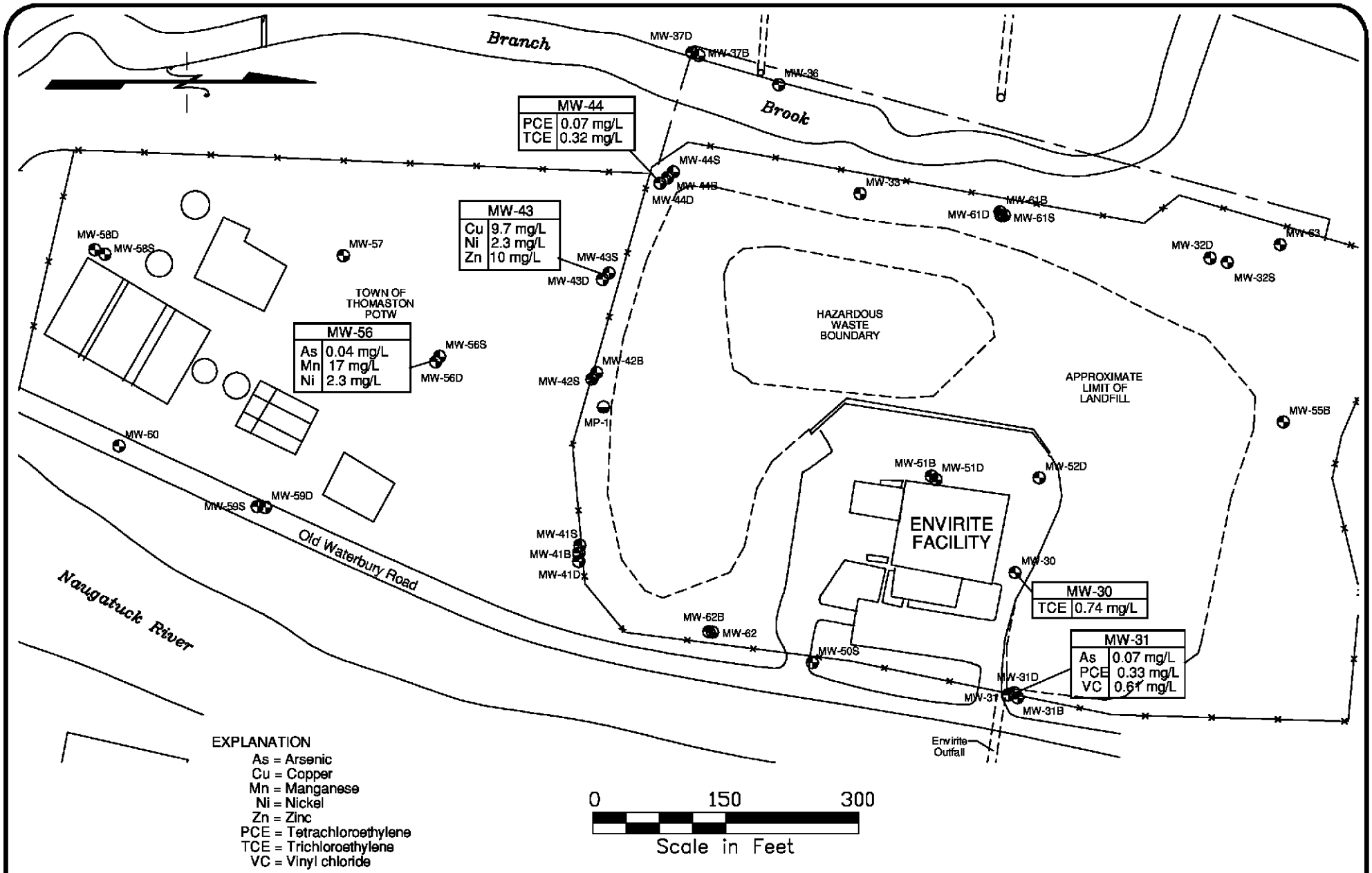

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

MAXIMUM CHEMICAL CONCENTRATIONS DETECTED IN GROUND WATER
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-9

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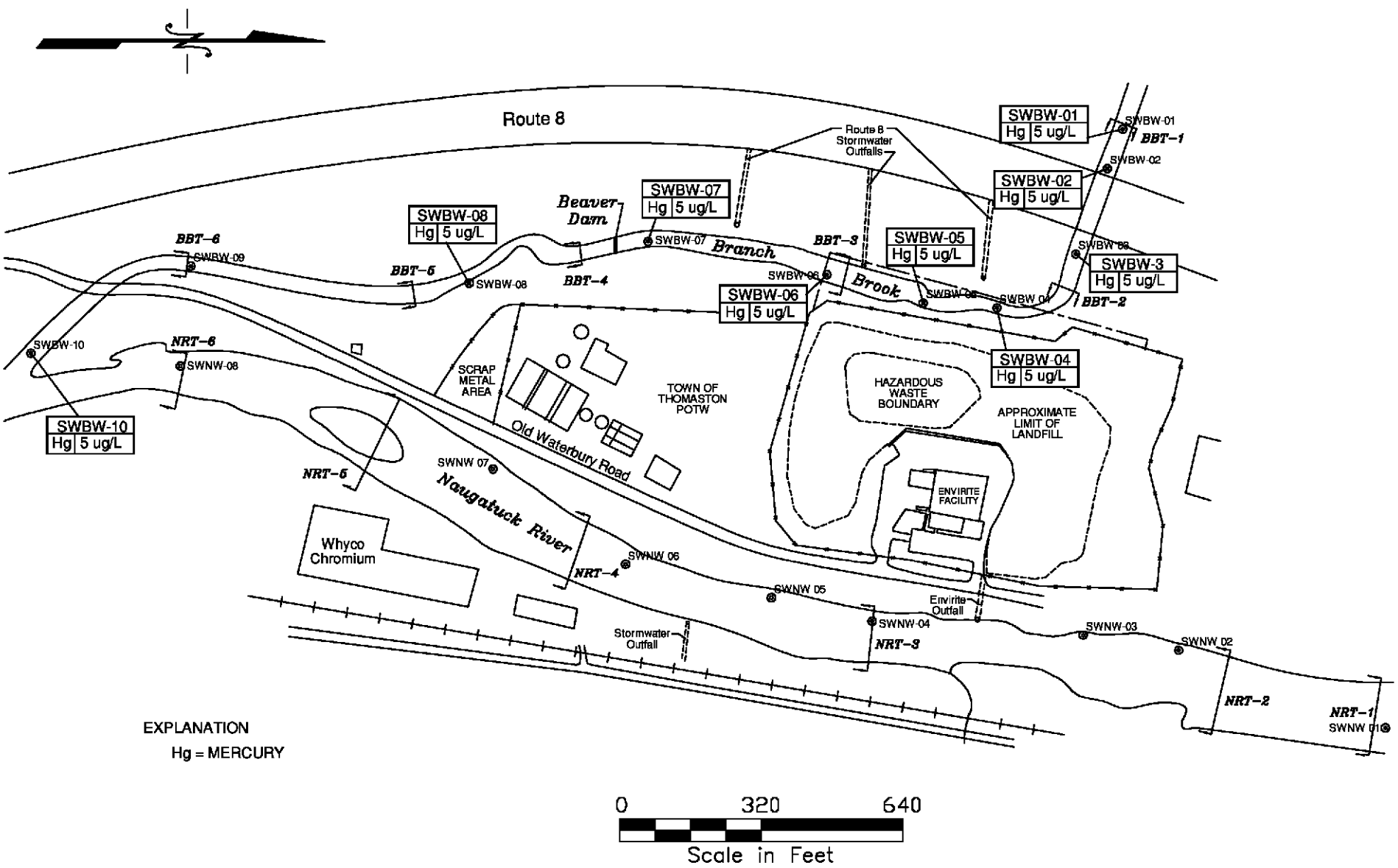

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

MAXIMUM CHEMICAL CONCENTRATIONS DETECTED IN SURFACE WATER
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-10

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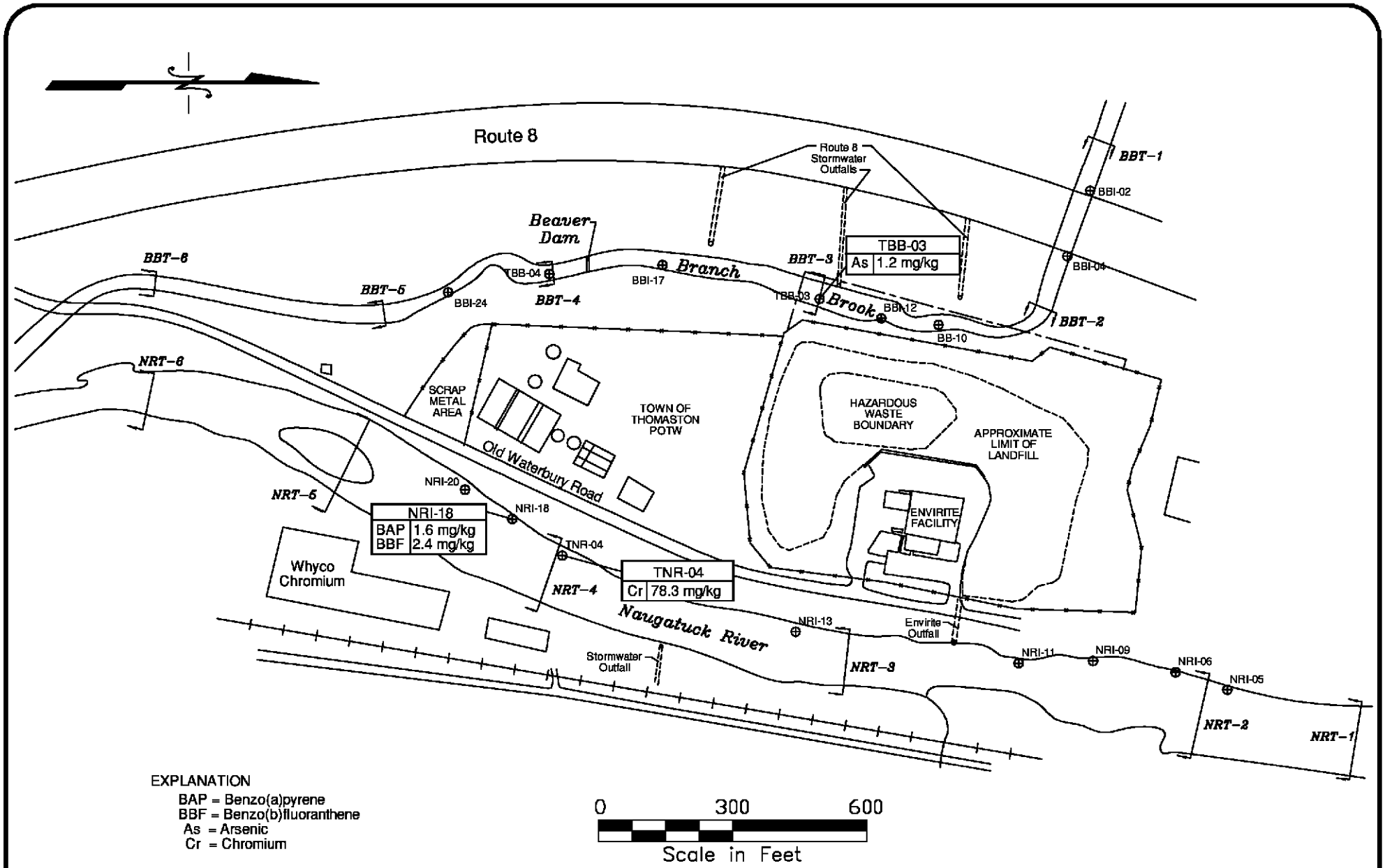


TBB-03	
As	1.2 mg/kg

NRI-18	
BAP	1.6 mg/kg
BBF	2.4 mg/kg

TNR-04	
Cr	78.3 mg/kg

EXPLANATION

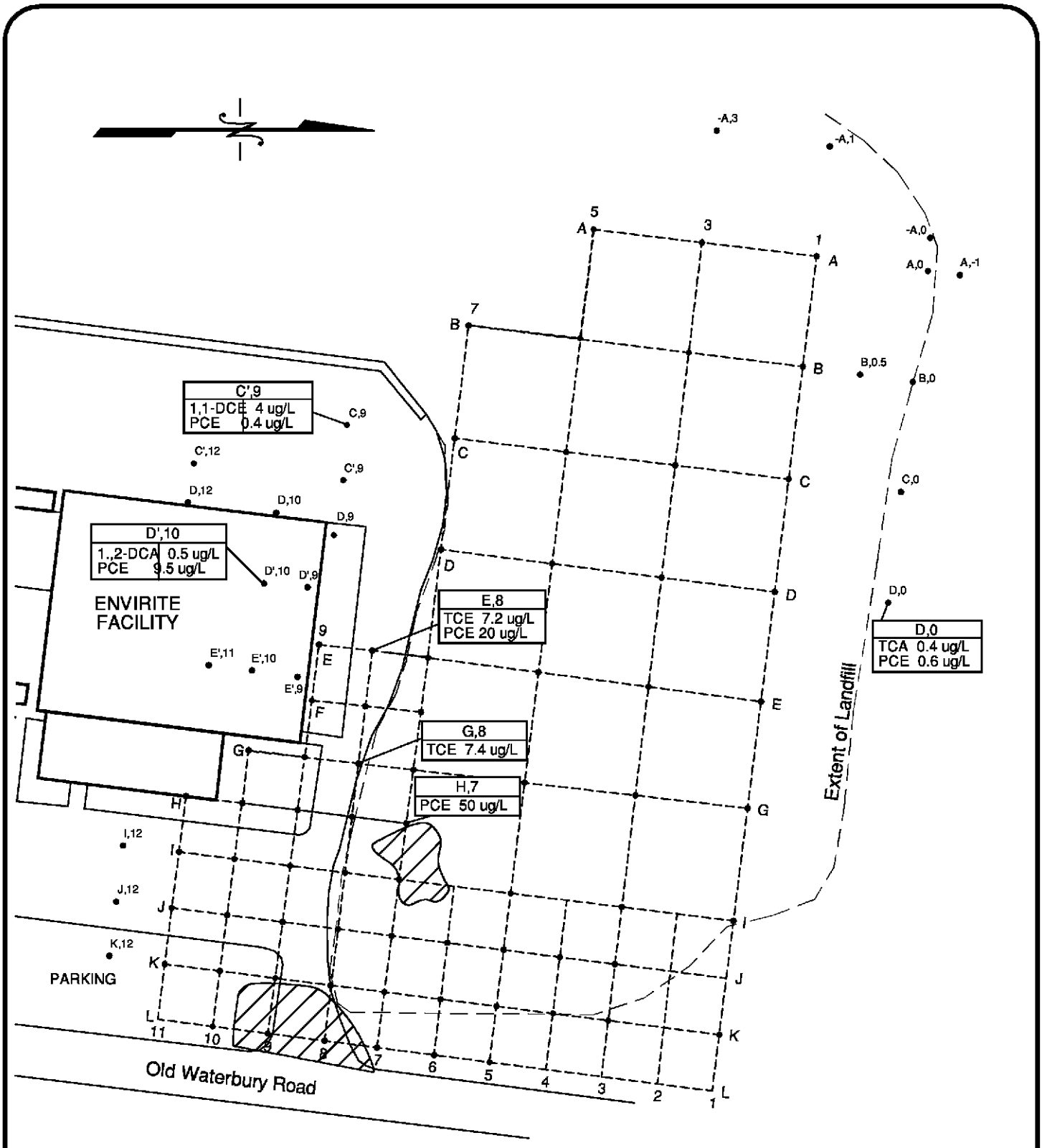
BAP = Benzo(a)pyrene
BBF = Benzo(b)fluoranthene
As = Arsenic
Cr = Chromium

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

MAXIMUM CHEMICAL CONCENTRATIONS DETECTED IN SEDIMENT
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
III-11



EXPLANATION

Pre-Envirite waste material

1,2-DCA = 1,2-Dichloroethane
1,1-DCE = 1,1-Dichloroethylene
PCE = Tetrachloroethylene
TCA = 1,1,1-Trichloroethane
TCE = Trichloroethylene
• Sampling location (including entire grid)

0 60 120
Scale in Feet

NOTE: Envirite facility building was dismantled in early 2008.

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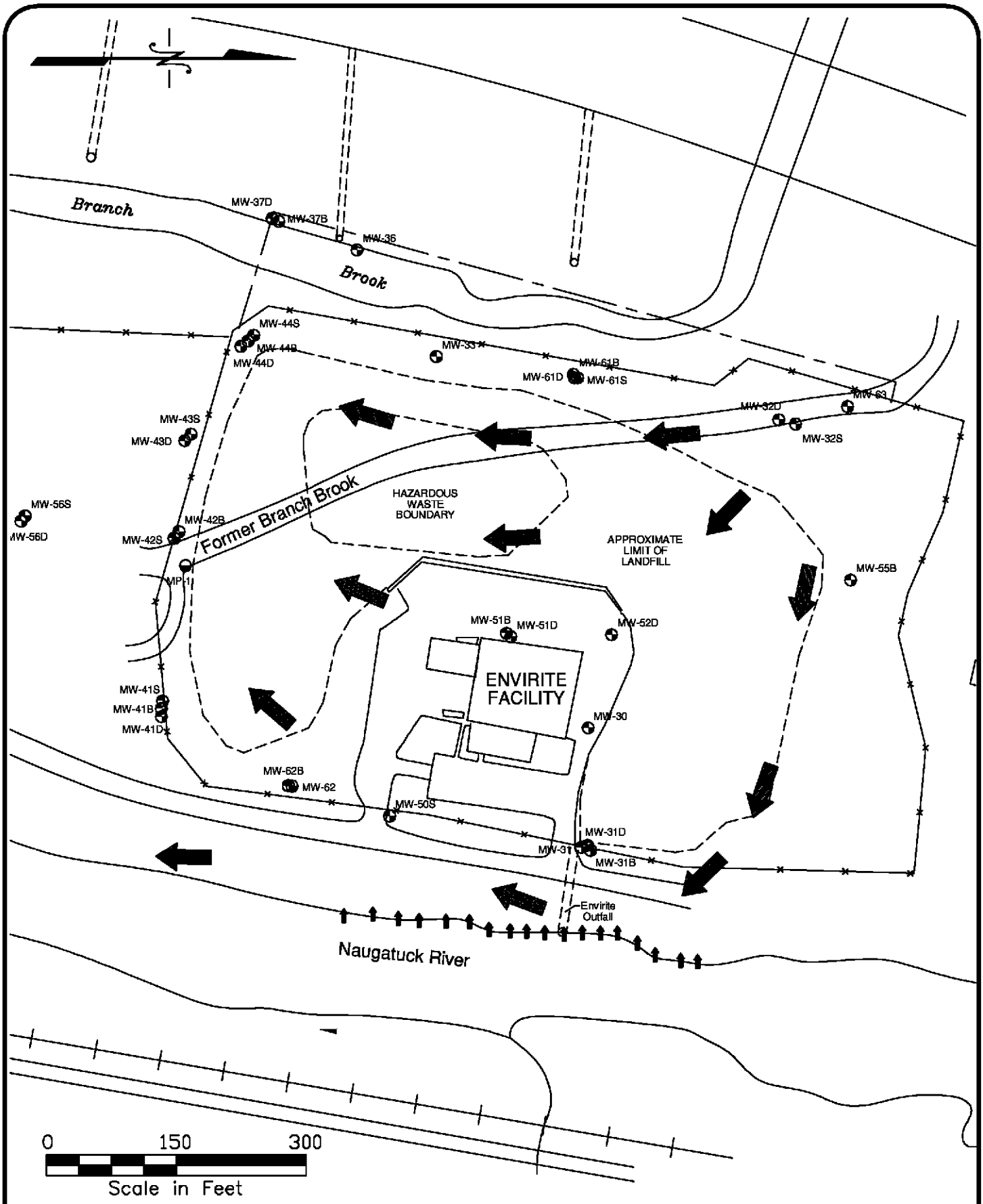
ENVIRON

MAXIMUM CHEMICAL CONCENTRATIONS DETECTED IN SOIL GAS
ENVIRITE CORPORATION
THOMASTON, CONNECTICUT

Figure III-12



NOTE: Envirite facility building was dismantled in early 2008.
SOURCE: XDD (1999)

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ENVIRON

GROUND WATER FLOW CONTOUR FOR APRIL 1994
ENVIRITE CORPORATION
THOMASTON, CONNECTICUT

Figure
III–13

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
Volatile Compounds																
Acetone	10	83	0	51	16	125	2	6	1	40	25	39	0	6		
Acetonitrile	0	1			0	1										
Acetophenone	0	4			0	1										
2-Acetylaminofluorene	0	4			0	1										
Acrolein	0	1			0	1										
Acrylonitrile	0	1			0	1										
Allyl chloride	0	1			0	1										
4-Aminobiphenyl	0	6			0	1										
Aniline	0	6			0	1										
Aramite	0	3														
Benzene	16	96	0	51	3	137	0	19	0	40	0	39	3	6		
Benzidine	0	78			0	1										
Benzyl alcohol	0	4			0	2										
Bromodichloromethane	4	96	1	51	0	137	0	6	0	40	1	39	0	6		
Bromoform	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
Bromomethane	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
4-Bromophenyl phenyl ether	0	81			0	19							0	6		
2-Butanone	3	83	0	51	13	135	4	19	0	40	9	39	1	6		
Carbazole	0	1			3	17							0	6		
Carbon disulfide	1	83	1	51	4	137	0	6	0	40	0	39	0	6		
Carbon tetrachloride	1	96	1	51	1	137	0	19	0	40	0	39	2	4		
2-Chloro-1,3-butadiene	0	1			0	1										
4-Chloroaniline	0	7			0	19							3	6		
Chlorobenzene	1	96	0	51	2	137	0	19	0	40	0	39	1	2		
Chlorobenzilate	0	6			0	1										
Chlorodibromomethane	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
Chloroethane	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
Chloroform	24	96	0	51	7	137	3	19	0	40	25	39	1	2		
Chloromethane	1	96	0	51	1	137	0	6	0	40	0	39	0	6		
4-Chlorophenyl phenyl ether	0	83			0	19							0	6		
m-Cresol	0	6														
Diallate	0	6			0	1										

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
1,2-Dibromo-3-chloropropane	0	1			0	1										
1,2-Dibromoethane	0	1			0	1										
1,4-Dichloro-2-butene	0	1			0	1										
1,3-Dichlorobenzene	0	95			0	19							0	6		
1,4-Dichlorobenzene	0	95			0	19	1	21					0	6		
1,1-Dichloroethane	5	96	0	51	0	137	0	6	0	40	0	39	0	6		
1,2-Dichloroethane	26	96	0	51	1	137	1	19	0	40	0	39	0	6	1	134
1,1-Dichloroethene	13	96	0	51	2	137	0	19	0	40	0	39	1	2	10	134
1,2-Dichloroethylene (cis)	53	83	7	51	25	137	0	6	0	40	1	39	3	6		
1,2-Dichloroethylene (trans)	12	96	0	51	8	137	0	6	0	40	0	39	3	6	0	134
1,2-Dichloropropane	3	95	0	51	0	137	0	6	0	40	0	39	0	6		
1,3-Dichloropropene (cis)	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
1,3-Dichloropropene (trans)	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
Dimethoate	0	6			0	1										
7,12-Dimethylbenz(a)anthracene	0	6			0	1										
alpha,alpha-Dimethylphenethylamine	0	6			0	1										
4,6-Dinitro-2-methylphenol	0	81			0	19							1	3		
m-Dinitrobenzene	0	6			0	1										
2,4-Dinitrotoluene	0	83			0	19	1	21					0	6		
2,6-Dinitrotoluene	0	83			0	19							0	6		
1,4-Dioxane	0	1			0	1										
Diphenylamine	0	6			0	1										
1,2-Diphenylhydrazine	0	78			0	1										
Disulfoton	0	6			0	1										
Ethyl Cyanide	0	4														
Ethyl methacrylate	0	1			0	1										
Ethyl methanesulfonate	0	6			0	1										
Ethylbenzene	4	96	24	51	68	137	1	6	0	40	0	39	5	6		
Famphur	0	6			0	1										
Hexachlorobenzene	0	83			0	19	1	21					0	6		
Hexachloroethane	0	83			0	19	1	21					0	6		
Hexachlorophene	0	6			0	1										
2-Hexanone	1	83	0	51	5	136	0	6	0	40	0	39	0	6		

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
Iodomethane	0	1			0	1										
Isobutanol	0	4														
Isodrin	0	4			0	1										
Isosafrole	0	4			0	1										
Kepone	0	4			0	1										
Methacrylonitrile	0	1			0	1										
Methapyrilene	0	4			0	1										
Methyl Cyanide	0	4														
Methyl methacrylate	0	1			0	1										
Methyl methanesulfonate	0	4			0	1										
4-Methyl-2-pentanone	5	83	5	51	28	136	0	6	0	40	0	39	2	6		
2-Methyl-5-nitroaniline	0	4														
2-Methylaniline	0	4														
3-Methylcholanthrene	0	4			0	1										
Methylene chloride	20	96	2	51	24	137	2	6	1	40	39	39	0	6		
Methylparathion	0	4														
1,4-Naphthoquinone	0	4			0	1										
1-Naphthylamine	0	4			0	1										
2-Naphthylamine	0	4			0	1										
2-Nitroaniline	0	5			0	19							0	6		
4-Nitroaniline	0	5			0	18							0	6		
4-Nitroquinoline 1-oxide	0	4														
2-Picoline	0	4														
Styrene	1	83	6	51	19	137	3	6	0	40	0	39	2	6		
1,1,2,2-Tetrachloroethane	1	96	0	51	0	137	0	6	0	40	0	39	0	6		
Tetrachloroethylene (PCE)	61	96	41	51	82	137	9	19	3	40	2	39	4	6	127	134
2,3,4,6-Tetrachlorophenol	0	4														
Toluene	4	96	35	51	95	136	0	6	0	40	1	39	6	6		
1,1,1-Trichloroethane	19	96	6	51	2	137	0	6	0	40	0	39	0	6	28	134
1,1,2-Trichloroethane	5	96	0	51	0	137	0	6	0	40	0	39	0	6		
Trichloroethene	62	96	28	51	60	137	5	19	17	40	1	39	3	6	28	134
1,3,5-Trinitrobenzene	0	4														
Vinyl acetate	5	82	0	51	0	130	0	6	0	40	0	39	0	1		

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
Vinyl chloride	25	96	0	51	0	137	0	19	0	40	0	39	0	6	0	6
Xylenes (total)	14	83	38	51	89	134	0	6	0	40	0	39	6	6		
Semivolatile Compounds																
Acenaphthene	1	83	10	49	19	116	0	9	0	40	4	38	0	6		
Acenaphthylene	1	83			4	19							1	3		
Anthracene	0	83	33	49	61	116	0	9	0	40	12	38	0	6		
Benz[a]anthracene	1	83			4	19							0	6		
Benzo(g,h,i)perylene	0	83			3	19							0	6		
Benzo[a]pyrene	1	83	40	49	75	116	0	15	0	40	23	38	0	6		
Benzo[b]fluoranthene	1	83	40	49	79	116	0	17	0	40	25	38	1	1		
Benzo[k]fluoranthene	1	83	40	49	79	116	0	18	0	40	25	38	2	3		
Benzoic acid					0	1										
Bis(2-chloro-1-methylethyl)ether	0	6			0	18							1	3		
Bis(2-chloroethoxy)methane	0	83			0	19							0	6		
Bis(2-chloroethyl)ether	0	83			0	19							0	6		
Bis(2-chloroisopropyl)ether	1	78			0	1										
Bis(2-ethylhexyl)phthalate	54	83	6	49	29	110	8	22	1	40	7	38	3	6		
Butylbenzylphthalate	18	83	5	49	11	115	0	9	0	40	3	38	1	6		
4-Chloro-3-methylphenol	2	83			0	18							0	6		
2-Chloroethyl vinyl ether	1	95	0	51	0	120	0	6	0	40	0	39				
2-Chloronaphthalene	0	83			0	18							0	6		
2-Chlorophenol	3	83	1	49	2	116	0	9	0	40	0	38	0	6		
Chrysene	3	83			6	19							0	6		
Di-n-Octyl phthalate	2	83	16	49	43	116	0	9	0	40	0	38	1	1		
Dibenzo(a,h)anthracene	0	83			2	19							0	6		
Dibenzofuran	0	47	11	49	25	116	0	9	0	40	4	38	0	6		
Dibutyl phthalate	50	83	8	49	33	113	0	9	7	40	22	38	3	6		
1,2-Dichlorobenzene	3	95			0	19							0	6		
3,3'-Dichlorobenzidine	0	83			0	19							0	6		
2,4-Dichlorophenol	17	83	1	49	2	116	0	9	0	40	0	38	0	6		
2,6-Dichlorophenol	5	46	1	49	2	98	0	9	0	40	0	38				
Diethylphthalate	4	83	9	49	21	116	0	9	0	40	16	38	0	6		
p-(Dimethylamino)azobenzene	0	6			0	1										

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
Phenacetin	0	4														
Phenanthrene	4	83	44	49	81	116	0	17	0	40	27	38	1	1		
Phenol	1	83			1	17							2	6		
p-Phenylenediamine	0	2														
Phorate	0	2														
Pronamide	0	4														
Pyrene	3	81	44	49	91	116	0	23	0	40	29	38	1	1		
Pyridine	0	4			0	1	1	21								
Safrole	0	4														
1,2,4,5-Tetrachlorobenzene	0	4														
Tetraethyldithiopyrophosphate	0	4														
Thionazin	0	3														
1,2,4-Trichlorobenzene	0	82			0	19							0	6		
Trichlorofluoromethane	0	14														
2,4,5-Trichlorophenol	12	47	1	49	2	116	1	30	0	40	1	38	0	6		
2,4,6-Trichlorophenol	8	83	1	49	2	116	1	30	0	40	0	38	0	6		
1,2,3-Trichloropropane	0	1			0	1										
O,O,O-Triethylphosphorothioate	0	4														
PCBs/Pesticides																
Aldrin	42	83	0	49	1	113	2	44	0	20	4	18	1	2		
Aroclor 1016	0	1			0	16							0	1		
Aroclor 1254	0	4	1	4	10	23			0	4			2	2		
BHC, beta	13	83	0	49	0	113	2	44	0	20	0	18	1	2		
BHC, delta	13	83	1	49	7	112	2	44	0	20	0	18	1	2		
Chlordane	0	43			1	22	1	21			0	1	1	2		
4,4'-DDD	0	43			1	22					0	1	1	2		
4,4'-DDE	12	83	11	48	29	113	2	44	0	20	0	18	1	2		
4,4'-DDT	12	83	32	49	68	114	2	44	0	20	1	18	1	2		
Dieldrin	17	83	2	49	5	114	2	44	0	20	2	18	1	2		
Endosulfan I	12	83	0	49	0	113	2	44	0	20	0	18	1	2		
Endosulfan II	13	83	0	49	0	114	2	44	0	20	0	18	1	2		
Endosulfan sulfate	2	43			0	22					0	1	1	2		
Endrin	0	43			0	22	1	21			0	1	1	2		

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
3,3'-Dimethylbenzidine	2	6			0	1										
2,4-Dimethylphenol	2	83			2	18							0	6		
Dimethylphthalate	1	82			0	19							0	6		
2,4-Dinitrophenol	0	83			0	19							3	6		
Fluoranthene	4	83	41	49	87	116	0	23	0	40	29	38	1	1		
Fluorene	0	83	14	49	31	116	0	9	0	40	14	38	0	6		
Hexachlorobutadiene	0	83			0	19	1	21					0	6		
Hexachlorocyclopentadiene	0	83			0	19							3	6		
Indeno[1,2,3-cd]pyrene	0	83			3	19							0	6		
Isophorone	0	83			2	19							2	6		
Methoxychlor	13	47	3	49	9	113	3	65	0	20	3	18	1	2		
2-Methylnaphthalene	0	46	11	49	26	116	0	9	0	40	0	38	3	3		
4-Methylphenol	0	7			2	19	2	21					0	6		
2-Methylphenol (o-cresol)	0	7			3	19	2	21					0	6		
Naphthalene	9	83	8	49	33	116	0	9	0	40	1	38	5	6		
3-Nitroaniline	0	1			0	18							1	3		
Nitrobenzene	0	82			0	19	1	21					0	6		
2-Nitrophenol	0	83			0	18							1	3		
4-Nitrophenol	1	83			0	18							0	6		
N-Nitroso di-n-propylamine	0	83			0	19							0	6		
N-Nitroso-N-methylethylamine	0	4														
N-Nitrosodi-n-butylamine	0	4														
N-Nitrosodiethylamine	0	4														
N-Nitrosodimethylamine	18	80	2	49	3	99	0	9	0	40	0	38				
N-Nitrosodiphenylamine	2	83	1	49	3	116	0	9	0	40	0	38	0	6		
N-Nitrosomorpholine	0	4														
N-Nitrosopiperidine	0	4														
N-Nitrosopyrrolidine	0	4														
Parathion	0	2														
Pentachlorobenzene	0	4														
Pentachloroethane	0	1			0	1										
Pentachloronitrobenzene	0	4														
Pentachlorophenol	1	83			0	19	1	21					2	6		

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
Endrin aldehyde	11	83	3	49	7	114	2	44	0	20	0	18	1	2		
Endrin ketone	0	7			0	21					0	1	1	2		
HCH (alpha)	1	43			1	22					0	1	1	2		
HCH (gamma) Lindane	12	83	10	49	25	113	3	65	2	20	0	18	1	2		
Heptachlor	13	83	0	49	1	113	3	64	0	20	3	18	1	2		
Heptachlor epoxide	1	43			1	22	1	21			0	1	1	2		
PCBs (total)	18	83	32	49	74	113	2	44	2	20	18	18	6	6		
2,4,5,6-Tetrachloro-m-xylene	16	47			4	4			2	20	18	18				
Toxaphene	0	43			0	21	1	21			0	1	1	2		
Other Parameters																
Cyanide	0	1									0	12	0	2		
Hardness (calculated)									72	72						
pH											34	34				
TOC											55	55				
Inorganic Compounds																
Aluminum			20	21	40	41										
Antimony	1	125	15	66	29	151	0	35	0	60	0	22	4	6		
Arsenic	44	125	45	45	104	110	0	45	0	60	3	22	6	6		
Barium	17	138	45	66	110	151	25	59	0	60	22	22	6	6		
Beryllium	2	125	28	45	62	109	0	35	0	60	0	22	4	6		
Cadmium	21	138	36	66	74	152	12	68	0	60	6	22	5	6		
Chromium	33	138	66	66	143	152	52	101	0	60	22	22	6	6		
Chromium VI and compounds			0	21	0	41										
Cobalt	14	84	45	66	108	150	0	35	0	40	22	22	6	6		
Copper	96	138	66	66	152	152	16	35	2	60	22	22	6	6		
Lead	14	125	63	66	129	152	9	70	0	60	20	22	6	6		
Manganese	124	138	39	39	76	76			30	60						
Mercury	2	125	11	66	23	152	2	54	9	60	0	22	5	6		
Nickel	92	138	66	66	152	152	4	35	0	60	21	22	6	6		
Selenium	0	45	2	24	18	80	0	14	0	20			4	6		
Silver	4	125	36	66	60	152	2	55	0	60	5	22	4	6		
Thallium	0	125	6	45	24	109	0	35	0	60	0	22	4	6		
Tin	0	84	11	66	20	151	0	35	0	40	0	22	3	6		

TABLE III-1
Chemicals Analyzed for in at Least One of the Media

Chemical	Ground Water		Soil (0-1 ft)		Soil (0-15 ft)		Leachate[1]		Surface Water		Sediment		Waste Material[2]		Soil Gas	
	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples	Detects	Samples
Titanium			39	39	76	76										
Vanadium	0	84	38	45	96	110	0	35	0	40	1	22	6	6		
Zinc	136	138	66	66	152	152	34	35	48	60	22	22	6	6		

[1] Leachate was extracted from soil and Pre-Envirite Waste Material samples. Leachate extracted from Pre-Envirite waste soils were analyzed using the toxicity characteristic leaching procedure (TCLP). Leachate extracted from all other soils (including Pre-Envirite Waste Material) were analyzed using the synthetic precipitation leaching procedure (SPLP).

[2] Samples collected from Pre-Envirite waste material.

TABLE III-2

Summary Statistics for Chemicals Detected in On-Site and Downgradient Ground Water Samples (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	10	80	1.00E-02	2.90E-01	2.50E-03	2.40E+00	3.71E-02	3.71E-02	5.00E+01
Benzene	16	93	1.00E-02	1.00E-02	6.00E-04	2.00E-01	7.96E-03	7.21E-03	5.30E-01
Bromodichloromethane	4	93	1.00E-02	2.00E-01	9.00E-04	1.00E-02	5.97E-03	5.86E-03	NA
Bromoform	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	3.80E+00
Bromomethane	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	NA
2-Butanone	3	80	1.00E-02	1.00E-02	1.00E-02	6.90E+00	9.82E-02	1.18E-02	5.00E+01
Carbon disulfide	1	80	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.25E-03	5.95E-03	NA
Carbon tetrachloride	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	4.00E-02
Chlorobenzene	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	6.15E+00
Chlorodibromomethane	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	6.08E-03	1.02E+00
Chloroethane	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	NA
Chloroform	24	93	1.00E-02	2.00E-01	6.00E-04	3.90E-02	7.03E-03	7.22E-03	7.10E-01
Chloromethane	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	NA
1,1-Dichloroethane	5	93	1.00E-02	2.00E-01	6.00E-04	1.00E-02	5.89E-03	6.01E-03	5.00E+01
1,2-Dichloroethane	26	93	1.00E-02	2.00E-01	6.00E-04	3.00E-01	9.67E-03	8.25E-03	9.00E-02
1,1-Dichloroethene	13	93	1.00E-02	2.00E-01	4.00E-04	1.00E-02	5.87E-03	6.04E-03	6.00E-03
1,2-Dichloroethylene (cis)	52	80	1.00E-02	1.00E-02	7.00E-04	2.40E+00	1.62E-01	2.89E-01	NA
1,2-Dichloroethylene (trans)	12	93	1.00E-02	2.00E-01	8.00E-04	2.95E-01	9.76E-03	7.67E-03	NA
1,2-Dichloropropane	3	92	1.00E-02	2.00E-01	9.00E-04	1.00E-02	6.00E-03	5.88E-03	6.00E-02
1,3-Dichloropropene (cis)	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	6.08E-03	3.40E+01
1,3-Dichloropropene (trans)	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	6.08E-03	3.40E+01
Ethylbenzene	4	93	1.00E-02	1.00E-02	1.00E-02	4.90E+00	8.80E-02	1.44E-02	5.00E+01
2-Hexanone	1	80	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.25E-03	5.95E-03	NA
4-Methyl-2-pentanone	5	80	1.00E-02	1.00E-02	1.00E-03	1.80E+01	2.80E-01	1.68E-02	NA
Methylene chloride	19	93	1.00E-02	2.00E-01	5.00E-04	4.60E-02	6.35E-03	6.35E-03	4.80E+01
Styrene	1	80	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.25E-03	5.95E-03	2.06E+00
1,1,2,2-Tetrachloroethane	1	93	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.08E-03	5.80E-03	1.00E-01
Tetrachloroethylene (PCE)	60	93	1.00E-02	1.00E-02	6.70E-04	3.30E-01	2.72E-02	3.60E-02	3.82E+00
Toluene	4	93	1.00E-02	1.00E-02	1.00E-02	2.00E+01	3.19E-01	2.12E-02	5.00E+01
1,1,1-Trichloroethane	19	93	1.00E-02	2.00E-01	6.00E-04	2.30E-02	6.12E-03	6.52E-03	5.00E+01
1,1,2-Trichloroethane	5	93	1.00E-02	2.00E-01	6.00E-04	2.50E-02	6.37E-03	6.37E-03	1.26E+00

TABLE III-2

Summary Statistics for Chemicals Detected in On-Site and Downgradient Ground Water Samples (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Trichloroethene	61	93	1.00E-02	1.00E-02	3.00E-04	7.40E-01	5.47E-02	8.57E-02	5.40E-01
Vinyl acetate	5	79	1.00E-02	2.00E-01	8.00E-04	2.30E-02	6.52E-03	6.40E-03	NA
Vinyl chloride	25	93	1.00E-02	1.00E-02	1.90E-03	6.10E-01	2.96E-02	2.30E-02	2.00E-03
Xylenes (total)	14	80	1.00E-02	1.00E-02	7.00E-04	5.00E+00	9.31E-02	1.52E-02	5.00E+01
Semivolatile Compounds									
Acenaphthene	1	80	1.00E-02	1.00E-02	1.80E-01	1.80E-01	7.19E-03	6.15E-03	NA
Acenaphthylene	1	80	1.00E-02	1.00E-02	2.00E-04	2.00E-04	4.94E-03	2.00E-04	3.00E-04
Benz[a]anthracene	1	80	1.00E-02	1.00E-02	5.00E-04	5.00E-04	4.94E-03	5.00E-04	NA
Benzo[a]pyrene	1	80	1.00E-02	1.00E-02	6.00E-04	6.00E-04	4.95E-03	6.00E-04	3.00E-04
Benzo[b]fluoranthene	1	80	1.00E-02	1.00E-02	6.00E-04	6.00E-04	4.95E-03	6.00E-04	3.00E-04
Benzo[k]fluoranthene	1	80	1.00E-02	1.00E-02	6.00E-04	6.00E-04	4.95E-03	6.00E-04	3.00E-04
Bis(2-chloroisopropyl)ether	1	75	1.00E-02	1.00E-02	6.10E-03	6.10E-03	5.01E-03	5.01E-03	3.40E+03
Bis(2-ethylhexyl)phthalate	52	80	1.30E-03	1.00E-02	3.00E-04	2.30E-01	1.77E-02	1.77E-02	5.90E-02
Butylbenzylphthalate	16	80	1.00E-02	1.00E-02	5.00E-04	2.00E-02	4.82E-03	5.65E-03	NA
4-Chloro-3-methylphenol	2	80	1.00E-02	2.00E-02	4.00E-03	4.30E-03	9.79E-03	4.30E-03	NA
2-Chloroethyl vinyl ether	1	92	1.00E-02	2.00E-01	1.00E-02	1.00E-02	6.09E-03	5.81E-03	NA
2-Chlorophenol	3	80	1.00E-02	1.00E-02	3.00E-04	1.20E-03	4.84E-03	1.20E-03	NA
Chrysene	2	80	1.00E-02	2.00E-02	7.00E-04	1.60E-03	4.97E-03	1.60E-03	NA
Di-n-Octyl phthalate	2	80	1.00E-02	1.00E-02	9.00E-04	1.90E-03	4.91E-03	1.90E-03	NA
Dibutyl phthalate	48	80	1.00E-02	1.00E-02	4.00E-04	3.10E-02	3.39E-03	3.39E-03	1.20E+02
1,2-Dichlorobenzene	3	92	1.00E-02	1.00E-02	1.00E-04	2.40E-03	4.87E-03	2.40E-03	5.00E+01
2,4-Dichlorophenol	17	80	1.00E-02	1.00E-02	1.20E-03	1.40E+00	5.08E-02	5.08E-02	1.58E+01
2,6-Dichlorophenol	5	44	1.00E-02	1.00E-02	1.90E-03	4.30E-02	6.11E-03	6.51E-03	NA
Diethylphthalate	3	80	1.00E-02	1.00E-02	1.30E-03	4.10E-03	4.90E-03	4.10E-03	NA
3,3'-Dimethylbenzidine	2	6	1.00E-02	1.00E-02	1.30E-03	1.30E-03	3.77E-03	1.30E-03	NA
2,4-Dimethylphenol	2	80	1.00E-02	1.00E-02	5.90E-02	6.60E-02	6.44E-03	6.24E-03	NA
Dimethylphthalate	1	79	1.00E-02	1.00E-02	5.90E-03	5.90E-03	5.01E-03	5.03E-03	NA
Fluoranthene	3	80	1.00E-02	1.00E-02	5.00E-04	3.60E-03	4.88E-03	3.60E-03	3.70E+00
Methoxychlor	13	45	1.50E-05	1.60E-03	5.50E-05	1.10E-03	2.54E-04	4.37E-04	NA
Naphthalene	9	80	1.00E-02	1.00E-02	1.00E-04	4.40E-02	5.58E-03	7.25E-03	NA
4-Nitrophenol	1	80	1.00E-02	5.00E-02	8.00E-04	8.00E-04	2.43E-02	8.00E-04	NA
N-Nitrosodimethylamine	17	77	1.00E-02	1.00E-02	6.00E-04	2.80E-02	5.72E-03	6.45E-03	NA
N-Nitrosodiphenylamine	2	80	1.00E-02	1.00E-02	6.00E-04	1.00E-02	5.01E-03	5.32E-03	NA

TABLE III-2

Summary Statistics for Chemicals Detected in On-Site and Downgradient Ground Water Samples (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Pentachlorophenol	1	80	2.50E-02	5.00E-02	1.00E-03	1.00E-03	2.45E-02	1.00E-03	NA
Phenanthrene	3	80	1.00E-02	1.00E-02	2.00E-04	2.50E-03	4.86E-03	2.50E-03	7.70E-05
Phenol	1	80	1.00E-02	2.00E-02	2.50E-02	2.50E-02	5.31E-03	5.31E-03	9.20E+04
Pyrene	2	78	1.00E-02	1.00E-02	3.00E-04	1.10E-03	4.89E-03	1.10E-03	1.10E+02
2,4,5-Trichlorophenol	12	45	1.00E-02	1.00E-02	5.00E-03	1.70E-01	1.54E-02	1.53E-02	NA
2,4,6-Trichlorophenol	8	80	1.00E-02	1.00E-02	6.00E-04	1.83E-01	6.98E-03	6.44E-03	NA
PCBs/Pesticides									
Aldrin	40	80	5.00E-05	1.00E-02	5.50E-06	2.00E-03	2.27E-03	2.00E-03	NA
BHC, beta	13	80	5.00E-05	1.00E-02	1.70E-05	4.30E-04	2.21E-03	4.30E-04	NA
BHC, delta	12	80	5.50E-06	1.00E-02	2.70E-05	7.80E-05	2.21E-03	7.80E-05	NA
4,4'-DDE	12	80	2.80E-05	1.00E-02	8.50E-06	1.90E-04	2.22E-03	1.90E-04	NA
4,4'-DDT	12	80	8.00E-06	1.00E-02	7.50E-06	1.00E-04	2.22E-03	1.00E-04	NA
Dieldrin	17	80	7.00E-06	1.00E-02	9.00E-06	1.30E-03	2.23E-03	1.30E-03	1.00E-04
Endosulfan I	12	80	9.00E-06	1.00E-02	8.00E-06	5.00E-05	2.20E-03	5.00E-05	NA
Endosulfan II	12	80	2.10E-05	1.00E-02	1.60E-05	7.00E-04	2.23E-03	7.00E-04	NA
Endosulfan sulfate	2	42	1.00E-04	1.00E-02	7.30E-05	7.90E-05	4.41E-03	7.90E-05	NA
Endrin aldehyde	11	80	1.20E-05	1.00E-02	1.00E-04	2.00E-04	2.22E-03	2.00E-04	NA
HCH (alpha)	1	42	5.00E-05	1.00E-02	1.30E-05	1.30E-05	4.41E-03	1.30E-05	NA
HCH (gamma) Lindane	12	80	4.00E-06	1.00E-02	4.00E-06	1.00E-04	2.20E-03	1.00E-04	NA
Heptachlor	13	80	3.50E-06	1.00E-02	3.00E-05	9.90E-04	2.23E-03	9.90E-04	5.00E-05
Heptachlor epoxide	1	42	1.40E-05	1.00E-02	2.00E-05	2.00E-05	4.41E-03	2.00E-05	5.00E-05
PCBs (total)	18	80	1.80E-05	2.50E-01	1.10E-04	4.81E-03	3.85E-01	4.81E-03	5.00E-04
2,4,5,6-Tetrachloro-m-xylene	16	45	1.10E-04	3.30E-04	5.30E-05	2.60E-04	1.35E-04	1.54E-04	NA
Inorganic Compounds									
Arsenic	33	79	5.00E-03	5.00E-02	1.70E-03	6.50E-02	9.66E-03	9.66E-03	4.00E-03
Barium	14	92	5.00E-01	5.00E-01	7.22E-02	2.00E+00	3.85E-01	4.02E-01	NA
Beryllium	1	79	1.00E-03	2.00E-02	4.00E-02	4.00E-02	1.03E-02	1.03E-02	4.00E-03
Cadmium	15	92	1.00E-02	1.00E-02	6.10E-03	1.10E-01	9.19E-03	9.19E-03	6.00E-03
Calcium	78	79	1.00E-01	1.00E-01	6.00E-01	4.80E+02	1.24E+02	2.83E+02	NA
Chromium	30	92	1.00E-02	4.00E-02	4.00E-02	6.00E-01	8.11E-02	8.11E-02	1.10E-01
Cobalt	10	42	1.00E-02	1.00E-01	1.00E-01	2.40E-01	7.92E-02	9.87E-02	NA
Copper	77	92	2.00E-02	1.10E-01	2.00E-02	9.70E+00	4.23E-01	4.23E-01	4.80E-02
Iron	84	92	3.00E-02	4.40E+01	5.00E-02	5.30E+02	4.70E+01	5.30E+02	NA

TABLE III-2

Summary Statistics for Chemicals Detected in On-Site and Downgradient Ground Water Samples (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Lead	13	79	2.00E-03	6.00E-02	6.00E-02	3.00E-01	4.86E-02	4.86E-02	1.30E-02
Magnesium	79	79			2.90E-01	6.90E+02	9.23E+01	1.88E+02	NA
Manganese	90	92	2.00E-02	2.00E-02	2.00E-02	2.00E+01	3.29E+00	1.07E+01	NA
Mercury	2	79	2.00E-04	5.00E-02	1.40E-03	2.20E+00	2.90E-02	2.90E-02	4.00E-04
Nickel	68	92	3.00E-02	3.00E-02	3.00E-02	2.30E+00	2.52E-01	2.52E-01	8.80E-01
Potassium	79	79			3.50E+00	6.40E+01	1.75E+01	2.13E+01	NA
Silver	4	79	3.00E-03	3.00E-01	3.00E-02	5.00E-02	1.76E-02	1.76E-02	1.20E-02
Sodium	92	92			9.40E+00	9.70E+02	1.78E+02	2.41E+02	NA
Zinc	91	92	4.00E-01	4.00E-01	1.90E-02	1.00E+01	8.27E-01	8.27E-01	1.23E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Surface Water Protection Criteria for Ground Water' and the 'Volatilization Criteria for Ground Water' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-3

Summary Statistics for Chemicals Detected in Background Ground Water Samples* (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
1,2-Dichloroethylene (cis)	1	3	1.00E-02	1.00E-02	4.00E-03	4.00E-03	4.67E-03	4.00E-03	NA
Methylene chloride	1	3	1.00E-02	1.00E-02	3.30E-03	3.30E-03	4.43E-03	3.30E-03	4.80E+01
Tetrachloroethylene (PCE)	1	3	1.00E-02	1.00E-02	2.00E-03	2.00E-03	4.00E-03	2.00E-03	3.82E+00
Trichloroethene	1	3	1.00E-02	1.00E-02	2.30E-03	2.30E-03	4.10E-03	2.30E-03	5.40E-01
Semivolatile Compounds									
Bis(2-ethylhexyl)phthalate	2	3	1.00E-02	1.00E-02	1.20E-02	2.50E-02	1.40E-02	1.40E-02	5.90E-02
Butylbenzylphthalate	2	3	1.00E-02	1.00E-02	5.00E-04	2.70E-03	2.73E-03	2.70E-03	NA
Chrysene	1	3	1.00E-02	1.00E-02	4.00E-04	4.00E-04	3.47E-03	4.00E-04	NA
Dibutyl phthalate	2	3	1.00E-02	1.00E-02	5.00E-04	1.60E-03	2.37E-03	1.60E-03	1.20E+02
Diethylphthalate	1	3	1.00E-02	1.00E-02	1.00E-04	1.00E-04	3.37E-03	1.00E-04	NA
Fluoranthene	1	3	1.00E-02	1.00E-02	7.00E-04	7.00E-04	3.57E-03	7.00E-04	3.70E+00
N-Nitrosodimethylamine	1	3	1.00E-02	1.00E-02	4.00E-04	4.00E-04	3.47E-03	4.00E-04	NA
Phenanthrene	1	3	1.00E-02	1.00E-02	3.00E-04	3.00E-04	3.43E-03	3.00E-04	7.70E-05
Pyrene	1	3	1.00E-02	1.00E-02	5.00E-04	5.00E-04	3.50E-03	5.00E-04	1.10E+02
PCBs/Pesticides									
Aldrin	2	3	1.00E-02	1.00E-02	5.00E-05	5.00E-05	1.70E-03	5.00E-05	NA
BHC, delta	1	3	1.40E-04	1.00E-02	1.20E-05	1.20E-05	1.69E-03	1.20E-05	NA
Endosulfan II	1	3	4.10E-05	1.00E-02	1.00E-04	1.00E-04	1.71E-03	1.00E-04	NA
Inorganic Compounds									
Arsenic	2	3	5.00E-03	5.00E-03	1.60E-02	2.60E-02	1.48E-02	1.48E-02	4.00E-03
Barium	2	3	5.00E-01	5.00E-01	9.70E-01	1.60E+00	9.40E-01	1.60E+00	NA
Calcium	3	3			1.50E+01	1.50E+02	7.43E+01	1.50E+02	NA
Chromium	2	3	4.00E-02	4.00E-02	1.80E-01	3.40E-01	1.80E-01	1.80E-01	1.10E-01
Cobalt	1	2	1.00E-01	1.00E-01	1.20E-01	1.20E-01	8.50E-02	1.20E-01	NA
Copper	3	3			8.00E-02	6.00E-01	3.27E-01	3.27E-01	4.80E-02
Iron	3	3			2.80E+01	2.90E+02	1.53E+02	2.90E+02	NA
Lead	1	3	6.00E-02	6.00E-02	1.60E-01	1.60E-01	7.33E-02	7.33E-02	1.30E-02
Magnesium	3	3			1.00E+01	9.10E+01	5.43E+01	9.10E+01	NA
Manganese	3	3			8.80E-01	5.30E+00	3.39E+00	5.30E+00	NA
Nickel	3	3			3.00E-02	3.90E-01	2.20E-01	2.20E-01	8.80E-01
Potassium	3	3			9.60E+00	4.00E+01	2.89E+01	4.00E+01	NA
Sodium	3	3			1.30E+01	2.00E+02	7.57E+01	2.00E+02	NA

TABLE III-3

Summary Statistics for Chemicals Detected in Background Ground Water Samples* (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Zinc	3	3			1.70E-01	1.30E+00	7.87E-01	7.87E-01	1.23E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Surface Water Protection Criteria for Ground Water' and the 'Volatilization Criteria for Ground Water' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Monitoring Wells MW-55B and MW-56S were considered to represent the background ground water samples.

TABLE III-4

Summary Statistics for Chemicals Detected in On-Site and Downgradient Ground Water Samples (Filtered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[a] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Inorganic Compounds									
Antimony	1	41	4.00E-01	4.00E-01	4.95E-02	4.95E-02	1.96E-01	4.95E-02	NA
Arsenic	9	41	5.00E-03	5.00E-02	2.50E-03	3.90E-02	5.32E-03	5.81E-03	NA
Barium	1	41	5.00E-01	5.00E-01	6.52E-02	6.52E-02	2.45E-01	6.52E-02	NA
Beryllium	1	41	1.00E-03	2.00E-02	2.00E-02	2.00E-02	1.00E-02	1.23E-02	NA
Cadmium	6	41	1.00E-02	1.00E-02	5.00E-03	6.50E-02	7.76E-03	8.23E-03	NA
Calcium	41	41			9.10E+00	5.70E+02	1.26E+02	2.45E+02	NA
Chromium	1	41	1.00E-02	4.00E-01	4.00E-02	4.00E-02	2.45E-02	2.61E-02	NA
Cobalt	3	38	1.00E-02	1.00E-01	1.00E-01	1.60E-01	5.49E-02	6.49E-02	NA
Copper	16	41	2.00E-02	2.00E-02	2.00E-02	5.90E+00	1.90E-01	1.28E-01	NA
Iron	29	41	2.00E-02	3.00E-02	3.00E-02	8.20E+01	2.48E+00	6.63E-01	NA
Magnesium	41	41			1.50E+00	7.00E+02	7.32E+01	1.62E+02	NA
Manganese	30	41	5.00E-02	5.00E-02	5.10E-02	1.70E+01	2.37E+00	1.70E+01	NA
Nickel	20	41	3.00E-02	3.00E-02	3.00E-02	1.50E+00	1.58E-01	2.53E-01	NA
Potassium	41	41			2.50E+00	4.60E+01	1.20E+01	1.59E+01	NA
Sodium	41	41			1.60E+01	8.40E+02	1.64E+02	2.55E+02	NA
Zinc	40	41	1.00E-02	1.00E-02	1.00E-02	5.10E+00	4.28E-01	8.93E-01	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] Criteria apply to unfiltered samples. Comparisons were made in Tables III-2 and III-3. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-5

Summary Statistics for Chemicals Detected in Background Ground Water Samples* (Filtered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[a] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Inorganic Compounds									
Calcium	2	2			1.30E+01	9.40E+01	5.35E+01	9.40E+01	NA
Iron	1	2	3.00E-02	3.00E-02	3.00E-02	3.00E-02	2.25E-02	3.00E-02	NA
Magnesium	2	2			2.20E+00	3.50E+01	1.86E+01	3.50E+01	NA
Manganese	1	2	5.00E-02	5.00E-02	2.80E-01	2.80E-01	1.53E-01	2.80E-01	NA
Nickel	1	2	3.00E-02	3.00E-02	6.00E-02	6.00E-02	3.75E-02	6.00E-02	NA
Potassium	2	2			3.60E+00	1.60E+01	9.80E+00	1.60E+01	NA
Sodium	2	2			1.40E+01	1.20E+02	6.70E+01	1.20E+02	NA
Zinc	2	2			3.30E-02	7.70E-02	5.50E-02	7.70E-02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] Criteria apply to unfiltered samples. Comparisons were made in Tables III-2 and III-3. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Monitoring Wells MW-55B and MW-56S were considered to represent the background ground water samples.

TABLE III-6

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-1 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Carbon disulfide	1	42	1.00E-02	1.00E-02	1.20E-03	1.20E-03	4.91E-03	1.20E-03	NA
Carbon tetrachloride	1	42	1.00E-02	1.00E-02	2.70E-03	2.70E-03	4.95E-03	2.70E-03	1.00E+00
1,2-Dichloroethylene (cis)	7	42	1.00E-02	1.00E-02	5.00E-04	2.00E-03	4.36E-03	2.00E-03	1.40E+01
Ethylbenzene	24	42	1.00E-02	1.00E-02	5.00E-04	1.20E-02	4.24E-03	5.92E-03	1.01E+01
4-Methyl-2-pentanone	5	42	1.00E-02	1.00E-02	6.80E-04	5.90E-03	4.79E-03	5.57E-03	NA
Styrene	6	42	1.00E-02	1.00E-02	5.30E-04	1.00E-02	4.72E-03	6.14E-03	2.00E+01
Tetrachloroethylene (PCE)	34	42	1.00E-02	1.00E-02	4.00E-04	8.00E-03	2.92E-03	3.96E-03	1.00E+00
Toluene	30	42	1.00E-02	1.00E-02	5.10E-04	6.50E-02	1.27E-02	2.09E-02	6.70E+01
Trichloroethene	24	42	1.00E-02	1.00E-02	4.00E-04	9.40E-03	3.72E-03	5.20E-03	1.00E+00
Xylenes (total)	31	42	1.00E-02	1.00E-02	4.00E-04	4.80E-02	8.89E-03	1.46E-02	1.95E+01
Semivolatile Compounds									
Acenaphthene	10	40	3.30E-01	9.70E-01	1.20E-02	1.60E-01	1.49E-01	1.60E-01	NA
Anthracene	26	40	3.30E-01	3.70E-01	1.00E-02	3.10E-01	9.75E-02	1.75E-01	4.00E+02
Benzo[a]pyrene	31	40	3.30E-01	3.70E-01	1.20E-02	1.50E+00	2.15E-01	3.47E-01	1.00E+00
Benzo[b]fluoranthene	31	40	3.30E-01	3.70E-01	1.30E-02	1.40E+00	2.31E-01	3.69E-01	1.00E+00
Benzo[k]fluoranthene	31	40	3.30E-01	3.70E-01	1.00E-02	1.60E+00	2.29E-01	3.83E-01	1.00E+00
Bis(2-ethylhexyl)phthalate	6	40	3.30E-01	9.70E-01	5.70E-02	1.30E+01	5.57E-01	4.12E-01	1.10E+01
Butylbenzylphthalate	4	40	3.30E-01	9.70E-01	1.00E-02	3.30E-01	1.77E-01	2.43E-01	2.00E+02
2-Chlorophenol	1	40	3.30E-01	9.70E-01	3.30E-01	3.30E-01	1.87E-01	1.98E-01	7.20E+00
Di-n-Octyl phthalate	16	40	3.30E-01	5.20E-01	6.00E-03	3.30E-01	1.29E-01	2.03E-01	2.00E+01
Dibenzofuran	11	40	3.30E-01	9.70E-01	9.00E-03	1.60E-01	1.44E-01	1.60E-01	NA
Dibutyl phthalate	8	40	3.30E-01	9.70E-01	1.70E-02	4.90E-01	1.85E-01	2.36E-01	1.40E+02
2,4-Dichlorophenol	1	40	3.30E-01	9.70E-01	3.30E-01	3.30E-01	1.87E-01	1.98E-01	4.00E+00
2,6-Dichlorophenol	1	40	3.30E-01	9.70E-01	3.30E-01	3.30E-01	1.87E-01	1.98E-01	NA
Diethylphthalate	6	40	3.30E-01	9.70E-01	1.00E-02	1.90E-02	1.57E-01	1.90E-02	NA
Fluoranthene	32	40	3.30E-01	3.90E-01	1.00E-02	3.80E+00	4.31E-01	8.46E-01	5.60E+01
Fluorene	13	40	3.30E-01	4.16E-01	1.30E-02	1.80E-01	1.34E-01	1.80E-01	5.60E+01
Methoxychlor	3	40	1.70E-02	2.70E-02	6.90E-04	1.00E-02	8.92E-03	1.00E-02	8.00E+00
2-Methylnaphthalene	11	40	3.30E-01	9.70E-01	8.00E-03	2.60E-01	1.56E-01	2.45E-01	NA
Naphthalene	8	40	3.30E-01	9.70E-01	9.00E-03	6.10E-02	1.51E-01	6.10E-02	5.60E+01
N-Nitrosodimethylamine	2	40	3.30E-01	9.70E-01	3.30E-01	3.70E-01	1.92E-01	2.05E-01	NA
N-Nitrosodiphenylamine	1	40	3.30E-01	9.70E-01	3.30E-01	3.30E-01	1.87E-01	1.98E-01	NA

TABLE III-6

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-1 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Phenanthrene	35	40	3.30E-01	3.30E-01	1.10E-02	1.50E+00	2.30E-01	4.59E-01	4.00E+01
Pyrene	35	40	3.30E-01	3.30E-01	1.10E-02	3.90E+00	3.67E-01	7.44E-01	4.00E+01
2,4,5-Trichlorophenol	1	40	3.76E-01	2.35E+00	8.00E-01	8.00E-01	4.47E-01	4.78E-01	NA
2,4,6-Trichlorophenol	1	40	3.30E-01	9.70E-01	3.30E-01	3.30E-01	1.87E-01	1.98E-01	NA
PCBs/Pesticides									
Aroclor 1254	1	2	3.30E-02	3.30E-02	1.60E-02	1.60E-02	1.63E-02	1.60E-02	NA
BHC, delta	1	40	1.70E-03	2.70E-03	3.90E-04	3.90E-04	9.03E-04	3.90E-04	NA
4,4'-DDE	9	39	3.30E-03	4.20E-03	9.70E-04	5.20E-02	3.37E-03	3.17E-03	NA
4,4'-DDT	27	40	3.30E-03	4.20E-03	3.70E-04	4.60E-02	3.67E-03	4.23E-03	NA
Dieldrin	1	40	2.40E-03	5.20E-03	1.10E-03	1.10E-03	1.75E-03	1.10E-03	7.00E-03
Endrin aldehyde	3	40	3.30E-03	4.70E-03	2.10E-03	8.20E-03	1.99E-03	2.12E-03	NA
HCH (gamma) Lindane	9	40	1.70E-03	2.70E-03	7.00E-05	1.00E-03	8.24E-04	1.00E-03	NA
PCBs (total)	29	40	3.30E-02	5.20E-02	3.90E-03	1.55E+00	1.45E-01	1.57E-01	5.00E-03
Inorganic Compounds									
Aluminum	20	21	8.60E+03	8.60E+03	5.40E+03	1.10E+04	8.62E+03	9.52E+03	NA
Antimony	15	58	8.00E+00	5.00E+01	7.90E+00	1.16E+01	1.29E+01	1.16E+01	8.20E+03
Arsenic	37	37			3.00E-01	3.50E+00	1.22E+00	1.50E+00	1.00E+01
Barium	37	58	1.00E+02	1.00E+02	2.10E+01	1.40E+02	4.72E+01	5.10E+01	1.40E+05
Beryllium	24	37	2.10E-01	4.00E-01	2.80E-01	3.40E+00	5.42E-01	7.40E-01	2.00E+00
Cadmium	32	58	2.00E-01	5.00E+00	2.80E-01	3.62E+01	2.69E+00	4.04E+00	1.00E+03
Calcium	21	21			8.90E+02	2.40E+03	1.35E+03	1.50E+03	NA
Chromium	58	58			5.20E+00	1.85E+03	1.04E+02	1.24E+02	1.00E+02
Cobalt	37	58	2.00E+01	2.00E+01	3.00E+00	2.91E+01	8.76E+00	9.75E+00	NA
Copper	58	58			1.50E+01	4.64E+03	2.71E+02	3.43E+02	7.60E+04
Iron	21	21			9.70E+03	1.50E+04	1.30E+04	1.36E+04	NA
Lead	55	58	1.20E+00	1.00E+01	4.00E+00	4.03E+02	3.59E+01	5.29E+01	1.00E+03
Magnesium	39	39			1.90E+03	3.80E+03	3.13E+03	3.28E+03	NA
Manganese	39	39			1.20E+02	3.80E+02	2.86E+02	3.12E+02	NA
Mercury	7	58	2.00E-02	5.00E-01	3.30E-02	1.20E+00	1.39E-01	2.16E-01	6.10E+02
Nickel	58	58			2.40E+00	1.22E+03	6.75E+01	7.75E+01	7.50E+03
Potassium	21	21			7.30E+02	1.80E+03	1.22E+03	1.31E+03	NA
Selenium	2	24	2.10E-01	3.00E-01	4.30E-01	5.60E-01	1.45E-01	1.66E-01	1.00E+04
Silver	31	58	6.00E-01	1.00E+01	6.00E-01	6.20E+01	6.80E+00	1.17E+01	1.00E+04

TABLE III-6

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-1 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Sodium	39	39			4.10E+01	7.40E+01	5.01E+01	5.20E+01	NA
Thallium	6	37	2.10E-01	8.00E+00	2.80E-01	9.60E+00	1.69E+00	4.84E+00	1.60E+02
Tin	11	58	2.70E+00	1.00E+02	2.80E+00	7.10E+01	2.23E+01	4.71E+01	NA
Titanium	39	39			3.10E+02	7.60E+02	5.86E+02	6.21E+02	NA
Vanadium	33	37	2.00E+01	2.00E+01	1.18E+01	1.23E+02	2.78E+01	3.28E+01	1.40E+04
Zinc	58	58			1.30E+01	2.52E+03	2.17E+02	2.60E+02	6.10E+05

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Pollutant Mobility Criteria' for a GB area and the 'Direct Exposure Criteria' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-7

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-15 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	16	125	1.00E-02	1.90E+00	2.00E-03	1.10E+00	4.95E-02	2.09E-02	1.40E+02
Benzene	3	137	5.00E-03	1.90E+00	4.30E-03	5.70E-01	3.81E-02	1.40E-02	2.00E-01
2-Butanone	13	135	1.00E-02	1.60E+00	1.10E-03	2.60E+00	4.58E-02	1.46E-02	8.00E+01
Carbazole	3	17	3.30E-01	8.90E+01	1.50E-02	4.20E-02	3.84E+00	4.20E-02	NA
Carbon disulfide	4	137	1.00E-02	1.90E+00	1.20E-03	3.40E-02	3.75E-02	1.37E-02	NA
Carbon tetrachloride	1	137	5.00E-03	1.90E+00	2.70E-03	2.70E-03	3.74E-02	2.70E-03	1.00E+00
Chlorobenzene	2	137	5.00E-03	1.90E+00	1.30E-03	3.80E-01	3.57E-02	1.30E-02	2.00E+01
Chloroform	7	137	5.00E-03	1.60E+00	1.50E-03	2.10E+00	4.40E-02	1.42E-02	1.20E+00
Chloromethane	1	137	1.00E-02	1.00E+01	1.20E-03	1.20E-03	7.38E-02	1.20E-03	NA
1,2-Dichloroethane	1	137	5.00E-03	1.90E+00	3.50E-03	3.50E-03	3.74E-02	3.50E-03	2.00E-01
1,1-Dichloroethene	2	137	5.00E-03	1.90E+00	5.00E-04	1.40E-02	3.74E-02	1.34E-02	1.40E+00
1,2-Dichloroethylene (cis)	25	137	1.00E-02	1.50E+00	5.00E-04	3.20E+00	5.13E-02	1.52E-02	1.40E+01
1,2-Dichloroethylene (trans)	8	137	1.00E-02	1.50E+00	1.00E-03	3.20E+00	4.45E-02	1.16E-02	2.00E+01
Ethylbenzene	68	137	5.00E-03	1.30E-02	5.00E-04	6.90E+01	1.19E+00	6.94E-02	1.01E+01
2-Hexanone	5	136	1.00E-02	1.90E+00	1.00E-03	2.00E-02	3.76E-02	1.36E-02	NA
4-Methyl-2-pentanone	28	136	1.00E-02	1.40E+00	5.00E-04	3.00E+00	5.75E-02	1.64E-02	NA
Methylene chloride	24	137	1.00E-02	1.60E+00	1.00E-03	5.10E-01	3.26E-02	1.36E-02	1.00E+00
Styrene	19	137	5.00E-03	1.90E+00	5.00E-04	5.00E+00	7.13E-02	1.91E-02	2.00E+01
Tetrachloroethylene (PCE)	82	137	1.00E-02	1.50E+00	4.00E-04	4.10E+01	3.29E-01	2.10E-02	1.00E+00
Toluene	95	136	1.00E-02	1.10E-02	4.00E-04	2.90E+01	2.93E-01	4.64E-02	6.70E+01
1,1,1-Trichloroethane	2	137	5.00E-03	1.90E+00	3.10E-03	8.30E-03	3.74E-02	8.30E-03	4.00E+01
Trichloroethene	60	137	1.00E-02	1.50E+00	4.00E-04	4.30E+01	3.50E-01	2.17E-02	1.00E+00
Xylenes (total)	89	134	5.00E-03	1.00E-02	4.00E-04	1.80E+02	1.96E+00	9.65E-02	1.95E+01
Semivolatile Compounds									
Acenaphthene	19	116	3.00E-01	8.90E+01	9.00E-03	5.60E-01	7.02E-01	3.57E-01	NA
Acenaphthylene	4	19	3.30E-01	8.90E+01	6.00E-03	1.10E-01	3.45E+00	1.10E-01	8.40E+01
Anthracene	61	116	3.00E-01	8.90E+01	3.00E-03	4.00E-01	6.57E-01	3.34E-01	4.00E+02
Benz[a]anthracene	4	19	3.30E-01	8.90E+01	1.10E-02	2.20E-01	3.46E+00	2.20E-01	NA
Benzo(g,h,i)perylene	3	19	3.30E-01	8.90E+01	4.00E-02	9.20E-02	3.46E+00	9.20E-02	NA
Benzo[a]pyrene	75	116	3.00E-01	8.90E+01	8.00E-03	1.50E+00	7.38E-01	4.84E-01	1.00E+00
Benzo[b]fluoranthene	79	116	3.00E-01	8.90E+01	5.00E-03	1.40E+00	7.45E-01	5.59E-01	1.00E+00
Benzo[k]fluoranthene	79	116	3.00E-01	8.90E+01	4.00E-03	1.60E+00	7.43E-01	5.84E-01	1.00E+00

TABLE III-7

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-15 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Bis(2-ethylhexyl)phthalate	29	110	3.30E-01	1.30E+00	2.70E-02	5.60E+02	5.50E+00	5.42E-01	1.10E+01
Butylbenzylphthalate	11	115	3.00E-01	8.90E+01	4.00E-03	3.30E-01	6.79E-01	3.30E-01	2.00E+02
2-Chlorophenol	2	116	3.00E-01	8.90E+01	3.30E-01	3.30E-01	7.23E-01	3.22E-01	7.20E+00
Chrysene	6	19	3.30E-01	8.90E+01	1.10E-02	3.50E-01	3.45E+00	3.50E-01	NA
Di-n-Octyl phthalate	43	116	3.00E-01	8.90E+01	6.00E-03	5.30E+00	6.87E-01	3.93E-01	2.00E+01
Dibenzo(a,h)anthracene	2	19	3.30E-01	8.90E+01	1.70E-02	2.70E-02	3.47E+00	2.70E-02	NA
Dibenzofuran	25	116	3.00E-01	8.90E+01	8.00E-03	4.40E-01	6.96E-01	3.76E-01	NA
Dibutyl phthalate	33	113	3.30E-01	8.90E+01	1.70E-02	4.50E+00	6.33E-01	3.29E-01	1.40E+02
2,4-Dichlorophenol	2	116	3.00E-01	8.90E+01	3.30E-01	3.30E-01	7.23E-01	3.22E-01	4.00E+00
2,6-Dichlorophenol	2	98	3.00E-01	9.70E-01	3.30E-01	3.30E-01	1.81E-01	1.86E-01	NA
Diethylphthalate	21	116	3.30E-01	8.90E+01	7.00E-03	3.50E+00	7.37E-01	4.74E-01	NA
2,4-Dimethylphenol	2	18	3.30E-01	8.90E+01	1.30E-02	4.50E-02	3.65E+00	4.50E-02	NA
Fluoranthene	87	116	3.30E-01	8.90E+01	8.00E-03	3.90E+00	9.04E-01	9.77E-01	5.60E+01
Fluorene	31	116	3.00E-01	8.90E+01	1.30E-02	5.40E-01	6.92E-01	3.46E-01	5.60E+01
Indeno[1,2,3-cd]pyrene	3	19	3.30E-01	8.90E+01	4.20E-02	1.10E-01	3.46E+00	1.10E-01	NA
Isophorone	2	19	3.30E-01	8.90E+01	4.60E-02	1.30E+01	4.15E+00	1.30E+01	NA
Methoxychlor	9	113	5.50E-05	9.40E-02	6.90E-04	1.00E-02	8.78E-03	1.00E-02	8.00E+00
2-Methylnaphthalene	26	116	3.00E-01	8.90E+01	7.00E-03	4.00E+00	6.93E-01	3.80E-01	NA
4-Methylphenol	2	19	3.30E-01	8.90E+01	4.10E-02	5.20E-02	3.47E+00	5.20E-02	NA
2-Methylphenol (o-cresol)	3	19	3.30E-01	8.90E+01	3.60E-02	3.60E+00	3.65E+00	3.60E+00	NA
Naphthalene	33	116	3.00E-01	1.90E+01	5.00E-03	2.00E+01	5.10E-01	4.33E-01	5.60E+01
N-Nitrosodimethylamine	3	99	3.00E-01	9.70E-01	3.30E-01	3.70E-01	1.84E-01	1.89E-01	NA
N-Nitrosodiphenylamine	3	116	3.00E-01	8.90E+01	2.60E-01	3.30E-01	7.24E-01	3.24E-01	NA
Phenanthrene	81	116	3.30E-01	8.90E+01	8.00E-03	2.70E+00	7.84E-01	5.88E-01	4.00E+01
Phenol	1	17	3.40E-01	8.90E+01	2.50E+01	2.50E+01	5.34E+00	2.50E+01	8.00E+02
Pyrene	91	116	3.00E-01	8.90E+01	9.00E-03	3.90E+00	8.57E-01	8.71E-01	4.00E+01
2,4,5-Trichlorophenol	2	116	3.00E-01	2.20E+02	8.00E-01	8.00E-01	1.76E+00	7.83E-01	NA
2,4,6-Trichlorophenol	2	116	3.00E-01	8.90E+01	3.30E-01	3.30E-01	7.23E-01	3.22E-01	NA
PCBs/Pesticides									
Aldrin	1	113	4.30E-04	3.30E-01	1.20E-03	1.20E-03	2.40E-03	1.20E-03	NA
Aroclor 1254	10	23	3.30E-02	8.20E+00	8.00E-03	8.40E-01	2.72E-01	4.76E-01	NA
BHC, delta	7	112	3.10E-04	3.30E-01	3.40E-04	1.50E-03	2.39E-03	1.23E-03	NA
Chlordane	1	22	4.30E-04	6.60E+00	1.90E-01	1.90E-01	1.76E-01	1.90E-01	6.60E-02

TABLE III-7

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-15 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
4,4'-DDD	1	22	5.90E-04	3.30E-01	1.10E-02	1.10E-02	9.50E-03	8.67E-03	NA
4,4'-DDE	29	113	5.90E-04	3.30E-01	2.90E-04	5.20E-02	3.98E-03	2.94E-03	NA
4,4'-DDT	68	114	6.50E-04	3.30E-01	3.70E-04	4.60E-02	4.28E-03	3.48E-03	NA
Dieldrin	5	114	5.50E-04	3.30E-01	3.20E-04	1.20E-03	3.21E-03	1.20E-03	7.00E-03
Endrin aldehyde	7	114	1.30E-03	3.30E-01	2.10E-03	1.20E-02	3.51E-03	2.53E-03	NA
HCH (alpha)	1	22	6.90E-04	3.30E-01	2.30E-04	2.30E-04	8.84E-03	2.30E-04	NA
HCH (gamma) Lindane	25	113	1.70E-03	3.30E-01	7.00E-05	2.00E-03	2.35E-03	1.28E-03	NA
Heptachlor	1	113	1.80E-04	3.30E-01	1.50E-03	1.50E-03	2.39E-03	1.26E-03	1.30E-02
Heptachlor epoxide	1	22	1.70E-03	3.30E-01	3.80E-04	3.80E-04	8.40E-03	3.80E-04	2.00E-02
PCBs (total)	74	113	3.30E-02	8.20E+00	3.90E-03	6.29E+00	5.41E-01	3.03E-01	5.00E-03
2,4,5,6-Tetrachloro-m-xylene	4	4			1.20E-02	1.30E-02	1.28E-02	1.30E-02	NA
Inorganic Compounds									
Aluminum	40	41	8.60E+03	8.60E+03	5.00E+03	8.50E+04	9.93E+03	1.05E+04	NA
Antimony	29	151	7.60E+00	5.00E+01	7.90E+00	1.24E+01	1.07E+01	1.19E+01	8.20E+03
Arsenic	104	110	1.00E-01	1.00E+00	1.80E-01	7.50E+00	1.46E+00	1.79E+00	1.00E+01
Barium	110	151	1.00E+02	1.00E+02	1.60E+01	1.49E+02	5.02E+01	5.31E+01	1.40E+05
Beryllium	62	109	2.10E-01	4.00E-01	2.30E-01	3.40E+00	4.64E-01	5.43E-01	2.00E+00
Cadmium	74	152	2.00E-01	5.00E+00	2.40E-01	3.90E+01	2.47E+00	3.42E+00	1.00E+03
Calcium	41	41			6.00E+02	3.00E+03	1.46E+03	1.65E+03	NA
Chromium	143	152	1.15E+01	2.00E+01	5.20E+00	3.82E+03	8.93E+01	7.40E+01	1.00E+02
Cobalt	108	150	2.00E+00	2.00E+01	2.00E+00	2.91E+01	8.03E+00	8.78E+00	NA
Copper	152	152			1.08E+01	2.84E+04	3.56E+02	2.24E+02	7.60E+04
Iron	41	41			7.60E+03	1.90E+04	1.28E+04	1.36E+04	NA
Lead	129	152	1.20E+00	1.00E+01	1.60E+00	8.62E+02	3.71E+01	4.13E+01	1.00E+03
Magnesium	76	76			1.70E+03	8.00E+03	3.51E+03	3.77E+03	NA
Manganese	76	76			1.20E+02	3.80E+02	2.68E+02	2.82E+02	NA
Mercury	23	152	2.00E-02	5.00E-01	2.20E-02	1.20E+00	1.16E-01	1.49E-01	6.10E+02
Nickel	152	152			1.00E+00	3.47E+03	6.40E+01	4.58E+01	7.50E+03
Potassium	41	41			4.50E+02	6.60E+03	1.96E+03	2.32E+03	NA
Selenium	18	80	2.10E-01	2.00E+00	2.10E-01	1.30E+00	2.41E-01	2.67E-01	1.00E+04
Silver	60	152	6.00E-01	1.00E+01	6.00E-01	7.85E+01	4.43E+00	5.21E+00	1.00E+04
Sodium	76	76			3.40E+01	1.40E+02	6.24E+01	6.66E+01	NA
Thallium	24	109	2.10E-01	8.00E+00	2.20E-01	1.20E+01	1.65E+00	2.91E+00	1.60E+02

TABLE III-7

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-15 feet)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Tin	20	151	2.60E+00	1.00E+02	2.80E+00	7.10E+01	1.71E+01	2.54E+01	NA
Titanium	76	76			3.10E+02	8.80E+03	8.32E+02	8.21E+02	NA
Vanadium	96	110	2.00E+01	2.00E+01	6.20E+00	1.23E+02	2.35E+01	2.56E+01	1.40E+04
Zinc	152	152			1.30E+01	5.80E+03	1.87E+02	1.74E+02	6.10E+05

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Pollutant Mobility Criteria' for a GB area and the 'Direct Exposure Criteria' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-8

Summary Statistics for Chemicals Detected in Background Soil Samples (0-1 feet)*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Bromodichloromethane	1	9	1.00E-02	1.00E-02	1.50E-03	1.50E-03	4.61E-03	1.50E-03	NA
Methylene chloride	2	9	1.00E-02	1.00E-02	1.00E-02	1.00E-02	6.11E-03	7.66E-03	1.00E+00
Tetrachloroethylene (PCE)	7	9	1.00E-02	1.00E-02	5.00E-04	1.40E-03	1.82E-03	1.40E-03	1.00E+00
Toluene	5	9	1.00E-02	1.00E-02	1.20E-03	4.00E-03	3.62E-03	4.00E-03	6.70E+01
1,1,1-Trichloroethane	6	9	1.00E-02	1.00E-02	4.00E-04	1.90E-03	2.27E-03	1.90E-03	4.00E+01
Trichloroethene	4	9	1.00E-02	1.00E-02	5.00E-04	1.10E-03	3.08E-03	1.10E-03	1.00E+00
Xylenes (total)	7	9	1.00E-02	1.00E-02	7.00E-04	1.90E-03	1.96E-03	1.90E-03	1.95E+01
Semivolatile Compounds									
Anthracene	7	9	3.30E-01	3.83E-01	1.50E-02	6.60E-02	6.20E-02	6.60E-02	4.00E+02
Benzo[a]pyrene	9	9			1.70E-02	3.40E-01	1.28E-01	3.40E-01	1.00E+00
Benzo[b]fluoranthene	9	9			1.40E-02	4.00E-01	1.43E-01	4.00E-01	1.00E+00
Benzo[k]fluoranthene	9	9			1.80E-02	4.20E-01	1.38E-01	4.20E-01	1.00E+00
Butylbenzylphthalate	1	9	3.30E-01	3.96E-01	1.50E-02	1.50E-02	1.59E-01	1.50E-02	2.00E+02
Diethylphthalate	3	9	3.30E-01	3.96E-01	6.00E-03	2.30E-02	1.20E-01	2.30E-02	NA
Fluoranthene	9	9			3.20E-02	6.90E-01	2.74E-01	6.90E-01	5.60E+01
Fluorene	1	9	3.30E-01	3.96E-01	8.00E-03	8.00E-03	1.58E-01	8.00E-03	5.60E+01
Phenanthrene	9	9			1.30E-02	3.20E-01	1.25E-01	3.20E-01	4.00E+01
Pyrene	9	9			2.50E-02	6.90E-01	2.46E-01	6.90E-01	4.00E+01
PCBs/Pesticides									
4,4'-DDE	2	9	3.30E-03	3.90E-03	3.20E-04	2.20E-03	1.66E-03	2.20E-03	NA
4,4'-DDT	5	9	3.30E-03	3.80E-03	1.70E-03	8.00E-03	3.03E-03	5.14E-03	NA
Dieldrin	1	9	3.30E-03	3.80E-03	9.70E-04	9.70E-04	1.64E-03	9.70E-04	7.00E-03
HCH (gamma) Lindane	1	9	1.70E-03	2.00E-03	1.60E-04	1.60E-04	8.29E-04	1.60E-04	NA
PCBs (total)	3	9	3.30E-02	3.90E-02	1.40E-02	7.00E-02	6.22E-02	7.00E-02	5.00E-03
Inorganic Compounds									
Arsenic	8	8			3.20E-01	1.30E+00	9.50E-01	1.30E+00	1.00E+01
Barium	8	8			3.70E+01	8.80E+01	5.93E+01	7.41E+01	1.40E+05
Beryllium	4	8	4.00E-01	4.00E-01	4.00E-01	1.40E+00	5.02E-01	1.13E+00	2.00E+00
Cadmium	4	8	2.00E-01	2.00E-01	2.40E-01	2.50E+00	6.05E-01	2.50E+00	1.00E+03
Chromium	8	8			1.00E+01	1.70E+02	4.85E+01	1.50E+02	1.00E+02
Cobalt	8	8			5.60E+00	1.00E+01	7.95E+00	9.43E+00	NA
Copper	8	8			1.50E+01	3.70E+02	9.93E+01	3.70E+02	7.60E+04

TABLE III-8

Summary Statistics for Chemicals Detected in Background Soil Samples (0-1 feet)*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Lead	8	8			6.80E+00	1.40E+02	3.04E+01	8.61E+01	1.00E+03
Mercury	4	8	5.00E-02	5.00E-02	2.30E-02	3.80E-02	2.79E-02	3.16E-02	6.10E+02
Nickel	8	8			1.00E+01	7.60E+01	2.59E+01	5.37E+01	7.50E+03
Silver	5	8	6.00E-01	6.00E-01	6.00E-01	2.80E+00	9.87E-01	2.67E+00	1.00E+04
Vanadium	5	8	2.00E+01	2.00E+01	2.60E+01	3.10E+01	2.20E+01	3.10E+01	1.40E+04
Zinc	8	8			3.60E+01	2.70E+02	8.75E+01	1.62E+02	6.10E+05

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Pollutant Mobility Criteria' for a GB area and the 'Direct Exposure Criteria' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples B-1, B-2, B-3, B-4, B-5, B-6, B-7, B-8 were considered to represent the background soil samples

TABLE III-9

Summary Statistics for Chemicals Detected in Landfill Treatment Residue (LTR) Samples

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	6	7	1.00E-02	1.00E-02	2.10E-03	2.10E-01	4.33E-02	2.10E-01	1.40E+02
Benzene	5	13	1.00E-02	1.00E-02	1.40E-03	1.40E-02	5.28E-03	7.52E-03	2.00E-01
2-Butanone	6	12	1.00E-02	1.00E-02	1.10E-03	3.90E-03	3.58E-03	3.90E-03	8.00E+01
Carbon disulfide	10	13	1.00E-02	1.00E-02	3.10E-03	2.40E-02	8.93E-03	1.43E-02	NA
Chloroform	6	13	1.00E-02	1.00E-02	1.30E-03	4.80E-02	9.53E-03	1.84E-02	1.20E+00
Ethylbenzene	3	13	1.00E-02	1.00E-02	1.50E-03	1.40E-02	5.96E-03	8.38E-03	1.01E+01
4-Methyl-2-pentanone	5	13	1.00E-02	1.00E-02	1.20E-03	7.60E-03	4.14E-03	6.47E-03	NA
Methylene chloride	12	12			2.90E-03	2.20E-02	1.15E-02	1.90E-02	1.00E+00
Tetrachloroethylene (PCE)	11	13	1.00E-02	1.00E-02	1.20E-03	7.10E+00	7.21E-01	7.10E+00	1.00E+00
Toluene	5	13	1.00E-02	1.00E-02	1.10E-03	5.70E-03	4.05E-03	5.70E-03	6.70E+01
1,1,1-Trichloroethane	2	13	1.00E-02	1.00E-02	1.50E-03	2.40E-03	4.53E-03	2.40E-03	4.00E+01
Trichloroethene	4	13	1.00E-02	1.00E-02	1.00E-03	3.40E-02	6.33E-03	1.29E-02	1.00E+00
Xylenes (total)	6	13	1.00E-02	1.00E-02	5.60E-03	6.80E-02	1.16E-02	1.74E-02	1.95E+01
Semivolatile Compounds									
Bis(2-ethylhexyl)phthalate	2	2			6.10E-01	6.30E-01	6.20E-01	6.30E-01	1.10E+01
Butylbenzylphthalate	1	2	3.30E-01	3.30E-01	1.90E-01	1.90E-01	1.77E-01	1.90E-01	2.00E+02
Di-n-Octyl phthalate	2	2			2.60E-02	7.20E-02	4.90E-02	7.20E-02	2.00E+01
Dibutyl phthalate	1	2	3.30E-01	3.30E-01	1.30E-01	1.30E-01	1.48E-01	1.30E-01	1.40E+02
Diethylphthalate	1	2	3.30E-01	3.30E-01	4.20E-02	4.20E-02	1.04E-01	4.20E-02	NA
2-Methylnaphthalene	1	2	3.30E-01	3.30E-01	2.80E-01	2.80E-01	2.23E-01	2.80E-01	NA
Phenacetin	1	2	3.30E-01	3.30E-01	3.00E-02	3.00E-02	9.75E-02	3.00E-02	NA
Phenanthrene	1	2	3.30E-01	3.30E-01	4.60E-02	4.60E-02	1.06E-01	4.60E-02	4.00E+01
Inorganic Compounds									
Arsenic	13	16	1.00E+00	1.00E+00	1.00E+00	4.40E+00	1.68E+00	2.48E+00	1.00E+01
Barium	16	16			1.60E+01	2.10E+02	8.93E+01	1.43E+02	1.40E+05
Beryllium	2	3	4.00E-01	4.00E-01	1.70E+01	3.50E+01	1.74E+01	3.50E+01	2.00E+00
Cadmium	16	16			1.20E+00	1.40E+02	5.24E+01	1.40E+02	1.00E+03
Chromium	16	16			2.00E+02	7.30E+03	3.78E+03	7.30E+03	1.00E+02
Cobalt	3	3			6.00E+00	4.60E+01	2.27E+01	4.60E+01	NA
Copper	16	16			9.00E+02	2.90E+04	1.12E+04	2.90E+04	7.60E+04
Lead	16	16			7.80E+01	1.30E+04	1.26E+03	2.10E+03	1.00E+03
Mercury	15	16	5.00E-02	5.00E-02	6.00E-02	1.20E+01	1.18E+00	3.73E+00	6.10E+02

TABLE III-9

Summary Statistics for Chemicals Detected in Landfill Treatment Residue (LTR) Samples

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Nickel	16	16			5.80E-01	2.20E+03	1.19E+03	2.20E+03	7.50E+03
Selenium	1	16	2.00E+00	2.00E+00	2.00E+00	2.00E+00	1.06E+00	1.15E+00	1.00E+04
Silver	16	16			1.80E+00	5.40E+01	2.54E+01	5.40E+01	1.00E+04
Thallium	3	3			1.60E+01	2.10E+01	1.87E+01	2.10E+01	1.60E+02
Tin	3	3			2.40E+02	5.00E+02	3.37E+02	5.00E+02	NA
Vanadium	1	3	2.00E+01	2.00E+01	8.40E+01	8.40E+01	3.47E+01	8.40E+01	1.40E+04
Zinc	16	16			6.60E+00	1.20E+04	4.11E+03	1.20E+04	6.10E+05

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Pollutant Mobility Criteria' for a GB area and the 'Direct Exposure Criteria' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-10

Summary Statistics for Chemicals Detected in On-Site Leachate Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	2	6	1.00E-02	1.00E-02	3.70E-03	4.70E-03	4.73E-03	4.70E-03	NA
2-Butanone	2	16	1.00E-02	1.00E-02	2.00E-02	1.30E-01	1.38E-02	1.67E-02	NA
Chloroform	3	16	5.00E-03	1.00E-02	7.00E-04	1.00E-03	2.98E-03	1.00E-03	NA
1,2-Dichloroethane	1	16	5.00E-03	1.00E-02	1.00E-03	1.00E-03	3.34E-03	1.00E-03	NA
Ethylbenzene	1	6	1.00E-02	1.00E-02	5.00E-04	5.00E-04	4.25E-03	5.00E-04	NA
Methylene chloride	2	6	1.00E-02	1.00E-02	4.20E-03	4.50E-03	4.78E-03	4.50E-03	NA
Styrene	3	6	1.00E-02	1.00E-02	6.00E-04	2.30E-03	3.25E-03	2.30E-03	NA
Tetrachloroethylene (PCE)	7	16	5.00E-03	1.00E-02	1.00E-03	2.60E-02	4.88E-03	7.96E-03	NA
Trichloroethene	3	16	5.00E-03	1.00E-02	1.00E-03	8.00E-03	3.91E-03	5.28E-03	NA
Semivolatile Compounds									
Bis(2-ethylhexyl)phthalate	8	22	1.00E-02	1.00E-02	6.00E-04	4.60E-01	2.44E-02	2.24E-02	NA
Methoxychlor	2	62	2.50E-03	1.70E-02	2.50E-03	2.50E-03	1.41E-03	1.45E-03	NA
PCBs/Pesticides									
Aldrin	2	44	2.50E-04	1.70E-03	2.50E-04	2.50E-04	1.47E-04	1.55E-04	NA
BHC, beta	2	44	2.50E-04	1.70E-03	2.50E-04	2.50E-04	1.47E-04	1.55E-04	NA
BHC, delta	2	44	2.50E-04	1.70E-03	2.50E-04	2.50E-04	1.47E-04	1.55E-04	NA
4,4'-DDE	2	44	5.00E-04	3.30E-03	5.00E-04	5.00E-04	2.93E-04	3.09E-04	NA
4,4'-DDT	2	44	5.00E-04	3.30E-03	5.00E-04	5.00E-04	2.93E-04	3.09E-04	NA
Dieldrin	2	44	5.00E-04	3.30E-03	5.00E-04	5.00E-04	2.93E-04	3.09E-04	NA
Endosulfan I	2	44	2.50E-04	1.70E-03	2.50E-04	2.50E-04	1.47E-04	1.55E-04	NA
Endosulfan II	2	44	5.00E-04	3.30E-03	5.00E-04	5.00E-04	2.93E-04	3.09E-04	NA
Endrin aldehyde	2	44	5.00E-04	3.30E-03	5.00E-04	5.00E-04	2.93E-04	3.09E-04	NA
HCH (gamma) Lindane	2	62	2.50E-04	1.70E-03	2.50E-04	2.50E-04	1.41E-04	1.45E-04	NA
Heptachlor	2	61	2.50E-04	1.70E-03	2.50E-04	2.50E-04	1.41E-04	1.46E-04	NA
PCBs (total)	2	44	5.00E-03	3.30E-02	1.50E-02	1.50E-02	8.80E-03	9.27E-03	NA
Inorganic Compounds									
Barium	22	56	5.00E-01	5.00E-01	4.58E-02	5.10E-01	2.35E-01	2.68E-01	1.00E+01
Cadmium	9	65	2.00E-03	1.00E-02	2.00E-03	2.00E-02	3.96E-03	5.05E-03	5.00E-02
Chromium	49	98	2.00E-03	4.00E-02	2.10E-03	4.40E+00	5.88E-02	3.15E-02	5.00E-01
Copper	16	35	2.00E-02	2.00E-02	2.00E-02	1.80E-01	2.63E-02	3.29E-02	1.30E+01
Lead	6	67	1.70E-02	6.00E-01	1.91E-02	3.89E-02	3.78E-02	3.89E-02	1.50E-01
Mercury	2	51	1.00E-03	1.70E-02	2.10E-03	8.00E-03	1.04E-03	1.10E-03	2.00E-02

TABLE III-10

Summary Statistics for Chemicals Detected in On-Site Leachate Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Nickel	4	35	3.00E-02	3.00E-01	3.00E-02	3.00E-02	3.21E-02	3.00E-02	1.00E+00
Silver	1	52	3.00E-03	3.00E-02	3.50E-02	3.50E-02	1.10E-02	1.94E-02	3.60E-01
Zinc	34	35	1.00E-02	1.00E-02	2.30E-02	2.00E-01	6.73E-02	8.84E-02	5.00E+01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria for inorganic compounds were determined to be the 'Pollutant Mobility Criteria' for a GB area established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Leachate extracted from soil samples using the synthetic precipitation leaching procedure(SPLP)for all samples except those taken in the Pre-Envirite Waste area. Leachate extracted from soil samples using Toxicity Characteristic Leaching Procedure (TCLP) for Pre-Envirite Waste soil samples. Pre-Envirite Waste Material leachate are not included.

TABLE III-11

Summary Statistics for Chemicals Detected in Upstream Branch Brook Surface Water Samples* (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[a] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Semivolatile Compounds									
Dibutyl phthalate	2	6	1.00E-02	1.00E-02	1.30E-03	2.30E-03	3.93E-03	2.30E-03	2.70E+00
Inorganic Compounds									
Calcium	6	6			7.50E+00	8.50E+00	8.10E+00	8.42E+00	NA
Copper	1	6	2.00E-02	2.00E-02	2.00E-02	2.00E-02	1.17E-02	1.53E-02	4.80E-03
Iron	6	6			4.00E-02	2.60E-01	1.48E-01	2.60E-01	NA
Magnesium	6	6			2.40E+00	2.80E+00	2.60E+00	2.79E+00	NA
Manganese	2	6	2.00E-02	6.10E-02	5.10E-02	6.00E-02	2.86E-02	6.00E-02	NA
Mercury	3	6	5.00E-03	5.00E-03	5.00E-03	5.00E-03	3.75E-03	5.00E-03	1.20E-05
Potassium	6	6			1.30E+00	2.00E+00	1.78E+00	2.00E+00	NA
Sodium	6	6			7.00E+00	1.20E+01	9.15E+00	1.18E+01	NA
Zinc	2	6	1.00E-02	1.00E-02	1.00E-02	1.20E-02	7.00E-03	1.11E-02	5.82E-02

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] The applicable CTDEP criteria were determined to be the 'Numerical Water Quality Criteria for Chemical Constituents' taken from Appendix D of the CTDEP Water Quality Standards. The criterion selected for each parameter represents the most stringent value of the Aquatic Life criteria, Freshwater (Acute and Chronic) criteria; the Human Health Consumption of Organisms Only criteria; and the Human Health consumption of water and organisms. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples SWBW-01, SWBW-02, SWBW-03 were considered to represent the upstream Branch Brook surface water samples

TABLE III-12

Summary Statistics for Chemicals Detected in Upstream Branch Brook Surface Water Samples* (Filtered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Inorganic Compounds									
Calcium	3	3			7.50E+00	7.90E+00	7.70E+00	7.90E+00	NA
Iron	3	3			9.00E-02	1.20E-01	1.10E-01	1.20E-01	NA
Magnesium	3	3			2.20E+00	2.20E+00	2.20E+00	2.20E+00	NA
Potassium	3	3			1.70E+00	1.80E+00	1.77E+00	1.80E+00	NA
Sodium	3	3			6.70E+00	6.90E+00	6.80E+00	6.90E+00	NA
Zinc	1	3	1.00E-02	1.00E-02	1.40E-02	1.40E-02	8.00E-03	1.40E-02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] Criteria apply to unfiltered samples. Comparisons were made in Tables III-11 and III-13. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples SWBW-01, SWBW-02, SWBW-03 were considered to represent the upstream Branch Brook surface water samples

TABLE III-13

Summary Statistics for Chemicals Detected in Downstream Branch Brook Surface Water Samples (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Semivolatile Compounds									
Dibutyl phthalate	2	16	1.00E-02	1.00E-02	1.20E-03	1.60E-03	4.55E-03	1.60E-03	2.70E+00
Inorganic Compounds									
Calcium	16	16			7.60E+00	1.10E+01	8.49E+00	8.89E+00	NA
Copper	1	16	2.00E-02	2.00E-02	2.00E-02	2.00E-02	1.06E-02	1.15E-02	4.80E-03
Iron	16	16			4.00E-02	3.50E-01	1.51E-01	2.69E-01	NA
Magnesium	16	16			2.30E+00	3.30E+00	2.63E+00	2.78E+00	NA
Manganese	13	16	2.00E-02	5.00E-02	2.20E-02	6.30E-02	4.64E-02	6.30E-02	NA
Mercury	6	16	1.00E-03	5.00E-03	5.00E-03	5.00E-03	3.31E-03	4.75E-03	1.20E-05
Potassium	16	16			1.60E+00	2.70E+00	1.87E+00	1.99E+00	NA
Sodium	16	16			5.90E+00	2.50E+01	1.04E+01	1.26E+01	NA
Zinc	14	16	1.00E-02	1.00E-02	1.00E-02	1.40E-02	1.02E-02	1.18E-02	5.82E-02

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP criteria were determined to be the 'Numerical Water Quality Criteria for Chemical Constituents' taken from Appendix D of the CTDEP Water Quality Standards. The criterion selected for each parameter represents the most stringent value of the Aquatic Life criteria, Freshwater (Acute and Chronic) criteria; the Human Health Consumption of Organisms Only criteria; and the Human Health consumption of water and organisms. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-14

Summary Statistics for Chemicals Detected in Downstream Branch Brook Surface Water Samples (Filtered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Inorganic Compounds									
Calcium	8	8			7.40E+00	8.00E+00	7.79E+00	7.92E+00	NA
Iron	8	8			9.00E-02	1.10E-01	9.87E-02	1.03E-01	NA
Magnesium	8	8			2.20E+00	2.40E+00	2.30E+00	2.35E+00	NA
Potassium	8	8			1.70E+00	1.90E+00	1.84E+00	1.89E+00	NA
Sodium	8	8			6.90E+00	7.40E+00	7.26E+00	7.38E+00	NA
Zinc	7	8	1.00E-02	1.00E-02	1.00E-02	2.20E-02	1.35E-02	2.02E-02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] Criteria apply to unfiltered samples. Comparisons were made in Tables III-11 and III-13. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-15

Summary Statistics for Chemicals Detected in Upstream Naugatuck River Surface Water Samples* (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	1	6	1.00E-02	1.00E-02	4.90E-03	4.90E-03	4.98E-03	4.90E-03	NA
Methylene chloride	1	6	1.00E-02	1.00E-02	6.00E-04	6.00E-04	4.27E-03	6.00E-04	1.60E+00
Trichloroethene	6	6			4.00E-04	9.20E-04	6.78E-04	9.20E-04	8.10E-02
PCBs/Pesticides									
HCH (gamma) Lindane	1	3	5.00E-05	5.20E-05	8.00E-06	8.00E-06	1.97E-05	8.00E-06	NA
PCBs (total)	2	3	1.80E-04	1.00E-03	1.60E-04	3.10E-04	1.19E-03	3.10E-04	1.70E-07
2,4,5,6-Tetrachloro-m-xylene	2	3	2.60E-04	2.60E-04	2.50E-04	2.70E-04	2.17E-04	2.70E-04	NA
Inorganic Compounds									
Calcium	6	6			9.20E+00	1.20E+01	1.06E+01	1.18E+01	NA
Iron	6	6			1.50E-01	3.90E-01	2.68E-01	3.90E-01	NA
Magnesium	6	6			3.10E+00	3.60E+00	3.33E+00	3.54E+00	NA
Manganese	4	6	6.70E-02	6.90E-02	5.00E-02	6.10E-02	4.77E-02	6.10E-02	NA
Potassium	6	6			2.60E+00	3.70E+00	2.95E+00	3.35E+00	NA
Sodium	6	6			1.80E+01	2.20E+01	1.98E+01	2.14E+01	NA
Zinc	5	6	1.00E-02	1.00E-02	1.00E-02	1.80E-02	1.32E-02	1.80E-02	5.82E-02

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP criteria were determined to be the 'Numerical Water Quality Criteria for Chemical Constituents' taken from Appendix D of the CTDEP Water Quality Standards. The criterion selected for each parameter represents the most stringent value of the Aquatic Life criteria, Freshwater (Acute and Chronic) criteria; and the Human Health Consumption of Organisms Only criteria. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples SWNW-01, SWNW-02, SWNW-03 were considered to represent the upstream Naugatuck River surface water samples

TABLE III-16

Summary Statistics for Chemicals Detected in Upstream Naugatuck River Surface Water Samples* (Filtered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Inorganic Compounds									
Calcium	3	3			9.40E+00	1.00E+01	9.70E+00	1.00E+01	NA
Iron	3	3			1.80E-01	1.90E-01	1.87E-01	1.90E-01	NA
Magnesium	3	3			2.90E+00	3.00E+00	2.97E+00	3.00E+00	NA
Manganese	1	3	5.00E-02	5.00E-02	5.50E-02	5.50E-02	3.50E-02	5.50E-02	NA
Potassium	3	3			2.60E+00	2.70E+00	2.63E+00	2.70E+00	NA
Sodium	3	3			1.70E+01	1.80E+01	1.77E+01	1.80E+01	NA
Zinc	3	3			1.40E-02	1.80E-02	1.57E-02	1.80E-02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] Criteria apply to unfiltered samples. Comparisons were made in Tables III-15 and III-18. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples SWNW-01, SWNW-02, SWNW-03 were considered to represent the upstream Naugatuck River surface water samples

TABLE III-17

Summary Statistics for Chemicals Detected in Downstream Naugatuck River Surface Water Samples (Filtered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[a] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Inorganic Compounds									
Calcium	6	6			8.90E+00	9.60E+00	9.20E+00	9.46E+00	NA
Iron	6	6			1.70E-01	1.90E-01	1.82E-01	1.88E-01	NA
Magnesium	6	6			2.90E+00	3.00E+00	2.92E+00	2.95E+00	NA
Manganese	2	6	5.00E-02	5.00E-02	5.00E-02	5.50E-02	3.42E-02	5.10E-02	NA
Potassium	6	6			2.40E+00	3.00E+00	2.67E+00	2.85E+00	NA
Sodium	6	6			1.50E+01	1.80E+01	1.63E+01	1.72E+01	NA
Zinc	6	6			1.20E-02	1.90E-02	1.60E-02	1.87E-02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] Criteria apply to unfiltered samples. Comparisons were made in Tables III-15 and III-18. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-18

Summary Statistics for Chemicals Detected in Downstream Naugatuck River Surface Water Samples (Unfiltered)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Tetrachloroethylene (PCE)	3	12	1.00E-02	1.00E-02	3.00E-04	7.00E-04	3.88E-03	7.00E-04	8.85E-03
Trichloroethene	11	12	1.00E-02	1.00E-02	4.00E-04	7.30E-04	9.37E-04	7.30E-04	8.10E-02
Semivolatile Compounds									
Bis(2-ethylhexyl)phthalate	1	12	1.00E-02	1.00E-02	2.20E-03	2.20E-03	4.77E-03	2.20E-03	5.90E-03
Dibutyl phthalate	3	12	1.00E-02	1.00E-02	1.20E-03	1.30E-03	4.07E-03	1.30E-03	1.20E+01
PCBs/Pesticides									
HCH (gamma) Lindane	1	6	1.50E-05	5.30E-05	1.50E-05	1.50E-05	2.08E-05	1.50E-05	NA
Inorganic Compounds									
Calcium	12	12			8.80E+00	1.30E+01	1.04E+01	1.11E+01	NA
Iron	12	12			1.20E-01	3.90E-01	2.78E-01	3.83E-01	NA
Magnesium	12	12			3.10E+00	3.70E+00	3.34E+00	3.47E+00	NA
Manganese	8	12	5.50E-02	7.20E-02	4.10E-02	6.90E-02	4.40E-02	5.31E-02	NA
Potassium	12	12			2.50E+00	4.70E+00	3.29E+00	3.79E+00	NA
Sodium	12	12			1.60E+01	2.90E+01	1.99E+01	2.21E+01	NA
Zinc	10	12	1.00E-02	1.00E-02	1.40E-02	2.10E-02	1.50E-02	2.10E-02	5.82E-02

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP criteria were determined to be the 'Numerical Water Quality Criteria for Chemical Constituents' taken from Appendix D of the CTDEP Water Quality Standards. The criterion selected for each parameter represents the most stringent value of the Aquatic Life criteria, Freshwater (Acute and Chronic) criteria; and the Human Health Consumption of Organisms Only criteria. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-19

Summary Statistics for Chemicals Detected in Upstream Branch Brook Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	1	4	1.00E-02	1.00E-02	6.40E-03	6.40E-03	5.35E-03	6.18E-03	NA
Chloroform	3	4	1.00E-02	1.00E-02	8.00E-04	1.00E-03	1.93E-03	1.00E-03	NA
Methylene chloride	4	4			7.40E-03	1.20E-02	8.88E-03	1.17E-02	NA
Semivolatile Compounds									
Acenaphthene	1	4	3.30E-01	3.30E-01	6.20E-02	6.20E-02	1.39E-01	6.20E-02	NA
Anthracene	1	4	3.30E-01	3.30E-01	5.20E-02	5.20E-02	1.37E-01	5.20E-02	NA
Benzo[a]pyrene	1	4	3.30E-01	3.30E-01	1.90E-01	1.90E-01	1.71E-01	1.85E-01	NA
Benzo[b]fluoranthene	1	4	3.30E-01	3.30E-01	1.80E-01	1.80E-01	1.69E-01	1.77E-01	NA
Benzo[k]fluoranthene	1	4	3.30E-01	3.30E-01	1.80E-01	1.80E-01	1.69E-01	1.77E-01	NA
Bis(2-ethylhexyl)phthalate	1	4	3.30E-01	3.30E-01	1.30E-01	1.30E-01	1.56E-01	1.30E-01	NA
Butylbenzylphthalate	1	4	3.30E-01	3.30E-01	1.30E-01	1.30E-01	1.56E-01	1.30E-01	NA
Dibenzofuran	1	4	3.30E-01	3.30E-01	4.20E-02	4.20E-02	1.34E-01	4.20E-02	NA
Dibutyl phthalate	2	4	3.30E-01	3.30E-01	1.90E-01	2.20E-01	1.85E-01	2.17E-01	NA
Diethylphthalate	3	4	3.30E-01	3.30E-01	2.60E-02	7.00E-02	7.23E-02	7.00E-02	NA
Fluoranthene	3	4	3.30E-01	3.30E-01	4.60E-02	6.00E-01	3.48E-01	6.00E-01	NA
Fluorene	1	4	3.30E-01	3.30E-01	5.00E-02	5.00E-02	1.36E-01	5.00E-02	NA
Phenanthrene	2	4	3.30E-01	3.30E-01	2.00E-01	3.10E-01	2.10E-01	3.05E-01	NA
Pyrene	4	4			3.80E-02	9.30E-01	3.70E-01	9.30E-01	NA
PCBs/Pesticides									
Aldrin	1	2	8.80E-03	8.80E-03	1.30E-03	1.30E-03	2.85E-03	1.30E-03	NA
PCBs (total)	2	2	4.20E-02	4.40E-02	2.30E-02	2.40E-02	6.65E-02	2.40E-02	NA
2,4,5,6-Tetrachloro-m-xylene	2	2			1.90E-02	1.90E-02	1.90E-02	1.90E-02	NA
Other Parameters									
pH	3	3			6.80E+00	9.40E+00	7.70E+00	9.40E+00	NA
TOC	5	5			1.30E+03	6.40E+03	4.18E+03	6.40E+03	NA
Inorganic Compounds									
Barium	2	2			2.90E+01	4.00E+02	2.15E+02	4.00E+02	NA
Chromium	2	2			8.80E+00	1.30E+01	1.09E+01	1.30E+01	NA
Cobalt	2	2			6.00E+00	7.60E+00	6.80E+00	7.60E+00	NA
Copper	2	2			6.60E+00	1.20E+01	9.30E+00	1.20E+01	NA
Lead	2	2			1.60E+00	4.10E+02	2.06E+02	4.10E+02	NA
Nickel	1	2	6.00E-01	6.00E-01	1.20E+01	1.20E+01	6.15E+00	1.20E+01	NA

TABLE III-19

Summary Statistics for Chemicals Detected in Upstream Branch Brook Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Zinc	2	2			2.20E+01	1.70E+02	9.60E+01	1.70E+02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] No applicable CTDEP criteria were identified for sediment. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples BBI-02, BBI-04, TBB-02 were considered to represent the upstream Branch Brook sediment samples

TABLE III-20

Summary Statistics for Chemicals Detected in Downstream Branch Brook Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	12	17	1.00E-02	1.00E-02	1.80E-03	3.70E-02	8.85E-03	1.37E-02	NA
2-Butanone	3	17	1.00E-02	1.00E-02	1.20E-03	8.30E-03	4.93E-03	6.02E-03	NA
Chloroform	13	17	1.00E-02	1.00E-02	4.00E-04	1.70E-03	1.85E-03	1.70E-03	NA
1,2-Dichloroethylene (cis)	1	17	1.00E-02	1.00E-02	1.10E-03	1.10E-03	4.77E-03	1.10E-03	NA
Methylene chloride	17	17			9.00E-04	1.60E-02	7.74E-03	1.25E-02	NA
Tetrachloroethylene (PCE)	1	17	1.00E-02	1.00E-02	3.00E-03	3.00E-03	4.88E-03	3.00E-03	NA
Trichloroethene	1	17	1.00E-02	1.00E-02	1.30E-03	1.30E-03	4.78E-03	1.30E-03	NA
Semivolatile Compounds									
Anthracene	4	17	3.30E-01	3.30E-01	1.90E-02	1.10E-01	1.37E-01	1.10E-01	NA
Benzo[a]pyrene	5	17	3.30E-01	3.30E-01	6.50E-02	6.00E-01	1.78E-01	2.21E-01	NA
Benzo[b]fluoranthene	7	17	3.30E-01	3.30E-01	5.50E-02	5.70E-01	1.74E-01	2.27E-01	NA
Benzo[k]fluoranthene	7	17	3.30E-01	3.30E-01	4.40E-02	5.50E-01	1.76E-01	2.32E-01	NA
Bis(2-ethylhexyl)phthalate	1	17	3.30E-01	3.30E-01	4.60E-01	4.60E-01	1.82E-01	2.03E-01	NA
Butylbenzylphthalate	1	17	3.30E-01	3.30E-01	1.70E-01	1.70E-01	1.65E-01	1.66E-01	NA
Dibutyl phthalate	12	17	3.30E-01	3.30E-01	1.20E-01	2.60E+00	3.83E-01	5.14E-01	NA
Diethylphthalate	12	17	3.30E-01	3.30E-01	2.60E-02	2.00E+00	3.52E-01	8.31E-01	NA
Fluoranthene	9	17	3.30E-01	3.30E-01	2.20E-02	1.60E+00	3.49E-01	6.89E-01	NA
Methoxychlor	2	7	4.10E-03	1.20E-02	3.70E-03	9.10E-03	3.75E-03	6.15E-03	NA
Phenanthrene	9	17	3.30E-01	3.30E-01	2.60E-02	4.90E-01	1.65E-01	2.52E-01	NA
Pyrene	8	17	3.30E-01	3.30E-01	4.70E-02	1.40E+00	2.91E-01	4.47E-01	NA
PCBs/Pesticides									
Aldrin	3	7	4.40E-04	1.10E-02	1.80E-03	2.10E-02	6.08E-03	2.10E-02	NA
4,4'-DDT	1	7	1.30E-03	3.50E-02	7.90E-03	7.90E-03	9.41E-03	7.90E-03	NA
Dieldrin	1	7	4.00E-03	4.40E-03	2.67E-02	2.67E-02	5.70E-03	2.05E-02	NA
PCBs (total)	7	7	4.00E-02	4.40E-02	2.00E-02	3.30E-02	8.69E-02	3.30E-02	NA
2,4,5,6-Tetrachloro-m-xylene	7	7			1.80E-02	2.10E-02	1.89E-02	1.98E-02	NA
Other Parameters									
pH	10	10			5.70E+00	6.80E+00	6.38E+00	6.62E+00	NA
TOC	20	20			4.15E+02	2.80E+04	4.05E+03	7.46E+03	NA
Inorganic Compounds									
Arsenic	2	10	1.00E+00	1.00E+00	1.00E+00	1.20E+00	6.20E-01	7.80E-01	NA
Barium	10	10			1.80E+01	3.80E+01	2.65E+01	3.30E+01	NA

TABLE III-20

Summary Statistics for Chemicals Detected in Downstream Branch Brook Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Chromium	10	10			5.00E+00	1.60E+01	8.68E+00	1.15E+01	NA
Cobalt	10	10			4.40E+00	1.00E+01	6.80E+00	8.17E+00	NA
Copper	10	10			8.00E+00	1.70E+01	1.19E+01	1.41E+01	NA
Lead	8	10	1.20E+00	1.20E+00	1.20E+00	9.80E+00	4.18E+00	9.80E+00	NA
Nickel	10	10			7.80E+00	1.30E+01	1.01E+01	1.12E+01	NA
Silver	1	10	6.00E-01	6.00E-01	6.00E-01	6.00E-01	3.30E-01	3.81E-01	NA
Zinc	10	10			1.70E+01	4.40E+01	2.72E+01	3.32E+01	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] No applicable CTDEP criteria were identified for sediment. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-21

Summary Statistics for Chemicals Detected in Upstream Naugatuck River Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	7	10	1.00E-02	1.00E-02	6.40E-03	3.70E-02	1.14E-02	1.95E-02	NA
2-Butanone	5	10	1.00E-02	1.00E-02	1.20E-03	9.20E-03	4.76E-03	9.20E-03	NA
Chloroform	5	10	1.00E-02	1.00E-02	8.00E-04	1.80E-03	3.09E-03	1.80E-03	NA
Methylene chloride	10	10			2.70E-03	9.40E-03	5.46E-03	6.92E-03	NA
Toluene	1	10	1.00E-02	1.00E-02	4.40E-03	4.40E-03	4.94E-03	4.40E-03	NA
Semivolatile Compounds									
Acenaphthene	2	9	3.30E-01	3.30E-01	2.90E-02	6.40E-02	1.39E-01	6.40E-02	NA
Anthracene	2	9	3.30E-01	3.30E-01	1.30E-01	4.20E-01	1.89E-01	2.40E-01	NA
Benzo[a]pyrene	9	9			1.00E-01	1.50E+00	6.60E-01	1.50E+00	NA
Benzo[b]fluoranthene	9	9			1.90E-01	1.80E+00	7.96E-01	1.80E+00	NA
Benzo[k]fluoranthene	9	9			2.10E-01	2.10E+00	8.36E-01	1.83E+00	NA
Bis(2-ethylhexyl)phthalate	2	9	3.30E-01	3.30E-01	2.10E-01	2.20E-01	1.76E-01	1.90E-01	NA
Butylbenzylphthalate	1	9	3.30E-01	3.30E-01	1.30E-01	1.30E-01	1.61E-01	1.30E-01	NA
Dibenzofuran	2	9	3.30E-01	3.30E-01	2.60E-02	3.30E-02	1.35E-01	3.30E-02	NA
Dibutyl phthalate	3	9	3.30E-01	3.90E-01	8.20E-02	2.00E-01	1.57E-01	1.93E-01	NA
Diethylphthalate	1	9	3.30E-01	3.30E-01	3.80E-02	3.80E-02	1.51E-01	3.80E-02	NA
Fluoranthene	9	9			5.70E-01	8.00E+00	2.76E+00	6.87E+00	NA
Fluorene	6	9	3.30E-01	3.30E-01	6.10E-02	1.50E-01	1.11E-01	1.50E-01	NA
Phenanthrene	8	9	3.30E-01	3.30E-01	2.60E-01	3.00E+00	1.07E+00	2.86E+00	NA
Pyrene	9	9			1.40E-01	2.90E+00	1.51E+00	2.90E+00	NA
2,4,5-Trichlorophenol	1	9	3.30E-01	3.30E-01	3.00E-01	3.00E-01	1.80E-01	2.05E-01	NA
PCBs/Pesticides									
Heptachlor	2	5	2.20E-04	2.70E-04	2.20E-04	6.30E-04	2.43E-04	6.30E-04	NA
PCBs (total)	5	5	4.00E-02	5.00E-02	5.50E-03	1.80E-02	5.81E-02	1.80E-02	NA
2,4,5,6-Tetrachloro-m-xylene	5	5			1.20E-02	2.00E-02	1.70E-02	2.00E-02	NA
Other Parameters									
pH	10	10			5.50E+00	6.60E+00	6.05E+00	6.25E+00	NA
TOC	15	15			4.00E+02	3.80E+04	7.11E+03	1.76E+04	NA
Inorganic Compounds									
Barium	5	5			2.40E+01	4.10E+01	3.20E+01	4.10E+01	NA
Cadmium	2	5	2.00E-01	2.00E-01	5.80E-01	1.10E+00	3.96E-01	1.10E+00	NA
Chromium	5	5			1.20E+01	2.50E+01	1.66E+01	2.42E+01	NA

TABLE III-21

Summary Statistics for Chemicals Detected in Upstream Naugatuck River Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Cobalt	5	5			3.80E+00	5.60E+00	4.84E+00	5.60E+00	NA
Copper	5	5			2.80E+01	9.20E+01	4.84E+01	9.04E+01	NA
Lead	5	5			7.20E+00	2.90E+01	1.66E+01	2.90E+01	NA
Nickel	5	5			7.00E+00	1.30E+01	9.60E+00	1.30E+01	NA
Silver	1	5	6.00E-01	6.00E-01	6.00E-01	6.00E-01	3.60E-01	5.15E-01	NA
Zinc	5	5			6.20E+01	1.70E+02	9.76E+01	1.67E+02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] No applicable CTDEP criteria were identified for sediment. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Samples NRI-02, NRI-05, NRI-09, NRI-11, TNR-02 were considered to represent the upstream Naugatuck River sediment samples

TABLE III-22

Summary Statistics for Chemicals Detected in Downstream Naugatuck River Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Acetone	5	8	1.00E-02	1.00E-02	2.90E-03	1.10E-02	6.32E-03	8.99E-03	NA
Bromodichloromethane	1	8	5.00E-03	1.00E-02	2.10E-03	2.10E-03	4.64E-03	2.10E-03	NA
2-Butanone	1	8	1.00E-02	1.00E-02	1.20E-03	1.20E-03	4.53E-03	1.20E-03	NA
Chloroform	4	8	1.00E-02	1.00E-02	1.20E-03	3.60E-02	8.40E-03	2.40E-02	NA
Methylene chloride	8	8			5.60E-03	4.00E-02	1.55E-02	3.33E-02	NA
Tetrachloroethylene (PCE)	1	8	5.00E-03	1.00E-02	1.50E-03	1.50E-03	4.56E-03	1.50E-03	NA
Semivolatile Compounds									
Acenaphthene	1	8	3.30E-01	3.30E-01	3.40E-02	3.40E-02	1.65E-01	3.40E-02	NA
Anthracene	5	8	3.30E-01	3.30E-01	9.20E-02	2.10E-01	1.60E-01	1.95E-01	NA
Benzo[a]pyrene	8	8			1.40E-01	1.60E+00	9.15E-01	1.60E+00	NA
Benzo[b]fluoranthene	8	8			1.40E-01	2.40E+00	1.17E+00	2.40E+00	NA
Benzo[k]fluoranthene	8	8			6.00E-02	2.20E+00	1.09E+00	2.20E+00	NA
Bis(2-ethylhexyl)phthalate	3	8	3.30E-01	3.30E-01	6.70E-02	4.80E-01	2.09E-01	3.53E-01	NA
Dibenzofuran	1	8	3.30E-01	3.30E-01	2.70E-02	2.70E-02	1.48E-01	2.70E-02	NA
Dibutyl phthalate	5	8	3.30E-01	4.00E-01	9.00E-03	1.50E-01	1.42E-01	1.50E-01	NA
Fluoranthene	8	8			3.30E-01	5.60E+00	3.09E+00	5.60E+00	NA
Fluorene	7	8	3.30E-01	3.30E-01	2.20E-02	5.70E-02	5.95E-02	5.70E-02	NA
Methoxychlor	1	4	1.40E-02	2.00E-02	6.60E-03	6.60E-03	8.65E-03	6.60E-03	NA
Naphthalene	1	8	3.30E-01	3.30E-01	2.10E-02	2.10E-02	1.65E-01	2.10E-02	NA
Phenanthrene	8	8			1.20E-01	1.80E+00	1.09E+00	1.80E+00	NA
Pyrene	8	8			2.00E-01	2.30E+00	1.51E+00	2.30E+00	NA
PCBs/Pesticides									
Dieldrin	1	4	2.20E-03	1.40E-02	3.60E-03	3.60E-03	3.32E-03	3.60E-03	NA
Heptachlor	1	4	2.00E-04	2.40E-03	3.10E-04	3.10E-04	6.67E-04	3.10E-04	NA
PCBs (total)	4	4	4.10E-02	4.40E-02	1.40E-02	1.70E-02	1.02E-01	1.70E-02	NA
2,4,5,6-Tetrachloro-m-xylene	4	4			1.70E-02	1.90E-02	1.78E-02	1.88E-02	NA
Other Parameters									
pH	11	11			5.90E+00	6.90E+00	6.40E+00	6.59E+00	NA
TOC	15	15			2.70E+03	1.90E+04	7.64E+03	1.06E+04	NA
Inorganic Compounds									
Arsenic	1	5	1.00E+00	1.00E+00	4.30E-01	4.30E-01	4.86E-01	4.30E-01	NA
Barium	5	5			2.30E+01	3.80E+01	3.20E+01	3.80E+01	NA

TABLE III-22

Summary Statistics for Chemicals Detected in Downstream Naugatuck River Sediment Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Cadmium	4	5	5.10E-01	5.10E-01	2.20E-01	1.10E+00	4.95E-01	1.10E+00	NA
Chromium	5	5			1.20E+01	7.83E+01	3.23E+01	7.83E+01	NA
Cobalt	5	5			2.10E+00	7.40E+00	4.22E+00	7.40E+00	NA
Copper	5	5			3.40E+01	1.01E+02	7.14E+01	1.01E+02	NA
Lead	5	5			1.10E+01	2.10E+01	1.76E+01	2.10E+01	NA
Nickel	5	5			7.80E+00	2.20E+01	1.30E+01	2.20E+01	NA
Potassium	1	1			7.70E+02	7.70E+02	7.70E+02	7.70E+02	NA
Silver	3	5	6.00E-01	6.00E-01	6.00E-01	2.20E+00	9.00E-01	2.20E+00	NA
Vanadium	1	5	2.00E+01	2.00E+01	7.00E+00	7.00E+00	9.40E+00	7.00E+00	NA
Zinc	5	5			8.00E+01	1.40E+02	1.06E+02	1.32E+02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] No applicable CTDEP criteria were identified for sediment. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-23

Summary Statistics for Chemicals Detected in Upstream Branch Brook Piezometer Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
PCBs/Pesticides									
PCBs (total)	1	2	2.90E-04	1.00E-03	2.20E-04	2.20E-04	2.43E-03	2.20E-04	5.00E-04
2,4,5,6-Tetrachloro-m-xylene	1	2	2.50E-04	2.50E-04	2.60E-04	2.60E-04	1.92E-04	2.60E-04	NA
Inorganic Compounds									
Calcium	2	2			1.40E+01	1.90E+01	1.65E+01	1.90E+01	NA
Iron	1	2	3.00E-02	3.00E-02	1.60E-01	1.60E-01	8.75E-02	1.60E-01	NA
Magnesium	2	2			3.40E+00	4.20E+00	3.80E+00	4.20E+00	NA
Manganese	1	2	5.00E-02	5.00E-02	5.10E-02	5.10E-02	3.80E-02	5.10E-02	NA
Potassium	2	2			5.70E+00	6.50E+00	6.10E+00	6.50E+00	NA
Sodium	2	2			3.20E+01	4.60E+01	3.90E+01	4.60E+01	NA
Zinc	2	2			3.00E-01	3.40E-01	3.20E-01	3.20E-01	1.23E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Surface Water Protection Criteria for Ground Water' and the 'Volatilization Criteria for Ground Water' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Sample BBP-02 was considered to represent upstream the Branch Brook piezometer sample

TABLE III-24

Summary Statistics for Chemicals Detected in Downstream Branch Brook Piezometer Samples

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Toluene	1	6	1.00E-02	1.00E-02	6.00E-04	6.00E-04	4.27E-03	6.00E-04	5.00E+01
PCBs/Pesticides									
Dieldrin	1	7	1.00E-04	1.00E-04	1.40E-05	1.40E-05	4.49E-05	1.40E-05	1.00E-04
PCBs (total)	4	7	1.20E-04	1.00E-03	1.60E-04	2.20E-04	2.58E-03	2.20E-04	5.00E-04
2,4,5,6-Tetrachloro-m-xylene	4	7	1.00E-04	2.80E-04	2.40E-04	2.50E-04	1.82E-04	2.50E-04	NA
Inorganic Compounds									
Calcium	7	7			8.10E+00	5.60E+01	1.88E+01	3.96E+01	NA
Iron	6	7	3.00E-02	3.00E-02	4.00E-02	1.60E+00	5.98E-01	1.60E+00	NA
Magnesium	7	7			1.60E+00	1.50E+01	4.94E+00	1.23E+01	NA
Manganese	3	7	2.00E-02	5.00E-02	1.10E-01	1.80E-01	6.93E-02	1.80E-01	NA
Potassium	7	7			2.80E+00	7.80E+00	4.66E+00	6.70E+00	NA
Sodium	7	7			1.10E+01	3.20E+01	2.34E+01	3.20E+01	NA
Zinc	7	7			2.80E-01	2.40E+00	1.37E+00	1.37E+00	1.23E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Surface Water Protection Criteria for Ground Water' and the 'Volatilization Criteria for Ground Water' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-25

Summary Statistics for Chemicals Detected in Upstream Naugatuck River Piezometer Samples*

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
PCBs/Pesticides									
BHC, delta	1	2	5.00E-05	5.00E-05	6.20E-05	6.20E-05	4.35E-05	6.20E-05	NA
Dieldrin	2	2			2.00E-05	3.50E-05	2.75E-05	2.75E-05	1.00E-04
PCBs (total)	1	2	1.90E-04	1.00E-03	1.10E-04	1.10E-04	2.35E-03	1.10E-04	5.00E-04
2,4,5,6-Tetrachloro-m-xylene	1	2	2.60E-04	2.60E-04	1.90E-04	1.90E-04	1.60E-04	1.90E-04	NA
Inorganic Compounds									
Calcium	2	2			8.00E+00	9.10E+00	8.55E+00	9.10E+00	NA
Copper	1	2	2.00E-02	2.00E-02	4.00E-02	4.00E-02	2.50E-02	2.50E-02	4.80E-02
Iron	2	2			2.60E+00	6.60E+00	4.60E+00	6.60E+00	NA
Magnesium	2	2			2.00E+00	2.90E+00	2.45E+00	2.90E+00	NA
Manganese	2	2			5.20E-01	6.80E-01	6.00E-01	6.80E-01	NA
Potassium	2	2			2.00E+00	2.80E+00	2.40E+00	2.80E+00	NA
Sodium	2	2			1.50E+01	1.70E+01	1.60E+01	1.70E+01	NA
Zinc	2	2			4.50E-01	1.30E+00	8.75E-01	8.75E-01	1.23E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Surface Water Protection Criteria for Ground Water' and the 'Volatilization Criteria for Ground Water' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Sample NRP-02 was considered to represent upstream the Naugatuck River piezometer sample

TABLE III-26

Summary Statistics for Chemicals Detected in Downstream Naugatuck River Piezometer Samples

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Trichloroethene	1	5	5.00E-03	1.00E-02	5.00E-04	5.00E-04	3.60E-03	5.00E-04	5.40E-01
Semivolatile Compounds									
Dibutyl phthalate	1	8	1.00E-02	1.00E-02	3.00E-04	3.00E-04	4.41E-03	3.00E-04	1.20E+02
PCBs/Pesticides									
BHC, delta	1	8	5.00E-05	5.00E-05	7.00E-06	7.00E-06	2.28E-05	7.00E-06	NA
PCBs (total)	3	8	2.50E-04	1.00E-03	1.70E-04	1.90E-04	2.45E-03	1.90E-04	5.00E-04
2,4,5,6-Tetrachloro-m-xylene	3	7	2.40E-04	2.90E-04	2.20E-04	2.60E-04	1.79E-04	2.48E-04	NA
Inorganic Compounds									
Antimony	1	8	4.00E-01	4.00E-01	3.82E-02	3.82E-02	1.80E-01	3.82E-02	8.60E+01
Barium	1	8	5.00E-01	5.00E-01	1.73E-02	1.73E-02	2.21E-01	1.73E-02	NA
Cadmium	1	8	1.00E-02	1.00E-02	2.50E-03	2.50E-03	4.69E-03	2.50E-03	6.00E-03
Calcium	8	8			7.60E+00	1.50E+01	1.03E+01	1.24E+01	NA
Chromium	1	8	4.00E-02	4.00E-02	4.50E-03	4.50E-03	1.81E-02	4.50E-03	1.10E-01
Copper	7	8	2.00E-02	2.00E-02	2.00E-02	4.00E-02	2.89E-02	2.89E-02	4.80E-02
Iron	8	8			3.00E-02	6.00E-01	1.89E-01	6.00E-01	NA
Lead	1	8	6.00E-02	6.00E-02	1.30E-03	1.30E-03	2.64E-02	1.30E-03	1.30E-02
Magnesium	8	8			2.40E+00	4.00E+00	3.08E+00	3.65E+00	NA
Manganese	5	8	5.00E-02	5.00E-02	5.40E-02	4.17E-01	1.78E-01	4.17E-01	NA
Potassium	8	8			2.30E+00	4.70E+00	3.01E+00	3.64E+00	NA
Sodium	8	8			1.30E+01	2.90E+01	1.88E+01	2.31E+01	NA
Zinc	8	8			2.80E-01	2.60E+00	1.06E+00	1.06E+00	1.23E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Surface Water Protection Criteria for Ground Water' and the 'Volatilization Criteria for Ground Water' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-27

Summary Statistics for Chemicals Detected in Pre-Envirite Waste Material Samples Located Below the Landfill (PEWM-L)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Benzene	2	4	1.30E+00	1.30E+00	2.00E-03	1.50E-01	3.63E-01	1.50E-01	2.00E-01
Carbon tetrachloride	2	4	1.10E-02	1.30E+00	1.30E+00	1.30E+00	8.14E-01	1.30E+00	1.00E+00
4-Chloroaniline	3	4	8.90E+01	8.90E+01	7.60E+00	7.40E+01	4.10E+01	7.40E+01	NA
Chlorobenzene	1	4	1.10E-02	1.30E+00	1.50E-01	1.50E-01	3.64E-01	1.50E-01	2.00E+01
Chloroform	1	4	1.10E-02	1.30E+00	2.40E-01	2.40E-01	3.86E-01	2.40E-01	1.20E+00
1,1-Dichloroethene	1	4	1.10E-02	1.30E+00	7.00E-02	7.00E-02	3.44E-01	7.00E-02	1.40E+00
1,2-Dichloroethylene (cis)	1	4	1.30E+00	1.30E+00	2.00E-03	2.00E-03	4.88E-01	2.00E-03	1.40E+01
1,2-Dichloroethylene (trans)	1	4	1.30E+00	1.30E+00	2.00E-03	2.00E-03	4.88E-01	2.00E-03	2.00E+01
4,6-Dinitro-2-methylphenol	1	4	1.80E+01	2.20E+02	9.10E+01	9.10E+01	7.50E+01	9.10E+01	NA
Ethylbenzene	3	4	1.30E+00	1.30E+00	4.70E-02	1.40E+01	5.82E+00	1.40E+01	1.01E+01
Tetrachloroethylene (PCE)	2	4	1.30E+00	1.30E+00	1.50E-02	1.00E-01	3.54E-01	1.00E-01	1.00E+00
Toluene	4	4			5.00E-03	9.20E-01	4.51E-01	9.20E-01	6.70E+01
Trichloroethene	1	4	1.10E-02	1.30E+00	2.00E-01	2.00E-01	3.76E-01	2.00E-01	1.00E+00
Xylenes (total)	4	4			1.80E-02	5.00E+01	1.93E+01	5.00E+01	1.95E+01
Semivolatile Compounds									
Acenaphthylene	1	4	7.60E+00	8.90E+01	3.80E+01	3.80E+01	3.08E+01	3.80E+01	8.40E+01
Benzo[k]fluoranthene	1	4	7.60E+00	8.90E+01	3.80E+01	3.80E+01	3.08E+01	3.80E+01	1.00E+00
Bis(2-chloro-1-methylethyl)ether	1	4	7.60E+00	8.90E+01	3.80E+01	3.80E+01	3.08E+01	3.80E+01	NA
Bis(2-ethylhexyl)phthalate	1	4	3.80E+01	3.40E+02	6.10E+02	6.10E+02	2.26E+02	6.10E+02	1.10E+01
Butylbenzylphthalate	1	4	7.60E+00	1.20E+02	2.00E+02	2.00E+02	7.71E+01	2.00E+02	2.00E+02
Di-n-Octyl phthalate	1	4	7.60E+00	7.40E+01	7.00E+00	7.00E+00	1.67E+01	7.00E+00	2.00E+01
Dibutyl phthalate	1	4	7.60E+00	7.40E+01	2.00E+02	2.00E+02	6.50E+01	2.00E+02	1.40E+02
2,4-Dinitrophenol	3	4	2.20E+02	2.20E+02	1.80E+01	1.80E+02	9.98E+01	1.80E+02	NA
Hexachlorocyclopentadiene	3	4	8.90E+01	8.90E+01	7.60E+00	7.40E+01	4.10E+01	7.40E+01	NA
Methoxychlor	1	4	2.00E-02	9.40E-02	3.60E-02	3.60E-02	3.50E-02	3.60E-02	8.00E+00
2-Methylnaphthalene	2	4	7.60E+00	7.40E+01	2.10E+00	4.50E+00	1.19E+01	4.50E+00	NA
Naphthalene	3	4	7.60E+00	7.60E+00	6.80E+00	1.80E+01	1.02E+01	1.80E+01	5.60E+01
3-Nitroaniline	1	4	1.80E+01	2.20E+02	9.10E+01	9.10E+01	7.50E+01	9.10E+01	NA
2-Nitrophenol	1	4	7.60E+00	8.90E+01	3.80E+01	3.80E+01	3.08E+01	3.80E+01	NA
Pentachlorophenol	2	4	9.10E+01	2.20E+02	1.80E+01	1.80E+02	8.84E+01	1.80E+02	1.00E+00
PCBs/Pesticides									
Aldrin	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	NA

TABLE III-27

Summary Statistics for Chemicals Detected in Pre-Envirite Waste Material Samples Located Below the Landfill (PEWM-L)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Aroclor 1254	2	2			7.10E-02	9.50E+00	4.79E+00	9.50E+00	NA
BHC, beta	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	NA
BHC, delta	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	NA
Chlordane	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	6.60E-02
4,4'-DDD	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
4,4'-DDE	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
4,4'-DDT	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
Dieldrin	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	7.00E-03
Endosulfan I	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	NA
Endosulfan II	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
Endosulfan sulfate	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
Endrin	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
Endrin aldehyde	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
Endrin ketone	1	4	3.80E-03	1.80E-02	7.10E-03	7.10E-03	6.75E-03	7.10E-03	NA
HCH (alpha)	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	NA
HCH (gamma) Lindane	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	NA
Heptachlor	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	1.30E-02
Heptachlor epoxide	1	4	2.00E-03	9.40E-03	3.60E-03	3.60E-03	3.50E-03	3.60E-03	2.00E-02
PCBs (total)	4	4	3.80E-02	1.80E-01	1.22E+00	1.74E+01	1.11E+01	1.74E+01	5.00E-03
Toxaphene	1	4	2.00E-01	9.40E-01	3.60E-01	3.60E-01	3.50E-01	3.60E-01	6.00E-01
Inorganic Compounds									
Antimony	3	4	8.40E+00	8.40E+00	8.50E+00	9.10E+00	7.60E+00	9.10E+00	NA
Arsenic	4	4			1.20E+00	2.30E+00	1.65E+00	2.30E+00	NA
Barium	4	4			3.27E+01	6.95E+01	5.29E+01	6.95E+01	NA
Beryllium	3	4	2.40E-01	2.40E-01	2.80E-01	8.70E-01	4.00E-01	8.70E-01	NA
Cadmium	3	4	4.30E-01	4.30E-01	5.60E-01	8.10E+00	3.29E+00	8.10E+00	NA
Chromium	4	4			1.55E+01	4.88E+01	3.11E+01	4.88E+01	NA
Cobalt	4	4			7.60E+00	1.05E+01	9.32E+00	1.05E+01	NA
Copper	4	4			2.65E+01	1.62E+02	9.65E+01	1.62E+02	NA
Lead	4	4			1.27E+01	2.59E+01	1.81E+01	2.59E+01	NA
Mercury	3	4	1.00E-01	1.00E-01	9.60E-02	1.10E-01	8.85E-02	1.10E-01	NA
Nickel	4	4			1.70E+01	4.45E+01	2.93E+01	4.45E+01	NA
Selenium	2	4	2.20E-01	2.20E-01	2.30E-01	2.40E-01	1.73E-01	2.40E-01	NA

TABLE III-27

Summary Statistics for Chemicals Detected in Pre-Envirite Waste Material Samples Located Below the Landfill (PEWM-L)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Silver	2	4	6.80E-01	7.20E-01	1.10E+00	3.65E+01	9.57E+00	3.65E+01	NA
Thallium	2	4	2.20E-01	2.40E-01	2.20E-01	2.50E-01	1.75E-01	2.50E-01	NA
Tin	2	4	3.00E+00	3.10E+00	2.80E+00	3.80E+00	2.41E+00	3.80E+00	NA
Vanadium	4	4			1.98E+01	3.88E+01	2.85E+01	3.88E+01	NA
Zinc	4	4			5.01E+01	1.88E+02	1.19E+02	1.88E+02	NA

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] The applicable CTDEP remediation criteria for organic compounds were determined to be the 'Pollutant Mobility Criteria' for a GB area established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-28

Summary Statistics for Chemicals Detected in Pre-Envirite Waste Material Samples Located near the Roadway (PEWM-R)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[4] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
Benzene	1	2	9.40E+01	9.40E+01	3.00E+01	3.00E+01	3.85E+01	3.00E+01	2.00E-01
2-Butanone	1	2	9.40E+01	9.40E+01	2.10E+03	2.10E+03	1.07E+03	2.10E+03	8.00E+01
1,2-Dichloroethylene (cis)	2	2			2.60E+01	7.00E+01	4.80E+01	7.00E+01	1.40E+01
1,2-Dichloroethylene (trans)	2	2			2.60E+01	7.00E+01	4.80E+01	7.00E+01	2.00E+01
Ethylbenzene	2	2			7.00E+02	3.10E+03	1.90E+03	3.10E+03	1.01E+01
4-Methyl-2-pentanone	2	2			5.40E+02	7.90E+03	4.22E+03	7.90E+03	NA
Styrene	2	2			6.20E+02	2.30E+03	1.46E+03	2.30E+03	2.00E+01
Tetrachloroethylene (PCE)	2	2			4.40E+02	3.10E+03	1.77E+03	3.10E+03	1.00E+00
Toluene	2	2			2.00E+03	1.50E+04	8.50E+03	1.50E+04	6.70E+01
Trichloroethene	2	2			2.50E+02	3.30E+03	1.78E+03	3.30E+03	1.00E+00
Xylenes (total)	2	2			2.60E+03	1.60E+04	9.30E+03	1.60E+04	1.95E+01
Semivolatile Compounds									
Benzo[b]fluoranthene	1	2	2.40E+02	2.40E+02	5.90E-01	5.90E-01	6.03E+01	5.90E-01	1.00E+00
Benzo[k]fluoranthene	1	2	2.40E+02	2.40E+02	8.20E-01	8.20E-01	6.04E+01	8.20E-01	1.00E+00
Bis(2-ethylhexyl)phthalate	2	2			1.90E+02	6.50E+03	3.35E+03	6.50E+03	1.10E+01
Dibutyl phthalate	2	2			7.40E+01	3.10E+03	1.59E+03	3.10E+03	1.40E+02
Fluoranthene	1	2	2.40E+02	2.40E+02	1.20E+00	1.20E+00	6.06E+01	1.20E+00	5.60E+01
Isophorone	2	2			1.90E+00	6.80E+01	3.50E+01	6.80E+01	NA
2-Methylnaphthalene	1	2	2.40E+02	2.40E+02	9.30E-01	9.30E-01	6.05E+01	9.30E-01	NA
Naphthalene	2	2			6.90E+00	1.60E+02	8.35E+01	1.60E+02	5.60E+01
Phenanthrene	1	2	2.40E+02	2.40E+02	9.30E-01	9.30E-01	6.05E+01	9.30E-01	4.00E+01
Phenol	2	2			5.70E+00	1.70E+02	8.78E+01	1.70E+02	8.00E+02
Pyrene	1	2	2.40E+02	2.40E+02	1.20E+00	1.20E+00	6.06E+01	1.20E+00	4.00E+01
PCBs/Pesticides									
PCBs (total)	2	2	2.50E-01	4.60E-01	1.61E+01	2.60E+01	2.22E+01	2.60E+01	5.00E-03
Inorganic Compounds									
Antimony	1	2	9.90E+00	9.90E+00	9.63E+01	9.63E+01	5.06E+01	9.63E+01	8.20E+03
Arsenic	2	2			2.80E+00	2.80E+00	2.80E+00	2.80E+00	1.00E+01
Barium	2	2			2.60E+02	1.71E+03	9.85E+02	1.71E+03	1.40E+05
Beryllium	1	2	2.90E-01	2.90E-01	4.30E-01	4.30E-01	2.87E-01	4.30E-01	2.00E+00
Cadmium	2	2			2.91E+01	3.94E+02	2.12E+02	3.94E+02	1.00E+03
Chromium	2	2			2.20E+02	1.24E+03	7.30E+02	1.24E+03	1.00E+02

TABLE III-28

Summary Statistics for Chemicals Detected in Pre-Envirite Waste Material Samples Located near the Roadway (PEWM-R)

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)	Potentially Applicable CTDEP Criteria[a] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Cobalt	2	2			1.10E+01	2.48E+01	1.79E+01	2.48E+01	NA
Copper	2	2			1.07E+03	3.34E+03	2.21E+03	3.34E+03	7.60E+04
Lead	2	2			5.41E+02	5.90E+03	3.22E+03	5.90E+03	1.00E+03
Mercury	2	2			3.00E-01	2.40E+00	1.35E+00	2.40E+00	6.10E+02
Nickel	2	2			2.50E+01	5.88E+01	4.19E+01	5.88E+01	7.50E+03
Selenium	2	2			6.30E+00	4.75E+01	2.69E+01	4.75E+01	1.00E+04
Silver	2	2			9.40E-01	1.08E+01	5.87E+00	1.08E+01	1.00E+04
Thallium	2	2			2.60E-01	5.90E-01	4.25E-01	5.90E-01	1.60E+02
Tin	1	2	3.40E+00	3.40E+00	3.54E+01	3.54E+01	1.86E+01	3.54E+01	NA
Vanadium	2	2			1.07E+01	2.39E+01	1.73E+01	2.39E+01	1.40E+04
Zinc	2	2			8.38E+02	5.57E+03	3.20E+03	5.57E+03	6.10E+05

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[a] The applicable CTDEP remediation criteria were determined to be the more stringent of the 'Pollutant Mobility Criteria' for a GB area and the 'Direct Exposure Criteria' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-29

Summary Statistics for Leachate Samples from Pre-Envirite Waste Material Located Below the Landfill

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
2-Butanone	1	1			1.00E-02	1.00E-02	1.00E-02	1.00E-02	NA
Inorganic Compounds									
Barium	1	1			2.30E-01	2.30E-01	2.30E-01	2.30E-01	1.00E+01
Cadmium	1	1			1.10E-01	1.10E-01	1.10E-01	1.10E-01	5.00E-02
Chromium	1	1			4.00E-02	4.00E-02	4.00E-02	4.00E-02	5.00E-01
Lead	1	1			4.00E-02	4.00E-02	4.00E-02	4.00E-02	1.50E-01
Silver	1	1			3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.60E-01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria for inorganic compounds were determined to be the 'Pollutant Mobility Criteria' for a GB area established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Leachate extracted from soil samples using the synthetic precipitation leaching procedure(SPLP)for all samples.

TABLE III-30

Summary Statistics for Leachate Samples from Pre-Envirite Waste Material Located near the Roadway

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
2-Butanone	1	2	2.00E-01	2.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	NA
1,4-Dichlorobenzene	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
2,4-Dinitrotoluene	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
Hexachlorobenzene	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
Hexachloroethane	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
Tetrachloroethylene (PCE)	2	2			7.00E-03	1.20E+00	6.03E-01	1.20E+00	NA
Trichloroethene	2	2			2.40E-02	9.30E-01	4.77E-01	9.30E-01	NA
Semivolatile Compounds									
Hexachlorobutadiene	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
Methoxychlor	1	2	2.50E-03	2.50E-03	2.50E-03	2.50E-03	1.87E-03	2.50E-03	NA
4-Methylphenol	2	2			1.10E-01	1.20E+00	6.55E-01	1.20E+00	NA
2-Methylphenol (o-cresol)	2	2			2.40E-02	5.00E-01	2.62E-01	5.00E-01	NA
Nitrobenzene	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
Pentachlorophenol	1	2	1.00E-01	1.00E-01	5.00E-01	5.00E-01	2.75E-01	5.00E-01	NA
Pyridine	1	2	2.00E-02	2.00E-02	2.90E-01	2.90E-01	1.50E-01	2.90E-01	NA
2,4,5-Trichlorophenol	1	2	1.00E-01	1.00E-01	5.00E-01	5.00E-01	2.75E-01	5.00E-01	NA
2,4,6-Trichlorophenol	1	2	2.00E-02	2.00E-02	1.00E-01	1.00E-01	5.50E-02	1.00E-01	NA
PCBs/Pesticides									
Chlordane	1	2	1.00E-03	1.00E-03	1.00E-03	1.00E-03	7.50E-04	1.00E-03	NA
Endrin	1	2	5.00E-04	5.00E-04	5.00E-04	5.00E-04	3.75E-04	5.00E-04	NA
HCH (gamma) Lindane	1	2	2.50E-04	2.50E-04	2.50E-04	2.50E-04	1.88E-04	2.50E-04	NA
Heptachlor	1	2	2.50E-04	2.50E-04	2.50E-04	2.50E-04	1.88E-04	2.50E-04	NA
Heptachlor epoxide	1	2	2.50E-04	2.50E-04	2.50E-04	2.50E-04	1.88E-04	2.50E-04	NA
Toxaphene	1	2	5.00E-03	5.00E-03	5.00E-03	5.00E-03	3.75E-03	5.00E-03	NA
Inorganic Compounds									
Barium	2	2			3.94E-01	5.10E-01	4.52E-01	5.10E-01	1.00E+01
Cadmium	2	2			3.60E-01	5.71E+00	3.04E+00	5.71E+00	5.00E-02
Chromium	2	2			3.00E-02	1.17E-01	7.35E-02	1.17E-01	5.00E-01
Lead	2	2			2.30E-01	1.12E+01	5.71E+00	1.12E+01	1.50E-01

TABLE III-30

Summary Statistics for Leachate Samples from Pre-Envirite Waste Material Located near the Roadway

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/L)		Range of Detected Concentrations (mg/L)		Mean of all Samples[2] (mg/L)	UCL conc.[3] (mg/L)	Potentially Applicable CTDEP Criteria[4] (mg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria for inorganic compounds were determined to be the 'Pollutant Mobility Criteria' for a GB area established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

* Leachate extracted from soil samples using the synthetic precipitation leaching procedure(SPLP)for all samples.

TABLE III-31

Summary Statistics for Chemicals Detected in On-Site Soil Gas Samples

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (µg/L)		Range of Detected Concentrations (µg/L)		Mean of all Samples[2] (µg/L)	UCL conc.[3] (µg/L)	Potentially Applicable CTDEP Criteria[4] (µg/L)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum			
Volatile Compounds									
1,2-Dichloroethane	1	134		6.39E-01	5.00E-01	5.00E-01	1.80E-02	5.00E-01	4.11E+00
1,1-Dichloroethene	10	134		2.98E-01	5.00E-02	4.00E+00	9.81E-02	1.12E+00	4.03E+00
Tetrachloroethylene (PCE)	127	134		2.31E-01	2.50E-02	5.00E+01	3.28E+00	6.54E+00	7.58E+01
1,1,1-Trichloroethane	28	134		4.65E-01	2.00E-02	4.00E-01	3.56E-02	4.00E-01	7.27E+03
Trichloroethene	28	134		1.35E-01	1.30E-01	7.40E+00	3.16E-01	1.28E+00	3.82E+01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

[4] The applicable CTDEP remediation criteria for organic compounds were determined to be the 'Volatilization Criteria for Soil Vapor' for an industrial/commercial site established in Section 22a-133k-1 of the Regulations of Connecticut State Agencies. NA - Chemicals for which applicable CTDEP requirements could not be located.

TABLE III-32

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-1 feet) - Ecology Data Set

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum		
Volatile Compounds								
Carbon disulfide	1	15	1.00E-02	1.00E-02	1.20E-03	1.20E-03	4.75E-03	1.20E-03
Carbon tetrachloride	1	15	1.00E-02	1.00E-02	2.70E-03	2.70E-03	4.85E-03	2.70E-03
1,2-Dichloroethylene (cis)	2	15	1.00E-02	1.00E-02	1.10E-03	1.20E-03	4.49E-03	1.20E-03
Ethylbenzene	10	15	1.00E-02	1.00E-02	5.00E-04	4.50E-03	3.00E-03	4.50E-03
4-Methyl-2-pentanone	2	15	1.00E-02	1.00E-02	5.40E-03	5.90E-03	5.09E-03	5.20E-03
Styrene	1	15	1.00E-02	1.00E-02	6.40E-04	6.40E-04	4.71E-03	6.40E-04
Tetrachloroethylene (PCE)	12	15	1.00E-02	1.00E-02	5.00E-04	3.00E-03	2.12E-03	3.00E-03
Toluene	12	15	1.00E-02	1.00E-02	5.10E-04	2.00E-02	5.27E-03	9.84E-03
1,1,1-Trichloroethane	1	15	1.00E-02	1.00E-02	4.00E-04	4.00E-04	4.69E-03	4.00E-04
Trichloroethene	7	15	1.00E-02	1.00E-02	5.00E-04	3.10E-03	3.31E-03	3.10E-03
Xylenes (total)	12	15	1.00E-02	1.00E-02	7.00E-04	1.40E-02	5.17E-03	1.40E-02
Semivolatile Compounds								
Acenaphthene	1	15	3.30E-01	9.70E-01	4.20E-02	4.20E-02	1.89E-01	4.20E-02
Anthracene	9	15	3.30E-01	3.83E-01	1.00E-02	3.10E-01	1.04E-01	3.10E-01
Benzo[a]pyrene	14	15	3.30E-01	3.30E-01	1.20E-02	1.50E+00	1.84E-01	4.50E-01
Benzo[b]fluoranthene	14	15	3.30E-01	3.30E-01	1.30E-02	1.40E+00	1.86E-01	4.58E-01
Benzo[k]fluoranthene	14	15	3.30E-01	3.30E-01	1.00E-02	1.60E+00	1.89E-01	4.67E-01
Bis(2-ethylhexyl)phthalate	1	15	3.30E-01	9.70E-01	2.00E-01	2.00E-01	2.01E-01	2.00E-01
Di-n-Octyl phthalate	10	15	3.30E-01	3.96E-01	6.00E-03	6.20E-02	8.39E-02	6.20E-02
Dibenzofuran	1	15	3.30E-01	9.70E-01	4.80E-02	4.80E-02	1.89E-01	4.80E-02
Dibutyl phthalate	2	15	3.30E-01	9.70E-01	3.20E-02	4.80E-02	1.80E-01	4.80E-02
Diethylphthalate	1	15	3.30E-01	9.70E-01	1.00E-02	1.00E-02	1.86E-01	1.00E-02
Fluoranthene	13	15	3.30E-01	3.90E-01	2.30E-02	3.80E+00	4.15E-01	9.65E-01
Fluorene	2	15	3.30E-01	3.96E-01	4.70E-02	5.50E-02	1.60E-01	5.50E-02
2-Methylnaphthalene	1	15	3.30E-01	9.70E-01	5.20E-02	5.20E-02	1.89E-01	5.20E-02
Naphthalene	1	15	3.30E-01	9.70E-01	2.00E-02	2.00E-02	1.87E-01	2.00E-02
Phenanthrene	13	15	3.30E-01	3.30E-01	1.10E-02	1.50E+00	1.90E-01	4.48E-01
Pyrene	14	15	3.30E-01	3.30E-01	2.30E-02	3.90E+00	4.09E-01	9.11E-01
PCBs/Pesticides								
Aroclor 1254	1	2	3.30E-02	3.30E-02	1.60E-02	1.60E-02	1.63E-02	1.60E-02
BHC, delta	1	15	1.70E-03	2.00E-03	3.90E-04	3.90E-04	8.76E-04	3.90E-04

TABLE III-32

Summary Statistics for Chemicals Detected in On-Site Soil Boring Samples (0-1 feet) - Ecology Data Set

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum		
4,4'-DDE	4	14	3.30E-03	3.90E-03	9.70E-04	3.60E-03	1.86E-03	2.15E-03
4,4'-DDT	12	15	3.50E-03	3.80E-03	5.90E-04	1.00E-02	2.99E-03	5.32E-03
Dieldrin	1	15	3.30E-03	3.90E-03	9.70E-04	9.70E-04	1.71E-03	9.70E-04
HCH (gamma) Lindane	2	15	1.70E-03	2.00E-03	7.00E-05	4.50E-04	8.28E-04	4.50E-04
PCBs (total)	10	15	3.30E-02	3.90E-02	4.60E-03	7.80E-02	6.07E-02	6.88E-02
Inorganic Compounds								
Antimony	2	13	8.00E+00	9.60E+00	8.30E+00	9.40E+00	4.92E+00	5.73E+00
Arsenic	13	13			3.00E-01	1.90E+00	1.08E+00	1.60E+00
Barium	13	13			3.38E+01	8.45E+01	5.55E+01	6.63E+01
Beryllium	7	13	2.10E-01	4.00E-01	3.50E-01	2.00E+00	6.32E-01	1.83E+00
Cadmium	12	13	4.30E-01	4.30E-01	3.00E-01	3.90E+00	1.60E+00	3.84E+00
Chromium	13	13			1.54E+01	2.60E+02	1.04E+02	2.40E+02
Cobalt	13	13			3.70E+00	1.40E+01	7.38E+00	9.17E+00
Copper	13	13			3.00E+01	6.70E+02	2.48E+02	5.66E+02
Lead	13	13			4.80E+00	3.85E+01	2.09E+01	3.60E+01
Mercury	2	13	2.00E-02	1.10E-01	2.80E-02	3.40E-02	3.89E-02	3.40E-02
Nickel	13	13			2.40E+00	1.80E+02	5.75E+01	1.80E+02
Selenium	1	8	2.10E-01	2.40E-01	4.30E-01	4.30E-01	1.52E-01	2.22E-01
Silver	8	13	6.00E-01	7.60E-01	6.00E-01	3.00E+00	1.35E+00	3.00E+00
Thallium	1	13	2.10E-01	8.00E+00	3.30E-01	3.30E-01	1.66E+00	3.30E-01
Tin	6	13	2.80E+00	1.60E+01	2.80E+00	2.00E+01	5.48E+00	1.01E+01
Vanadium	11	13	2.00E+01	2.00E+01	1.43E+01	4.20E+01	2.33E+01	3.12E+01
Zinc	13	13			3.54E+01	3.70E+02	1.65E+02	3.03E+02

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

*Samples B-6, B-7, B-8, G-1, G-3, P-1, P-2, P-3, P-4, P-5, P-6, P-7, P-8, P-9, P-10 were considered to represent upstream the on-site soil samples

TABLE III-33

Summary Statistics for Chemicals Detected in Background Soil Samples (0-1 feet) - Ecology Data Set

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum		
Volatile Compounds								
Bromodichloromethane	1	6	1.00E-02	1.00E-02	1.50E-03	1.50E-03	4.42E-03	1.50E-03
Methylene chloride	2	6	1.00E-02	1.00E-02	1.00E-02	1.00E-02	6.67E-03	9.68E-03
Tetrachloroethylene (PCE)	4	6	1.00E-02	1.00E-02	6.00E-04	1.40E-03	2.37E-03	1.40E-03
Toluene	3	6	1.00E-02	1.00E-02	1.20E-03	3.90E-03	3.57E-03	3.90E-03
1,1,1-Trichloroethane	5	6	1.00E-02	1.00E-02	7.00E-04	1.90E-03	1.67E-03	1.90E-03
Trichloroethene	3	6	1.00E-02	1.00E-02	5.00E-04	1.10E-03	2.87E-03	1.10E-03
Xylenes (total)	4	6	1.00E-02	1.00E-02	7.00E-04	1.90E-03	2.52E-03	1.90E-03
Semivolatile Compounds								
Anthracene	5	6	3.30E-01	3.30E-01	2.10E-02	6.60E-02	5.52E-02	6.60E-02
Benzo[a]pyrene	6	6			1.70E-02	3.40E-01	1.48E-01	3.40E-01
Benzo[b]fluoranthene	6	6			1.40E-02	4.00E-01	1.68E-01	4.00E-01
Benzo[k]fluoranthene	6	6			1.80E-02	4.20E-01	1.53E-01	4.20E-01
Butylbenzylphthalate	1	6	3.30E-01	3.63E-01	1.50E-02	1.50E-02	1.43E-01	1.50E-02
Diethylphthalate	2	6	3.30E-01	3.30E-01	6.00E-03	2.30E-02	1.15E-01	2.30E-02
Fluoranthene	6	6			3.20E-02	6.90E-01	3.20E-01	6.90E-01
Fluorene	1	6	3.30E-01	3.63E-01	8.00E-03	8.00E-03	1.42E-01	8.00E-03
Phenanthrene	6	6			1.30E-02	3.20E-01	1.47E-01	3.20E-01
Pyrene	6	6			2.50E-02	6.90E-01	2.82E-01	6.90E-01
PCBs/Pesticides								
4,4'-DDE	2	6	3.30E-03	3.60E-03	3.20E-04	2.20E-03	1.55E-03	2.20E-03
4,4'-DDT	3	6	3.30E-03	3.60E-03	1.70E-03	6.30E-03	2.55E-03	4.75E-03
HCH (gamma) Lindane	1	6	1.70E-03	1.90E-03	1.60E-04	1.60E-04	7.52E-04	1.60E-04
PCBs (total)	2	6	3.30E-02	3.60E-02	1.40E-02	7.00E-02	5.87E-02	7.00E-02
Inorganic Compounds								
Arsenic	5	5			3.20E-01	1.20E+00	9.44E-01	1.20E+00
Barium	5	5			3.70E+01	8.80E+01	5.82E+01	8.47E+01
Beryllium	2	5	4.00E-01	4.00E-01	4.00E-01	5.00E-01	3.00E-01	5.00E-01
Cadmium	1	5	2.00E-01	2.00E-01	2.40E-01	2.40E-01	1.28E-01	2.01E-01
Chromium	5	5			1.00E+01	2.80E+01	1.96E+01	2.80E+01
Cobalt	5	5			6.00E+00	1.00E+01	7.92E+00	9.95E+00
Copper	5	5			1.50E+01	4.00E+01	2.48E+01	3.93E+01

TABLE III-33

Summary Statistics for Chemicals Detected in Background Soil Samples (0-1 feet) - Ecology Data Set

Chemical	Detection Frequency		Range of Reported Quantitation Limits[1] (mg/kg)		Range of Detected Concentrations (mg/kg)		Mean of all Samples[2] (mg/kg)	UCL conc.[3] (mg/kg)
	Detects	Samples	Minimum	Maximum	Minimum	Maximum		
Lead	5	5			6.80E+00	1.40E+02	3.78E+01	1.40E+02
Mercury	2	5	5.00E-02	5.00E-02	2.30E-02	3.80E-02	2.72E-02	3.33E-02
Nickel	5	5			1.00E+01	1.60E+01	1.36E+01	1.60E+01
Silver	3	5	6.00E-01	6.00E-01	6.00E-01	6.00E-01	4.80E-01	6.00E-01
Vanadium	3	5	2.00E+01	2.00E+01	2.60E+01	3.10E+01	2.12E+01	3.10E+01
Zinc	5	5			3.60E+01	1.10E+02	5.82E+01	9.97E+01

[1] The range of reported quantitation limits is based on nondetects only.

[2] The mean was calculated using one-half the quantitation limit for nondetected chemicals. This mean could exceed the maximum detected concentration in cases in which the quantitation limit for one or more samples exceeds the maximum detected concentration for a chemical.

[3] In accordance with USEPA guidance, the UCL concentration is represented by the 95% upper confidence limit of the mean or the maximum detected concentration, whichever is lower. The 95% UCL was calculated using one-half the detection limit for nondetected chemicals.

*Samples B-1, B-2, B-3, B-4, B-5 were considered to represent the background soil samples

Table III-34
Chemicals Measured at UCL Levels that Exceed CTDEP Criteria

Medium[1]	Chemical[2]	Detects	Samples	UCL Concentration[3]	Units	CTDEP Criteria*		Table III-
GW	Arsenic	33	79	9.66E-03	mg/L	4.00E-03	SWPC	2
GW	Benzo(a)pyrene	1	80	6.00E-04	mg/L	3.00E-04	SWPC	2
GW	Benzo(b)fluoranthene	1	80	6.00E-04	mg/L	3.00E-04	SWPC	2
GW	Benzo(k)fluoranthene	1	80	6.00E-04	mg/L	3.00E-04	SWPC	2
GW	Beryllium	1	79	1.03E-02	mg/L	4.00E-03	SWPC	2
GW	Cadmium	15	92	9.19E-03	mg/L	6.00E-03	SWPC	2
GW	Copper	77	92	4.23E-01	mg/L	4.80E-02	SWPC	2
GW	Dieldrin	17	80	1.30E-03	mg/L	1.00E-04	SWPC	2
GW	Heptachlor	13	80	9.90E-04	mg/L	5.00E-05	SWPC	2
GW	Lead	13	79	4.86E-02	mg/L	1.30E-02	SWPC	2
GW	Mercury	2	79	2.90E-02	mg/L	4.00E-04	SWPC	2
GW	PCBs (total)	18	80	4.81E-03	mg/L	5.00E-04	SWPC	2
GW	Phenanthrene	3	80	2.50E-03	mg/L	7.70E-05	SWPC	2
GW	Silver	4	79	1.76E-02	mg/L	1.20E-02	SWPC	2
GW	Zinc	91	92	8.27E-01	mg/L	1.23E-01	SWPC	2
GW	1,1-Dichloroethene	13	93	6.04E-03	mg/L	6.00E-03	VCGW	2
GW	Vinyl chloride	25	93	2.30E-02	mg/L	2.00E-03	VCGW	2
LTR	Beryllium	2	3	3.50E+01	mg/kg	2.00E+00	DEC	9
LTR	Chromium	16	16	7.30E+03	mg/kg	1.00E+02	DEC	9
LTR	Lead	16	16	2.10E+03	mg/kg	1.00E+03	DEC	9
LTR	Tetrachloroethylene (PCE)	11	13	7.10E+00	mg/kg	1.00E+00	PMC	9
SL	Chromium	58	58	1.24E+02	mg/kg	1.00E+02	DEC	9
SL	Chlordane	1	22	1.90E-01	mg/kg	6.60E-02	DEC	9
SW	Copper	1	6	1.53E-02	mg/L	4.80E-03	SWBB	11
SW	Copper	1	16	1.15E-02	mg/L	4.80E-03	SWBB	13
SW	Mercury	3	6	5.00E-03	mg/L	1.20E-05	SWBB	11
SW	Mercury	6	16	4.75E-03	mg/L	1.20E-05	SWBB	13
SW	PCBs (total)	2	3	3.10E-04	mg/L	1.70E-07	SWHH	15
W-SL	Chromium	2	2	1.24E+03	mg/kg	1.00E+02	DEC[4]	28
W-SL	Lead	2	2	5.90E+03	mg/kg	1.00E+03	DEC	28
W-SL	1,2-Dichloroethylene (cis)	2	2	7.00E+01	mg/kg	1.40E+01	PMC	28
W-SL	1,2-Dichloroethylene (trans)	2	2	7.00E+01	mg/kg	2.00E+01	PMC	28
W-SL	2-Butanone	1	2	2.10E+03	mg/kg	8.00E+01	PMC	28
W-SL	Benzene	1	2	3.00E+01	mg/kg	2.00E-01	PMC	28
W-SL	Benzo(k)fluoranthene	1	4	3.80E+01	mg/kg	1.00E+00	PMC	27
W-SL	Bis(2-ethylhexyl)phthalate	1	4	6.10E+02	mg/kg	1.10E+01	PMC	27
W-SL	Bis(2-ethylhexyl)phthalate	2	2	6.50E+03	mg/kg	1.10E+01	PMC	28
W-SL	Butylbenzylphthalate	1	4	2.00E+02	mg/kg	2.00E+02	PMC	27
W-SL	Carbon tetrachloride	2	4	1.30E+00	mg/kg	1.00E+00	PMC	27
W-SL	Dibutyl phthalate	1	4	2.00E+02	mg/kg	1.40E+02	PMC	27
W-SL	Dibutyl phthalate	2	2	3.10E+03	mg/kg	1.40E+02	PMC	28
W-SL	Dieldrin	1	4	7.10E-03	mg/kg	7.00E-03	PMC	27
W-SL	Ethylbenzene	3	4	1.40E+01	mg/kg	1.01E+01	PMC	27

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Table III-34
Chemicals Measured at UCL Levels that Exceed CTDEP Criteria

Medium[1]	Chemical[2]	Detects	Samples	UCL Concentration[3]	Units	CTDEP Criteria*		Table III-
W-SL	Ethylbenzene	2	2	3.10E+03	mg/kg	1.01E+01	PMC	28
W-SL	Naphthalene	2	2	1.60E+02	mg/kg	5.60E+01	PMC	28
W-SL	Pentachlorophenol	2	4	1.80E+02	mg/kg	1.00E+00	PMC	27
W-SL	Sytrene	2	2	2.30E+03	mg/kg	2.00E+01	PMC	28
W-SL	Tetrachloroethylene (PCE)	2	2	3.10E+03	mg/kg	1.00E+00	PMC	28
W-SL	Toluene	2	2	1.50E+04	mg/kg	6.70E+01	PMC	28
W-SL	Trichloroethene	2	2	3.30E+03	mg/kg	1.00E+00	PMC	28
W-SL	Xylenes (total)	4	4	5.00E+01	mg/kg	1.95E+01	PMC	27
W-SL	Xylenes (total)	2	2	1.60E+04	mg/kg	1.95E+01	PMC	28
W-SL-LP	Cadmium	1	1	1.10E-01	mg/L	1.00E+00	PMC	29
W-SL-LP	Cadmium	2	2	5.71E+00	mg/L	1.00E+00	PMC	30
W-SL-LP	Lead	2	2	1.12E+01	mg/L	1.50E-01	PMC	30
SD	Benzo(a)pyrene	9	9	1.60E+00	mg/kg	1.00E+00	PMC[5]	22
SD	Benzo(a)pyrene	8	8	1.50E+00	mg/kg	1.00E+00	PMC[5]	21
SD	Benzo(b)fuoranthene	9	9	2.40E+00	mg/kg	1.00E+00	PMC[5]	22
SD	Benzo(b)fuoranthene	8	8	1.80E+00	mg/kg	1.00E+00	PMC[5]	21
SD	Benzo(k)fluoranthene	9	9	2.20E+00	mg/kg	1.00E+00	PMC[5]	22
SD	Benzo(k)fluoranthene	8	8	1.83E+00	mg/kg	1.00E+00	PMC[5]	21

[1] GW – Ground Water; LTR – Landfill Treatment Residue; SD – Sediment; SL – Soil; SL-LP – Soil Leachate; SG – Soil Gas; SW – Surface Water; W-SL – Pre-Envirite Waste Material; W-SL-LP – Pre-Envirite Waste Material Leachate

[2] Chemicals listed multiple times were detected at several locations.

[3] UCL concentration is mean for SWPC Criteria and 95% UCL or maximum detected concentration, whichever is lower for all other Criteria (USEPA 1992).

[4] DEC criteria for total chromium has not been established, the direct exposure criteria for hexavalent chromium have been used. The direct exposure for trivalent chromium is 5.10 E+04 mg/kg.

[5] Remediation Standards have not been established for sediment. The DEC and PMC for soils were used for the sediment comparison.

* SWPC – Surface-water Protection Criteria; VCGW – Volatilization Criteria for Ground Water; DEC – Direct Exposure Criteria for Soil; PMC – Pollutant Mobility Criteria for Soil; SWBB – Water Quality Criteria for Aquatic Life; SWHH – Water Quality Criteria for Human Health.

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Table III-35
Chemicals Measured at Levels that Exceed Two Times Appropriate CTDEP Criteria

Medium[1]	Chemical[2]	Concentration	Units	CTDEP Criteria		Table III-	Location
GW	1,2-Dichloroethane	3.00E-01	mg/L	9.00E-02	VCGW	2	MW-31
GW	Vinyl chloride	1.10E-01	mg/L	2.00E0-03	VCGW	2	MW-30
GW	Vinyl chloride	6.30E-02	mg/L	2.00E-03	VCGW	2	MW-30
GW	Vinyl chloride	1.80E-01	mg/L	2.00E-03	VCGW	2	MW-30
GW	Vinyl chloride	2.80E-01	mg/L	2.00E-03	VCGW	2	MW-31
GW	Vinyl chloride	4.30E-01	mg/L	2.00E-03	VCGW	2	MW-31
GW	Vinyl chloride	6.10E-01	mg/L	2.00E-03	VCGW	2	MW-31
GW	Vinyl chloride	8.00E-03	mg/L	2.00E-03	VCGW	2	MW-31B
GW	Vinyl chloride	1.50E-02	mg/L	2.00E-03	VCGW	2	MW-31B
GW	Vinyl chloride	1.70E-01	mg/L	2.00E-03	VCGW	2	MW-31D
GW	Vinyl chloride	2.30E-02	mg/L	2.00E-03	VCGW	2	MW-31D
GW	Vinyl chloride	1.50E-02	mg/L	2.00E-03	VCGW	2	MW-43D
GW	Vinyl chloride	5.70E-02	mg/L	2.00E-03	VCGW	2	MW-43D
GW	Vinyl chloride	9.20E-03	mg/L	2.00E-03	VCGW	2	MW-43D
GW	Vinyl chloride	4.90E-03	mg/L	2.00E-03	VCGW	2	MW-43S
GW	Vinyl chloride	2.80E-02	mg/L	2.00E-03	VCGW	2	MW-44B
GW	Vinyl chloride	3.00E-02	mg/L	2.00E-03	VCGW	2	MW-44B
GW	Vinyl chloride	3.30E-02	mg/L	2.00E-03	VCGW	2	MW-44B
GW	Vinyl chloride	6.60E-02	mg/L	2.00E-03	VCGW	2	MW-44D
GW	Vinyl chloride	2.80E-02	mg/L	2.00E-03	VCGW	2	MW-44D
GW	Vinyl chloride	3.00E-02	mg/L	2.00E-03	VCGW	2	MW-44D
GW	Vinyl chloride	4.80E-03	mg/L	2.00E-03	VCGW	2	MW-51B
GW	Vinyl chloride	1.40E-01	mg/L	2.00E-03	VCGW	2	MW-52D
GW	Vinyl chloride	1.10E-02	mg/L	2.00E-03	VCGW	2	MW-53D
LTR	Beryllium	3.50E+01	mg/kg	2.00E+00	DEC	9	L-01
LTR	Beryllium	1.70E+01	mg/kg	2.00E+00	DEC	9	L-03
LTR	Chromium	3.20E+02	mg/kg	1.00E+02	DEC	9	L-01
LTR	Chromium	3.30E+03	mg/kg	1.00E+02	DEC	9	L-01
LTR	Chromium	5.00E+03	mg/kg	1.00E+02	DEC	9	L-02
LTR	Chromium	7.30E+03	mg/kg	1.00E+02	DEC	9	L-03
LTR	Chromium	4.30E+03	mg/kg	1.00E+02	DEC	9	L-04
LTR	Chromium	3.90E+03	mg/kg	1.00E+02	DEC	9	L-05
LTR	Chromium	2.60E+03	mg/kg	1.00E+02	DEC	9	L-06
LTR	Chromium	3.40E+03	mg/kg	1.00E+02	DEC	9	L-06
LTR	Chromium	4.10E+03	mg/kg	1.00E+02	DEC	9	L-07
LTR	Chromium	4.10E+03	mg/kg	1.00E+02	DEC	9	L-08
LTR	Chromium	4.70E+03	mg/kg	1.00E+02	DEC	9	L-08
LTR	Chromium	6.30E+03	mg/kg	1.00E+02	DEC	9	L-09
LTR	Chromium	2.70E+03	mg/kg	1.00E+02	DEC	9	L-09
LTR	Chromium	4.00E+03	mg/kg	1.00E+02	DEC	9	L-10
LTR	Chromium	4.20E+03	mg/kg	1.00E+02	DEC	9	L-10
LTR	Lead	1.30E+04	mg/kg	1.00E+03	DEC	9	L-01
LTR	Tetrachloroethylene (PCE)	7.10E+00	mg/kg	1.00E+00	PMC	9	L-07
SL	Chromium	2.84E+02	mg/kg	1.00E+02	DEC[3]	6,7	F-10
SL	Chromium	2.60E+02	mg/kg	1.00E+02	DEC[3]	6,7	G-1
SL	Chromium	3.00E+02	mg/kg	1.00E+02	DEC[3]	6,7	G-7

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Table III-35
Chemicals Measured at Levels that Exceed Two Times Appropriate CTDEP Criteria

Medium[1]	Chemical[2]	Concentration	Units	CTDEP Criteria		Table III-	Location
SL	Chromium	2.16E+02	mg/kg	1.00E+02	DEC[3]	7	P-6
SL	Chromium	3.10E+02	mg/kg	1.00E+02	DEC[3]	7	P-8
SL	Chromium	2.04E+02	mg/kg	1.00E+02	DEC[3]	6,7	P-8
SL	Chromium	2.66E+02	mg/kg	1.00E+02	DEC[3]	7	P-9
SL	Chromium	1.85E+03	mg/kg	1.00E+02	DEC[3]	6,7	R-1
SL	Chromium	2.76E+02	mg/kg	1.00E+02	DEC[3]	6,7	R-13
SL	Chromium	3.82E+03	mg/kg	1.00E+02	DEC[3]	7	W-03
SL-LP	Chromium	4.40E+00	mg/L	5.00E-01	PMC	10	P-7
SL	Benzene	5.70E-01	mg/kg	2.00E-01	PMC	7	W-24
SL	Bis(2-ethylhexyl)phthalate	5.60E+02	mg/kg	1.10E+01	PMC	7	R-12
SL	Chlordane	1.90E-01	mg/kg	6.60E-02	PMC	7	W-25
SL	Ethylbenzene	6.90E+01	mg/kg	1.10E+01	PMC	7	W-01
SL	Ethylbenzene	6.70E+01	mg/kg	1.01E+01	PMC	7	W-24
SL	Tetrachloroethylene (PCE)	4.10E+01	mg/kg	1.00E+00	PMC	7	W-24
SL	Trichloroethene	4.30E+01	mg/kg	1.00E+00	PMC	7	W-24
SL	Xylenes (total)	4.10E+01	mg/kg	1.95E+01	PMC	7	R-12
SL	Xylenes (total)	1.80E+02	mg/kg	1.95E+01	PMC	7	W-01
SW	Copper	2.00E-02	mg/L	4.80E-03	SWBB	11	SWBW-03
SW	Copper	2.00E-02	mg/L	4.80E-03	SWBB	13	SWBW-10
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	11	SWBW-01
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	11	SWBW-02
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	11	SWBW-03
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	13	SWBW-04
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	13	SWBW-05
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	13	SWBW-06
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	13	SWBW-07
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	13	SWBW-08
SW	Mercury	5.00E-03	mg/L	1.20E-05	SWBB	13	SWBW-10
SW	PCBs (total)	3.10E-04	mg/L	1.70E-07	SWHH	15	SWNW-01
SW	PCBs (total)	1.60E-04	mg/L	1.70E-07	SWHH	15	SWNW-02
W-SL	1,2-Dichloroethylene (cis)	7.00E+01	mg/kg	1.40E+01	PMC	28	W-25
W-SL	1,2-Dichloroethylene (trans)	7.00E+01	mg/kg	2.00E+01	PMC	28	W-25
W-SL	2-Butanone	2.10E+03	mg/kg	8.00E+01	PMC	28	W-25
W-SL	Benzene	3.00E+01	mg/kg	2.00E-01	PMC	28	W-25
W-SL	Benzo(k)fluoranthene	3.80E+01	mg/kg	1.00E+00	PMC	27	W-09
W-SL	Bis(2-ethylhexyl)phthalate	6.10E+02	mg/kg	1.10E+01	PMC	27	W-19
W-SL	Bis(2-ethylhexyl)phthalate	6.50E+03	mg/kg	1.10E+01	PMC	28	W-25
W-SL	Bis(2-ethylhexyl)phthalate	1.90E+02	mg/kg	1.10E+01	PMC	28	W-30
W-SL	Dibutyl phthalate	3.10E+03	mg/kg	1.40E+02	PMC	28	W-25
W-SL	Ethylbenzene	3.10E+03	mg/kg	1.01E+01	PMC	28	W-25
W-SL	Ethylbenzene	7.00E+02	mg/kg	1.01E+01	PMC	28	W-30
W-SL	Naphthalene	1.60E+02	mg/kg	5.60E+01	PMC	28	W-25
W-SL	Pentachlorophenol	1.80E+02	mg/kg	1.00E+00	PMC	27	W-09
W-SL	Pentachlorophenol	1.80E+01	mg/kg	1.00E+00	PMC	27	W-11
W-SL	Styrene	2.30E+03	mg/kg	2.00E+01	PMC	28	W-25
W-SL	Styrene	6.20E+02	mg/kg	2.00E+01	PMC	28	W-30

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Table III-35
Chemicals Measured at Levels that Exceed Two Times Appropriate CTDEP Criteria

Medium[1]	Chemical[2]	Concentration	Units	CTDEP Criteria		Table III-	Location
W-SL	Tetrachloroethylene (PCE)	3.10E+03	mg/kg	1.00E+00	PMC	28	W-25
W-SL	Tetrachloroethylene (PCE)	4.40E+01	mg/kg	1.00E+00	PMC	28	W-30
W-SL	Toluene	1.50E+04	mg/kg	6.70E+01	PMC	28	W-25
W-SL	Toluene	2.00E+03	mg/kg	6.70E+01	PMC	28	W-30
W-SL	Trichloroethene	3.30E+03	mg/kg	1.00E+00	PMC	28	W-25
W-SL	Trichloroethene	2.50E+02	mg/kg	1.00E+00	PMC	28	W-30
W-SL	Xylenes (total)	5.00E+01	mg/kg	1.95E+01	PMC	27	W-09
W-SL	Xylenes (total)	1.60E+04	mg/kg	1.95E+01	PMC	28	W-25
W-SL	Xylenes (total)	2.60E+03	mg/kg	1.95E+01	PMC	28	W-30
SD	Benzo(b)fuoranthene	2.40E+00	mg/kg	1.00E+00	PMC[4]	22	NRI-18
SD	Benzo(k)fluoranthene	2.10E+00	mg/kg	1.00E+00	PMC[4]	21	NRI-02
SD	Benzo(k)fluoranthene	2.20E+00	mg/kg	1.00E+00	PMC[4]	22	NRI-18

[1] GW – Ground Water; LTR – Landfill Treatment Residue; SD – Sediment, SL – Soil; SL-LP – Soil Leachate; SG – Soil Gas; SW – Surface Water; W-SL – Pre-Envirite Waste Material; W-SL-LP – Pre-Envirite Waste Material Leachate

[2] Chemicals listed multiple times were detected at several locations.

[3] DEC criteria for total chromium has not been established, the direct exposure criteria for hexavalent chromium have been used in this Table. The direct exposure for trivalent chromium is 5.10 E+04 mg/kg.

[4] Remediation Standards have not been established for sediment. The DEC and PMC for soils were used for the sediment comparison.

* VCGW – Volatilization Criteria for Ground Water; DEC – Direct Exposure Criteria for Soil; PMC – Pollutant Mobility Criteria for Soil; SWBB – Water Quality Criteria for Aquatic Life; SWHH – Water Quality Criteria for Human Health.

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TABLE III-36
Analysis of Metals from Acid Spills

Parameter	February 1978 Spill		January 1983 Spill	
	Envirite Sample (mg/L)	DEP Sample (mg/L)	Inside Building (mg/L)	Outside Composite (mg/L)
pH	---	0.6	<1.0	1.4
Aluminum	233	---	510	211
Barium	---	---	0.25	0.54
Cadmium	---	8.0	9.29	2.84
Calcium	109	---	---	---
Chromium	23.1	270	1,440	493
Chromium (hexavalent)	---	---	<0.01	<0.01
Copper	10,393	8,200	4,770	839
Iron	9,888	14,000	69,100	5,330
Lead	400	---	380	44
Manganese	101	---	---	---
Nickel	27	260	940	529
Potassium	26	---	---	---
Silver	---	---	13.7	0.12
Sodium	635	---	---	---
Tin	12.5	---	110	24.8
Titanium	12.6	---	---	---
Zinc	104	---	7,450	1,100

Notes: Detectable levels of organic compounds were also reported for the February 1978 spill. The organic compound results are reported on a Connecticut State Department of Health laboratory report as "approximate relative concentrations," and are of questionable accuracy. See GZA (1995) for full analytical results.

TABLE III-37 Comparison of Upstream and Downstream Surface Water Samples from Branch Brook					
Sampling Date	**Chemical**	**Upstream**		**Downstream**	
		Frequency of Detection	**Mean Conc. (mg/L)**	**Frequency of Detection**	**Mean Conc. (mg/L)**
06-Jun-94	Calcium	3/3	8.2	7/7	9.2
	Copper	1/3	0.013	1/7	0.011
	Dibutyl phthalate	2/3	0.003	1/7	0.005
	Iron	3/3	0.043	7/7	0.053
	Magnesium	3/3	2.8	7/7	2.9
	Manganese	0/3	0.01	7/7	0.042
	Potassium	3/3	1.8	7/7	2.1
	Sodium	3/3	11	7/7	14
	Zinc	3/3	0.009	6/7	0.011
03-Oct-94	Calcium	6/6	7.8	14/14	7.8
	Iron	6/6	0.18	14/14	0.18
	Magnesium	6/6	2.3	14/14	2.3
	Manganese	2/6	0.036	6/14	0.039
	Mercury	3/6	0.003	6/14	0.003
	Potassium	6/6	1.8	14/14	1.8
	Sodium	6/6	7.0	14/14	7.1
	Zinc	1/6	0.007	14/14	0.012

TABLE III-38
Comparison of Upstream and Downstream Surface Water Samples from Naugatuck River

Sampling Date	Chemical	Upstream		Downstream	
		Frequency of Detection	Mean Conc. (mg/L)	Frequency of Detection	Mean Conc. (mg/L)
06-Jun-94	Bis(2-ethylhexyl)phthalate	0/3	0.005	1/5	0.004
	Calcium	3/3	12	5/5	12
	Dibutyl phthalate	0/3	0.005	3/5	0.004
	Iron	3/3	0.15	5/5	0.18
	Magnesium	3/3	3.5	5/5	3.6
	Manganese	3/3	0.05	5/5	0.05
	Potassium	3/3	3.3	5/5	4.1
	Sodium	3/3	21	5/5	23
	Trichloroethylene	3/3	0.0009	4/5	0.001
	Zinc	2/3	0.010	3/5	0.012
20-Sept-94	HCH (gamma) Lindane	0/1	0.00003	1/5	0.00002
	Tetrachloroethylene (PCE)	0/1	0.005	3/5	0.002
	Trichloroethylene	1/1	0.0005	5/5	0.0005
03-Oct-94	Calcium	6/6	9.6	10/10	9.3
	Iron	6/6	2.9	10/10	2.8
	Magnesium	6/6	3.1	10/10	3.0
	Manganese	2/6	0.039	4/10	0.041
	Potassium	6/6	2.6	10/10	2.7
	Sodium	6/6	18	10/10	17
	Zinc	6/6	0.016	10/10	0.017

4 HUMAN HEALTH RISK ASSESSMENT

4.1 Introduction

In the human health risk assessment (HHRA), potential risks to human health associated with the site are quantitatively evaluated using the principles discussed in Chapter 1.2. First, potentially exposed populations and exposure pathways are identified, and the magnitude of exposure to individuals in that population is quantified. These exposure doses subsequently are combined with available toxicological information to develop estimates of potential risks to human health. This chapter outlines the steps of the HHRA and presents the results of the assessment. Discussions of the risk characterization results and the uncertainties associated with these results are also presented.

4.2 Identification of Potentially Exposed Populations

For the purposes of this PHERE, potential exposures under both current and hypothetical future land uses of the study area are evaluated. A current exposure scenario was developed to evaluate whether a potential health threat exists under present land use conditions. A future exposure scenario was developed to evaluate whether there is a potential health threat under reasonable hypothetical future land use conditions (USEPA 1995c).

The following populations were considered for quantitative evaluation of potential exposure to chemicals present in the study area under current or future exposure scenarios, in accordance with USEPA guidance (USEPA 1991a, 1995c):

- On-Site Residents: The portion of the site occupied by the monofill is not currently being used; the former on-site building was previously leased to a printed circuit board etchant processing facility. The site vicinity's current zoning for "light manufacturing" uses is unlikely to change in the future. Residential use of the site is unreasonable given the physical characteristics of the site and its location in an area with a low population density and a low projected growth rate.[18] In accordance with USEPA guidance concerning reasonably anticipated future land use (USEPA 1995c), on-site residents are not quantitatively evaluated in the current or future exposure scenarios.
- Off-Site Residents: There are currently no residences immediately adjacent to the site. As shown in Figure II-1, the western edge of the site is bordered by the Mattatuck State Forest. To the north, east, and south of the site are industrial facilities and sporadic residences. A residential population in some areas adjacent to the site is evaluated in

[18]This assertion will be supported at a later date with information from the following sources: 1) local zoning laws and zoning maps showing current zoning (which permits only "light manufacturing" uses); 2) relevant development plans: 3) population growth populations; 4) valid deed restrictions restricting the use of the land to non-residential purposes; and 5) characteristics of neighboring properties.

the future exposure scenario. As discussed in the next section, the future residents will conservatively be assumed to be situated adjacent to the western (downgradient) edge of the site (on the present State Forest land).

- On-Site Workers: The site is currently being used for industrial purposes. An on-site worker population is evaluated in both the current and future exposure scenarios.
- Off-Site Workers: Based on the close proximity of the Thomaston POTW and other industrial facilities to the site, exposures to off-site workers are evaluated in both the current and future exposure scenarios.
- Trespassers: Although access to the site is restricted as a result of fencing, occasional trespassing onto the site by the local residential population is conservatively assumed to occur. Trespassers are evaluated in both the current and future exposure scenarios.
- Recreational visitors: Recreational visitors, who are assumed to engage in activities such as fishing in Branch Brook and Naugatuck River, are included in both the current and future exposure scenarios.

For the recreational visitor exposure populations, both adult and child receptors are considered. The inclusion of child receptors for the recreational visitor population is intended to take into consideration available data that suggest certain intake rates during childhood (e.g., incidental ingestion of soil or sediment) may be substantially greater on a mg/kg/day basis than the comparable values for an adult. Workers are assumed to be adults, whereas trespassers are assumed to be children and teenagers. As discussed later in this chapter, exposure pathways involving the ingestion of site-related soil and sediment were not considered applicable for the resident population. Therefore, for the exposure pathways considered for residents (i.e., those associated with ground water and air), the resident population is adequately characterized using parameters for an average adult, and the child resident subpopulation does not need to be evaluated separately.

In addition to the populations described above, the following scenario was also evaluated in this PHERE:

- Utility/construction worker: Subsurface utility repair, maintenance, and installation are common activities that may result in periodic contact with contaminated soils by utility workers in the future. Potential on-site construction work may also result in periodic contact with contaminated soils by construction workers in the future. Because of the presence of high concentrations of VOCs in the Pre-Envirite Waste Material, significant exposures would be expected if a utility or construction worker were to come into contact with the waste material during excavation activities. Because of the potential for significant exposures from this pathway, a utility/construction worker is also considered in the future exposure scenario. This scenario conservatively assumes that a utility/ construction worker conducts an excavation at the location on-site in which the Pre-Envirite Waste Material is situated.

4.3 Exposure Assessment

The exposure assessment step of the risk assessment process involves the measurement or estimation of the magnitude of exposure to individuals in the potentially exposed populations. This section presents the steps used in assessing exposure to the population in the study area (i.e., the site and adjacent areas). In this section, the potential exposure pathways under current and hypothetical future land-use conditions of the study area are identified. The potential exposure pathways are identified based primarily on information obtained during the Phase I RFI activities (GZA 1995) and subsequent studies (ENVIRON 1996; Envirite 1996a, 1996b), local land-use patterns, and professional judgments about what constitutes reasonable behavior. Following the identification of exposure pathways, chemicals of potential concern (COPCs) are selected, and their concentrations in environmental media are estimated. Finally, the predicted environmental concentrations are combined with estimated activity patterns of the potentially exposed populations to quantify human intake of the COPCs.

4.3.1 Identification of Exposure Pathways

Potential exposure pathways are those mechanisms by which a population or individual could be exposed to chemical or physical agents at or originating from the site. The pathways identified are described below and summarized in Table IV-1. These pathways are summarized as a conceptual site model in Figure IV-1.

4.3.1.1 Soil Exposure Pathways

Although the site currently is either paved or vegetated, various populations in the site vicinity may be exposed to contaminants present in on-site soils through incidental ingestion or dermal contact. Potential exposures via the following pathways were considered:

- **Ingestion**

  Outdoor activities at the site could potentially involve contact with soils. Incidental ingestion of on-site soil is quantitatively assessed for (1) current and future trespassers on the site, and (2) current and future on-site workers. Because the unpaved portions of the site are completely vegetated, it is likely that only de minimis quantities of on-site soils have been transported off-site by fugitive dust emissions. Any soil erosion by storm water runoff would have been received by the Naugatuck River and Branch Brook. Thus, it is unlikely that any off-site populations have been exposed to on-site soils. Therefore, no soil exposure pathways are evaluated for off-site residents, workers, or recreational visitors.

- **Dermal Contact**

  Exposure could potentially occur by the absorption of chemicals in the soil through the skin. The relative importance of different exposure pathways for exposure to chemicals in soil is dependent on the absorbed dose via each pathway. According to USEPA (1996b),

absorption via the dermal route is negligible compared to exposure via ingestion for all chemicals except pentachlorophenol, which was not detected in the soils at the site.[19] Therefore, the dermal pathway is not considered to be important for exposure to soils at this site compared to soil ingestion. Potential exposure via dermal contact with soils is discussed in the uncertainty analysis (Chapter 4.6).

4.3.1.2 Ground Water Exposure Pathways

Based on a review of the Water Quality Classification maps for the site vicinity (CTDEP 1985), the ground water beneath the site and to the south up to the confluence of Naugatuck River and Branch Brook is designated Class GB, indicating that the water is presumed not suitable for human consumption without treatment. Class GB ground water is assumed by CTDEP to be degraded due to waste discharges, spills or leaks of chemicals, or land use impacts typical of highly urbanized areas or areas of intense industrial activity (CTDEP 1992). The ground water on the other side of Naugatuck River to the east and Branch Brook to the west is designated Class GA, indicating that the water from existing private and potential public or private wells is suitable for drinking without treatment. The RFI report (GZA 1995) does not document any known current use of ground water as a source of drinking water in the site vicinity downgradient of the site. The following exposure pathways involving ground water were considered:

- **Use of On-Site Ground Water**

  There are no current uses of ground water on-site. Based on the GB classification for the site, the ground water on-site is not suitable for drinking purposes. Therefore, future exposures via ingestion of on-site ground water are not likely. Furthermore, institutional controls (e.g., deed restrictions) will be put in place to prevent future industrial use of on-site ground water for other purposes (e.g., process or cooling water). Therefore, current and future exposures associated with on-site ground water are not quantitatively evaluated in the PHERE.

- **Industrial Use of Off-Site Ground Water**

  Under CTDEP ground water classifications, Class GB ground water could be used as industrial process water and cooling water. Examples of such industrial uses include the rinsing and washing of equipment. It is conservatively assumed that as part of the industrial use of ground water by off-site workers, small quantities of water may be

[19]Assuming 100% of the ingested dose is absorbed, USEPA (1992) concluded that only compounds with a dermal percent absorbed exceeding 10% are likely to be of greater potential concern than direct soil ingestion. Based on experimental studies conducted on 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), 3,3',4,4'-tetrachlorobiphenyl (TCB) and cadmium, the percent absorption is estimated to range from 0.1 to 6% for many organic compounds and from 0.1 to 1% for metals (USEPA 1992a). According to USEPA (1996b), based on all chemicals for which adequate data are available, absorption via the dermal route is comparable to exposure via ingestion (i.e., having greater than 10% dermal absorption) for only one chemical - pentachlorophenol.

incidentally ingested. Although there currently are no known uses of ground water within the designated Class GB aquifer, these exposure scenarios are quantitatively assessed for possible future off-site workers. Five well clusters are located on the POTW property (MW-56, MW-57, MW-58, MW-59, and MW-60), and four additional well clusters are situated on the property boundary between the POTW and the site (MW-41, MW-42, MW-43, and MW-44) (Figure III-3). From this group of wells, the three most contaminated clusters (MW-43, MW-44, and MW-56) were selected to represent potential exposures to off-site workers, in accordance with USEPA guidance (USEPA 1994a).

- **Residential Use of Off-Site Ground Water**

  The ground water on the west side of Branch Brook (downgradient of the site) is designated Class GA, indicating that the water is suitable for drinking purposes and other potable uses (e.g., showering). Although there are no known wells in the immediate downgradient vicinity of the site (i.e., to the southwest), the possibility exists that the ground water may be used for drinking purposes in the future. Because the Mattatuck State Forest is situated adjacent to the western edge of the site, it is unlikely that this area will be used in the future for residential purposes. However, exposures to ground water by off-site residents via ingestion and dermal contact while showering are conservatively included for evaluation in the future use scenario. In addition, the inhalation pathway is included for future off-site residents to account for volatile chemicals that may be released from ground water during showering. The off-site monitoring wells in this area are MW-37B, MW-37D, and MW-36, situated between Branch Brook and Route 8. Being the only wells situated in the Class GA region, they are used in the PHERE for quantifying off-site exposures to ground water.

4.3.1.3 Air Exposure Pathways

Chemicals present in on-site soil and ground water may volatilize into the subsurface soil gas and subsequently into the air, or be released into the atmosphere as fugitive dust emissions. Once emitted, the airborne substances are dispersed throughout the site and transported off-site. The following air exposure pathways were considered:

- **Inhalation of Chemicals Volatilizing from Soils and Ground Water Into Outdoor Air**

  Chemicals in the soil gas could be released into the ambient air on-site, and subsequently be dispersed off-site. Therefore, the inhalation pathway associated with volatilizing chemicals is quantitatively evaluated for (1) current and future trespassers to the site, (2) current and future on-site workers, (3) current and future off-site workers, and (4) future off-site residents. Air concentrations are assumed to have dissipated to background levels at off-site locations applicable to recreational visitors.

- **Inhalation of Chemicals Volatilizing from Soils Into Indoor Air**

  In the presence of a building, volatile chemicals can migrate upward and infiltrate the building through cracks in the building foundation. Because of the proximity of the former treatment and storage building to sampling locations where chemicals were detected in soil gas, the indoor air inhalation pathway could be applicable for the current and future on-site worker if a new building is constructed in the future. CTDEP has developed risk-based volatilization criteria for soil gas that take this pathway into consideration. These criteria represent soil gas concentrations that are predicted, under conservative exposure assumptions, to result in an indoor air concentration that corresponds with a target risk level. As shown in Table IV-2, the maximum soil gas concentrations measured on-site do not exceed the soil vapor criteria for any of the detected constituents. Furthermore, the building size on which the CTDEP standards are based is much smaller than the former treatment and storage building situated on-site. As a result, CTDEP's predicted indoor air concentrations that correspond with the volatilization criteria are higher than those that would be expected at this site. Given the above, the soil gas data indicate that there is no need for further quantification of potential risks associated with this pathway.

- **Inhalation of Airborne Soil Dust**

  Inhalation exposure to chemicals in the soil can potentially occur via fugitive dust that is re-entrained into the air. However, because all of the unpaved sections of the site are completely vegetated, significant soil dust reentrainment is unlikely. Therefore, this scenario is not considered to be important for exposure to soils at this site compared to soil ingestion.

4.3.1.4 Surface Water and Sediment Exposure Pathways

During activities such as fishing, swimming, and wading, potential exposure to chemicals present in the surface waters or sediments of Branch Brook and the Naugatuck River may occur. The following exposure pathways associated with surface water and sediment were considered:

- **Ingestion of Surface Water and Sediment**

  Potential exposure is quantitatively assessed for the incidental ingestion of surface water and sediment during these recreational activities. Populations potentially exposed via these pathways are assumed to be current and future recreational visitors. The on-site trespasser may also have contact with the surface water and sediment; however, it is assumed that the risks to recreational visitors would be higher than those of the trespasser.

- **Dermal Contact with Surface Water**

  In addition to incidental ingestion of surface water, current and future recreational visitors that swim in Branch Brook or Naugatuck River could potentially be exposed to

chemicals in the surface water through dermal contact. This exposure pathway is quantitatively evaluated for the current and future recreational visitor.

- **Dermal Contact with Sediment**

  For reasons similar to those discussed for soil, the dermal contact pathway for sediments is not considered to be significant compared to the ingestion exposure pathway. Based on a review of available data related to the relative importance of ingestion and dermal exposure pathways for exposure to chemicals in soils and sediments, USEPA (1992a) concluded that absorption via the dermal route is only comparable to exposure via ingestion for chemicals with a dermal percent absorbed exceeding 10%. The only chemical that meets this criterion is pentachlorophenol, which was not detected in sediment collected from the site vicinity. Potential exposure via dermal contact with sediments is discussed in the uncertainty analysis (Chapter 4.6).

4.3.1.5 Utility/Construction Worker Scenario

Exposures are also assessed for a hypothetical utility/construction worker scenario, considering the following exposure pathways:

- **Inhalation of Chemicals Volatilizing from Excavated Soils**

  During potential future excavation activities by utility/construction workers, chemicals could be released as the soil is disturbed, particularly in the vicinity of the Pre-Envirite Waste Material near the roadway (PEWM-R). Thus, the inhalation pathway associated with such activities is quantitatively assessed for future on-site utility/construction workers. Although releases occurring during such activities could also be dispersed off-site and inhaled by off-site residents and workers, it is assumed that these potential risks would be much lower than those of the on-site utility/construction worker. Because utility maintenance/ construction activities are assumed to involve excavation of soil at depths up to 10 feet below ground surface (bgs) (USEPA 1994a), these activities would only encounter PEWM-R, whose upper limit is located at depths of 9 to 11.5 feet bgs. The upper limit of PEWM-L is located at depths of 15 to 25.5 feet bgs and would not be encountered during excavation activities.

- **Inhalation of Chemicals Volatilizing from Ground Water Into Outdoor Air**

  Although chemicals in the ground water could volatilize into the ambient air on-site, the levels are expected to be very small compared to the amounts that volatilize from the soil during excavation activities, as described above. Therefore, the inhalation pathway associated with volatilizing chemicals is assumed to be adequately characterized by only considering chemicals volatilizing from excavated soils.

- **Ingestion of Soil During Excavation Activities**

  Incidental ingestion of soil containing Pre-Envirite Waste Material constituents during excavation activities is quantitatively assessed for the on-site utility/construction worker.

- **Dermal Contact with Ground Water During Excavation Activities**

  Based on ground water table elevation data summarized by Envirite (1998), the general depth to ground water on-site is approximately 15 to 20 feet bgs or greater. Construction and utility maintenance activities are assumed to be limited to excavating soil to a depth of 10 feet bgs (USEPA 1994a). Therefore, it is assumed that direct contact with ground water would not occur during excavation activities, and dermal contact with ground water is not quantitatively assessed for the utility/construction worker.

Based on the above discussion, the potential exposure pathways and populations included for evaluation in the PHERE are summarized in Table IV-1.

4.3.2 Selection of Chemicals of Potential Concern (COPCs)

Many of the 142 chemical contaminants detected on- and off-site are unlikely to contribute significantly to overall public health or environmental risk because of low frequency of detection, low detected concentrations, and/or comparatively low intrinsic toxicities compared with other substances detected at the site. Consequently, in order to focus the PHERE on the most significant chemicals with respect to risk, a subset of all detected substances was developed by considering certain criteria, including: (1) the frequency of detection; (2) an evaluation of essential nutrients; and (3) a comparison of environmental concentrations with risk-based screening concentrations.

In addition, it is important that the quantitative risk assessment conducted in the PHERE includes all chemicals that exceed the standards specified in the Connecticut Remediation Standard Regulations (RSRs). Upon completion of the chemical screening process described above, a comparison was made between the COPC selected in the chemical screening process and the chemicals identified in Chapter 3 as exceeding Connecticut RSRs. All chemicals found to exceed the RSRs that were not selected in the chemical screening process were added as COPC.

The contaminants eliminated from further consideration in the PHERE, based on this chemical screening process, are discussed below.

4.3.2.1 Frequency of Detection

Chemical contaminants that are infrequently detected may be artifacts in the data due to sampling, analytical, or other problems, and therefore might not be related to site operations (USEPA 1989). Accordingly, any chemical that was detected in less than five percent of the samples taken in each on-site medium is eliminated from further consideration in the risk assessment. The chemicals that were eliminated in this step are summarized in Table IV-3.

4.3.2.2 Essential Nutrients

A number of trace elements that are present naturally in the environment are essential nutrients. A deficiency in these elements can result in impairment of biological functioning. In recognition of this, USEPA risk assessment guidance states that essential nutrients need not be considered in the quantitative risk assessment (USEPA 1989). Consistent with this guidance, the following five essential nutrients are not considered further in the risk assessment: calcium, iron, magnesium, potassium, and sodium.

4.3.2.3 Risk-Based Concentration Screen

The objective of the risk-based concentration (RBC) screening procedure is to identify the chemicals in a particular environmental medium that, based on concentration and toxicity, are most likely to contribute significantly to risks calculated for exposure scenarios involving that medium. USEPA Region III has developed a table of risk-based concentrations ("Region III RBCs") for risk screening purposes (USEPA 1997a). The Region III RBCs include screening values for tap water, ambient air, fish, and soil ingestion. These RBCs are chemical concentrations that correspond to a "target" level of risk under very conservative exposure assumptions. For carcinogens, the target cancer risk in the Region III RBC table is $1x10^{-6}$; for noncarcinogens, the target risk level is a hazard quotient of 1.0. By conducting such a screening procedure, the risk assessment will be focused on the risk "drivers" (USEPA 1989).

In the RBC screening procedure, the maximum concentration of each chemical in a medium is compared to risk-based concentrations associated with target risks and conservative default exposure assumptions. For the purposes of conducting RBC screens, USEPA Region I has adopted the Region III RBCs, with the following modifications (USEPA 1995d):

- Region I requires the use of a Target Hazard Quotient (THQ) of 0.1 per chemical for screening noncarcinogens. The Region III RBCs for noncarcinogens were calculated based on a THQ of 1.0. Therefore, for the RBC screening procedure in the PHERE, the Region III RBCs for noncarcinogens were reduced by a factor of ten to meet the Region I criteria. For chemicals that potentially have both cancer and noncancer health effects, an RBC based on the carcinogenic potential was also calculated, and the lower of the two RBCs was used. This calculation of RBCs used in this screening process is described in Appendix IV-1.
- For the soil ingestion pathway, Region III provides RBCs for both industrial and residential scenarios. For RBC screening purposes, Region I requires the use of the residential-based concentrations for this pathway.

Chemicals that were detected in at least five percent of the samples for any medium, but for which no RBCs were available, are discussed qualitatively in Chapter 4.4.

For each chemical, the greater of the maximum detected concentration and the highest detection limit[20] in each of the environmental media was compared to RBC values as follows:

- The soil and sediment data were compared to the residential soil ingestion pathway values.
- The ground water data were conservatively compared to the tap water pathway values.
- The surface water data were compared to Water Quality Criteria (WQC) developed by CTDEP for human health protection based on consumption of water and organisms (CTDEP 1997).
- Because of the relatively low number of constituents detected in the soil gas (five), all of these chemicals were retained for quantitative analysis in the PHERE for this pathway.
- Because the analysis of ground water will be based on a limited number of monitoring wells, as discussed previously, all of the chemicals detected in these wells will be retained for quantitative analysis in the PHERE for this pathway.
- Since the Pre-Envirite Waste Material is located at depth, the exposure pathway of concern for constituents in the waste material is soil-to-air volatilization. Therefore, the Pre-Envirite Waste Material samples were compared to values for the soil-to-air volatilization pathway developed in USEPA's recently updated *Soil Screening Guidance* (SSG) document (USEPA 1996b).[21] SSG values for the soil-to-air pathway are listed in the Region III RBC table. However, these tabulated values were taken from an older version of the SSG (USEPA 1994b). For the PHERE, values from the most recent SSG were used.

The chemicals that were eliminated from further consideration as a result of the RBC screen are summarized in Table IV-3.

In summary, 105 of the 142 chemicals were retained for consideration in the quantitative risk assessment through the chemical screening process (i.e., only 37 chemicals were eliminated). Additional details on the selection process are provided in Appendix IV-1. Some of the chemicals retained as COPCs were detected in more than one environmental medium. Twenty-seven chemicals are retained in on-site soil; 81 in ground water; 34 in the Pre-Envirite Waste Material; five in the surface water of Naugatuck River or Branch Brook; four in the sediment of Naugatuck River or Branch Brook.

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[20]The greater of the maximum detected concentration or the highest detection limit was used to prevent chemicals with sample quantitation limits that exceed the screening criteria from being eliminated from consideration. However, if a chemical with a high detection limit was not detected in any sample in a medium (or related media), the chemical was assumed to not be present and was not included as a COPC, in accordance with USEPA (1989) guidance. For example, chemicals with high detection limits in the PEWM that were not detected in any PEWM or on-site soil samples were not included as COPC.

[21] If no soil-to-air volatilization value was listed in the SSG for a chemical (USEPA 1996b), the chemical was automatically retained for quantitative evaluation if a toxicity value is available for that chemical. Chemicals for which toxicity values are not available are discussed qualitatively in Chapter 4/4.4/4.4.2.

As discussed previously, it is important that the quantitative risk assessment conducted in the PHERE includes all chemicals that exceed the standards specified in the Connecticut RSRs. USEPA guidance requires chemicals that exceed applicable or relevant and appropriate requirements (ARARs) to be retained as COPC (USEPA 1995d). To ensure the inclusion of all of these chemicals, a comparison was made between the COPC selected previously in the chemical screening process and the chemicals identified in Tables III-34 and III-35 as having 95% UCL concentrations at levels that exceed Connecticut RSRs or individual samples with concentrations exceeding two times the Connecticut RSRs. Based on this comparison, one additional chemical - chlordane - was included in the list of COPC to be considered in the quantitative risk assessment. The full list of 106 COPC is provided in Table IV-4.

4.3.3 Estimation of Environmental Concentrations

In order to assess the potential chronic exposure to site-related chemicals within the study area, it is necessary to develop estimates of the concentrations of the contaminants of potential concern in the following environmental media:

On-site:

- soil
- ambient air

Off-site:

- surface water
- sediment
- ambient air
- ground water

In addition to chronic exposures to constituents in these environmental media, the short term exposure to chemicals in the Pre-Envirite Waste Material by a utility/construction worker is evaluated in this PHERE. Therefore, estimates of the air concentrations resulting from these excavations activities are required.

Estimates of chemical concentrations for on-site soil and off-site ground water, surface water, and sediment are based on sampling data collected during the RFI. For other environmental media, concentrations are estimated using fate and transport models designed to simulate the transport of substances in the environment over time. Mathematical models were used to estimate:

- long-term emissions and ambient air concentrations on-site and at the site boundary, based on the soil gas data;

- short-term emissions and ambient air concentrations resulting from on-site excavation activities by a utility/construction worker, based on measurements of the Pre-Envirite Waste Material[22]; and
- periodic emissions and indoor air concentrations during showering, based on the ground water data.

It is not possible to estimate the exposures for potentially exposed populations accurately due to uncertainties in both current and future behavior patterns of these populations, and due to limitations in knowledge of other exposure parameters. Given the range of different exposure conditions encountered for most environmental chemicals and exposed populations, USEPA (1995b) recommends the exposure assessment include both the "high end" and "central tendency" portions of the risk distribution. The high end exposure refers to "exposure above about the 90th percentile of the population distribution" (USEPA 1995b), and is designated the reasonable maximum exposure (RME), the highest exposure that is reasonably expected to occur. The central tendency exposure (CTE) generally reflects central estimates of exposure or dose, and may be based on either the arithmetic mean exposure or the median exposure.

In accordance with USEPA guidance (USEPA 1989, 1992b, 1994a), the chemical concentration for both the CTE and RME scenarios is represented by either the highest observed (detected) concentration or the 95 percent upper confidence limit on the mean concentration (95% UCL), whichever is lower. The procedure used to calculate the 95% UCL was discussed in Chapter 3.

4.3.3.1 Surface Soil Concentration

In the PHERE, surface soil concentrations for current and future exposure scenarios are based on data collected at depths from zero to one foot, in accordance with USEPA (1995d) guidance. The 95% UCL concentrations for chemicals evaluated in surface soils are presented in Table IV-5.

For future exposure scenarios involving utility and construction workers, all soil data collected at depths between 0 and 15 feet were used. The 95% UCL concentrations for chemicals evaluated in subsurface soils are presented in Table IV-6.

[22]When calculating average concentrations, half the detection limit was used for chemicals that were not detected in a given sample, but had been detected in other samples in a particular medium. Some of the environmental samples, however, had unusually high detection limits, which resulted in average concentrations that exceed the maximum detected concentration. This was particularly true of samples collected from the Pre-Envirite Waste Material. In accordance with USEPA guidance, all nondetected samples associated with high detection limits in the Pre-Envirite Waste Material were excluded if their inclusion results in a calculated average concentration that exceeds the maximum detected concentration (USEPA 1989).

4.3.3.2 Ground Water Concentration

The concentrations for chemicals evaluated in off-site ground water are presented in Tables IV-7 and IV-8. The maximum detected chemical concentrations from the three most contaminated wells on the POTW property or the on the property boundary (MW-43, MW-44, and MW-56) are used to model exposures to hypothetical future off-site workers (Table IV-7); the chemical concentrations from well cluster MW-37 are used to model exposures to hypothetical future off-site residents (Table IV-8). Because of the limited number of samples taken at these wells, ENVIRON used the maximum detected concentrations for each chemical from these wells for both the RME and CTE scenarios.

4.3.3.3 Indoor Air Concentration

Inhalation of volatile organic compounds during showering could result in exposure because of elevated temperatures associated with shower water, the confining nature of the shower stall, and the increased surficial area of atomized water droplets. Under the hypothetical future use scenario, off-site residents in households were assumed to be exposed to volatilized chemicals present in ground water that are released during showering. The following equation was used to model the average indoor air concentration over the shower duration (Foster and Chrostowski 1986):

$$C_a = \frac{C_w (1 - e^{-K_{LS} t / 600 d}) SW}{2 V_s}$$

where:

C_a,	=	average air concentration in shower stall over shower duration, mg/m^3
C_w	=	tap water chemical concentration, mg/m^3
K_{LS}	=	overall mass transfer coefficient at shower water temperature, cm/hr
t	=	shower droplet free fall time, s
d	=	mean shower droplet diameter, cm
SW	=	volume of water used while showering, m^3
V_s	=	shower stall air volume, m^3

A detailed discussion of the shower model, the underlying assumptions on which the model is based, and the values used as input parameters are presented in Appendix IV-2.

4.3.3.4 Outdoor Air Concentration

Concentrations of volatile soil constituents in the ambient air were estimated from soil gas measurements collected on-site. The maximum detected concentrations for each chemical was used in the PHERE, as presented in Table IV-9. Based on a review of the soil gas data, most of the detected samples were collected at a depth of 42 inches below ground surface (bgs); VOCs were not detected in most samples collected at depths less than 42 inches bgs. Thus, the emissions of VOCs from the soil were characterized as a covered landfill with no internal gas

generation. The emissions into the ambient air were modeled using the following equation (Eklund and Albert 1993; Farmer et al. 1972):

$$ER = \frac{C_{PS}\ x\ D_e\ x\ SA}{d_{cover}}$$

where:

ER	=	calculated emission rate, g/sec
C_{PS}	=	chemical concentration in air-filled pore spaces, g/cm^3
D_e	=	effective diffusivity (cm^2/sec)
SA	=	area of emitting surface, cm^2
d_{cover}	=	depth of soil cover (cm)

Further details regarding the covered landfill emissions model and parameter values used are provided in Appendix IV-2.

To estimate air concentrations on the site resulting from these emissions, a dispersion factor recommended by USEPA (1996b) was used. Using the Industrial Source Complex (ISC2) model, USEPA developed a series of dispersion factors (Q/C) for estimating exposure concentrations to on-site and near-field receptors. Different dispersion factors were calculated for various combinations of source size and meteorological conditions, as represented by 29 locations throughout the United States. Based on a 0.5-acre source area and meteorological conditions for Hartford, Connecticut, a dispersion factor of 71.35 (g/m^2-sec)/(kg/m^3) was used to estimate air concentrations, as follows:

$$C_{air} = \frac{(ER\ /\ SA)}{(Q\ /\ C)}\ x \left(1{,}000\ \frac{g}{kg}\right)$$

where:

C_{air}	=	concentration in air, g/m^3
ER	=	calculated emission rate, g/sec
SA	=	area of emitting surface, m^2
Q/C	=	dispersion factor, (g/m^2-sec)/(kg/m^3)

These air concentrations were used to estimate exposures to trespassers on the site. The same air concentrations were used for assessing exposure to off-site residents and workers, which conservatively assumes a receptor located at the site fenceline.

4.3.3.5 Surface Water and Sediment Concentrations

Surface water concentrations in Branch Brook and Naugatuck River upstream and downstream of the site, used in modeling exposures of a current and hypothetical future recreational visitor, are presented in Table IV-10. Sediment concentrations along Branch Brook and Naugatuck

River upstream and downstream of the site, used in modeling exposures of a current and hypothetical future recreational visitor, are presented in Table IV-11.

4.3.3.6 Short-Term Air Concentration

In areas where high concentrations of VOCs are known to exist (i.e., the Pre-Envirite Waste Material), elevated VOC emissions could potentially occur when these soils are disturbed and handled. Thus, the inhalation pathway of VOCs emitted from subsurface soils during excavation activities was assessed for hypothetical future utility workers. It is conservatively assumed that a utility/construction worker excavates all of the Pre-Envirite Waste Material near the roadway (i.e., PEWM-R), which is located at depths of 9 to 11.5 feet bgs, during the utility maintenance/construction activities. The waste material below the monofill residues (PEWM-L) is located at depths of 15 to 25.5 feet bgs, and is assumed to be beneath any excavation region. Therefore, this exposure scenario was based only on the PEWM-R waste material sampling data.

For estimating emission rates from excavation activities, Eklund et al. (1992) developed a model for estimating emission rates from the soil pore space:

$$ER_{PS} = \frac{VP \; x \; MW \; x \left(10^6 \frac{cm^3}{m^3} \right) x \; \varepsilon_a \; x \; Q \; x \; (E \; x \; C)}{R \; x \; T}$$

and from diffusion:

$$ER_{diff} = \frac{C_s \; x \; SA \; x \; 10{,}000}{\left(\frac{\varepsilon_a}{K_{eq} \; x \; k_g} \right) + \sqrt{\frac{\pi \; x \; t}{D_e \; x \; K_{eq}}}}$$

where:

ER_{PS}	=	soil porosity emission rate (g/sec)
ER_{diff}	=	diffusion emission rate (g/sec)
VP	=	vapor pressure (mm Hg)
MW	=	molecular weight (g/mol)
ε_a	=	air-filled porosity (unitless)
Q	=	excavation rate (m^3/sec)
EHC	=	soil gas-to-atmosphere exchange constant (unitless)
R	=	gas constant (mm Hg-cm^3/gmole-K)
T	=	temperature (K)
C_s	=	chemical mass loading in soil (g/cm^3)
SA	=	area of emitting surface (m^2)
K_{eq}	=	weight fraction of VOC in air space (unitless)
k_g	=	gas phase mass transfer coefficient (cm/sec)
D_e	=	effective diffusivity (cm^2/sec)

t = time since start of excavation of soil of interest (sec)

The total emission rate, *ER*, is the sum of the emission rates from the soil pore space and from diffusion:

$$ER = ER_{PS} + ER_{diff}$$

Further details regarding the Eklund model and parameter values for these equations are provided in Appendix IV-2. Based on a review of Figure 6-3 from the RFI report (GZA 1995) (see Figure III-9), the Pre-Envirite Waste Material near the roadway (PEWM-R) is estimated to be present over an area of approximately 40 feet by 60 feet, or 2,400 square feet (i.e., 223 square meters).

To estimate air concentrations to on-site utility workers, the same dispersion factor of 71.35 (g/m^2-sec)/(kg/m^3) discussed previously for the trespasser scenario was used with Equation (2). The 95% UCL concentrations for chemicals evaluated in PEWM-R are presented in Table IV-12.

4.3.4 Estimation of Exposure Dose

The next step in the risk assessment process is the estimation of the human intake received through exposure to the chemicals evaluated in the various environmental media. Chemical intakes (also referred to as Chronic Daily Intakes or CDIs) are expressed in terms of the mass of substance in contact with the body per unit body weight per time (or mg/kg/day), and are calculated as a function of chemical concentration in the medium, contact rate, exposure frequency and duration, body weight, and averaging time. The values for some of these variables are dependent upon conditions specific to the site and characteristics of the potentially exposed populations.

In an exposure assessment, it is generally necessary to provide two different estimates of the CDI, one for noncarcinogenic effects and a second for carcinogens. The CDI generally used in the assessment of noncarcinogenic effects is the average daily dose (ADD) an individual is likely to receive on any day during the period of exposure. For potential carcinogens, the CDI is estimated by averaging the total cumulative intake over a lifetime (USEPA 1989), i.e., the lifetime average daily dose (LADD).[23] This distinction in the calculation of the CDI for potential carcinogens and noncarcinogens relates to the currently-held scientific opinion that the mechanisms of action of the two categories of chemicals are different. For carcinogens, the assumption is made that a high dose received over a short period of time produces a carcinogenic effect comparable to a corresponding low dose spread over a lifetime (USEPA

[23] Averaging time (AT) for noncarcinogens and potential carcinogens will differ as follows: For noncarcinogens, the AT is the period over which exposure is assumed to occur (i.e., exposure duration (ED) x 365 days/year). For potential carcinogens, intakes are calculated by prorating the total cumulative dose over a lifetime (70 years). Therefore, the AT equals 70 years x 365 days/year or 25,550 days.

1989), whereas for noncarcinogens, a threshold level for ADD during the period of exposure exists below which the adverse health effects will not occur. It should be noted, however, that new information about the potential mechanisms of carcinogenesis suggests that such an assessment is not always warranted.

The rate of chemical intake is dependent upon the concentration of chemicals in environmental media to which individuals come into contact, and the nature and duration of contact. The concentrations of chemicals in environmental media are estimated using data collected during the RFI process and fate and transport models, as described in the previous section. The nature and duration of contact with contaminated media are estimated for generally homogenous subgroups within the population, based on assumptions about behavior. These assumptions of behavior can be represented by discrete values, referred to as exposure factors, which represent such parameters as the exposure duration, exposure frequency, and the media intake rate.

The exposure factors are combined with the media concentrations in equations that estimate the chronic daily intake (i.e., ADD or LADD). These equations, used to estimate the dose, are dependent on the route of exposure (e.g., ingestion, inhalation, dermal contact). Exposure through inhalation or ingestion pathways is calculated using the following equation:

$$CDI = \frac{C \text{ x } IR \text{ x } FI \text{ x } EF \text{ x } ED}{BW \text{ x } AT}$$

where:

CDI	=	chronic daily intake, mg/kg/day
C	=	chemical concentration in medium of interest, mg/kg (soil), mg/L (water), or mg/m^3 (air)
IR	=	intake rate, mg/day (soil), L/day (water), or m^3/day (air)
FI	=	fraction ingested from contaminated source, unitless
EF	=	exposure frequency, days/year
ED	=	exposure duration, years
BW	=	body weight, kilograms
AT	=	time over which the dose is averaged, days

In assessing non-cancer effects, *AT* is set equal to *ED*, and *CDI* represents the ADD. When evaluating carcinogenic health effects, *AT* is replaced by the number of days in a lifetime, *LT*, and *CDI* represents the LADD.

Dermal exposure to chemicals in surface water and ground water is estimated using the following equation:

$$CDI = \frac{DA_{event} \text{ x } SA \text{ x } EF \text{ x } ED}{BW \text{ x } AT}$$

where:

CDI	=	chronic daily intake, mg/kg/day
DA_{event}	=	adsorbed dose per event, mg/cm^2-event
SA	=	skin surface area available for contact, cm^2
EF	=	exposure frequency, events/year
ED	=	exposure duration, years
BW	=	body weight, kilograms
AT	=	time over which the dose is averaged, days

DA_{event} is estimated based on the water concentration in accordance to USEPA guidance (USEPA 1992a), as described in Appendix IV-3.

As previously described, estimates of human intake have been developed for populations potentially exposed under current or future land use conditions to on- and off-site media. The populations are:

On-Site

- Worker (current and future land use)
- Trespasser (current and future land use)
- Utility/construction worker (future land use)

Off-Site

- Resident (future land use)
- Worker (future land use)
- Recreational visitor (current and future land use)

Exposure parameters and assumptions were primarily based on USEPA's *Exposure Factors Handbook* (USEPA 1997b) and other USEPA guidance (USEPA 1989, 1991a, 1991b, 1992a, 1994a). The specific assumptions and parameter values used to estimate potential exposures of each of the potentially exposed populations are presented in Appendix IV-3. A more general discussion of the assumptions used to estimate intakes for these populations is presented below.

4.3.4.1 On-Site Worker

Potential exposures of an on-site worker under current and future land use conditions have been evaluated quantitatively for the following pathways:

- Inhalation of outdoor air
- Ingestion of soil

Under the CTE scenario, the worker is assumed to be employed for 6.6 years (USEPA 1997b), and to be exposed for 150 days/year (USEPA 1994a). The worker is assumed to ingest 50 mg/day of soil (USEPA 1991a, 1991b) and the fraction of soil ingested from on-site soils is assumed to be 50 percent; the remaining 50 percent of the worker's daily soil ingestion is assumed to occur during the time the worker spends off-site (e.g., at home or at other recreational activities). The worker is also assumed to inhale 12 m^3/day of outdoor air while on-site, which is based on a short-term inhalation rate of 1.5 m^3/hr for moderate/industrial activities (USEPA 1997b) and an eight hour day spent on-site.

Under the RME scenario, the worker is assumed to be employed for 25 years, and to be exposed for 250 days/year (USEPA 1991a, 1991b). The worker is assumed to ingest 100 mg/day of soil (USEPA 1997b) and the fraction of soil ingested from on-site soils is assumed to be 50 percent; the worker is assumed to inhale 20 m^3/day of outdoor air while on-site, which is based on a short-term inhalation rate of 2.5 m^3/hr for heavy/construction activities (USEPA 1997b) and an eight hour day spent on-site.

4.3.4.2 On-Site Trespasser

Potential exposures of a trespasser onto the site under current and future land use conditions have been evaluated quantitatively for the following pathways:

- Inhalation of outdoor air
- Ingestion of soil

Although the trespasser may also be exposed to off-site surface water and sediment, these exposures are expected to be lower than for the recreational visitor population. In general, the intake assumptions were developed under the assumption that the types of populations most likely to trespass on the property are children and teenagers. Therefore, for estimating exposures for the trespasser, the potentially exposed population was conservatively assumed to be school-age children exposed over a six-year period as older children and young teenagers (7 to 13 years of age). Estimates of intake have been specifically developed using the physiologic parameters for a 12-year old as representative of this age group.

Under the CTE scenario, the trespasser is assumed to be on-site for 24 days/year (two times per week during the summer months), for 6 years. The trespasser is assumed to ingest 100 mg/day of soil and the fraction of soil ingested from on-site soils is assumed to be 50 percent; the remaining 50 percent of the trespasser's daily soil ingestion is assumed to occur during the time the trespasser spends off-site (e.g., at home, at other recreational activities, or while trespassing on other sites). The trespasser is also assumed to inhale 2.4 m^3/day of air while on-site, which is based on a short-term inhalation rate of 1.2 m^3/hr for moderate activities (USEPA 1997b) and two hours per day spent on-site.

Under the RME scenario, the trespasser is assumed to be on-site for 48 days/year (two times per week for a 12-week period during the warmer months between April and September), for 6 years. The trespasser is assumed to ingest 200 mg/day of soil (USEPA 1997b) and the fraction

of soil ingested from on-site soils is assumed to be 50 percent; the trespasser is also assumed to inhale 4.8 m^3/day of air while on-site, which is based on a short-term inhalation rate of 1.2 m^3/hr for moderate activities (USEPA 1997b) and four hours per day spent on-site.

4.3.4.3 Off-Site Resident

Potential exposures of an off-site resident under future land use conditions have been evaluated quantitatively for the following pathways:

- Inhalation of outdoor air
- Ingestion of ground water
- Dermal contact with ground water while showering
- Inhalation of indoor air while showering

Under the CTE scenario, the resident is assumed to live at the same location adjacent to the site for 9 years, and to be exposed for 234 days/year (USEPA 1994a). The resident is assumed to ingest 1.4 L/day of water (USEPA 1994a) and inhale 15 m^3/day of outdoor air (USEPA 1997b). For evaluating the shower exposure pathway, the resident is assumed to take one 10-minute shower per day, with a skin surface area of 20,000 cm^2 (USEPA 1997d). During the 10-minute shower, the resident was assumed to inhale 0.17 m^3 of air, which is based on an hourly inhalation rate of 1.0 m^3/hr for light activities.

Under the RME scenario, the resident is assumed to live at the same location adjacent to the site for 30 years, and to be exposed for 350 days/year (USEPA 1994a). The resident is assumed to ingest 2 L/day of water and inhale 20 m^3/day of outdoor air (USEPA 1994a). For evaluating the shower exposure pathway, the resident is assumed to take one 15-minute shower per day, with a skin surface area of 23,000 cm^2 (USEPA 1997d). During the 15-minute shower, the resident was assumed to inhale 0.25 m^3 of air, which is based on an hourly inhalation rate of 1.0 m^3/hr for light activities.

4.3.4.4 Off-Site Worker

Potential exposures of an off-site worker (e.g., at the POTW) under future land use conditions have been evaluated quantitatively for the following pathways:

- Inhalation of outdoor air
- Incidental ingestion of ground water (during use as industrial process water)

Under the CTE scenario, the worker is assumed to be employed for 6.6 years (USEPA 1997b), and to be exposed for 150 days/year (USEPA 1994a). The incidental ingestion of 10 mL/day of industrial process water (e.g., used for cooling water or rinsing equipment) is assumed to occur. As a point of comparison, incidental ingestion while swimming is generally estimated to be 50 mL/day (USEPA 1997b). The worker is also assumed to inhale 12 m^3/day of outdoor air while

on-site, which is based on a short-term inhalation rate of 1.5 m^3/hr for moderate/industrial activities (USEPA 1997b) and an eight hour day spent on-site.

Under the RME scenario, the worker is assumed to be employed for 25 years (USEPA 1994a), and to be exposed for 250 days/year (USEPA 1991a, 1991b). The incidental ingestion of 10 mL/day of industrial process water is assumed to occur, and the worker is assumed to inhale 20 m^3/hr of outdoor air, which is based on a short-term inhalation rate of 2.5 m^3/hr for heavy/ construction activities (USEPA 1997b) and an eight hour day spent on-site.

4.3.4.5 Off-Site Recreational Visitor

Potential exposure of a recreational population who regularly visits Naugatuck River and Branch Brook has been evaluated quantitatively for the following pathways:

- Ingestion of surface water
- Dermal contact with surface water
- Ingestion of sediment

Available data suggest that certain intake rates during childhood (e.g., incidental ingestion of sediment) may be substantially greater on a mg/kg/day basis than the comparable values for an adult. In order to account for these differences in intake rates when estimating cancer risks for the recreational visitor population, the exposure for a 1- to 6-year old child are combined with that of an adult to develop age-adjusted intake rates (USEPA 1991b). In this method, the exposure duration (ED) is divided between the two age groups as follows: under the CTE scenario, the ED for ages 1 to 6 is assumed to be two years and the ED for the adult is assumed to be seven years (USEPA 1994a); under the RME scenario, the ED for ages 1 to 6 is assumed to be six years and the ED for the adult is assumed to be 24 years (USEPA 1991b). This results in the calculation of an age-adjusted ingestion factor:

$$IF_{age\text{-}adjusted} = \frac{IR_{child}\ x\ ED_{child}}{BW_{child}} + \frac{IR_{adult}\ x\ ED_{adult}}{BW_{adult}}$$

where:

$IF_{age\text{-}adjusted}$	= age-adjusted intake factor (mg-yr/kg-day)
BW_{child}	= average body weight for child (kg)
BW_{adult}	= average body weight for adult (kg)
ED_{child}	= exposure duration for child (yr) (i.e., 2 or 6 years)
ED_{adult}	= exposure duration for adult (yr) (i.e., 7 or 24 years)
IR_{child}	= intake rate for child (mg/day)
IR_{adult}	= intake rate for adult (mg/day)

The age-adjusted exposure factor (mg/kg/day) is calculated from the age-adjusted ingestion factor divided by the total exposure duration (i.e., 9 or 30 years).

For evaluating noncancer risks, the daily intake is averaged over the exposure duration (rather than a 70-year lifetime). Therefore, noncancer risks are conservatively assumed to be represented by exposure solely to the child, i.e., the age-adjusted approach was not used to calculate noncancer risks for the child.

Under the CTE scenario, the adult is assumed to ingest 50 mL/day of surface water and 50 mg/day of sediment for 12 days/year (equivalent to one day per week for three months). The child is assumed to ingest 50 mL/day of surface water and 100 mg/day of sediment. The exposed dermal surface areas are assumed to be 20,000 cm^2 for the adult and 7,860 cm^2 for the child (USEPA 1997b) and dermal contact is assumed to be one hour per visit.

Under the RME scenario, the adult is assumed to ingest 50 mL/day of surface water and 100 mg/day of sediment for 180 days/year (equivalent to six months per year). The child is assumed to ingest 50 mL/day of surface water and 200 mg/day of sediment. The exposed surface areas are assumed to be 23,000 cm^2 for the adult and 9,350 cm^2 for the child (USEPA 1997b) and dermal contact is assumed to be one hour per visit.

4.3.4.6 Utility/Construction Worker

Potential exposures of an on-site utility or construction worker under future land use conditions have been evaluated quantitatively for the following pathways:

- Inhalation of outdoor air
- Ingestion of soil

The excavation associated with utility installation/maintenance or construction is conservatively assumed to occur in the vicinity of PEWM-R. It is expected that, once the waste material is excavated, it will be properly disposed of and not returned to the ground. Therefore, only a one-time utility/construction scenario is considered in the PHERE.

Under the CTE scenario, the excavation is assumed to occur over a five day period, during which a utility worker is exposed for 8 hrs/day, inhaling 20 m^3/day of air (based on a short-term inhalation rate of 2.5 m^3/hr) and ingesting 100 mg/day of soil. The daily soil ingestion rate is divided equally between deep (0 to 15 feet bgs) soil and the waste material (i.e., 50 mg/day of each is assumed to be ingested). Typical excavation parameters were provided by Eklund et al. (1992).

Under the RME scenario, construction-related excavation activities are assumed to occur over a six-week period, during which a construction worker is exposed for 8 hrs/day, inhaling 24 m^3/day of outdoor air (based on a short-term inhalation rate of 3.0 m^3/hr) and ingesting 480 mg/day of soil (USEPA 1997b). It is assumed that excavation activities resulting in contact with PEWM-R will only occur for one week, and excavation activities over the remaining five weeks occurs elsewhere on the site. Thus, the daily soil ingestion rate is divided equally between deep (0 to 15 feet bgs) soil and the waste material (i.e., 240 mg/day of each is assumed to be ingested) for five days, and the soil ingestion rate of 480 mg/day is applied to deep soil for the

remaining 25 days (i.e., time-weighted average daily soil ingestion rate of 440 mg/day over 30 days).

4.4 Toxicological Assessment

To assess the potential health risks associated with exposure to chemicals evaluated quantitatively in the risk assessment, it is necessary to examine the relevant toxicological literature to determine the effects in humans or laboratory animals of chemical exposure as a function of exposure levels. USEPA has conducted such assessments on many frequently occurring environmental chemicals and has developed standardized toxicity values for use in risk assessment. These toxicity values - reference doses (RfDs) for noncarcinogenic chemicals and the noncarcinogenic effects of potential carcinogens, and cancer slope factors (SFs) for known, suspected, or possible human carcinogens - are published by USEPA in its *Health Effects Assessment Summary Tables* (HEAST) (USEPA 1995) and its on-line database, the *Integrated Risk Information System* (IRIS). It should be noted, however, that USEPA has not developed toxicity values for all chemicals evaluated in the risk assessment.

An RfD is USEPA's estimate (with uncertainty spanning perhaps an order of magnitude) of the daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime. Unless adequate human data are available, an RfD is generally based on a study of the most sensitive animal species tested and is calculated based on the most sensitive endpoint measured. From this critical study, the experimental exposure representing the highest dose level tested at which no adverse effects were demonstrated (the no-observed-adverse-effect level, NOAEL) is identified. The RfD is derived from the NOAEL for the critical toxic effect by dividing the NOAEL by uncertainty (or safety) factors. These factors generally consist of multiples of 10, with each factor representing a specific area of uncertainty in the extrapolation from the available data. Two 10-fold uncertainty factors are typically used to extrapolate results of long-term studies in experimental animals to humans, with additional factors applied where there are limitations in the available experimental data. Consequently, the RfD derived by this process does not provide a sharp demarcation between "safe" and "unsafe" levels of exposure. If the exposure level exceeds the RfD, there may be concern for noncancer effects. Because of the substantial safety factors incorporated in the RfD, however, an exposure in excess of the RfD does not indicate that adverse effects will necessarily occur.

In assessing carcinogenic potential, USEPA uses a two-part evaluation process in which 1) the likelihood that the substance is a human carcinogen (i.e., a weight-of-evidence assessment) is evaluated, and 2) the quantitative relationship between dose and response is defined (i.e., development of a SF). USEPA classifies chemicals being evaluated for carcinogenic potential into five groups based on the weight-of-evidence for carcinogenicity from human and animal investigations. These groups are as follows (USEPA 1989, 1995):

Group A: Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Group B: Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Group C: Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

Group D: Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)

Group E: Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

When evaluating potential cumulative risk associated with exposure to multiple carcinogens and the uncertainty about estimates of potential risk, it is important to consider the weight-of-evidence classifications for those chemicals that contribute most significantly to potential risk (USEPA 1989).

As noted above, the output of the second part of the evaluation is the derivation of a SF. A SF represents the upper 95 percent confidence limit on the linear component of the slope of the dose-response curve in the low-dose (low-risk) region. The cancer SF is derived by applying a mathematical model to extrapolate from the relatively high doses administered to experimental animals to the lower exposure levels expected for human contact in the environment. A number of low-dose extrapolation models have been developed. Each is based on general theories of carcinogenesis or certain statistical principles rather than on tumor data for the specific chemical of interest. Historically, USEPA has generally used the linearized multistage model in cancer risk assessment. Other models are available, but generally predict lower cancer potency estimates than the linearized multistage model. The latter model does not necessarily provide the most "correct" or "accurate" measure of carcinogenic potency, but has been used by USEPA in part as a policy matter to provide a conservative (i.e., health protective) estimate of potential carcinogenic potency.

In April 1996, USEPA published *Proposed Guidance for Carcinogen Risk Assessment* (USEPA 1996b) to replace the 1986 carcinogen risk assessment guidelines that served as the basis for deriving the CSFs applied in the current assessment. There are a number of significant changes to carcinogen risk assessment proposed in the 1996 guidelines. USEPA is proposing to replace the current letter/number designation for Weight-of-Evidence of carcinogenicity with a revised classification system that would be accompanied by narrative explanations of the available evidence for carcinogenicity. Under the proposed guidelines, while animal tumor findings and epidemiological evidence will remain important determinants in the classification of carcinogenic potential, greater weight will be given to structure-activity relationships, modes of action at the cellular and subcellular levels, toxicokinetics, and factors affecting the expression of carcinogenic potential (e.g., carcinogenicity that is secondary to noncarcinogenic toxicity). For performing low-dose extrapolations, the preferred approach under the proposed guidelines

is the use of a biologically-based model. Because data are rarely available for this type of assessment, a linear low-dose extrapolation procedure (other than the linearized multistage model) is recommended when information on the agent's mode of action supports linearity. If adequate data show that the dose-response relationship is not linear, USEPA has proposed that a margin of exposure (MOE) approach be used. The MOE is defined as the lower 95th percentile confidence limit on the dose associated with a 10th percentile response (LED_{10}) divided by the environmental dose of interest. The MOE approach is a significant change from the probabilistic approach used historically by USEPA to estimate excess cancer risk. Also significant in the 1996 guidelines is the acknowledgment of the possibility of a threshold for certain carcinogens. The proposed guidance document is currently a draft that is subject to change; however, USEPA is in the process of developing an implementation policy for the revised guidelines that will determine how to apply newer concepts to older assessments of carcinogenicity.

4.4.1 Toxicity Values for Chemicals Evaluated in the PHERE

USEPA-derived toxicity values used by Region III (USEPA 1997a) were used in this PHERE. These include separate RfD and SF values for exposure via oral intake or inhalation. In accordance with USEPA guidance (USEPA 1995d), in the absence of route-specific toxicity values, no inter-route extrapolation was performed (i.e., an oral toxicity value was not used for inhalation pathways in the absence of an inhalation toxicity value). The toxicity values provided by Region III for chemicals detected during the RFI activities were checked against the values listed in IRIS and HEAST. Where differences were encountered, the values from IRIS and HEAST were used. Chronic RfD values for the noncarcinogenic effects of chemicals and SFs for carcinogens for all of the constituents evaluated in this assessment are summarized in Table IV-13, along with the bases for these values.[24]

In addition to noncarcinogenic toxicity values for chronic exposures, USEPA has developed separate toxicity values for subchronic exposures to certain chemicals. Subchronic RfDs for certain chemicals are also summarized in Table IV-13. Subchronic exposures are generally defined as periods ranging from two weeks to three months. The utility worker scenario involves the excavation of the Pre-Envirite Waste Material over a limited one- to five-day period. For such a short period of exposure, neither the chronic nor the subchronic RfDs are appropriate measures of noncarcinogenic risk. A qualitative discussion of risks associated with this exposure pathway is presented in Chapter 4.5.

[24] For certain chemicals, such as chromium and mercury, the toxicity value will depend on the form in which the chemical exists. Chromium can exist in either a trivalent or hexavalent oxidation state. The toxicity values for hexavalent chromium are more conservative than those for trivalent. Therefore, chromium detected in environmental media was conservatively assumed to be hexavalent. Mercury can exist in either organic (e.g., methylmercury) or inorganic forms. Based on the recommendations of USEPA's *Mercury Study Report to Congress* (USEPA 1995a), it is assumed that 25 percent of mercury in aquatic environments (i.e., surface water) is in the organic form. Mercury in ground water is assumed to be entirely inorganic.

As stated above, USEPA-derived toxicity values, where available, have been used in this assessment; however, as pointed out in Chapter 4.6 (Uncertainties and Limitations) in the discussion of uncertainties associated with the risk assessment process, differences of opinion exist among scientists with respect to some of the underlying assumptions made in estimating these values. The risks estimated using USEPA-derived toxicity values must be interpreted in light of the conservative assumptions built into the toxicity values.

4.4.2 Chemicals for which No Toxicity Values Were Available

Slope factors or reference dose values were not available for 15 chemicals detected in site media. For some of these chemicals, the toxicity values from surrogate chemicals were used. These chemicals include the following:

- 2,6-Dichlorophenol - The available data are inadequate to assess the toxicity of 2,6-dichlorophenol. In the absence of such data, the toxicity values for 2,4-dichlorophenol were used.
- Endosulfan I and II - Endosulfan I and II (also referred to as alpha and beta endosulfan) are stereoisomers of endosulfan. Technical endosulfan contains 90 to 95 percent of a 70:30% mixture of the alpha and beta forms (ACGIH 1991; ATSDR 1993). Most toxicity testing has been performed on the mixture, whereas little toxicity information is available for the individual stereoisomers (ATSDR 1993). In the absence of isomer-specific toxicity data, the toxicity values for endosulfan were used for both endosulfan I and II. To the extent that the relative percentages of endosulfan I and II in environmental samples are similar to those in technical endosulfan, use of endosulfan toxicity values should provide a reasonably accurate approximation of potential toxicity.
- 2-Nitrophenol - The available data are inadequate to assess the toxicity of 2-nitrophenol. In the absence of such data, the toxicity values for 4-nitrophenol were used.
- Phenanthrene - The available data are inadequate to assess the toxicity of phenanthrene. In the absence of such data, the toxicity values for naphthalene were used.
- Thallium - USEPA has performed health assessments for several thallium compounds, although not for elemental thallium. The RfDs developed by USEPA for these thallium compounds range from $8x10^{-5}$ to $9x10^{-5}$ mg/kg/day (IRIS). In this assessment, the RfD for thallium chloride of $8x10^{-5}$ mg/kg/day was used.

The remaining chemicals for which no toxicity values are available are discussed qualitatively below:

- Acenaphthylene – USEPA's Weight-of-Evidence Classification for acenaphthylene is Group D, "not classifiable as to human carcinogenicity," based on no human carcinogenicity data and inadequate data from animal bioassays (IRIS). Therefore, it is unlikely that this chemical would significantly add to the overall health risk of those PAHs evaluated quantitatively in this risk assessment. Acenaphthylene was detected in one

deep soil sample (out of two) at a concentration of 0.075 mg/kg and one ground water sample (out of 81) at a concentration of 0.2 µg/L. Particularly in ground water, the low frequency of detection indicates a limited potential for exposure. Based both on known toxicity and low exposure potential, site-related risks associated with acenaphthylene are not likely to be significant.

- Delta-BHC - Delta-BHC, also referred to as delta-hexachlorocyclohexane or delta-HCH, is an isomer of HCH. The gamma-isomer of HCH is lindane. USEPA's Weight-of-Evidence Classification for delta-BHC is Group D, "not classifiable as to human carcinogenicity" (IRIS). According to ATSDR (1994a), little toxicity information is available for the delta isomer of BHC. Delta-BHC appears, however, to be the least toxic of the BHC isomers, with relative chronic toxicity (in decreasing order) characterized as: beta > alpha > gamma > delta (ATSDR 1994a). Although the available toxicity data are inadequate to characterize the toxicity of delta-BHC, it is unlikely that the delta isomer would contribute significantly to the toxicity of other HCH isomers present in site media.
- 4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol) - The available data are inadequate to assess the toxicity of 4,6-Dinitro-2-methylphenol.
- Endrin aldehyde - Little toxicity information is available for endrin aldehyde. Endrin aldehyde occurs as a degradation product or impurity of endrin, and does not appear to be a metabolic product of endrin (ATSDR 1994b). The available toxicity data are inadequate to characterize the toxicity of the aldehyde relative to endrin itself.
- Endrin ketone - Little toxicity information is available for endrin ketone. Endrin ketone does not appear to be a metabolic product of endrin (ATSDR 1994b). The available toxicity data are inadequate to characterize the toxicity of the ketone relative to endrin itself.
- 2-Methylnaphthalene - The available data are inadequate to assess the toxicity of 2-methylnaphthalene. 2-Methylnaphthalene is not considered by USEPA to be a carcinogenic PAH (USEPA 1993). Furthermore, there is no evidence that 2-methylnaphthalene is more toxic than other noncarcinogenic PAHs that were evaluated in the RBC screen and were not retained for further consideration. Therefore, it is unlikely that this chemical would significantly add to the overall risk of those chemicals evaluated quantitatively in this assessment.
- 2,4,5,6-Tetrachloro-m-xylene - The available data are inadequate to assess the toxicity of 2,4,5,6-tetrachloro-m-xylene.
- Titanium - Titanium and its salts are relatively nontoxic. Titanium dioxide, the most widely used titanium compound, has been considered physiologically inert by all routes of exposure. Titanium occurs widely in the environment, and the principal source of titanium exposure for humans is the diet. The extremely low toxicity of titanium and several titanium compounds when in direct contact with the skin and tissues has been demonstrated by its use in the therapy of skin disorders and its use as an implant material in orthopedics, oral surgery and neurosurgery. There is no evidence that

titanium is carcinogenic in humans (Klaassen 1996; HSDB 1997). Given the low inherent toxicity of titanium, potential risks associated with site exposures are considered to be small.

The above eight chemicals were not considered further in the PHERE. While the inability to evaluate potential risks associated with these chemicals adds some uncertainty to the risk assessment, this uncertainty is judged to be low. In most instances, chemicals not considered in the PHERE are considered to be either of low inherent toxicity (titanium), detected in few samples (acenaphthylene), or of lower inherent toxicity as compared to other related chemicals considered in the risk assessment (2-methylnaphthylene, and delta-BHC).

The final chemical for which no slope factor or reference dose are available is lead. Average and maximum lead concentrations are summarized in Tables III-2 through III-33. Because no reference dose or cancer slope factor values have been published by USEPA for lead, the risks associated with lead cannot be included in the total carcinogenic and noncarcinogenic risk estimates. USEPA guidance regarding levels of lead in soil (OSWER Directive #9355.4-12) provides a residential screening level of 400 mg/kg[25] and notes that the Integrated Exposure Uptake Biokinetic (IEUBK) model can be used for evaluating the risks of exposure to lead in children up to six years old. Because the IEUBK model does not apply to any of the on-site populations of concern at the Envirite site (i.e., adult industrial or utility/construction workers and trespassers, who are assumed to be older than six years old), the IEUBK model was not used in the PHERE to evaluate potential risks due to exposure to lead.

However, risks associated with exposure to lead by non-residential adults (e.g., workers) were quantified in the PHERE using the methodology outlined by USEPA's Technical Review Workgroup (TRW) for Lead (USEPA 1996c, 1999). In the TRW approach, the blood lead concentration is calculated for women of child-bearing age, and the corresponding 95th percentile fetal blood lead concentration is estimated. The predicted fetal blood lead concentrations will be compared to the level of 10 micrograms of lead per deciliter of blood (µg Pb/dL), the level determined by USEPA and the Centers for Disease Control and Prevention (CDC) to present a risk to a child's health. The non-residential adult populations most likely to be exposed to lead are the future on-site industrial worker and on-site utility/construction worker. However, the TRW approach assumes exposure durations of three months or more to allow blood lead concentrations to approach quasi-steady state (USEPA 1999). Because the utility/construction worker scenario involves one-time exposures of one to six weeks, exposures to lead were only assessed for the on-site industrial worker population. The specific assumptions and parameter values used to estimate potential risks associated with exposure to lead are presented in Appendix IV-3.

[25] The 95 percent UCL concentrations of lead in the soil samples collected at the site are below this screening level of 400 mg/kg.

4.5 Risk Characterization

Risk characterization is the final step of the risk assessment in which the toxicological assessment and exposure assessment are integrated into quantitative and qualitative expressions of risk. In this step, the toxicity values (i.e., SFs and RfDs) for the chemicals carried through the quantitative risk assessment are used in conjunction with the estimated chemical intakes for the modeled populations to estimate both potential carcinogenic and noncarcinogenic health risks.

It is important to reemphasize that the risk values estimated in this assessment are not actuarial risks, i.e., they are not risks that have been documented as a result of human exposure to the chemicals evaluated. As discussed in Chapter 1.2, risk estimates are based on a series of conservative assumptions and, as such, represent an upper bound on risk. The risk values presented below are useful because they can be compared with other risks that have been estimated using the same procedures. Perhaps the most useful application of the quantitative risk estimates that follow is as a means for identifying the most significant potential exposure pathways in terms of potential health risks.

The numerical risk estimates that are presented in this chapter must be interpreted in the context of the uncertainties and assumptions associated with each step of the risk assessment process. The major uncertainties and assumptions associated with this risk assessment are discussed in Chapter 4.6.

4.5.1 Methodology for Quantitative Risk Estimation

4.5.1.1 Estimation of Cancer Risks

The numerical estimate of the excess lifetime cancer risk resulting from the modeled exposure to a specific potentially carcinogenic chemical can be calculated by multiplying the lifetime average daily dose (LADD) by the risk per unit dose, or SF, as follows:

$$Risk = LADD \times SF$$

where:

Risk	=	lifetime probability of developing cancer due to exposure to the chemical evaluated
LADD	=	lifetime average daily dose, mg/kg/day
SF	=	carcinogenic slope factor, $(mg/kg/day)^{-1}$

The excess lifetime cancer risk is an upper bound on the probability that lifetime exposure to a chemical under specific conditions of exposure will lead to excess cancer risk. For example, an upper bound risk of one in one million (i.e., 1×10^{-6}) indicates that no more than one additional case of cancer per lifetime might be incurred for every one million people exposed at the estimated levels of exposure.

The above equation is based on the assumption that the dose-response relationship for relatively low intakes (compared to doses frequently administered to laboratory animals, from which dose-response values are generally derived) is linear, and that risk, therefore, is linearly proportional to dose. According to USEPA guidance (1989), this assumption of linearity is generally valid only at low risk levels (i.e., when intake is generally low). As risk levels approach or exceed $1x10^{-2}$, the linear proportionality between risk and dose tends to deviate. While alternate modeling equations are available to extrapolate carcinogenicity data at higher dose levels, the uncertainty associated with the derived risk parameters probably does not warrant a more refined estimation of risk.

Regulatory agencies generally make the conservative assumption that any internal dose of any chemical classified as being potentially carcinogenic, no matter how small, presents some potential carcinogenic risk to humans. This assumption is based on the hypothesis that a small number of molecular events can produce changes in a single cell that can lead to uncontrolled cellular proliferation and eventually to the development of tumor formation (USEPA 1989). However, the hypothesis that no threshold dose exists for carcinogens is by no means proven, and may not hold for some carcinogens that do not appear to act directly on genetic material (i.e., DNA). In cases of multiple chemical exposures, regulatory agencies also assume cancer risks to be additive (USEPA 1986, 1989). Accordingly, the risk estimates summarized in this chapter are the sums of the risk estimates for all chemicals evaluated in this assessment for all exposure pathways.

In interpreting the significance of the cancer risk estimates, USEPA has stated that it does not consider any specific cancer risk level as representing an insignificant risk. Instead, USEPA has adopted a risk range of acceptable exposures. In the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 CFR Part 300), USEPA states that: "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." In the evaluation of estimated cancer risks developed in this PHERE, potential cancer risks are evaluated in light of the range of risks generally regarded as acceptable by USEPA.

4.5.1.2 Estimation of Risks for Noncancer Effects

Unlike the measure of risk used for carcinogens, the measure used to describe the potential for noncarcinogenic toxicity to occur is not expressed as a probability of experiencing an adverse effect. Instead, the numerical estimate of the potential for adverse noncancer effects resulting from exposure to a chemical is derived in the following manner:

$$HQ = \frac{ADD}{RfD}$$

where:

HQ	=	hazard quotient, unitless
ADD	=	average daily dose, mg/kg/day

RfD = Reference Dose, mg/kg/day

If the resulting ratio, also referred to as the hazard quotient (HQ), is less than or equal to one, it is assumed that the exposed population would not be adversely affected. If the hazard quotient is greater than one, there may be concern for potential noncancer effects. A hazard quotient that is greater than one should not be interpreted to mean that adverse effects will occur because of the uncertainty (safety) factors used in estimating the RfD, and the conservative assumptions used in estimating the ADD that tend to overestimate exposure. As a rule, however, the greater the value of the hazard quotient above one, the greater the level of potential concern.

As a first screening, the hazard quotients for individual chemicals can be added for any single pathway to estimate the occurrence and severity of toxic effects resulting from exposure to multiple contaminants. USEPA (1989) refers to these summed quotients as the Hazard Index (HI). The HI approach assumes that multiple sub-threshold (below the RfD) exposures could result in an adverse effect and that a reasonable criterion for evaluating the potential for adverse effects is the sum of the hazard quotients. If the HI is less than one, cumulative exposures to the substances of interest would probably not result in adverse effects. If the HI is greater than one, there is an increased potential for adverse effects under the assumed exposure conditions. An HI greater than one, however, does not necessarily indicate that the multiple exposure would harm individuals. According to USEPA (1986, 1989), this methodology is most properly applied to substances that induce the same effect on the same target organs. Consequently, application of the HI methodology to a mixture of substances that are not expected to induce the same effect on the same organs would likely overestimate the potential for adverse health effects.

4.5.1.3 Estimation of Risks Associated with Exposure to Lead

In accordance with USEPA guidance (USEPA 1999), the fetal geometric mean blood lead level was determined using the TRW model (USEPA 1996c) and the probability that the blood lead level for a fetus carried by a woman exposed to lead at the site exceeds 10 µg/dL was calculated. This exposure was assessed for the on-site industrial worker population only.

4.5.2 Risk Estimates

Tables IV-14 through IV-21 summarize the potential lifetime excess cancer risk and hazard index estimates for all of the COPCs and exposure pathways under the current and future use scenarios considered in the PHERE. Chemical-specific parameters used are summarized in Appendix IV-4, along with estimated CDIs, cancer risks, and hazard quotients for each of the chemicals for each of the modeled pathways.

4.5.2.1 Current Use Scenario

Resulting CTE and RME cancer risk estimates and HI values for the potentially exposed populations evaluated under the current use scenario are presented in Tables IV-14 through IV-17, and discussed below.

- **On-Site Trespasser**

  This scenario modeled exposure of an on-site trespasser to chemicals present at the site via incidental ingestion of soils and inhalation of outdoor air. The total excess lifetime cancer risk associated with these pathways is $5x10^{-8}$ in the CTE scenario and $2x10^{-7}$ in the RME scenario. The cumulative HI value for the on-site trespasser is 0.01 in the CTE scenario and 0.05 in the RME scenario. Both cancer and noncancer risks are driven by the soil ingestion pathway. Beryllium, benzo(a)pyrene, and arsenic in soil account for over 90 percent of the cancer risk. Thallium, antimony, and chromium (conservatively assumed to be hexavalent) in soil account for approximately 70 percent of the noncancer risk.

- **On-Site Worker**

  This scenario modeled exposure of an on-site worker to chemicals present at the site via the incidental ingestion of soils and inhalation of outdoor air. The total excess lifetime cancer risk associated with these pathways is $1x10^{-7}$ in the CTE scenario and $2x10^{-6}$ in the RME scenario. The cumulative HI value for the on-site worker is 0.02 in the CTE scenario and 0.08 in the RME scenario. For cancer risk, approximately 85 percent of the risk is associated with soil ingestion and 15 percent is associated with inhalation; noncancer risk is driven primarily by soil ingestion. Beryllium, benzo(a)pyrene, and arsenic in soil account for over 90 percent of the cancer risk. Thallium, antimony, and chromium (conservatively assumed to be hexavalent) in soil account for approximately 75 percent of the noncancer risk.

- **Worker at Locations Adjacent to Site**

  This scenario modeled exposure of a worker at the adjacent Thomaston POTW via inhalation of outdoor air only. The total excess lifetime cancer risk associated with this pathway is $3x10^{-8}$ in the CTE scenario and $3x10^{-7}$ in the RME scenario. The cumulative HI value for the on-site worker is 0.00001 in the CTE scenario and 0.00003 in the RME scenario. 1,1-Dichloroethylene accounts for over 99 percent of the cancer risk, and 1,2-dichloroethane accounts for 99 percent of the noncancer risk.

- **Recreational Visitor**

  This scenario modeled exposure of recreational visitors to chemicals present at the site via the incidental ingestion of surface water and sediments and dermal contact with surface water. The total excess lifetime cancer risk associated with these pathways is $4x10^{-7}$ in the CTE scenario and $1x10^{-6}$ in the RME scenario. The cumulative HI value for the recreational visitor is 0.01 in the CTE scenario and 0.02 in the RME scenario. Cancer risk is driven by sediment ingestion and surface water dermal contact; noncancer risk is driven primarily by surface water and sediment ingestion. Cancer risk is primarily driven by

dermal contact with polychlorinated biphenyls (PCBs) in surface water and ingestion of benzo(a)pyrene in sediment. Mercury in surface water (both dermal contact and ingestion) and ingestion of cadmium in sediment account for approximately 80 percent of the noncancer risk.

4.5.2.2 Future Use Scenario

Resulting CTE and RME cancer risk estimates and HI values for the potentially exposed populations evaluated under the future use scenario are presented in Table IV-18 through IV-21, and discussed below.

- **On-Site Trespasser**

  This scenario, which modeled exposure of on-site trespassers via inhalation of outdoor air and incidental ingestion of soils, is the same as that presented above for the current use scenario. The total excess lifetime cancer risk associated with these pathways is $5x10^{-8}$ in the CTE scenario and $2x10^{-7}$ in the RME scenario, driven primarily by ingestion of beryllium, benzo(a)pyrene, and arsenic in soil. The cumulative HI value for the on-site trespasser is 0.01 in the CTE scenario and 0.05 in the RME scenario, driven primarily by ingestion of thallium, antimony, and chromium in soil.

- **On-Site Worker**

  This scenario, which modeled exposure of on-site workers via inhalation of outdoor air and the incidental ingestion of soils, is the same as that presented above for the current use scenario. The total excess lifetime cancer risk associated with this pathway is $1x10^{-7}$ in the CTE scenario and $2x10^{-6}$ in the RME scenario, driven primarily by ingestion of beryllium, benzo(a)pyrene, and arsenic in soil. The cumulative HI value for the on-site worker is 0.02 in the CTE scenario and 0.08 in the RME scenario, driven primarily by ingestion of thallium, antimony, and chromium in soil.

- **Worker at Locations Adjacent to Site**

  This scenario modeled exposure of a worker at the adjacent Thomaston POTW to chemicals present in the ground water via incidental ingestion and inhalation of outdoor air. The total excess lifetime cancer risk associated with this pathway is $6x10^{-6}$ in the CTE scenario and $4x10^{-5}$ in the RME scenario, driven primarily by ground water ingestion. N-Nitrosodimethylamine in ground water accounts for 65 percent of the cancer risk. Other than ground water, N-nitrosodimethylamine was not detected in any other environmental media in more than five percent of the samples collected.[26] Therefore, the source(s) of the N-nitrosodimethylamine in ground water is unclear.

[26] The only medium other than ground water in which N-nitrosodimethylamine was detected is soil, in which N-nitrosodimethylamine was detected in five out of 139 samples, i.e., four percent of the soil samples.

The cumulative HI value for the on-site worker is 0.06 in the CTE scenario and 0.1 in the RME scenario, driven primarily by ground water ingestion. Copper, cadmium, manganese, and nickel account for over 60 percent of the noncancer risk.

- **Resident at Locations Adjacent to Site**

  This scenario modeled exposure of a resident situated on the property adjacent to the western edge of the site to chemicals present in the ground water via ingestion and dermal contact and to chemicals volatilizing from the site soils and ground water via inhalation. The total excess lifetime cancer risk associated with these pathways is $4x10^{-4}$ in the CTE scenario and $1x10^{-3}$ in the RME scenario. Cancer risk is driven primarily by ground water dermal contact. PCBs in ground water account for over 75 percent of the cancer risk.

  The cumulative HI value for the on-site worker is 500 in the CTE scenario and 700 in the RME scenario. The noncancer risk is driven by vapor inhalation and ingestion of mercury in ground water. However, mercury was only detected in two out of 125 ground water samples collected from the site vicinity during the RFI activities. Based on this low frequency of detection, it is likely that these two samples are artifacts in the data due to sampling, analytical, or other problems. Eliminating mercury from the analysis for this scenario, the cumulative HI is 1 for both scenarios.

- **Recreational Visitor**

  This scenario, which modeled exposure of on-site trespassers via inhalation , incidental ingestion of soils and dermal contact with surface water, is the same as that presented above for the current use scenario. The total excess lifetime cancer risk associated with these pathways is $4x10^{-7}$ in the CTE scenario and $1x10^{-6}$ in the RME scenario. The cumulative HI value for the recreational visitor is 0.01 in the CTE scenario and 0.02 in the RME scenario. Cancer risk is driven by sediment ingestion and surface water dermal contact; noncancer risk is driven primarily by surface water and sediment ingestion. Cancer risk is primarily driven by dermal contact with PCBs in surface water and ingestion of benzo(a)pyrene in sediment. Mercury in surface water (both dermal contact and ingestion) and ingestion of cadmium in sediment account for approximately 80 percent of the noncancer risk.

4.5.2.3 On-Site Excavation Worker

This scenario modeled exposure of an on-site excavation (utility/construction) worker to chemicals present in the Pre-Envirite Waste Material that volatilize during excavation. Incidental ingestion of soil was also evaluated as an exposure pathway. The total excess lifetime cancer risk associated with this pathway is $8x10^{-5}$ in the CTE scenario and $2x10^{-4}$ in the RME scenario, driven primarily by the inhalation of benzene (over 75 percent of the total cancer risk). For assessing noncarcinogenic health effects, it would not be appropriate to use the chronic or subchronic RfDs for assessing the effect of acute exposures such as those in this scenario. Consideration of these toxicity values results in a cumulative HI value several orders of

magnitude greater than one. A detailed discussion of the noncarcinogenic risks associated with this pathway is presented in the following section.

4.5.2.4 Risks Associated with Lead

Lead exposure was evaluated for the on-site worker in the future land use scenario. The fetal blood lead concentration calculated is 2 µg/dL in both the CTE and RME scenarios.

4.5.3 Discussion of Risk Estimates

An evaluation of the risk estimates from exposure to chemicals for each of the modeled populations indicates the following:

- For the populations modeled in the current use scenario, no excess cancer risks are above $1x10^{-6}$ with the exception of the on-site worker under the RME scenario. The cancer risk to the on-site worker under RME conditions is $2x10^{-6}$. This is at the lower end of the risk range judged to be acceptable by USEPA. In addition, no HI values are above one for any of the populations modeled in the current use scenario. This indicates that the concentration levels present in the study area are acceptable for the exposures assessed under the current use scenario.
- Excess cancer risks under the future use scenario for off-site residents are between $4x10^{-4}$ (CTE) and $1x10^{-3}$ (RME). Under this hypothetical future use scenario, the risks would exceed the range of risk deemed acceptable by USEPA. These risks, as shown in Tables IV-18 and IV-19, are attributable to the ingestion of ground water by a resident situated adjacent to the western edge of the site. The cancer risks are primarily attributable to polychlorinated biphenyls (PCBs). While PCBs were detected in many on-site media, PCBs were also detected in background soil and upstream sediment samples, and is unlikely to be site-related. Furthermore, because this area currently is part of the Mattatuck State Forest, the actual use of this location for residential purposes in the future is unlikely. Therefore, this situation clearly is a worst case estimate and in no way implies that this scenario is remotely likely in the future.
- The cumulative HI values under the future use scenario for off-site residents are between 500 (CTE) and 700 (RME). This is above the upper range of HI values deemed acceptable by USEPA. These values, as shown in Tables IV-20 and IV-21, are attributable to ingestion and inhalation with mercury in the ground water. Due to the low frequency of detection of mercury in ground water (2 detects out of 125 samples), it is likely that these two samples are artifacts in the data due to sampling, analytical, or other problems. Eliminating mercury from the analysis for this scenario, the cumulative HI is 1 for both CTE and RME scenarios, which is considered acceptable by USEPA.
- Excess cancer risks under the future use scenario for off-site workers are between $6x10^{-6}$ (CTE) and $4x10^{-5}$ (RME). Under this hypothetical future use scenario, the risks would be within the range of risk deemed acceptable by USEPA. These risks, as shown in Tables IV-18 and IV-19, are attributable to the incidental ingestion of ground water by

a worker situated adjacent to the southern edge of the site. These risks are primarily attributable to N-nitrosodimethylamine, the source of which is unclear.

- Excess cancer risks under the future use scenario for on-site excavation activities are between $8x10^{-5}$ (utility worker) and $2x10^{-4}$ (construction worker). Under this hypothetical future use scenario, the risks would exceed the range of risk deemed acceptable by USEPA. These risks, shown in Tables IV-18 and IV-19, are attributable to the inhalation of chemicals volatilizing during the excavation of the Pre-Envirite Waste Material, which is situated over nine feet below ground level, for utility installation/maintenance or construction purposes.
- In addition to the cancer risks, noncancer risks associated with this scenario were determined to be high and unacceptable. Because of the acute nature of this scenario, the use of chronic or subchronic RfDs was not judged to be appropriate for this assessment. However, the use of these toxicity values would result in a HI several orders of magnitude greater than one. Based on this analysis, the risks associated with this pathway would be unacceptable.
- Fetal blood lead concentrations used to evaluate lead exposures for on-site workers are 2 µg/dL for both CTE and RME scenarios. In both scenarios, the contribution from ingestion of lead-containing soil was an order of magnitude lower than the background contributions (i.e., typical blood lead concentration in adults in the absence of exposures to the site being assessed). These values are below the threshold of 10 µg/dL considered acceptable by USEPA (1999).

4.6 Uncertainties and Limitations

Risk assessment provides a systematic means for organizing, analyzing, and presenting information on the nature and magnitude of risks posed by chemical exposures. Nevertheless, uncertainties and limitations are present in all risk assessments because of the quality of available data and the need to make assumptions and develop inferences based on incomplete information about existing conditions and future circumstances. These uncertainties and limitations should be recognized and considered when discussing quantitative risk estimates.

Some of the general categories of uncertainty inherent in the risk assessment process are (1) measurement uncertainty, (2) model uncertainty, and (3) data gaps (NRC 1994). Examples of these categories of uncertainties are discussed below in the context of this PHERE.

4.6.1 Uncertainties in Environmental Sampling and Laboratory Measurement

The quality of the analytical data used in a risk assessment depends on the adequacy of the set of rules or procedures that specify how a sample is selected and handled. There are certain errors that inherently accompany most analytical measurements, such as random sampling errors or systematic biases (nonrandom errors). These types of errors can largely be classified as measurement uncertainty. The quality assurance and quality control review procedures used to minimize these uncertainties are described in the RFI report (GZA 1995).

4.6.2 Uncertainties in Fate and Transport Modeling

Model uncertainty arises as a result of gaps in scientific knowledge or simplifying assumptions used in models to predict chemical and physical process behavior. The use of mathematical models to predict the fate and transport of chemicals is well accepted in the professional scientific community and has been widely endorsed by USEPA since it issued its *Superfund Exposure Assessment Manual* (USEPA 1988b). USEPA does not, however, provide specific guidance concerning the selection of specific models from among a wide variety available for a given purpose. Indeed, the trade-off between simplicity, generality, and accuracy is best made by considering the needs and available data of the site in question. Examples of model uncertainty in the PHERE include the emissions modeling and the use of a box model for dispersion modeling.

4.6.3 Exposure Assessment Uncertainties

4.6.3.1 General Considerations

In any risk assessment, a large number of assumptions must be made to assess potential human exposure. In the conduct of the exposure assessment, it was necessary to develop assumptions about general characteristics and potential activity or exposure patterns for current and hypothetical future populations in the study area. In developing the future use scenarios, exposure assumptions were made that involved the absence of actions already taken to mitigate exposures to chemicals in on- and off-site media. For example, for the future off-site worker and resident scenarios, it was assumed that the ground water would be used (and ingested) by these populations.

For each exposure pathway modeled, assumptions were made about the number of times per year an activity could occur, the routes of exposure by which an individual could be exposed, the amount of contaminated media to which an individual could be exposed by the activity, and the amount of chemical that could be absorbed by each route of exposure. In the absence of site-specific data, the assumptions used in this PHERE are generally based on USEPA guidance (e.g., USEPA 1989, 1991a, 1991b, 1997b) or professional judgment.

4.6.3.2 Qualitative Evaluation of Potential Dermal Exposure

Potential exposures resulting from dermal contact with contaminated soil and sediment were evaluated qualitatively in this assessment relative to the potential exposures estimated quantitatively for incidental ingestion of soil and sediment. As noted in USEPA's *Dermal Exposure Assessment: Principles and Applications* (USEPA 1992a), dose and risk estimates based on the available models for estimating dermal uptake of chemical compounds in soil are considered highly uncertain. Experimental data on dermal absorption from soil relevant to quantitative risk assessment are available for only a limited number of compounds. Even less is known about dermal uptake from sediments. Given the substantial uncertainty in the estimation of exposures associated with dermal contact with soil and sediment, this pathway was not quantitatively evaluated in this PHERE. Because incidental ingestion of soil and sediment were

assessment quantitatively, it is expected that the majority of estimated exposures to chemicals in soil and sediment were captured.

4.6.4 Toxicological Assessment Uncertainties

Data gaps are a third source of uncertainty in the risk assessment. Uncertainties associated with data gaps include the use of default assumptions or generic/surrogate data in the absence of site-specific or chemical-specific data. Data gaps also exist because of incomplete knowledge of the human toxicity of the chemicals at issue in the case, often requiring the extrapolation of toxicity data collected in laboratory animals exposed to high doses to predict responses in humans. Regulatory agencies use procedures for developing toxicity factors that incorporate a series of conservative assumptions to account for limitations in the underlying toxicity data; these procedures were applied in this assessment for the chemicals at issue in the PHERE.

Experimental animal data have been relied upon for many years by regulatory agencies and other expert groups for assessing the hazards and safety of human exposure to chemicals. This reliance has been supported in general by empirical observations. There may be differences in chemical absorption, metabolism, excretion, and toxic response, however, between humans and the species for which experimental toxicity data are generally available. Uncertainties in using animal data to predict potential effects in humans are introduced when routes of exposure in animal studies differ from human exposure routes; when the exposures in animal studies are short-term or subchronic; and when effects seen at relatively high exposure levels in animal studies are used to predict effects at the much lower exposure levels found in the environment. The methods for dealing with these uncertainties in the toxicological assessments for noncarcinogens and carcinogens is discussed below.

4.6.4.1 Characterization of the Toxicity of Noncarcinogens

In order to adjust for uncertainties such as those discussed above, regulatory agencies often base the acceptable daily intake (or for USEPA, the RfD) for noncarcinogenic effects on the most sensitive animal species (i.e., the species that experiences adverse effects at the lowest dose). This dose is then adjusted via the use of safety factors or uncertainty factors to compensate for lack of knowledge regarding interspecies extrapolation and to guard against the possibility that humans are more sensitive than the most sensitive experimental animal species tested. As indicated by USEPA, the resulting RfD is a dose likely to be without appreciable risk with uncertainties spanning perhaps an order of magnitude.

4.6.4.2 Characterization of the Toxicity of Carcinogens

For many substances that are carcinogenic in animals, there is uncertainty as to whether they are also carcinogenic in humans. While many substances are carcinogenic in one or more animal species, only a small number of substances are known to be human carcinogens. The fact that some chemicals are carcinogenic in some animals but not in others raises the

possibility that not all animal carcinogens are human carcinogens, as well as the possibility that not all human carcinogens are animal carcinogens. The finding that relatively few substances are known human carcinogens may be due in part to the difficulty in performing adequately designed epidemiologic investigations in exposed human populations. Regulatory agencies generally assume that humans are as sensitive to carcinogens as the most sensitive animal species. This is a policy decision designed to prevent underestimating carcinogenic risk. In addition, there are several mathematical models available to derive low-dose SFs from high exposure levels used in experiments. The model used by USEPA (and therefore in this risk assessment) is the linearized multistage model, which provides a conservative estimate of risk at low doses (i.e., the model is likely to overestimate the actual SF). Several of the alternative models often predict lower risk at low doses, sometimes by orders of magnitude. Thus, the use of the linearized multistage model ensures a conservative estimate of the SF. The lack of knowledge regarding the validity and accuracy of this model, however, contributes to the uncertainties in cancer risk estimates.

For suspected carcinogens, the normal procedure used by regulatory agencies, and therefore used here for chemicals of potential concern, is to use the 95 percent upper confidence limit estimated by the linearized multistage model. Use of the 95 percent upper confidence limit value rather than the SF that represents the maximum likelihood estimate provides an estimate of the upper bound on risk.

Application of these mathematical low-dose extrapolation models for carcinogens is predicated on the conservative assumption generally made by regulatory agencies that no threshold exists for carcinogens, i.e., that there is some risk of cancer at all exposure levels above zero.[27] As previously noted, this no-threshold hypothesis for carcinogens is by no means proven, and may not hold for some carcinogens that do not appear to act directly on genetic material (DNA).

4.6.4.3 Lack of Toxicity Information

In most risk assessments, chemicals are present that cannot be included in the quantitative risk assessment because little or no information on the toxicity of the chemical is available. In the current assessment, 16 of 142 chemicals considered in the risk assessment had no toxicity values. As indicated in Chapter 4.4, none of these chemicals are considered by USEPA to be carcinogens or are appropriately treated as carcinogens. For some of these substances, toxicity data from surrogate chemicals were used to compensate for these data gaps. It is unlikely that failure to consider the remaining substances in the quantitative risk assessment would result in an underestimation of total risk for the exposed populations modeled.

[27] While this suggests that any exposure to a carcinogen poses some risk of cancer, the probability may be extraordinarily small, so that, for all practical purposes, no risk exists.

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TABLE IV-1
Potential Exposure Pathways Quantitatively Assessed in the PHERE

Exposure Medium/ Exposure Route	Potentially Exposed Population					
	On-Site Worker	On-Site Utility/ Construction Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Off-Site Recreational Visitor
Ingestion of Soil	C,F	F	C,F	---	---	---
Inhalation of Outdoor Air	C,F	F	C,F	F	C,F	---
Ingestion of Off-Site Ground Water	---	---	---	F	F	---
Dermal Contact with Ground Water	---	---	---	F	---	---
Inhalation of Ground Water Constituents while Showering	---	---	---	F	---	---
Ingestion of Surface Water	---	---	---	---	---	C,F
Dermal Contact with Surface Water	---	---	---	---	---	C,F
Ingestion of Sediments	---	---	---	---	---	C,F

C,F Indicates that potential exposure is possible under both current and hypothetical future exposure scenarios.
F Indicates that potential exposure is possible only under the hypothetical future exposure scenario.
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-2
Comparison of Maximum Soil Gas Concentrations with CTDEP Volatilization Criteria

Chemical	Maximum Soil Gas Concentration (mg/m^3)	CTDEP Volatilization Criteria (mg/m^3)	
		Residential	Industrial
1,2-Dichloroethane (1,2-DCA)	0.5	4.11	4.11
1,1-Dichloroethylene (1,1-DCE)	4.0	4.03	4.03
Tetrachloroethylene (PCE)	50	75.8	186
1,1,1-Trichloroethane (TCA)	0.4	7,270	25,100
Trichloroethylene (TCE)	7.4	38.2	87.4
Vinyl chloride (VC)	<1	2.60	2.60

Notes: CTDEP volatilization criteria for soil vapor from Appendix F to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.
The following conversion factors were use: 1,2-DCA=4.11 (mg/m^3)/ppm; 1,1-DCE=4.03 (mg/m^3)/ppm; PCE=6.89 (mg/m^3)/ppm; TCA=5.55 (mg/m^3)/ppm; TCE=5.46 (mg/m^3)/ppm; VC=2.60 (mg/m^3)/ppm.

TABLE IV-3
Results of Chemical of Potential Concern Selection

Contaminant	CAS	Soil	Surface Water	Sediment	PEWM
Acenaphthene	83329	RBC	ND	RBC	ND
Acenaphthylene	208968	NT	ND	ND	RBC
Acetone	67641	RBC	FD	RBC	ND
Aldrin	309002	FD	ND	RBC	RBC
Aluminum	7429905	**COPC**	ND	ND	ND
Anthracene	120127	RBC	ND	RBC	ND
Antimony	7440360	**COPC**	ND	ND	**COPC**
Aroclor 1254	11097691	**COPC**	ND	ND	RBC
Arsenic (as carcinogen)	7440382	**COPC**	ND	**COPC**	RBC
Barium	7440393	RBC	ND	RBC	RBC
Benz[a]anthracene	56553	**COPC**	ND	ND	ND
Benzene	71432	**COPC**	ND	ND	**COPC**
Benzo[a]pyrene	50328	**COPC**	ND	**COPC**	ND
Benzo[b]fluoranthene	205992	**COPC**	ND	**COPC**	RBC
Benzo[k]fluoranthene	207089	**COPC**	ND	RBC	**COPC**
beta-BHC (beta-HCH)	319857	ND	ND	ND	RBC
Beryllium	7440417	**COPC**	ND	ND	RBC
Bis(2-chloro-1-methylethyl)ether	108601	ND	ND	ND	**COPC**
Bis(2-chloroisopropyl)ether	39638329	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate (DEHP)	117817	**COPC**	FD	RBC	**COPC**
Bromodichloromethane	75274	FD	ND	FD	ND
Bromoform (tribromomethane)	75252	ND	ND	ND	ND
Bromomethane	74839	ND	ND	ND	ND
2-Butanone (MEK)	78933	RBC	ND	RBC	**COPC**
Butyl benzyl phthalate	85687	RBC	ND	RBC	RBC
Cadmium	7440439	**COPC**	ND	RBC	**COPC**
Calcium	7440702	EN	EN	EN	EN
Carbazole		**COPC**	ND	ND	ND
Carbon disulfide	75150	FD	ND	ND	ND
Carbon tetrachloride	56235	FD	ND	ND	**COPC**
Chlordane	57749	**COPC**	ND	ND	RBC
4-Chloroaniline	106478	ND	ND	ND	RBC
Chlorobenzene	108907	FD	ND	ND	RBC
Chlorodibromomethane	124481	ND	ND	ND	ND
Chloroethane	75003	ND	ND	ND	ND
Chloroform	67663	FD	ND	RBC	RBC
Chloromethane	74873	FD	ND	ND	ND
2-Chloroethyl vinyl ether	110758	ND	ND	ND	ND
2-Chlorophenol	95578	FD	ND	ND	ND
Chromium (assumed hexavalent)	18540299	**COPC**	ND	**COPC**	**COPC**
Chrysene	218019	**COPC**	ND	ND	ND
Cobalt	7440484	RBC	ND	RBC	**COPC**
Copper	7440508	**COPC**	**COPC**	RBC	**COPC**
4,4'-DDD	72548	FD	ND	ND	RBC
4,4'-DDE	72559	RBC	ND	ND	RBC
4,4'-DDT	50293	RBC	ND	RBC	RBC
delta-BHC		FD	ND	ND	NT
di-n-Octyl phthalate	117840	RBC	ND	ND	RBC
Dibenzo(a,h)anthracene		**COPC**	ND	ND	ND
Dibenzofuran	132649	**COPC**	ND	RBC	ND

TABLE IV-3
Results of Chemical of Potential Concern Selection

Contaminant	CAS	Soil	Surface Water	Sediment	PEWM
Dibutyl phthalate	84742	RBC	RBC	RBC	**COPC**
1,2-Dichlorobenzene	95501	ND	ND	ND	ND
1,1-Dichloroethane	75343	ND	ND	ND	ND
1,2-Dichloroethane	107062	FD	ND	ND	ND
1,1-Dichloroethylene	75354	FD	ND	ND	RBC
1,2-Dichloroethylene (cis)	156592	RBC	ND	FD	**COPC**
1,2-Dichloroethylene (trans)	156605	FD	ND	ND	**COPC**
2,4-Dichlorophenol	120832	FD	ND	ND	ND
2,6-Dichlorophenol	87650	FD	ND	ND	ND
1,2-Dichloropropane	78875	ND	ND	ND	ND
1,3-Dichloropropene	542756	ND	ND	ND	ND
Dieldrin	60571	FD	ND	RBC	**COPC**
Diethyl phthalate	84662	RBC	ND	RBC	ND
2,4-Dimethylphenol	105679	RBC	ND	ND	ND
Dimethyl phthalate	131113	ND	ND	ND	ND
2,4-Dinitrophenol	51285	ND	ND	ND	**COPC**
Endosulfan	115297	ND	ND	ND	RBC
Endrin	72208	ND/NT	ND	ND	**COPC**
Ethylbenzene	100414	**COPC**	ND	ND	**COPC**
Fluoranthene	206440	RBC	ND	RBC	**COPC**
Fluorene	86737	RBC	ND	RBC	ND
HCH (alpha)	319846	FD	ND	ND	RBC
HCH (gamma) Lindane	58899	RBC	**COPC**	ND	**COPC**
Heptachlor	76448	FD	ND	RBC	RBC
Heptachlor epoxide	1024573	FD	ND	ND	RBC
Hexachlorocyclopentadiene	77474	ND	ND	ND	**COPC**
2-Hexanone	591786	FD	ND	ND	ND
Indeno[1,2,3]cd]pyrene		**COPC**	ND	ND	ND
Iron	7439896	EN	EN	EN	EN
Isophorone	78591	RBC	ND	ND	RBC
Lead	7439921	**COPC**	ND	**COPC**	**COPC**
Magnesium	7439954	EN	EN	EN	EN
Manganese	7439965	**COPC**	NT	ND	ND
Mercury (inorganic)	7439976	RBC	**COPC**	ND	RBC
Mercury (methyl/inorganic mixture)	22967926	RBC	**COPC**	ND	RBC
Methoxychlor	72435	RBC	ND	RBC	**COPC**
Methylene chloride	75092	RBC	FD	RBC	ND
2-Methylnaphthalene		NT	ND	ND	NT
4-Methyl-2-pentanone (MIBK)	108101	RBC	ND	ND	RBC
4-Methylphenol		**COPC**	ND	ND	ND
Naphthalene	91203	RBC	ND	FD	**COPC**
Nickel	7440020	**COPC**	ND	RBC	RBC
3-Nitroaniline	99092	ND	ND	ND	**COPC**
2-Nitrophenol	88755	ND	ND	ND	**COPC**
4-Nitrophenol	100027	ND	ND	ND	ND
N-Nitrosodimethylamine	62759	FD	ND	ND	ND
N-Nitrosodiphenylamine	86306	FD	ND	ND	ND
Polychlorinated biphenyls (PCBs)	1336363	**COPC**	**COPC**	RBC	**COPC**
Pentachlorophenol	87865	ND	ND	ND	**COPC**
Phenanthrene	85018	RBC	ND	RBC	**COPC**

TABLE IV-3
Results of Chemical of Potential Concern Selection

Contaminant	CAS	Soil	Surface Water	Sediment	PEWM
Phenol	108952	RBC	ND	ND	**COPC**
Potassium	7440097	EN	EN	EN	EN
Pyrene	129000	RBC	ND	RBC	**COPC**
Selenium	7782492	RBC	ND	ND	**COPC**
Silver	7440224	**COPC**	ND	RBC	**COPC**
Sodium	7440235	EN	EN	EN	EN
Styrene	100425	RBC	ND	ND	**COPC**
1,1,2,2-Tetrachloroethane	79345	ND	ND	ND	ND
Tetrachloroethylene	127184	**COPC**	**COPC**	RBC	**COPC**
2,4,5,6-Tetrachloro-m-xylene	877098	NT	NT	NT	NT
Thallium	7791120	**COPC**	ND	ND	**COPC**
Tin	7440315	RBC	ND	ND	**COPC**
Toluene	108883	RBC	ND	FD	**COPC**
Toxaphene	8001352	ND	ND	ND	RBC
1,1,1-Trichloroethane	71556	FD	ND	ND	ND
1,1,2-Trichloroethane	79005	ND	ND	ND	ND
Trichloroethylene	79016	**COPC**	**COPC**	FD	**COPC**
2,4,5-Trichlorophenol	95954	FD	ND	FD	ND
2,4,6-Trichlorophenol	88062	FD	ND	ND	ND
Vanadium	7440622	**COPC**	ND	FD	**COPC**
Vinyl acetate	108054	ND	ND	ND	ND
Vinyl chloride	75014	ND	ND	ND	ND
Xylene (mixed)	1330207	**COPC**	ND	ND	**COPC**
Zinc	7440666	**COPC**	NT	RBC	**COPC**

Notes:

COPC	Retained as chemical of potential concern
EN	Essencial nutrient; eliminated as COPC
FD	Eliminated as COPC based on low frequency of detection
ND	Not detected in this medium
NT	No toxicity value; eliminated as COPC on qualitative basis
RBC	Eliminated as COPC based on comparison with RBC values

TABLE IV-4
Summary of Chemicals of Potential Concern[a]

VOCs	SVOCs	Pesticides and PCBs	Inorganics
Soil			
Benzene	Benz[a]anthracene	Aroclor 1254	Aluminum
Carbazole	Benzo[a]pyrene	Chlordane	Antimony
Ethylbenzene	Benzo[b]fluoranthene	PCBs (total)	Arsenic
Tetrachloroethylene (PCE)	Benzo[k]fluoranthene		Beryllium
Trichloroethene	Bis(2-ethylhexyl)phthalate		Cadmium
Xylenes (total)	Chrysene		Chromium
	Dibenzo(a,h)anthracene		Copper
	Dibenzofuran		Lead
	Indeno[1,2,3-cd]pyrene		Manganese
	4-Methylphenol		Nickel
			Silver
			Thallium
			Vanadium
			Zinc
Surface Water			
Tetrachloroethylene (PCE)		HCH (gamma) Lindane	Copper
Trichloroethene		PCBs (total)	Mercury
Sediment			
	Benzo[a]pyrene		Arsenic
	Benzo[b]fluoranthene		Chromium
Soil Gas			
1,2-Dichloroethane			
1,1-Dichloroethene			
Tetrachloroethylene (PCE)			
1,1,1-Trichloroethane			
Trichloroethene			
Pre-Envirite Waste Material			
Benzene	Benzo[k]fluoranthene	Dieldrin	Antimony
2-Butanone	Bis(2-chloro-1-methylethyl)ether	Endrin	Chromium
Carbon tetrachloride	Bis(2-ethylhexyl)phthalate	HCH (gamma) Lindane	Cobalt
1,2-Dichloroethylene (cis)	Butylbenzylphthalate	PCBs (total)	Copper
1,2-Dichloroethylene (trans)	Dibutyl phthalate		Lead
Ethylbenzene	2,4-Dinitrophenol		Selenium
Styrene	Fluoranthene		Silver
Tetrachloroethylene (PCE)	Hexachlorocyclopentadiene		Thallium
Toluene	Methoxychlor		Tin
Trichloroethene	Naphthalene		Vanadium
Xylenes (total)	3-Nitroaniline		Zinc
	2-Nitrophenol		
	Pentachlorophenol		
	Phenanthrene		
	Phenol		
	Pyrene		

TABLE IV-4
Summary of Chemicals of Potential Concern[a]

VOCs	SVOCs	Pesticides and PCBs	Inorganics
	Ground Water		
Acetone	Benzo[a]pyrene	Aldrin	Arsenic
Benzene	Benzo[b]fluoranthene	BHC, beta	Barium
Bromodichloromethane	Benzo[k]fluoranthene	BHC, delta	Beryllium
Bromoform	Bis(2-ethylhexyl)phthalate	4,4'-DDE	Cadmium
Bromomethane	Butylbenzylphthalate	4,4'-DDT	Chromium
2-Butanone	2-Chloroethyl vinyl ether	Dieldrin	Cobalt
Carbon disulfide	Chrysene	Endosulfan I	Copper
Carbon tetrachloride	Di-n-Octyl phthalate	Endosulfan II	Lead
Chlorobenzene	Dibutyl phthalate	Endosulfan sulfate	Manganese
Chlorodibromomethane	1,2-Dichlorobenzene	Endrin aldehyde	Mercury
Chloroethane	2,4-Dichlorophenol	HCH (gamma) Lindane	Nickel
Chloroform	Diethylphthalate	Heptachlor	Silver
Chloromethane	Fluoranthene	Heptachlor epoxide	Zinc
1,1-Dichloroethane	Methoxychlor	PCBs (total)	
1,2-Dichloroethane	Naphthalene	2,4,5,6-Tetrachloro-m-xylen	
1,1-Dichloroethene	4-Nitrophenol		
1,2-Dichloroethylene (cis)	N-Nitrosodimethylamine		
1,2-Dichloroethylene (trans)	Pentachlorophenol		
1,2-Dichloropropane	Phenanthrene		
1,3-Dichloropropene (cis)	Pyrene		
1,3-Dichloropropene (trans)	2,4,5-Trichlorophenol		
Ethylbenzene	2,4,6-Trichlorophenol		
2-Hexanone			
4-Methyl-2-pentanone			
Methylene chloride			
Styrene			
1,1,2,2-Tetrachloroethane			
Tetrachloroethylene (PCE)			
Toluene			
1,1,1-Trichloroethane			
1,1,2-Trichloroethane			
Trichloroethene			
Vinyl acetate			
Vinyl chloride			
Xylenes (total)			

Notes: VOCs = volatile organic compounds; SVOCs=semivolatile organic compounds; PCBs=polychlorinated biphenyls

[a] Includes chemicals from the RBC screen (Table IV-1-2) and those measured in excess of the CTDEP criteria (Tables III-34 and III-35).

TABLE IV-5
Concentrations of Chemicals of Potential Concern in Surficial Soil Samples (mg/kg)

Chemical	Minimum	Maximum	95% UCL	Location of Max. Conc.[1]
Volatile Compounds				
Ethylbenzene	5.00E-04	1.20E-02	5.92E-03	R-6
Tetrachloroethylene (PCE)	4.00E-04	8.00E-03	3.96E-03	R-1
Trichloroethene	4.00E-04	9.40E-03	5.20E-03	R-1
Xylenes (total)	4.00E-04	4.80E-02	1.46E-02	R-6
Semivolatile Compounds				
Benzo[a]pyrene	1.20E-02	1.50E+00	3.47E-01	P-1
Benzo[b]fluoranthene	1.30E-02	1.40E+00	3.69E-01	P-1
Benzo[k]fluoranthene	1.00E-02	1.60E+00	3.83E-01	P-1
Bis(2-ethylhexyl)phthalate	5.70E-02	1.30E+01	4.12E-01	R-5
Dibenzofuran	9.00E-03	1.60E-01	2.44E-01	R-13
PCBs/Pesticides				
Aroclor 1254	1.60E-02	1.60E-02	1.73E-02	G-1
PCBs (total)	3.90E-03	1.55E+00	1.57E-01	F-8
Inorganic Compounds				
Aluminum	5.40E+03	1.10E+04	9.52E+03	H-13
Aluminum	5.40E+03	1.10E+04	9.52E+03	H-15
Antimony	7.90E+00	1.16E+01	1.62E+01	R-1
Arsenic	3.00E-01	3.50E+00	1.50E+00	R-1
Beryllium	2.80E-01	3.40E+00	7.40E-01	R-1
Cadmium	2.80E-01	3.62E+01	4.04E+00	R-1
Chromium	5.20E+00	1.85E+03	1.24E+02	R-1
Copper	1.50E+01	4.64E+03	3.43E+02	R-1
Lead	4.00E+00	4.03E+02	5.29E+01	R-1
Manganese	1.20E+02	3.80E+02	3.12E+02	H-1
Nickel	2.40E+00	1.22E+03	7.75E+01	R-1
Silver	6.00E-01	6.20E+01	1.17E+01	H-7
Thallium	2.80E-01	9.60E+00	4.84E+00	R-3
Vanadium	1.18E+01	1.23E+02	3.28E+01	R-1
Zinc	1.30E+01	2.52E+03	2.60E+02	R-1

[1] Chemicals listed multiple times were detected at several locations at a concentration equal to the maximum.

TABLE IV-6
Concentrations of Chemicals of Potential Concern in Deep Soil Samples (mg/kg)

Chemical	Minimum	Maximum	95% UCL	Location of Max. Conc.[1]
Volatile Compounds				
Benzene	4.30E-03	5.70E-01	1.40E-02	W-24
Carbazole	1.50E-02	4.20E-02	5.05E+01	W-28
Ethylbenzene	5.00E-04	6.90E+01	6.94E-02	W-01
Tetrachloroethylene (PCE)	4.00E-04	4.10E+01	2.10E-02	W-24
Trichloroethene	4.00E-04	4.30E+01	2.17E-02	W-24
Xylenes (total)	4.00E-04	1.80E+02	9.65E-02	W-01
Semivolatile Compounds				
Benz[a]anthracene	1.10E-02	2.20E-01	1.57E+01	W-28
Benzo[a]pyrene	8.00E-03	1.50E+00	4.84E-01	P-1
Benzo[b]fluoranthene	5.00E-03	1.40E+00	5.59E-01	P-1
Benzo[b]fluoranthene	5.00E-03	1.40E+00	5.59E-01	R-12
Benzo[k]fluoranthene	4.00E-03	1.60E+00	5.84E-01	P-1
Bis(2-ethylhexyl)phthalate	2.70E-02	5.60E+02	5.42E-01	R-12
Chrysene	1.10E-02	3.50E-01	4.02E+01	W-28
Dibenzo(a,h)anthracene	1.70E-02	2.70E-02	1.56E+01	W-28
Dibenzofuran	8.00E-03	4.40E-01	3.76E-01	F-6
Indeno[1,2,3-cd]pyrene	4.20E-02	1.10E-01	1.23E+01	W-28
4-Methylphenol	4.10E-02	5.20E-02	1.23E+01	W-30
PCBs/Pesticides				
Aroclor 1254	8.00E-03	8.40E-01	4.76E-01	W-29
Chlordane	1.90E-01	1.90E-01	1.77E+00	W-25
PCBs (total)	3.90E-03	6.29E+00	3.03E-01	R-12
Inorganic Compounds				
Aluminum	5.00E+03	8.50E+04	1.05E+04	H-7
Antimony	7.90E+00	1.24E+01	1.19E+01	G-8
Arsenic	1.80E-01	7.50E+00	1.79E+00	W-31
Beryllium	2.30E-01	3.40E+00	5.43E-01	R-1
Cadmium	2.40E-01	3.90E+01	3.42E+00	W-01
Chromium	5.20E+00	3.82E+03	7.40E+01	W-03
Copper	1.08E+01	2.84E+04	2.24E+02	W-03
Lead	1.60E+00	8.62E+02	4.13E+01	W-03
Manganese	1.20E+02	3.80E+02	2.82E+02	H-1
Nickel	1.00E+00	3.47E+03	4.58E+01	W-03
Silver	6.00E-01	7.85E+01	5.21E+00	W-03
Thallium	2.20E-01	1.20E+01	2.91E+00	D-1
Vanadium	6.20E+00	1.23E+02	2.56E+01	R-1
Zinc	1.30E+01	5.80E+03	1.74E+02	W-03

[1] Chemicals listed multiple times were detected at several locations at a concentration equal to the maximum.

TABLE IV-7
Maximum Detected Concentrations of Ground Water Constituents Found in MW-43, MW-44, MW-56 (Off-Site Worker Scenario)

Chemical	CAS RN	Maximum Detected Concentration (mg/L)
Acetone	67641	1.50E-02
Aldrin	309002	2.10E-04
Arsenic	7440382	3.60E-02
Barium	7440393	1.60E+00
Benzene	71432	2.70E-03
Beryllium	7440417	4.00E-02
BHC, delta	319868	5.00E-05
Bis(2-ethylhexyl)phthalate	117817	1.20E-02
Bromodichloromethane	75274	1.00E-02
Bromoform	75252	1.00E-02
Bromomethane	74839	1.00E-02
2-Butanone	78933	1.00E-02
Butylbenzylphthalate	85687	5.00E-04
Cadmium	7440439	1.10E-01
Carbon disulfide	75150	1.00E-02
Carbon tetrachloride	56235	1.00E-02
Chlorobenzene	108907	1.00E-02
Chlorodibromomethane	124481	1.00E-02
Chloroethane	75003	1.00E-02
2-Chloroethyl vinyl ether	110758	1.00E-02
Chloroform	67663	3.90E-02
Chloromethane	74873	1.00E-02
Chromium	7440473	3.40E-01
Chrysene	218019	4.00E-04
Cobalt	7440484	1.90E-01
Copper	7440508	9.70E+00
4,4'-DDT	50293	9.00E-05
Di-n-Octyl phthalate	117840	1.90E-03
Dibutyl phthalate	84742	1.10E-02
1,2-Dichlorobenzene	95501	3.00E-04
1,1-Dichloroethane	75343	1.00E-02
1,2-Dichloroethane	107062	1.60E-02
1,1-Dichloroethene	75354	1.00E-02
1,2-Dichloroethylene (cis)	156592	4.90E-01
1,2-Dichloroethylene (trans)	156605	1.00E-02
2,4-Dichlorophenol	120832	1.20E-01
1,2-Dichloropropane	78875	1.00E-02
1,3-Dichloropropene (cis)	10061015	1.00E-02
1,3-Dichloropropene (trans)	10061026	1.00E-02
Dieldrin	60571	1.30E-03
Diethylphthalate	84662	1.30E-03
Endosulfan sulfate	1031078	7.90E-05
Ethylbenzene	100414	1.00E-02

TABLE IV-7
Maximum Detected Concentrations of Ground Water Constituents Found in MW-43, MW-44, MW-56 (Off-Site Worker Scenario)

Chemical	CAS RN	Maximum Detected Concentration (mg/L)
Fluoranthene	206440	7.00E-04
HCH (gamma) Lindane	58899	5.50E-05
Heptachlor epoxide	1024573	2.00E-05
2-Hexanone	591786	1.00E-02
Lead	7439921	1.60E-01
Manganese	7439965	1.70E+01
4-Methyl-2-pentanone	108101	1.00E-02
Methylene chloride	75092	1.00E-02
Naphthalene	91203	3.00E-04
Nickel	7440020	2.30E+00
4-Nitrophenol	100027	8.00E-04
N-Nitrosodimethylamine	62759	1.50E-02
PCBs (total)	1336363	2.60E-04
Pentachlorophenol	87865	1.00E-03
Phenanthrene	85018	3.00E-04
Pyrene	129000	5.00E-04
Styrene	100425	1.00E-02
2,4,5,6-Tetrachloro-m-xylene	877098	2.60E-04
1,1,2,2-Tetrachloroethane	79345	1.00E-02
Tetrachloroethylene (PCE)	127184	7.40E-02
Toluene	108883	1.00E-02
1,1,2-Trichloroethane	79005	1.00E-02
1,1,1-Trichloroethane	71556	2.30E-02
Trichloroethene	79016	3.20E-01
2,4,6-Trichlorophenol	88062	6.00E-04
2,4,5-Trichlorophenol	95954	2.20E-02
Vinyl acetate	108054	1.10E-02
Vinyl chloride	75014	6.60E-02
Xylenes (total)	1330207	6.60E-03
Zinc	7440666	1.00E+01

TABLE IV-8
Maximum Detected Concentrations of Ground Water Constituents Found in MW-37 (Off-Site Resident Scenario)

Chemical	CAS RN	Maximum Detected Concentration (mg/L)
Aldrin	309002	5.00E-05
BHC, beta	319857	5.00E-05
BHC, delta	319868	5.00E-05
Bis(2-ethylhexyl)phthalate	117817	1.10E-01
Bromodichloromethane	75274	9.00E-04
Butylbenzylphthalate	85687	5.50E-03
Chloroform	67663	8.90E-03
Copper	7440508	4.00E-02
4,4'-DDE	72559	1.00E-04
4,4'-DDT	50293	1.00E-04
Dibutyl phthalate	84742	6.30E-03
1,2-Dichloroethane	107062	2.00E-03
1,2-Dichloroethylene (cis)	156592	1.10E-02
Dieldrin	60571	1.00E-04
Endosulfan I	959988	5.00E-05
Endosulfan II	33213659	1.00E-04
Endrin aldehyde	7421934	1.00E-04
HCH (gamma) Lindane	58899	9.50E-06
Heptachlor	76448	5.00E-05
Manganese	7439965	7.20E-01
Mercury	7439976	2.20E+00
Methoxychlor	72435	5.00E-04
Methylene chloride	75092	5.70E-03
Nickel	7440020	4.00E-02
PCBs (total)	1336363	2.02E-03
2,4,5,6-Tetrachloro-m-xylene	877098	5.30E-05
Tetrachloroethylene (PCE)	127184	2.20E-03
1,1,1-Trichloroethane	71556	6.00E-04
Trichloroethene	79016	4.00E-03
Zinc	7440666	1.60E-01

TABLE IV-9
Concentrations of Chemicals of Potential Concern in Soil Gas Samples (µg/L)

Chemical	Minimum	Maximum	95% UCL	Location of Max. Conc.[1]
Volatile Compounds				
1,2-Dichloroethane	5.00E-01	5.00E-01	1.01E+00	D,10
1,1-Dichloroethene	5.00E-02	4.00E+00	1.12E+00	C,9
Tetrachloroethylene (PCE)	2.50E-02	5.00E+01	6.54E+00	H,7
1,1,1-Trichloroethane	2.00E-02	4.00E-01	1.26E+00	D,0
Trichloroethene	1.30E-01	7.40E+00	1.28E+00	G,8

[1] Chemicals listed multiple times were detected at several locations at a concentration equal to the maximum.

TABLE IV-10
Concentrations of Chemicals of Potential Concern in Surface Water Samples (mg/L)

Chemical	Minimum	Maximum	95% UCL	Location of Max. Conc.[1]
Volatile Compounds				
Tetrachloroethylene (PCE)	3.00E-04	7.00E-04	6.31E-03	SWNW-07
Trichloroethene	4.00E-04	9.20E-04	5.67E-03	SWNW-03
PCBs/Pesticides				
HCH (gamma) Lindane	8.00E-06	1.50E-05	2.75E-05	SWNW-06
PCBs (total)	1.60E-04	3.10E-04	1.15E-03	SWNW-01
Inorganic Compounds				
Copper	2.00E-02	2.00E-02	1.09E-02	SWBW-03
Copper	2.00E-02	2.00E-02	1.09E-02	SWBW-10
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-01
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-02
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-03
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-04
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-05
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-06
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-07
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-08
Mercury	5.00E-03	5.00E-03	3.76E-03	SWBW-10

[1] Chemicals listed multiple times were detected at several locations at a concentration equal to the maximum.

TABLE IV-11
Concentrations of Chemicals of Potential Concern in Sediment Samples (mg/kg)

Chemical	Minimum	Maximum	95% UCL	Location of Max. Conc.[1]
Semivolatile Compounds				
Benzo[a]pyrene	6.50E-02	1.60E+00	6.33E-01	NRI-18
Benzo[b]fluoranthene	5.50E-02	2.40E+00	8.05E-01	NRI-18
Inorganic Compounds				
Arsenic	4.30E-01	1.20E+00	6.02E-01	TBB-03
Chromium	5.00E+00	7.83E+01	2.09E+01	TNR-04

[1] Chemicals listed multiple times were detected at several locations at a concentration equal to the maximum.

[2] Nondetect samples in the Pre-Envirite Waste Material area with detection limits greater than the maximum measured concentration of the chemical in the medium and for which the arithmetic mean of all samples was greater than the maximum measured concentration in the medium were not included in the calculation of the 95% UCL.

TABLE IV-12
Concentrations of Chemicals of Potential Concern in Pre-Envirite Waste Material Samples Located near the Roadway (mg/kg)

Chemical	Minimum	Maximum	95% UCL	Location of Max. Conc.[1]
Volatile Compounds				
Benzene	3.00E+01	3.00E+01	2.07E+02	W-25
2-Butanone	2.10E+03	2.10E+03	6.90E+49	W-25
1,2-Dichloroethylene (cis)	2.60E+01	7.00E+01	8.11E+04	W-25
1,2-Dichloroethylene (trans)	2.60E+01	7.00E+01	8.11E+04	W-25
Ethylbenzene	7.00E+02	3.10E+03	7.43E+10	W-25
Styrene	6.20E+02	2.30E+03	3.29E+08	W-25
Tetrachloroethylene (PCE)	4.40E+02	3.10E+03	1.71E+15	W-25
Toluene	2.00E+03	1.50E+04	2.03E+16	W-25
Trichloroethene	2.50E+02	3.30E+03	2.47E+24	W-25
Xylenes (total)	2.60E+03	1.60E+04	1.27E+15	W-25
Semivolatile Compounds				
Benzo[k]fluoranthene	8.20E-01	8.20E-01	6.16E+83	W-30
Bis(2-ethylhexyl)phthalate	1.90E+02	6.50E+03	7.30E+39	W-25
Dibutyl phthalate	7.40E+01	3.10E+03	1.56E+49	W-25
Fluoranthene	1.20E+00	1.20E+00	1.29E+68	W-30
Naphthalene	6.90E+00	1.60E+02	1.42E+34	W-25
Phenanthrene	9.30E-01	9.30E-01	7.94E+71	W-30
Phenol	5.70E+00	1.70E+02	6.76E+36	W-25
Pyrene	1.20E+00	1.20E+00	1.29E+68	W-30
PCBs/Pesticides				
PCBs (total)	1.61E+01	2.60E+01	1.46E+02	W-25
Inorganic Compounds				
Antimony	9.63E+01	9.63E+01	1.24E+32	W-25
Chromium	2.20E+02	1.24E+03	5.18E+11	W-25
Cobalt	1.10E+01	2.48E+01	1.73E+03	W-25
Copper	1.07E+03	3.34E+03	3.32E+07	W-25
Lead	5.41E+02	5.90E+03	4.49E+20	W-25
Selenium	6.30E+00	4.75E+01	6.93E+13	W-25
Silver	9.40E-01	1.08E+01	1.98E+18	W-25
Thallium	2.60E-01	5.90E-01	4.27E+01	W-25
Tin	3.54E+01	3.54E+01	2.34E+32	W-25
Vanadium	1.07E+01	2.39E+01	1.59E+03	W-30
Zinc	8.38E+02	5.57E+03	1.33E+15	W-25

[1] Chemicals listed multiple times were detected at several locations at a concentration equal to the maximum.

TABLE IV-13
Summary of Toxicity Values Used in the PHERE

Contaminant	CAS	Chronic RfD		Subchronic RfD		Slope Factor	
		RfDo	RfDi	RfDo	RfDi	SFo	SFi
		mg/kg/day	mg/kg/day	mg/kg/day	mg/kg/day	kg-day/mg	kg-day/mg
Acenaphthene	83329	6.00E-02 I					
Acetone	67641	1.00E-01 I					
Aldrin	309002	3.00E-05 I				1.70E+01 I	1.71E+01 I
Aluminum	7429905	1.00E+00 E					
Anthracene	120127	3.00E-01 I					
Antimony and compounds	7440360	4.00E-04 I		4.00E-04 H			
Aroclor 1254	11097691	2.00E-05 I					
Arsenic	7440382	3.00E-04 I					
Arsenic (as carcinogen)	7440382					1.50E+00 I	5.00E+01 H
Barium and compounds	7440393	7.00E-02 I	1.43E-04 A				
Benz[a]anthracene	56553					7.30E-01 E	6.10E-01 E
Benzene	71432		1.71E-03 E			2.90E-02 I	2.90E-02 I
Benzo[a]pyrene	50328					7.30E+00 I	6.10E+00 W
Benzo[b]fluoranthene	205992					7.30E-01 E	6.10E-01 E
Benzo[k]fluoranthene	207089					7.30E-02 E	6.10E-02 E
beta-BHC (beta-HCH)	319857					1.80E+00 I	1.80E+00 I
Beryllium and compounds	7440417	5.00E-03 I				4.30E+00 I	8.40E+00 I
Bis(2-chloro-1-methylethyl)ether	108601					7.00E-02 H	3.50E-02 H
Bis(2-chloroisopropyl)ether	39638329	4.00E-02 I				7.00E-02 H	3.50E-02 H
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02 I				1.40E-02 I	
Bromodichloromethane	75274	2.00E-02 I				6.20E-02 I	
Bromoform (tribromomethane)	75252	2.00E-02 I				7.90E-03 I	3.85E-03 H
Bromomethane	74839	1.40E-03 I	1.43E-03 I				
2-Butanone (MEK)	78933	6.00E-01 I	2.86E-01 I	2.00E+00 H			
Butyl benzyl phthalate	85687	2.00E-01 I					
Cadmium and compounds	7440439	5.00E-04 I	5.71E-05 W				6.10E+00 H
Carbon disulfide	75150	1.00E-01 I	2.00E-01 I				
Carbon tetrachloride	56235	7.00E-04 I	5.71E-04 E	7.00E-03 H		1.30E-01 I	5.25E-02 I
Chlordane	57749	6.00E-05 I				1.30E+00 I	1.29E+00 I
4-Chloroaniline	106478	4.00E-03 I					
Chlorobenzene	108907	2.00E-02 I	5.71E-03 A				
Chlorodibromomethane	124481	2.00E-02 I				8.40E-02 I	
Chloroethane	75003	4.00E-01 E	2.86E+00 I				
Chloroform	67663	1.00E-02 I				6.10E-03 I	8.05E-02 I

TABLE IV-13
Summary of Toxicity Values Used in the PHERE

Contaminant	CAS	Chronic RfD		Subchronic RfD		Slope Factor	
		RfDo	RfDi	RfDo	RfDi	SFo	SFi
		mg/kg/day	mg/kg/day	mg/kg/day	mg/kg/day	kg-day/mg	kg-day/mg
Chloromethane	74873					1.30E-02 H	6.30E-03 H
2-Chloroethyl vinyl ether	110758	2.50E-02 O					
2-Chlorophenol	95578	5.00E-03 I					
Chromium III and compounds	16065831	1.00E+00 I	5.71E-07 W	1.00E+00 H			
Chromium VI and compounds	18540299	5.00E-03 I		2.00E-02 H			4.10E+01 H
Chrysene	218019					7.30E-03 E	6.10E-03 E
Cobalt	7440484	6.00E-02 E					
Copper and compounds	7440508	4.00E-02 E					
4,4'-DDD	72548					2.40E-01 I	
4,4'-DDE	72559					3.40E-01 I	
4,4'-DDT	50293	5.00E-04 I				3.40E-01 I	3.40E-01 I
di-n-Octyl phthalate	117840	2.00E-02 H					
Dibenzofuran	132649	4.00E-03 E					
Dibutyl phthalate	84742	1.00E-01 I		1.00E+00 H			
1,2-Dichlorobenzene	95501	9.00E-02 I	4.00E-02 A				
1,1-Dichloroethane	75343	1.00E-01 H	1.43E-01 A				
1,2-Dichloroethane	107062		2.86E-03 E			9.10E-02 I	9.10E-02 I
1,1-Dichloroethylene	75354	9.00E-03 I				6.00E-01 I	1.20E+00 H
1,2-Dichloroethylene (cis)	156592	1.00E-02 H					
1,2-Dichloroethylene (trans)	156605	2.00E-02 I					
2,4-Dichlorophenol	120832	3.00E-03 I					
2,6-Dichlorophenol (as 2,4-Dichlorophen	87650	3.00E-03 I					
1,2-Dichloropropane	78875		1.14E-03 I			6.80E-02 H	
1,3-Dichloropropene (cis)	542756	3.00E-04 I	5.71E-03 I			1.75E-01 H	1.30E-01 H
Dieldrin	60571	5.00E-05 I				1.60E+01 I	1.61E+01 I
Diethyl phthalate	84662	8.00E-01 I					
2,4-Dimethylphenol	105679	2.00E-02 I					
Dimethyl phthalate	131113	1.00E+01 H					
2,4-Dinitrophenol	51285	2.00E-03 I		2.00E-03 H			
Endosulfan	115297	6.00E-03 I					
Endrin	72208	3.00E-04 I		3.00E-04 H			
Ethylbenzene	100414	1.00E-01 I	2.86E-01 I	1.00E+00 H	2.86E-01 H		
Fluoranthene	206440	4.00E-02 I		4.00E-01 H			
Fluorene	86737	4.00E-02 I					

TABLE IV-13
Summary of Toxicity Values Used in the PHERE

Contaminant	CAS	Chronic RfD		Subchronic RfD		Slope Factor	
		RfDo	RfDi	RfDo	RfDi	SFo	SFi
		mg/kg/day	mg/kg/day	mg/kg/day	mg/kg/day	kg-day/mg	kg-day/mg
HCH (alpha)	319846					6.30E+00 I	6.30E+00 I
HCH (gamma) Lindane	58899	3.00E-04 I		3.00E-03 H		1.30E+00 H	
Heptachlor	76448	5.00E-04 I				4.50E+00 I	4.50E+00 I
Heptachlor epoxide	1024573	1.30E-05 I				9.10E+00 I	9.10E+00 I
Hexachlorocyclopentadiene	77474	7.00E-03 I	2.00E-05 H	7.00E-02 H	2.00E-04 H		
Iron	7439896	3.00E-01 E					
Isophorone	78591	2.00E-01 I				9.50E-04 I	
Manganese and compounds	7439965	1.40E-01 I	1.43E-05 I				
Mercury (inorganic)	7439976	3.00E-04 H	8.57E-05 H				
Mercury (methyl)	22967926	1.00E-04 I					
Methoxychlor	72435	5.00E-03 I		5.00E-03 H			
Methylene chloride	75092	6.00E-02 I	8.57E-01 H			7.50E-03 I	1.64E-03 I
4-Methyl-2-pentanone (MIBK)	108101	8.00E-02 H	2.29E-02 A				
Naphthalene	91203	4.00E-02 W		4.00E-02 H			
Nickel and compounds	7440020	2.00E-02 I					
3-Nitroaniline	99092	3.00E-03 O					
2-Nitrophenol (as 4-Nitrophenol)	88755	6.20E-02 O					
4-Nitrophenol	100027	6.20E-02 O					
N-Nitrosodimethylamine	62759					5.10E+01 I	5.10E+01 H
N-Nitrosodiphenylamine	86306					4.90E-03 I	
Polychlorinated biphenyls (PCBs)	1336363					2.00E+00 I	
Pentachlorophenol	87865	3.00E-02 I		3.00E-02 H		1.20E-01 I	
Phenanthrene (as Naphthalene)	85018	4.00E-02 W		4.00E-02 H			
Phenol	108952	6.00E-01 I		6.00E-01 H			
Pyrene	129000	3.00E-02 I		3.00E-01 H			
Selenium	7782492	5.00E-03 I		5.00E-03 H			
Silver and compounds	7440224	5.00E-03 I		5.00E-03 H			
Styrene	100425	2.00E-01 I	2.86E-01 I		8.57E-01 H		
1,1,2,2-Tetrachloroethane	79345					2.00E-01 I	2.03E-01 I
Tetrachloroethylene	127184	1.00E-02 I		1.00E-01 H		5.20E-02 E	2.03E-03 E
Thallium (as Thallium chloride)	7791120	8.00E-05 I		8.00E-04 H			
Tin and compounds	7440315	6.00E-01 H		6.00E-01 H			
Toluene	108883	2.00E-01 I	1.14E-01 I	2.00E+00 H			
Toxaphene	8001352					1.10E+00 I	1.12E+00 I

TABLE IV-13
Summary of Toxicity Values Used in the PHERE

Contaminant	CAS	Chronic RfD		Subchronic RfD		Slope Factor	
		RfDo	RfDi	RfDo	RfDi	SFo	SFi
		mg/kg/day	mg/kg/day	mg/kg/day	mg/kg/day	kg-day/mg	kg-day/mg
1,1,1-Trichloroethane	71556	3.50E-02 E	2.86E-01 W				
1,1,2-Trichloroethane	79005	4.00E-03 I				5.70E-02 I	5.70E-02 H
Trichloroethylene	79016	6.00E-03 E				1.10E-02 W	6.00E-03 E
2,4,5-Trichlorophenol	95954	1.00E-01 I					
2,4,6-Trichlorophenol	88062					1.10E-02 I	1.00E-02 H
Vanadium	7440622	7.00E-03 H		7.00E-03 H			
Vinyl acetate	108054	1.00E+00 H	5.71E-02 I				
Vinyl chloride	75014					1.90E+00 H	3.00E-01 H
Xylene (mixed)	1330207	2.00E+00 I					
Zinc	7440666	3.00E-01 I		3.00E-01 H			

Notes:

RfDo	Reference dose, oral
RfDi	Reference dose, inhalation
	Subchronic RfDo and RfDi values provided only for chemicals of potential concern under utility worker scenario
SFo	Cancer slope factor, oral
SFi	Cancer slope factor, inhalation

References:

H	HEAST
I	IRIS
A	HEAST alternate
W	Withdrawn from IRIS or HEAST
E	EPA-NCEA Regional Support provisional value
O	Other EPA documents

TABLE IV-14
Estimated Current CTE Cancer Risk Estimates

Exposure Route	Potentially Exposed Population				
	On-Site Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	1×10^{-7}	5×10^{-8}	---	---	---
Inhalation of Outdoor Air	3×10^{-8}	1×10^{-9}	---	3×10^{-8}	---
Ingestion of Off-Site Ground Water	---	---	---	---	---
Ingestion of Surface Water	---	---	---	---	2×10^{-8}
Dermal Contact with Surface Water	---	---	---	---	2×10^{-7}
Ingestion of Sediments	---	---	---	---	2×10^{-7}
TOTAL	1×10^{-7}	5×10^{-8}	---	3×10^{-8}	4×10^{-7}

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-15
Estimated Current RME Cancer Risk Estimates

Exposure Route	Potentially Exposed Population				
	On-Site Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	2×10^{-6}	2×10^{-7}	---	---	---
Inhalation of Outdoor Air	3×10^{-7}	5×10^{-9}	---	3×10^{-7}	---
Ingestion of Off-Site Ground Water	---	---	---	---	---
Ingestion of Surface Water	---	---	---	---	2×10^{-8}
Dermal Contact with Surface Water	---	---	---	---	5×10^{-7}
Ingestion of Sediments	---	---	---	---	7×10^{-7}
TOTAL	2×10^{-6}	2×10^{-7}	---	3×10^{-7}	1×10^{-6}

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-16
Estimated Current CTE Noncancer Hazard Quotients

Exposure Route	Potentially Exposed Population				
	On-Site Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	0.02	0.01	---	---	---
Inhalation of Outdoor Air	0.00001	0.0000005	---	0.00001	---
Ingestion of Off-Site Ground Water	---	---	---	---	---
Ingestion of Surface Water	---	---	---	---	0.008
Dermal Contact with Surface Water	---	---	---	---	0.002
Ingestion of Sediments	---	---	---	---	0.0009
TOTAL	0.02	0.01	---	0.00001	0.01

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-17
Estimated Current RME Noncancer Hazard Quotients

Exposure Route	Potentially Exposed Population				
	On-Site Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	0.08	0.05	---	---	---
Inhalation of Outdoor Air	0.00003	0.000002	---	0.00003	---
Ingestion of Off-Site Ground Water	---	---	---	---	---
Ingestion of Surface Water	---	---	---	---	0.008
Dermal Contact with Surface Water	---	---	---	---	0.004
Ingestion of Sediments	---	---	---	---	0.004
TOTAL	0.08	0.05	---	0.00003	0.02

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-18
Estimated Future CTE Cancer Risk Estimates

Exposure Route	Potentially Exposed Population					
	On-Site Worker	On-Site Trespasser	On-Site Utility Worker	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	1×10^{-7}	5×10^{-8}	2×10^{-8}	---	---	---
Ingestion of Pre-Envirite Waste Material	---	---	5×10^{-8}	---	---	---
Inhalation of Outdoor Air	3×10^{-8}	1×10^{-9}	8×10^{-5}	7×10^{-8}	3×10^{-8}	---
Ingestion of Off-Site Ground Water	---	---	---	2×10^{-5}	6×10^{-6}	---
Dermal Contact with Ground Water	---	---	---	3×10^{-4}	---	
Inhalation of Ground Water Constituents while Showering	---	---	---	2×10^{-6}	---	
Ingestion of Surface Water	---	---	---	---	---	2×10^{-8}
Dermal Contact with Surface Water	---	---	---	---	---	2×10^{-7}
Ingestion of Sediments	---	---	---	---	---	2×10^{-7}
TOTAL	1×10^{-7}	5×10^{-8}	8×10^{-5}	4×10^{-4}	6×10^{-6}	4×10^{-7}

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-19
Estimated Future RME Cancer Risk Estimates

Exposure Route	Potentially Exposed Population					
	On-Site Worker	On-Site Trespasser	On-Site Construction Worker	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	2×10^{-6}	2×10^{-7}	1×10^{-6}	---	---	---
Ingestion of Pre-Envirite Waste Material	---	---	2×10^{-7}	---	---	---
Inhalation of Outdoor Air	3×10^{-7}	5×10^{-9}	2×10^{-4}	4×10^{-7}	3×10^{-7}	---
Ingestion of Off-Site Ground Water	---	---	---	1×10^{-4}	4×10^{-5}	---
Dermal Contact with Ground Water	---	---	---	1×10^{-3}	---	
Inhalation of Ground Water Constituents while Showering	---	---	---	9×10^{-6}	---	
Ingestion of Surface Water	---	---	---	---	---	2×10^{-8}
Dermal Contact with Surface Water	---	---	---	---	---	5×10^{-7}
Ingestion of Sediments	---	---	---	---	---	7×10^{-7}
TOTAL	2×10^{-6}	2×10^{-7}	2×10^{-4}	1×10^{-3}	4×10^{-5}	1×10^{-6}

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.

TABLE IV-20
Estimated Future CTE Noncancer Hazard Quotients

Exposure Route	Potentially Exposed Population				
	On-Site Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	0.02	0.01	---	---	---
Inhalation of Outdoor Air	0.00001	0.0000005	0.00002	0.00001	---
Ingestion of Off-Site Ground Water	---	---	100 / 0.4	0.06	---
Dermal Contact with Ground Water	---	---	1 / 0.6	---	---
Inhalation of Ground Water Constituents while Showering	---	---	300 / 0.01	---	---
Inhalation of Surface Water	---	---	---	---	0.008
Dermal Contact with Surface Water	---	---	---	---	0.002
Ingestion of Sediments	---	---	---	---	0.0009
TOTAL	0.02	0.01	500 / 1 (a)	0.06	0.01

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.
a The HI value of 500 is primarily due to mercury. Mercury was only detected in 2 out of 125 ground water samples collected during the RFI process. Therefore, its presence may be an artifact in the data due to sampling, analytical, or other problems. Excluding mercury, the cumulative HI value is 1.

TABLE IV-21
Estimated Future RME Noncancer Hazard Quotients

Exposure Route	Potentially Exposed Population				
	On-Site Worker	On-Site Trespasser	Off-Site Resident	Off-Site Worker	Recreational Visitor
Ingestion of Soil	0.08	0.05	---	---	---
Inhalation of Outdoor Air	0.00003	0.000002	0.00004	0.00003	---
Ingestion of Off-Site Ground Water	---	---	200 / 0.6	0.1	---
Dermal Contact with Ground Water			1 / 0.7		
Inhalation of Ground Water Constituents while Showering			500 / 0.02		
Ingestion of Surface Water	---	---	---	---	0.008
Dermal Contact with Surface Water	---	---	---	---	0.004
Ingestion of Sediments	---	---	---	---	0.004
TOTAL	0.08	0.05	700 / 1 (a)	0.1	0.02

Notes:
--- Indicates that this is not a complete exposure pathway for this receptor population.
a The HI value of 700 is primarily due to mercury. Mercury was only detected in 2 out of 125 ground water samples collected during the RFI process. Therefore, its presence may be an artifact in the data due to sampling, analytical, or other problems. Excluding mercury, the cumulative HI value is 1.

5 ECOLOGICAL RISK ASSESSMENT

5.1 Introduction

The objective of the ecological portion of the Public Health and Environmental Risk Evaluation (PHERE) is to characterize the potential risks to ecological resources from hazardous substances present in environmental media on the Envirite monofill, or which may have migrated to adjacent areas, particularly Branch Brook and the Naugatuck River. Data collected during the RCRA Facility Investigation (GZA 1995) on: (1) chemical concentrations in Branch Brook and Naugatuck River surface water and sediments; (2) fish and benthic macroinvertebrate communities in Branch Brook and the Naugatuck River; and (3) chemical concentrations in surface soil samples collected on and immediately adjacent to the monofill, were considered in this ecological risk assessment. This assessment uses measured and modeled estimates of exposure, the available guidance and published information on the environmental fate and toxicity of the chemicals selected for evaluation, and the expected/known habitats and likely species in the site vicinity. Comments from USEPA Region I on the first interim deliverable of the PHERE (March 1995) were also incorporated into the approach and methodologies utilized in this revised assessment.

This assessment considered current national and Region I USEPA guidance for conducting ecological risk assessments including:

- *The Framework for Ecological Risk Assessment* (USEPA 1992), as updated by the draft *Proposed Guidelines for Ecological Risk Assessment* (USEPA 1996a);
- *Risk Assessment Guidance for Superfund, Volume II - Environmental Evaluation Manual* (USEPA 1989a), as updated by the draft document entitled *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1996b);
- *Supplemental Risk Assessment Guidance for the Superfund Program, Part 2 - Guidance for Ecological Risk Assessments, Draft Final* (USEPA 1989b);
- *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference* (USEPA 1989c);
- *Wildlife Exposure Factors Handbook* (USEPA 1993); and
- *EcoUpdate 3(2): Ecotox Thresholds* (USEPA 1996c).

The ecological risk assessment portion of the PHERE is divided into nine sections as follows:

Section 5.1. Introduction - describes the purpose and scope of the ecological risk assessment and outlines the report organization.

Section 5.2. Site Characterization - summarizes the analytical chemistry data collected at the site, in Branch Brook, and in the Naugatuck River for ecologically relevant media, and describes the ecological resources (habitats and biota) which occur on or adjacent to the site.

Section 5.3. Selection of Chemicals for Evaluation - describes the screening process used to select ecological chemicals of concern (ECOCs) for evaluation from those chemical constituents detected in ecologically relevant media (surface water, sediment, and surface soil).

Section 5.4. Characterization of Exposure - presents a diagrammatic conceptual site model that describes the relevant exposure routes and pathways, selects receptor species, selects assessment and measurement endpoints, and calculates medium-specific exposure point concentrations.

Section 5.5. Characterization of Ecological Effects - develops toxicological benchmark values for the ECOCs based on the published ecotoxicological literature and available guidance or criteria values for each chemical - exposure pathway - receptor combination. The results of benthic macroinvertebrate and fish surveys are also evaluated.

Section 5.6. Risk Characterization - compares medium-specific exposure point concentrations for each receptor species with the appropriate criteria values or toxicological benchmarks, evaluates the assessment endpoints, and integrates endpoint evaluations using a weight-of-the-evidence approach to characterize the likelihood and/or magnitude of risks to ecological receptors from exposure to the ECOCs.

Section 5.7. Uncertainties and Limitations - describes the uncertainties and limitations associated with the exposure and toxicological parameter values, models, and other assumptions used in the assessment, as well as any data limitations.

Section 5.8. Risk Summary and Conclusions - summarizes the major findings and conclusions of the ecological risk assessment.

Section 5.9. References - lists the references cited in Chapter 5.

Details regarding the methodologies and data used in the ecological risk assessment are provided in technical appendices.

5.2 Site Characterization

The purpose of the site characterization is to: (1) summarize the available data on the nature and extent of the chemical constituents in ecologically-relevant media on the site and in Branch Brook and the Naugatuck River; and (2) identify sensitive ecological habitats and receptors that may be impacted as a result of exposure to these chemicals. The identification of receptors also provides the basis for selecting appropriate receptor species for risk characterization (see Section 5.4), and establishes the presence of special concern species and habitats.

5.2.1 Summary of Available Analytical Data

Analytical data on chemical constituents in on-site surface soils, and in surface water and sediments of Branch Brook and the Naugatuck River, are available from sampling conducted

during June and September-October 1994 RFI studies (GZA 1995). A total of 54 surface water samples were collected from Branch Brook and the Naugatuck River during these studies. This includes 30 (20 unfiltered and 10 filtered) samples from Branch Brook, 9 upstream of the site (3 locations) and 21 adjacent to, or downstream of, the site (7 locations), and 24 (16 unfiltered and 8 filtered) samples from the Naugatuck River, 9 upstream of the site (3 locations) and 15 adjacent to, or downstream of, the site (5 locations). The upstream samples were used to characterize "background" conditions (Figure V-1).

A total of 32 sediment samples were collected from Branch Brook and the Naugatuck River during RFI studies and analyzed for chemical constituents. This includes 16 samples from Branch Brook, 4 upstream of the site (2 locations) and 12 adjacent to, or downstream of, the site (6 locations), and 16 samples from the Naugatuck River, 8 upstream of the site (4 locations) and 8 adjacent to, or downstream of, the site (4 locations). The upstream samples were used to characterize "background" conditions (Figure V-2). For sampling locations where more than one depth of sediment was sampled during a sampling event, only the data from the top-most stratum (0 to 0.5 feet for these samples) were used in this assessment since these data are most relevant to ecological exposures.

Surface soil data from soil borings (zero to one foot strata) were used to characterize ecological exposures in terrestrial habitats. For this ecological risk assessment, the 12 borings taken outside of the developed portion of the site (i.e., those areas not occupied by former buildings or paved areas; see the following section) were used (Figure V-3). In addition, three of the "background" samples collected by GZA (B-6, B-7, and B-8; Figure V-3) were included as on-site samples due to their proximity to the monofill for a total of 15 on-site surface soil samples. Samples B-1 through B-5 (Figure V-3) were used to represent "background" locations not likely to have been affected by the monofill.

5.2.2 General Physiographic Features

The Envirite facility/monofill is situated in a valley formed by the confluence of Branch Brook and the Naugatuck River. The site is located within the Green Mountain Plateau Physiographic Province. The general topography of this region consists of rolling hills with occasional steep valleys associated with the Naugatuck River and its tributaries. In the vicinity of the site, the Naugatuck River is at an elevation of approximately 340 feet above mean sea level (msl). The surrounding highlands range in elevation from 550 to 850 feet msl (GZA 1995).

This area of Connecticut falls within the Transitional Hardwoods vegetation zone (NERBC 1980). This zone is comprised of a mixture of southern and northern tree species, including oaks, hickories, basswood, white ash, sugar maple, black birch, yellow birch, eastern hemlock, and eastern white pine (NERBC 1980). Average annual precipitation in this region is 48 to 50 inches and annual snowfall averages 40 to 60 inches. The average winter temperature is 30.6°F, the average summer temperature is 71.4°F, and the annual average temperature is 47°F. The average length of the growing season ranges from 150 to 160 days (NERBC 1980).

5.2.3 Habitat Characterization

The site is bounded to the north by a steep wooded hill occupied by a private commercial facility (Cametrics). Branch Brook flows through the extreme western edge of the site. A portion of the Mattatuck State Forest, west of Branch Brook, borders the site to the west; Connecticut Route 8 is approximately 250 feet west of the site. Immediately south of the site is the Thomaston publicly owned treatment works (POTW), a solid waste transfer station, and the Thomaston Dog Pound. The site is bounded to the east by Old Waterbury Road; a narrow strip of land separates Old Waterbury Road from the Naugatuck River, which is less than 100 feet east of the site boundary (Figure V-1).

The site is approximately 13 acres in size. The east-central two-acre portion of the site is occupied by building slabs and paved roads/parking areas. The five-acre solid waste monofill surrounds this developed area to the south, west, and north (Figure V-1). A storage and treatment building and materials handling areas were formerly centrally located at the site. The monofill and immediately bordering areas to the south, west, and north are covered by mowed lawn consisting of grasses and other herbaceous plants. The northern edge of the site is wooded, with quaking aspen dominating the area nearest the monofill, and sugar maple dominating in areas near, and north of, the site boundary.

Scrub habitat, dominated by American sycamore, staghorn sumac, and autumn olive, borders the area immediately west of the monofill. Further west, along Branch Brook, relatively open (canopy cover of approximately 20 percent), early to mid-successional wooded habitats (maximum canopy height of approximately 40 feet) occur. The dominant tree species in this area is American sycamore, with staghorn sumac and speckled alder dominating the shrub stratum. The dominant herbaceous species in the ground layer is goldenrod. West of Route 8, the habitat changes to mature deciduous forest. The area along Branch Brook south of the site (part of the state forest, adjacent to the POTW) is also composed of mature deciduous forest, with canopy heights reaching 60 to 80 feet and a canopy cover of approximately 85 percent. The dominant tree species is sugar maple and the understory (scattered shrubs) and ground layers (40 percent cover by herbaceous plants) are poorly developed.

Other than Branch Brook, which flows through the extreme western edge of the site, there are no wetlands present on-site. Branch Brook and the Naugatuck River are classified on National Wetland Inventory (NWI) maps (USFWS 1980) as Riverine, Upper Perennial, Open Water wetlands. Physical descriptions and habitat characteristics of these two water bodies are summarized in Tables V-1 and V-2, respectively. Based on NWI maps and an October 1996 site visit, the nearest wetlands (other than Branch Brook and the Naugatuck River) occur south of the site on the POTW property. These four small, artificial, open water wetlands constitute the POTW's clarifier ponds.

5.2.4 Wildlife and Aquatic Organisms

A general description of the ecological receptors present on, and in the immediate vicinity of, the site was compiled from: (1) the information provided in GZA (1995) on aquatic receptors

present in Branch Brook and the Naugatuck River; (2) limited literature review and agency consultation; and (3) a reconnaissance-level field visit to the site and immediate vicinity conducted by ENVIRON on October 14, 1996. The ecological receptors known or expected to occur in the site vicinity are discussed by major taxonomic group below.

5.2.4.1 Birds

Representative bird species which are either known to, or may, occur in the site vicinity are listed in Table V-3. Site-specific data on the avifauna present in the site vicinity were obtained during the October 1996 field visit; a total of 15 bird species were observed during this brief visit.

The *Atlas of Breeding Birds of Connecticut* (Bevier 1994) lists 94 bird species known or suspected of breeding in the survey block containing the site, including 36 species listed as confirmed breeders, 43 species listed as probable breeders, and 15 species listed as possible breeders (Appendix V-1). To characterize winter bird usage in the site vicinity, Christmas Bird Count data from 1991 to 1996 were used (Belding 1996, 1995, 1994, 1993, 1992). Christmas Bird Counts are one day counts conducted annually by the National Audubon Society using volunteer observers during the months of December or January within a circle with a diameter of 15 miles. Birds seen or heard are enumerated during these counts. The nearest Christmas Bird Count plot, Litchfield Hills, is centered approximately ten miles northwest of the site.

Appendix V-2 lists the number of birds, by species, observed during the past five Christmas Bird Count surveys for the Litchfield Hills census plot; a total of 111 species were observed during this period. Based upon five-year mean values, the five most commonly observed bird species during the winter period are: (1) European starling; (2) American crow; (3) Canada goose; (4) black-capped chickadee; and (5) house finch. Since this census plot encompass a much larger area and more diverse habitats than are present on the site, many of the species listed in Appendix V-2 may not occur in the immediate site vicinity.

5.2.4.2 Mammals

Representative mammalian species which are either known to, or may, occur in the site vicinity are listed in Table V-3. Site-specific data on the mammalian fauna present in the site vicinity were obtained during the October 1996 field visit. A total of six mammalian species were observed during this brief visit, including beaver sign along Branch Brook adjacent to the site.

5.2.4.3 Reptiles and Amphibians

Representative amphibian and reptile species which may occur in the site vicinity are listed in Table V-3. Site-specific data on the occurrence of individual species of reptiles and amphibians was obtained from Klemens (1993).

5.2.4.4 Aquatic Organisms

Benthic macroinvertebrate surveys in Branch Brook and the Naugatuck River were conducted by GZA in the spring and fall of 1994 using the USEPA Rapid Bioassessment Protocol III methodology. Four locations were sampled in each water body, one upstream of the site, and the other three adjacent to or downstream of the site (Figure V-4). Details on the sampling methodology used during these surveys can be found in GZA (1995).

Twenty distinct taxa were observed during spring surveys in Branch Brook (Appendix V-3). The number of taxa observed were similar among all sampling locations in the spring. Twelve taxa were observed at the upstream location, with between 11 and 15 taxa observed at the three downstream locations (Table V-4). Mayflies (Ephemeroptera) were the dominant taxa present at each location, comprising 48.7 percent of the individuals sampled at the upstream location and between 66.3 and 72.3 percent of the individuals sampled at the three downstream locations.

Twenty-two distinct taxa were observed during fall surveys in Branch Brook (Appendix V-3). The number of taxa observed were similar among all sampling locations in the fall. Fourteen taxa were observed at the upstream location, with between 11 and 14 taxa observed at the three downstream locations (Table V-4). Caddisflies (Trichoptera) were the dominant taxa present at each location, comprising 65.0 percent of the individuals sampled at the upstream location and between 59.5 and 68.7 percent of the individuals sampled at the three downstream locations.

Thirty-six distinct taxa were observed during spring surveys in the Naugatuck River (Appendix V-3). The number of taxa observed were similar among all sampling locations in the spring. Twenty taxa were observed at the upstream location, with between 20 and 22 taxa observed at the three downstream locations (Table V-5). Mayflies (Ephemeroptera) were the dominant taxa present at three of the four locations, comprising 38.2 percent of the individuals sampled at the upstream location, and 48.1 and 48.7 percent of the individuals sampled at the first two downstream locations. Caddisflies were the most common taxa (42.8 percent) at the most downstream location (Table V-5).

Seventeen distinct taxa were observed during fall surveys in the Naugatuck River (Appendix V-3), which is about half that observed in the spring. The number of taxa observed among the sampling locations showed more variability in the fall relative to the spring. Sixteen taxa were observed at the upstream location, with between 7 and 14 taxa observed at the three downstream locations (Table V-5). Caddisflies (Trichoptera) were the dominant taxa present at each location, comprising 78.9 percent of the individuals sampled at the upstream location and between 56.5 and 85.5 percent of the individuals sampled at the three downstream locations.

GZA (1995) also conducted qualitative surveys for fish in Branch Brook and the Naugatuck River during the early summer and fall of 1994. Four reaches were sampled using an electroshocker in each water body, one upstream of the site, and the other three adjacent to or

downstream of the site (Figure V-4). Details on the sampling methodology used during these surveys can be found in GZA (1995).

Table V-6 summarizes the results of the fish surveys in Branch Brook. Eight fish species were observed during spring surveys. The number of species observed was similar among all sampling locations, with five species observed at the upstream location, and between 5 and 8 species observed at the three downstream locations (Table V-6). Blacknose dace was most abundant at the upstream location and Location BB-A2. Fallfish was most abundant at Location BB-A1 while white sucker and bluegill were numerically dominant at the most downstream location (BB-A3). Eleven fish species were observed during fall surveys (Table V-6). The number of species observed was similar among all sampling locations, with five species observed at the upstream location, and between 4 and 8 species observed at the three downstream locations. Blacknose dace was most abundant at the upstream location and the first downstream location (BB-A1). Fallfish was most abundant at the two most downstream locations (BB-A2 and BB-A3).

Table V-7 summarizes the results of the fish surveys in the Naugatuck River. Eight fish species were observed during spring surveys. The number of species observed was similar among all sampling locations, with four species observed at the upstream location, and between 6 and 7 species observed at the three downstream locations (Table V-7). Rock bass and white sucker were most common. Eleven fish species were observed during fall surveys (Table V-7). The number of species observed was similar among all sampling locations, with eight species observed at the upstream location, and between 6 and 7 species observed at the three downstream locations. Fallfish was most abundant at the upstream location and at the first two downstream locations (NR-A1 and NR-A2). Tessellated darter was most common at the most downstream location (NR-A3).

5.2.4.5 Threatened, Endangered, and Special Concern Species

Based on consultations with the U.S. Fish and Wildlife Service, no federally-listed or proposed threatened and endangered species are known to occur within the site vicinity with the exception of occasional transient bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus*) (USFWS 1996). Based on consultations with the Connecticut Department of Environmental Protection (CTDEP 1996), there are no known occurrences of state-listed threatened, endangered, or special concern species on the site. There are recent records within a one-mile radius of the site for one special concern plant species, hairy woodmint (*Blephilia hirsuta*), one special concern reptile, eastern hognose snake (*Heterodon platirhinos*), and one endangered reptile, timber rattlesnake (*Crotalus horridus*). As noted above, there is no record of these three species occurring on the site. As each of these three species occurs in terrestrial habitats and the available habitat on the site is not suitable, no adverse impacts are expected to these species.

5.3 Selection of Chemicals for Evaluation

Ecological Chemicals of Concern (ECOCs) for surface water, sediment, surface soil, and food chain exposures were selected in order to identify chemical constituents with a potential to pose ecological risk at the site.

5.3.1 Methodology

The ECOCs were selected based on a set of general screening criteria, consistent with USEPA guidance (e.g., USEPA 1991a), including: (1) the observed magnitude and distribution of chemical concentrations; (2) the frequency of detection; (3) comparison to background concentrations; (4) potential toxicity to ecological receptors; (5) potential for bioaccumulation; and (6) mobility/persistence. Ground water, subsurface soils (at depths greater than 12 inches), and subsurface sediments (at depths greater than 6 inches) were not evaluated since ecological receptors typically have limited direct contact with these media. Indirect exposure to ground water (e.g., when ground water discharges to surface water bodies or enters sediment pore water) were addressed through the evaluation of surface water and sediment. Since the plants present on the monofill are shallow-rooted herbaceous species, plant exposure to ground water in the root zone is not expected to be significant.

Chemicals that were detected in at least one surface water (Tables V-8 and V-9), sediment (Tables V-10 and V-11), or surface soil (Table V-12) sample were screened through a comparison of maximum observed concentrations with medium-specific toxicological benchmarks. It should be noted that detection limits for some analytes exceeded applicable benchmark values in some of these media. Tables III-10 through III-21, III-28, and III-29 show the range of detection limits for the media evaluated. In all cases, the detection limits employed in analyzing these chemicals were consistent with, or below, the practical quantitation limits (PQLs) recognized by USEPA in the RCRA program.

Screening benchmarks for surface water were based on acute and chronic USEPA Ambient Water Quality Criteria (AWQC) for the protection of aquatic life (USEPA 1994), chronic screening benchmarks in USEPA (1996c), acute and chronic Connecticut aquatic life criteria (CTDEP 1997), and screening benchmarks compiled by Suter and Tsao (1996). Surface water benchmarks for zinc were adjusted based on site-specific water hardness levels[28]. Since hardness was not measured during RFI studies, it was calculated based on measured concentrations of calcium and magnesium using the following formula (from Franson 1992):

$$Hardness = 2.497\ [Ca] + 4.118\ [Mg]$$

Screening benchmarks are available for both total and dissolved metals, however, since current USEPA guidance (USEPA 1996c) indicates that the dissolved metal fraction should be

[28] The benchmark for copper was not adjusted based on hardness since a water body-specific benchmark has been promulgated for the Naugatuck River by CTDEP (1997).

preferentially used to the total metal fraction in screening surface water chemicals relative to benchmarks, the results of the dissolved metal comparisons are given greater weight when deciding to retain or screen out a surface water metal.

Screening benchmarks for organic chemicals in sediments were obtained from, or calculated as described in, USEPA (1996c), NYSDEC (1994), and Jones et al. (1996). For non-polar organic compounds, these screening benchmarks are derived using the equilibrium partitioning approach (USEPA 1996c), as follows:

$$SQC = (f_{oc})(K_{oc})(FCV)$$

where:

SQC	=	Sediment Quality Criteria (mg/kg)
f_{oc}	=	total organic carbon content; percent (as a fraction)
K_{oc}	=	adsorption coefficient normalized to the organic content of the sediment; unitless
FCV	=	chronic AWQC; mg/L

The f_{oc} values used in this assessment were averages for the site being evaluated. For Branch Brook, the average site-specific f_{oc} percentage was 0.4%, while for Naugatuck River, the average site-specific f_{oc} percentage was 0.7%. K_{oc} values were obtained from the literature or calculated from K_{ow} values (obtained from USEPA 1995a) using the following formula (from USEPA 1996c):

$$\log_{10} K_{oc} = 0.00028 + 0.983(\log_{10} K_{ow})$$

The equilibrium partitioning approach is widely used for determining sediment benchmark values for non-polar organic chemicals and is the recommended approach in USEPA (1996c) for deriving screening benchmarks for organic chemicals in sediments. Where available data did not allow sediment benchmarks based on equilibrium partitioning to be calculated for an organic chemical, sediment benchmarks developed by the Ontario Ministry of the Environment (MOE 1993), the New York State Department of Environmental Conservation (NYSDEC 1994), and the National Oceanic and Atmosphere Administration (NOAA) (Long et al. 1995) were used. For the MOE (1993) sediment guidelines, the Lowest Effect Level (LEL) value was used; the LEL represents the concentration at which no adverse effect on the majority of freshwater benthic species is likely. Effects Range-Low (ER-L) values from Long et al. (1995) were also considered, which are similar to LEL values. Since ER-L values are based on data from marine or estuarine habitats and Branch Brook and the Naugatuck River are freshwater habitats, ER-L values were not used if a LEL or other freshwater-based value was available, even if they were lower. LEL, ER-L, and NYSDEC guideline values are generally considered conservative screening benchmarks since they do not account for site-specific chemical bioavailability. Since the equilibrium partitioning approach is not applicable to metals, sediment screening benchmarks for these chemicals were based on LEL or ER-L values, where available.

Promulgated criteria for assessing the toxicity of chemicals in surface soil to terrestrial ecological receptors are not available. As part of this assessment, soil benchmarks were developed based on the toxicity of chemicals in soil to plants and soil fauna as determined from the literature. Data compilations by Oak Ridge National Laboratory (Will and Suter 1995a, 1995b) were the primary source of benchmark values. These benchmarks were used to screen the chemicals detected in surface soils.

Chemicals lacking benchmark values for a particular medium were screened based on frequency of detection and background concentrations as follows:

- **Frequency of Detection** - because of limited sample sizes, frequency of detection was only applied to surface soil screening. If a chemical was detected in only a single on-site surface soil sample and at least 15 on-site soil samples were available, it was screened out of the assessment. This is justified for ecological risk assessments based on the premise that significant impacts on individuals will not occur from a rare exposure and that only a very small portion of a population would be exposed at all to infrequently occurring chemicals.
- **Background Concentrations** - on-site chemical concentrations were considered to be consistent with background chemical concentrations if the mean and/or maximum on-site concentration was less than twice the respective mean or maximum background concentration.

5.3.2 Results of the Chemical Screening

5.3.2.1 Surface Water

5.3.2.1.1 Branch Brook

Nine inorganic chemicals and one organic chemical were detected in unfiltered downstream Branch Brook surface water samples, although three (copper, manganese, and mercury) of the nine inorganics were not detected in filtered surface water samples (Table V-13). Maximum measured concentrations for seven of the nine inorganic chemicals and the single organic chemical were below their respective toxicological benchmark values. Copper and mercury exceeded benchmark values in unfiltered samples; the single exceedance for copper was by a small margin (ratio of 1.1). However, mercury and copper were not detected in filtered surface water samples and were screened out on this basis. In addition, it should be noted that upstream and downstream concentrations of these two metals in unfiltered water samples were practically identical (Table V-8), suggesting that they are not site related. Based on the above, no chemicals were selected as ECOCs in Branch Brook surface water.

5.3.2.1.2 Naugatuck River

Seven inorganic chemicals and five organic chemicals were detected in downstream Naugatuck River surface water samples (Table V-14). None of these 12 chemicals exceeded surface water benchmarks in filtered or unfiltered samples. Therefore, no chemicals were selected as ECOCs in Naugatuck River surface water.

5.3.2.2 Sediment

5.3.2.2.1 Branch Brook

Nine inorganic chemicals were detected in downstream Branch Brook sediment samples (Table V-15). Copper was the only inorganic which exceeded benchmark values; the single exceedance for copper was by a small margin (ratio of 1.1). In addition, upstream and downstream concentrations of copper in Branch Brook sediments were similar (Table V-10). Based on the above, no inorganic chemicals were selected as ECOCs in Branch Brook sediments.

Twenty-four organic chemicals were detected in downstream Branch Brook sediment samples (Table V-15). Maximum measured concentrations for 18 of these 24 organic chemicals did not exceed sediment benchmarks; these chemicals were therefore screened out. Acetone, a common laboratory contaminant, exceeded its benchmark by a factor of four at the maximum detected concentration. However, the screening benchmark for acetone, based on the equilibrium partitioning (EP) approach, was considered overly conservative since the EP approach is most applicable to non-polar organic chemicals and acetone is a polar compound (Jones et al. 1996). Thus, acetone is not likely to cause adverse effects at the detected concentrations and was screened out. The five remaining chemicals (aldrin, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, and diethylphthalate) were retained as ECOCs in Branch Brook sediments.

5.3.2.2.2 Naugatuck River

Twelve inorganic chemicals were detected in downstream Naugatuck River sediment samples (Table V-16). Six - cadmium, copper, chromium, nickel, silver, and zinc - exceeded sediment benchmarks in at least one sample and were retained as ECOCs in Naugatuck River sediments. However, it should be noted that downstream sediment concentrations of these metals, except for chromium and silver, were consistent with upstream sediment concentrations (Table V-11). No screening benchmarks were available for potassium or vanadium. Potassium, an essential nutrient, is unlikely to cause adverse effects to aquatic receptors. Vanadium was detected in only a single sample at relatively low concentrations. These two metals were screened out on this basis.

Twenty-four organic chemicals were detected in downstream Naugatuck River sediment samples (Table V-16). Maximum measured concentrations for 17 of these 24 organic chemicals did not exceed sediment benchmarks; these chemicals were therefore screened out. Acetone, a common laboratory contaminant, exceeded its benchmark in a single sample by a factor of 1.2. As discussed previously, the screening benchmark for acetone was considered overly conservative. Thus, acetone is not likely to cause adverse effects at the detected concentrations and was screened out. Heptachlor exceeded its sediment benchmark by a very small margin (ratio of 1.03) in a single sample and was also screened out. The five remaining organic chemicals (benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, fluoranthene, and phenanthrene) were retained as ECOCs in Naugatuck River sediments. However, it should be noted that downstream sediment concentrations of these five organics were consistent with upstream sediment concentrations (Table V-11).

5.3.2.3 Surface Soil

Seventeen inorganic chemicals were detected in on-site surface soils (Table V-17). Nine of these 17 (arsenic, barium, beryllium, cobalt, lead, mercury, selenium, thallium, and tin) did not exceed soil benchmarks and were screened out of the assessment. Chromium exceeded soil benchmarks frequently (14 exceedances), as did copper (14), nickel (8), vanadium (12), and zinc (13). Antimony (2), cadmium (3), and silver (4) exceeded benchmarks less frequently. These eight metals were retained as ECOCs in surface soil. However, it should be noted that on-site concentrations of vanadium were consistent with background concentrations (Table V-12).

Thirty-three organic chemicals were detected in on-site surface soils (Table V-17). Maximum measured concentrations for 24 of these 33 organic chemicals did not exceed soil benchmarks; these chemicals were therefore screened out. Di-n-octylphthalate only marginally exceeded its screening benchmark (ratio of 1.07) in a single sample and was screened out on this basis. Benzo(a)pyrene exceeded its screening benchmark by 1.5 times in a single sample but was retained as an ECOC.

The remaining seven organic chemicals lacked screening benchmarks. Four of these (carbon disulfide, delta-BHC, dieldrin, and 2-methylnaphthalene) were detected in only 1 of 15 samples and were screened out based on frequency of detection. 4-methyl-2-pentanone, detected in 2 of 15 samples, was also screened out since this chemical is not particularly toxic and the detected concentrations were relatively low. The two remaining organic chemicals (benzo[b]fluoranthene and benzo[k]fluoranthene) were detected more frequently and at higher concentrations and were retained as ECOCs in surface soils.

5.3.2.4 Summary of Chemicals Retained for Further Evaluation

Based on this screening analysis, eight inorganic and seven organic chemicals were retained as ECOCs, 11 of the 15 in Naugatuck River sediments, five of the 15 in Branch Brook sediments, and 11 of the 15 in surface soils (Table V-18). Sediment ECOCs were evaluated in subsequent portions of this assessment for lower trophic level biota based on the results of benthic invertebrate and fish surveys. The 11 surface soil ECOCs were evaluated, using food chain modeling, to determine if on-site soil concentrations pose a risk to upper trophic level ecological receptors.

5.4 Characterization of Exposure

USEPA (1992) defines characterization of exposure as an evaluation of the interaction of stressors with one or more ecological components. This is accomplished through an evaluation of potential exposure pathways and exposure routes for selected receptor species. Exposure point concentrations are estimated for the media applicable to each chemical → exposure pathway → receptor combination.

5.4.1 Fate and Transport Mechanisms of the Chemicals Evaluated

Measured surface water, sediment, and surface soil concentrations reflect the acting fate and transport mechanisms of the ECOCs at the site and provide a direct means to characterize exposure to the abiotic media. In the absence of measured values (e.g., for biotic media), the transport and partitioning of chemicals into particular environmental compartments, and their ultimate fate in those compartments, can be predicted from key physico-chemical characteristics. The physico-chemical characteristics that are most relevant for exposure modeling in this assessment include water solubility, adsorption to solids, octanol-water partitioning, and degradability. These characteristics are defined below and the corresponding numerical values for each ECOC are presented in Table V-19.

The **water solubility** of a compound influences its partitioning to aqueous media. Highly water soluble chemicals have a tendency to remain dissolved in the water column rather than partitioning to soil or sediment (Howard 1991). Compounds with high water solubilities also generally exhibit lower tendencies to bioconcentrate in aquatic organisms and greater likelihoods of biodegradation, at least over the short term (Howard 1991).

Adsorption is a measure of a compound's affinity for binding to solids, such as soil or sediment particles. Adsorption is expressed in terms of partitioning, either K_d (adsorption coefficient; a unitless expression of the equilibrium concentration in the solid phase versus the water phase) or as K_{oc} (K_d normalized to the organic carbon content of the solid phase; again unitless) (Howard 1991). The higher the K_{oc} or K_d value, the greater the tendency for the chemical to adhere strongly to soil or sediment particles. K_{oc} values can be measured directly or can be estimated from either water solubility or the octanol-water partitioning coefficient using one of several available regression equations (Howard 1991).

Octanol-water partitioning indicates whether a compound is hydrophilic or hydrophobic. The **octanol-water partition coefficient** (K_{ow}) expresses the relative partitioning of a compound between octanol (lipids) and water. A high affinity for water equates to a low K_{ow} and vice versa. K_{ow} has been shown to correlate well with bioconcentration factors in aquatic organisms, adsorption to soil or sediment particles, and the potential to bioaccumulate in the food chain (Howard 1991). Typically expressed as log K_{ow}, a log K_{ow} of three or less generally indicates that the chemical will not bioconcentrate to a significant degree (Maki and Duthie 1978). A log K_{ow} of three equates to an aquatic species bioconcentration factor of about 100, using the equation: $\log BCF = (0.76)(\log K_{ow}) - 0.23$ (Lyman et al. 1990).

Degradability is an important factor in determining whether there will be significant loss of mass of a substance over time in the environment. The half-life ($T_{1/2}$) of a compound is typically used to describe losses from either degradation (biological or abiotic) or from transfer from one compartment to another (e.g., volatilization from soil to air). The half-life is the time required for one-half of the mass of a compound to undergo the loss or degradation process.

5.4.2 Potential Exposure Pathways

As depicted on Figure V-5, a number of complete exposure pathways exist which could potentially link site-related chemicals to ecological receptors present in on-site terrestrial habitats, as well as in Branch Brook and the Naugatuck River. Terrestrial receptors may be exposed, directly or via the food chain, to chemicals released to surface soils. Chemicals released to surface drainage ditches may directly enter Branch Brook. Chemicals released to ground water may be discharged to Branch Brook and the Naugatuck River. Chemicals which enter these two water bodies through surface runoff or ground water flow can become incorporated directly into surface water or indirectly into sediments via partitioning from the water column.

5.4.3 Potential Exposure Routes

Terrestrial plants may be exposed through their root surfaces during water and nutrient uptake to chemicals deposited to surface soils. Unrooted, floating aquatic plants, and submerged vascular aquatic plants and algae, may be exposed to chemicals directly from the water.

Animals may be exposed to chemicals through any of four major routes: (1) direct inhalation of gaseous chemicals or of chemicals adhered to particulate matter; (2) direct ingestion of contaminated abiotic media (e.g., soil); (3) consumption of contaminated plant and/or animal tissues for chemicals which have entered the food chain; or (4) dermal contact with contaminated abiotic media. These routes, where applicable, are depicted on Figure V-5. Based on the fate properties of the chemicals evaluated, dermal and inhalation exposures are not considered significant relative to ingestion exposures for upper trophic level species and are therefore not considered in this assessment.

5.4.4 Receptor Species Selection

Because of the complexity of ecosystems, it is rarely, if ever, possible to assess potential impacts to all the biota present within an area. Therefore, receptor species are typically used in ecological risk assessments to evaluate potential risks to populations of the ecological community (USEPA 1988). Thus, receptor species are those species that are chosen to represent the larger biological community in the risk characterization. Selection criteria include species that: (1) can reliably be determined to be part of the community; (2) have a particular ecological, economic, or aesthetic value in the site vicinity; (3) are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present in the site vicinity; (4) can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent the potentially most sensitive populations in the site vicinity; and (5) have sufficient ecotoxicological information available on which to base an evaluation.

The following upper trophic level receptor species have been chosen for exposure modeling and risk characterization at the site based on the criteria listed above and the general guidelines presented in USEPA (1991b)[29]:

- **Meadow Vole** (*Microtus pennsylvanicus*) - a small herbivorous rodent which represents small mammalian primary consumers (herbivores) present in terrestrial systems. This species is also important in the terrestrial food chain since it is consumed by many species of hawks and owls, as well as mammalian predators such as foxes (USEPA 1993).
- **Red Fox** (*Vulpes vulpes*) - a medium-sized mammalian carnivore that inhabits a variety of habitats, including woodlands, pastures, and agricultural areas (USEPA 1993). This species preys extensively on small mammals, particularly voles and mice, in terrestrial habitats and represents an upper trophic level mammalian predator.
- **American Robin** (*Turdus migratorius*) - a small songbird that uses a variety of forested habitats, including woodlots and suburban areas. This species forages primarily on soil invertebrates during the breeding season and primarily on fruits during the nonbreeding season (USEPA 1993). This species represents a secondary avian consumer (insectivore) in terrestrial habitats which is tolerant of man-dominated landscapes.
- **Red-tailed Hawk** (*Buteo jamaicensis*) - a large hawk that inhabits woodlands, pastures, and prairies (USEPA 1993). This species forages primarily on small mammals present in terrestrial habitats and represents an upper trophic level avian predator.

The following lower trophic level terrestrial indicator species groups were used previously during chemical screening of surface soils (see Section 5.3):

[29] Specific species of aquatic biota (e.g., fish and macroinvertebrates) are not chosen as receptor species because aquatic biota are dealt with on a community level via benthic and fish surveys, and a comparison to surface water and sediment benchmark values.

- **Terrestrial Plants** - plants are exposed to chemicals present in surface soils though root uptake. As such, they are representative of direct effects to primary producers, and indirect effects (habitat alteration and food chain transfer of chemicals) to various animal groups.
- **Soil Invertebrates** - earthworms are the standard surrogate, since it is the species group for which the most toxicological information is available. These organisms are maximally exposed to chemicals present in soils, both by direct contact and by ingestion, and thus serve as good indicators of potential effects to detritivores present in terrestrial systems. In addition, these organisms serve as food for many other organisms and are therefore important in terrestrial food chains.

5.4.5 Endpoint Selection

Two types of ecological endpoints, assessment endpoints and measurement endpoints, are defined as part of the ecological risk assessment process (USEPA 1992). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1992) and discussed in detail in Suter (1989, 1990, 1993).

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself (USEPA 1992). Effects on individuals are important for some receptors, such as rare and endangered species; population- and community-level effects are typically more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level. In addition, use of criteria values designed to protect the vast majority (e.g., 95 percent) of the components of a community (e.g., Ambient Water Quality Criteria for the Protection of Aquatic Life) can be useful in evaluating potential community- and/or population-level effects. The assessment and measurement endpoints selected for this assessment are listed in Table V-20.

5.4.6 Exposure Point Concentrations

Measured surface water, sediment, and surface soil concentrations of the ECOCs (see Tables V-8 through V-12) are used as exposure point concentrations for exposure estimation and food chain modeling. Exposure point concentrations for terrestrial prey items, including plants, earthworms, and small mammals, are estimated using bioaccumulation models and measured concentrations in surface soils. The methodology and models used for these estimations are described in the following subsections.

5.4.6.1 Plants

Estimated aboveground plant tissue concentrations are calculated by multiplying the mean measured on-site surface soil concentration by chemical-specific bioconcentration factors (BCFs). Soil-to-plant BCFs for metals are from Baes et al. (1984) and soil-to-plant BCFs for organic chemicals are calculated as described below.

Travis and Arms (1988) have related organic chemical uptake by plants from soils (via the roots) with the octanol-water partition coefficient (K_{ow}) using a geometric mean regression for uptake of nearly thirty different organic chemicals by plants. The algorithm for determining the bioconcentration factor in vegetation from root uptake from soil is:

$$\log B_v = 1.588 - (0.578)\ (\log K_{ow})$$

where:

B_v = bioconcentration factor in vegetation (unitless)

K_{ow} = octanol-water partition coefficient (unitless)

The resulting chemical concentrations in plants are converted to a wet-weight basis based on an estimated seven percent solids content in aboveground leafy plant parts (Baes et al. 1984). This solids content is a weighted average value from measurements of the water content of nine crop species. Estimated plant tissue concentrations are shown in Table V-21.

5.4.6.2 Earthworms

Estimated earthworm tissue concentrations are calculated by multiplying the mean measured on-site surface soil concentration by chemical-specific BCFs or bioaccumulation factors (BAFs). BCFs are calculated by dividing the concentration of a chemical in the tissues of an organism by the concentration of that same chemical in the surrounding environmental medium (in this case, soil) without accounting for chemical uptake via the diet. BAFs consider both exposure to the environmental medium and exposure via the diet. Since earthworms consume soil, BAFs are more appropriate values and are used in the models when available from the literature; BAFs based on undepurated analyses (i.e., soil was not purged from the earthworm's gut prior to analysis) are given preference when selecting values.

Measured BAFs for metals and organic chemicals are obtained from the literature. For metals without available measured BAFs, an earthworm BAF of 1.0 is assumed, that is, the tissue concentration in the earthworm is assumed to be equal to the soil concentration.

Since multiplying the soil concentration (in dry weight) by the measured or estimated BAF/BCF yields tissue concentrations in mg/kg dry weight, the resulting values are divided by a factor of four to yield wet-weight tissue concentrations; this factor of four is based upon a measured 25 percent average solids content in earthworms, as reported by Connell and Markwell (1990) using data from Gish and Hughes (1982). Calculated earthworm tissue concentrations (in mg/kg wet-weight) are presented in Tables V-22.

5.4.6.3 Small Mammals

Tissue concentrations in meadow voles are calculated using the dietary intake equation described in the following subsection and assuming that the resulting tissue concentration is in equilibrium with the dietary intake. These calculated whole-body tissue concentrations are shown in Table V-23.

5.4.6.4 Dietary Intakes

Dietary intakes are calculated for each upper trophic level wildlife receptor species using the following equation (modified from Ma et al. 1991 and USEPA 1993):

$$DI_x = \frac{[\sum_i (FR)(MC_{xi})(PDC_i)] + [(FR)(MC_{xs})(PDC_s)]}{BW}$$

where:

DI_x	=	intake of chemical x (µg/g-BW/day)
FR	=	feeding rate (g food/day)
MC_{xi}	=	concentration of chemical *x* in food item *i* (µg/g)
MC_{xs}	=	concentration of chemical *x* in soil (µg/g)
PDC_i	=	proportion of diet for food item *i*
PDC_s	=	proportion of diet that is incidental soil
BW	=	body weight (g)

The above equation relates the estimated intake of chemicals via food to the chemical concentration in each prey item consumed by the particular receptor. Each dietary food component is weighted by its relative contribution to the total diet (as a proportion). Incidental ingestion of soil is included. Dietary dose for food is then obtained by multiplying by the food ingestion rate. This dose is then standardized by dividing by the body weight of the animal. Receptor species-specific input values used in the models are summarized in Table V-24.

5.5 Characterization of Ecological Effects

USEPA (1992) defines the characterization of ecological effects as the portion of an ecological risk assessment that evaluates the ability of a stressor to cause adverse effects under a particular set of circumstances. This ecological risk assessment uses the following measurement endpoints to characterize potential ecological effects for ecological receptors inhabiting the site, Branch Brook, and the Naugatuck River:

- **Benthic Invertebrate Surveys** - a comparison of RBP III metrics between downstream and upstream locations in Branch Brook and the Naugatuck River.

- **Fish Surveys** - a qualitative comparison of species richness, species diversity, and relative abundance between downstream and upstream locations in Branch Brook and the Naugatuck River.
- **Toxicological Benchmarks for Surface Water and Sediment** - promulgated criteria or conservatively derived literature values which relate chemical concentrations in surface water and sediment with ecological effects to lower trophic level aquatic receptors. These benchmarks are compared to the concentrations of the ECOCs in each Branch Brook and Naugatuck River surface water and sediment sample (in Section 5.6) to determine the relative magnitude and spatial distribution of potential effects.
- **Toxicological Benchmarks for Surface Soil** - conservatively derived literature values which relate chemical concentrations in surface soil with ecological effects to lower trophic level terrestrial receptors. These benchmarks are compared to the concentrations of the ECOCs in each on-site surface soil sample (in Section 5.6) to determine the relative magnitude and spatial distribution of potential effects.
- **Toxicological Benchmarks for Ingestion** - conservatively derived literature values which relate chemical exposures via the food chain (ingestion) with ecological effects to selected upper trophic level wildlife receptors. These benchmarks are compared to site-wide species-specific estimates of exposure to ECOC concentrations (in Section 5.6) to determine the magnitude of potential risk to these receptors.

These measurement endpoints are discussed in the following subsections. The results from all five of these evaluations are integrated in Section 5.6 (risk characterization) using a weight-of-the evidence approach relative to the selected assessment endpoints.

5.5.1 Benthic Invertebrate Surveys

The overall results of benthic invertebrate surveys conducted in Branch Brook and the Naugatuck River were introduced in Section 5.2.4.4. In this section, the results of these surveys are considered in more detail to determine if there are any differences in the RBP metrics between downstream and upstream locations in each of the water bodies that could potentially be due to the presence of site-related chemicals.

Table V-25 presents the values of the seven metrics evaluated for each Branch Brook sampling location, as well as the total scores. In the fall, total scores among all four sampling locations (one upstream and three downstream) were very similar, and the three downstream locations were rated as “non-impaired” relative to the upstream location. In the spring, total scores for all sampling locations were very similar except for Location BB-A2, located downstream of the site adjacent to the Thomaston POTW (Figure V-4). Location BB-A2 was rated as “slightly impaired” relative to the upstream location based largely on the difference in the score for the EPT index, which reflects the abundance of three pollution-sensitive benthic invertebrate taxa. The other two downstream locations, including the location immediately adjacent to the site, were rated as “non-impaired” (Table V-25).

Table V-26 presents the values of the seven metrics evaluated for each Naugatuck River sampling location, as well as the total scores. In the spring, total scores among all four sampling locations (one upstream and three downstream) were similar, and the three downstream locations were rated as "non-impaired" relative to the upstream location. In the fall, total scores for all sampling locations were similar except for Location NR-A1, located immediately adjacent to the former facility buildings (Figure V-4). Location NR-A1 was rated as "slightly impaired" relative to the upstream location based primarily on the difference in the score for taxa richness (i.e., the number of taxa present). The other two downstream locations, including the location immediately downstream of the monofill, were rated as "non-impaired" (Table V-26).

5.5.2 Fish Surveys

The overall results of qualitative fish surveys conducted in Branch Brook and the Naugatuck River were introduced in Section 5.2.4.4. There were no notable differences between upstream and downstream locations in either water body for the two seasons (spring and fall) for which sampling occurred (see Tables V-6 and V-7).

5.5.3 Toxicological Benchmarks for Surface Water, Sediment, and Surface Soil

Toxicological benchmarks for surface water, sediment, and surface soil were described and developed in Section 5.3 as part of chemical screening for lower trophic level receptors. These benchmarks are listed in Tables V-13 and V-14 (surface water), V-15 and V-16 (sediment), and V-17 (surface soil). These same benchmarks are compared with the chemical concentrations of the ECOCs in each sample in Section 5.6 (risk characterization).

5.5.4 Toxicological Benchmarks for Ingestion

Toxicological benchmark values for dietary ingestion exposures are derived for each of the four upper trophic level bird and mammal receptor species and the 12 ECOCs evaluated for potential food chain effects. Toxicological information for wildlife species most closely related to the receptors species is used, where available, but is supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) where necessary. The ingestion benchmarks are expressed as milligrams of the ECOC per kilogram of body weight of the receptor per day (mg/kg-BW/day).

Growth and reproduction are emphasized as toxicological endpoints since they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied chronic toxicological endpoints for ecological receptors. No Observed Adverse Effect Levels (NOAELs) based on growth and reproduction are utilized, where available, as the benchmark values. When chronic NOAEL values are unavailable, estimates are derived or extrapolated from chronic Lowest Observed Adverse Effect Level (LOAEL) or subchronic NOAELs using uncertainty factors as outlined in Sample et al. (1996).

A scaling factor to account for differences in body size is applied to mammalian receptors when the best available toxicological data for a receptor species is from a test species that is notably different in size, for example, extrapolating to a fox using toxicological data from a laboratory mouse. This approach is described in USEPA (1995b) and is based on the observation that toxicity is a function of physiological processes, most notably metabolic rate. Smaller animals have higher metabolic rates and are usually more resistant to adverse effects from toxic chemicals because of more rapid metabolic processing (Sample et al. 1996; USEPA 1995b). The scaling factor that best accounts for differences in body size is the body weight divided by the body surface area, where the body surface area is approximately equivalent to body weight raised to the 3/4 power (USEPA 1995b). This scaling factor is then used to translate experimentally determined toxic daily intake information from one species to another by the following formula:

$$D_a = (D_b)\left(\frac{BW_b}{BW_a}\right)^{1/4}$$

where:

D_a	=	intake or dose in an untested species *a;* mg/kg/day
D_b	=	experimentally determined intake in species *b*; mg/kg/day
BW_a	=	body weight of untested species *a*; kg
BW_b	=	body weight of species *b;* kg

The allometric scaling approach can be applied to pairs of mammalian species within the same taxonomic class. For example, mammalian toxicity data are used to predict toxic effects in mammals. Avian toxicity data are used to predict avian toxic effects without allometric scaling factors in accordance with Sample et al. (1996). Appendix V-5 contains the data used to derive the benchmark values for the ECOCs using allometric scaling.

The scaling factor approach is widely used in both human health and ecological risk assessment. As used this ecological risk assessment, the most appropriate test species (considering factors such as taxonomic relatedness, trophic level, and similarity of diet) for which suitable toxicity data were available was selected to represent each receptor species. Once this selection occurred, the values were scaled for each test and receptor species pair.

The ingestion-based toxicological benchmark values for the 12 ECOCs evaluated for potential food chain effects are listed in Table V-27. Ingestion benchmarks were unavailable for all four receptor species for benzo(b)fluoranthene and benzo(k)fluoranthene, and were unavailable for the two avian receptor species for silver and benzo(a)pyrene. A comparison of benchmarks with estimated on-site chemical exposures to the ECOCs is conducted in Section 5.6.

5.5.5 Risk Characterization

Risk characterization is the final component of an ecological risk assessment (USEPA 1992). The data from the characterization of exposure and the characterization of effects serve as the

primary inputs to the risk characterization. The uncertainties identified during all parts of the risk assessment are also analyzed and summarized in the risk characterization phase of the assessment (see Section 5.7).

Baseline (current condition) ecological risks for Branch Brook and the Naugatuck River are characterized based on a consideration of three endpoints: (1) the benthic invertebrate surveys; (2) the fish surveys; and (3) surface water and sediment toxicological benchmarks for lower trophic level aquatic biota. The presence/absence of significant impacts or risks is based on a weight-of-the-evidence analysis of the three endpoints.

Baseline ecological risks for on-site terrestrial habitats are characterized based upon surface soil toxicological benchmarks for lower trophic level biota and ingestion toxicological benchmarks for upper trophic level biota from food chain exposures. A site-wide assessment is used to characterize baseline risks for populations of the upper trophic level wildlife receptors. The mean concentrations of the ECOCs in on-site surface soil provide the most realistic exposure estimate for mobile biota whose habitat/feeding area is relatively large (especially considering the area occupied by the population) and could well encompass the entire site (and beyond), or at least large portions of it.

5.5.5.1 Branch Brook

5.5.5.1.1 Benchmark Comparisons

Concentrations of the ECOCs measured in Branch Brook sediments were compared to appropriate toxicological benchmark values for lower trophic level aquatic receptors (see Section 5.3) to identify ECOCs for this medium (no ECOCs were identified in surface water). In this section, the spatial extent and magnitude of the sediment benchmark exceedances are identified.

The magnitude of the observed sediment benchmark exceedances was evaluated using the hazard quotient method (Suter 1993). Hazard quotients are calculated by dividing the chemical concentration in the medium being evaluated by the corresponding toxicological benchmark value. Hazard quotients exceeding one indicate the potential for risk since the chemical concentration (exposure) exceeds the toxicological benchmark value. However, toxicological benchmarks are derived using intentionally conservative assumptions such that hazard quotients greater than one do not necessarily indicate that risks are present or impacts are occurring. Following the same reasoning, hazard quotients that are less than one indicate that risks are very unlikely.

Five ECOCs exceeded chronic sediment benchmarks; acute sediment benchmarks, where available, were not exceeded (Table V-28). Maximum hazard quotients were of low magnitude, ranging from 2.3 to 3.2. The three PAHs exceeded benchmarks in only 1 of 17 samples and mean concentrations were consistent with mean

upstream concentrations (Table V-28). Thus, there are several possible site-related benchmark exceedances in Branch Brook sediments, all of which were of limited frequency and magnitude.

5.5.5.1.2 Biotic Surveys

Relative to upstream locations, benthic invertebrate communities in areas adjacent to and downstream of the site were comparable in terms of the seven RBP metrics evaluated. Slight impairment of these communities was detected at one of the downstream locations (BB-A2) during spring surveys, although conditions were comparable to the upstream location during fall surveys (Table V-25). The fish community in areas adjacent to and downstream of the site was generally comparable to that occurring upstream of the site based on qualitative fish surveys. Based on these data, significant site-related impacts to aquatic biota are not indicated.

5.5.5.1.3 Weight-of-the-Evidence Evaluation

The weight-of-the-evidence approach for evaluating potential risks to aquatic communities integrates the measurement endpoints based on the benthic invertebrate surveys, the fish surveys, and a comparison of measured ECOC concentrations to sediment benchmarks. Since the benthic invertebrate surveys, being quantitative and site-specific, give the best indication of any site-related impacts to lower trophic level aquatic organisms, this endpoint is given the greatest weight in the analysis. Since sediment benchmarks are conservative and not site-specific, this endpoint is given the least weight in the analysis. The results of qualitative fish surveys are given a weight intermediate between the other two endpoints because, although they are site-specific, they were qualitative.

The site-specific biotic surveys indicate that there are no significant site-related impacts to the aquatic biota present in Branch Brook. Exceedances of sediment benchmarks were infrequent and of low magnitude. Thus, a low magnitude of risk is indicated for Branch Brook.

5.5.5.2 Naugatuck River

5.5.5.2.1 Benchmark Comparisons

Concentrations of the ECOCs measured in Naugatuck River sediments were compared to appropriate toxicological benchmark values for lower trophic level aquatic receptors (see Section 5.3) to identify ECOCs for this medium (no ECOCs were identified in surface water). In this section, the spatial extent and magnitude of the sediment benchmark exceedances are identified.

Six inorganic and five organic ECOCs exceeded chronic sediment benchmarks; acute sediment benchmarks, where available, were not exceeded (Table V-29). Benchmarks were also exceeded at upstream locations for all five organic ECOCs and for three (cadmium, copper, and zinc) of the six inorganic ECOCs. In addition, downstream mean and maximum sediment concentrations were consistent with mean and maximum upstream sediment concentrations for all of the ECOCs except silver and chromium. The maximum HQ for silver was of relatively low magnitude (2.2) and mean upstream sediment concentrations of chromium were consistent with mean downstream sediment concentrations. Thus, there are several possible site-related sediment benchmark exceedances, but these are of limited magnitude.

5.5.5.2.2 Biotic Surveys

Relative to upstream locations, benthic invertebrate communities in areas adjacent to and downstream of the site were comparable in terms of the seven RBP metrics evaluated. Slight impairment of these communities was detected at one of the downstream locations (NR-A1) during fall surveys, although conditions were comparable to the upstream location during spring surveys (Table V-26). The fish community in areas adjacent to and downstream of the site was generally comparable to that occurring upstream of the site based on qualitative fish surveys. Based on these data, significant site-related impacts to aquatic biota are not indicated.

5.5.5.2.3 Weight-of-the-Evidence Evaluation

The weight-of-the-evidence approach for evaluating potential risks to aquatic communities in the Naugatuck River was conducted as described for Branch Brook. The site-specific biotic surveys indicate that there are no significant site-related impacts to the aquatic biota present in the Naugatuck River. While there were exceedances of sediment benchmarks in downstream areas, exceedances also occurred in upstream locations for 8 of the 11 ECOCs. In addition, downstream concentrations were consistent with upstream concentrations for all of the ECOCs except silver and chromium, whose exceedances were of relatively low magnitude. Thus, a low magnitude of risk is indicated for the Naugatuck River.

5.5.5.2.4 On-site Terrestrial Habitats

5.5.5.2.4.1 <u>Soil Benchmark Comparisons</u>

Concentrations of the ECOCs measured in on-site surface soils were compared to appropriate toxicological benchmark values for lower trophic level terrestrial receptors (see Section 5.3) to identify ECOCs for this medium. In this section, the spatial extent and magnitude of the soil benchmark exceedances are identified.

Eight inorganic and three organic ECOCs exceeded soil benchmarks (Table V-30). Benchmarks were also exceeded at background locations for three (chromium, vanadium, and zinc) of the eight inorganic ECOCs. In addition, on-site concentrations were consistent with background concentrations for vanadium (at mean and maximum concentrations), and for the three organic ECOCs (at mean concentrations). The frequency (< four of 13 samples) and/or magnitude (HQ less than three) of soil benchmark exceedances were relatively low for antimony, cadmium, and silver (Table V-30). Exceedances of relatively high frequency and magnitude occurred for chromium (13 exceedances in 13 samples; maximum HQ of 650), copper (12/13; 13.4), nickel (8/13; 6.0), and zinc (13/13; 7.4) (Table V-30). Thus, there is the potential for risks to lower level terrestrial organisms (plants and/or soil invertebrates) from exposure to on-site soil concentrations of chromium, copper, nickel, and zinc. However, these potential risks are likely to have low ecological significance due to the limited nature and low quality of the habitats present on the monofill (mowed lawn). In addition, there were no obvious impacts (e.g., dead or dying vegetation) to plants on the monofill observed during the October 1996 site visit.

5.5.5.2.4.2 Food Chain Modeling

Potential risks for upper trophic level wildlife were evaluated on a site-wide basis for each food chain ECOC using the hazard quotient method. Ingestion exposures for the four receptor species were calculated using the mean measured soil concentration since this provides the most realistic exposure estimation for population-level impacts on mobile species with relatively large home ranges.

Estimated exposure concentrations are divided by the toxicological benchmark values derived in Section 5.5.4 to calculate the hazard quotients. The calculated hazard quotients are presented in Table V-31. Hazard quotients did not exceed one for any of the receptor-ECOC combinations with the exception of chromium exposures to the American robin; this hazard quotient exceedance (1.98) was of relatively low magnitude.

Overall, the evaluation of potential food chain risks from the ECOCs, which is based on the conservative assumption that the receptors obtain their entire diet from the site, indicates a low likelihood of adverse effects to populations of upper trophic level wildlife. Chromium is the only ECOC where the estimated dietary exposure levels exceed the conservatively derived chronic ingestion toxicological benchmark value; the exceedance was marginal (HQ less than 2) for the one exceedance.

5.5.5.2.4.3 Weight-of-the-Evidence Evaluation

Although potential risks to lower trophic level receptors were predicted from exposure to on-site soil concentrations of chromium, copper, nickel, and zinc, these potential risks are likely to have low ecological significance due to the limited nature and low quality of the habitats present on the monofill (mowed lawn). The risk evaluation indicates a low likelihood of adverse effects to populations of upper trophic level wildlife.

5.5.6 Ecological Risk Conclusions

Based on the assessment endpoints evaluated and the weight-of-the evidence approach utilized in this assessment, risk of adverse ecological effects on wildlife receptors is expected to be low for both Branch Brook and Naugatuck River areas. Based on the available assessment endpoints, there may be the potential for adverse impacts to lower trophic level soil biota in on-site terrestrial habitats. These potential risks are likely to have low ecological significance due to the limited nature and low quality of the habitats present on the monofill. In addition, the vegetation on the monofill was not visibly stressed. The risk evaluation indicates a low likelihood of adverse effects to populations of upper trophic level wildlife that might consume soil invertebrates, plants, and soil from the site.

5.6 Uncertainties and Limitations

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. The uncertainty in this risk assessment is mainly attributable to the following factors:

- **Selection of ECOCs** - There is some uncertainty as a result of the initial screening of detected chemicals to derive the list of ECOCs, which are the chemicals that are carried through the assessment. The selection of ECOCs is a standard approach for ecological and human health risk assessments particularly when there are a large number of chemicals that have been detected. The objective of the screening is to identify and characterize those chemicals and exposure pathways that have the potential to contribute the most to potential risks and at the same time to minimize the likelihood that screening out chemicals will result in an underestimate of the true risks.

  The ECOC selection process relied primarily on a comparison of maximum observed media concentrations with conservative screening benchmark values. For those chemicals without available screening benchmarks, a comparison of the on-site/downstream media concentrations was made to background/upstream concentrations along with consideration of the frequency of detection in order to determine the likelihood that they might pose a risk. The use of these two additional screening considerations is consistent with USEPA guidance (e.g., USEPA 1991a). The use of background concentrations is justified based on the premise that local populations of organisms will be adapted to naturally occurring levels of these constituents and, thus, such concentrations would not pose an unacceptable risk. The

use of frequency of detection is justified for these chemicals based on the premise that significant impacts to individuals will not occur from a rare (infrequent) exposure and that only a very small portion of a population would be exposed at all to infrequently occurring chemicals. Note that infrequently occurring chemicals that exceeded available screening benchmarks were retained as ECOCs.

- **Detection Limits** - Detection limits for some analytes exceeded applicable benchmark values in some media. This occurred primarily in surface water samples for pesticides/PCBs, some semivolatile organics, and some metals. In all cases, the detection limits employed in analyzing these chemicals were consistent with, or below, the practical quantitation limits (PQLs) recognized by USEPA in the RCRA program.
- **Fish Surveys** - Fish surveys were conducted in a qualitative manner, thus limiting the ability to detect differences between downstream and upstream locations. Comparisons to upstream areas were made on the basis of species richness and diversity rather than on quantitative indices.
- **Co-location of Sampling Locations** - Surface water, sediment, and biota sampling locations were generally not co-located, limiting the ability for conducting direct comparative evaluations.
- **Sediment Benchmarks** - The sediment benchmarks used for all of the inorganic, and several of the organic, ECOCs do not consider the site-specific bioavailability of the chemical to ecological receptors and are typically based on correlational studies (termed the Screening Level Concentration [SLC] approach). These factors make the resulting benchmark values very conservative and likely overestimate potential risk.

  The equilibrium partitioning approach is widely used for determining sediment benchmark values for non-polar organic chemicals and is the recommended approach in USEPA (1996c) for deriving screening benchmarks for these types of organic chemicals in sediments. In contrast to the SLC approach, the equilibrium partitioning approach takes into account the site-specific bioavailability of the chemicals through normalization based on the total organic carbon (TOC) levels in the sediments. While the equilibrium partitioning approach does not account for direct ingestion of sediments by benthic organisms, other components used in the weight-of-the-evidence approach (i.e., benthic invertebrate surveys) do account for these types of exposures and therefore reduce the uncertainty inherent in the sediment benchmark analysis.

- **Toxicological Benchmarks for Ingestion** - Data on the toxicity of many of the ECOCs to the four receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation for ecological risk assessments because so few wildlife species have been tested directly for most chemicals. The uncertainties associated with toxicity extrapolation were minimized through the selection of the most appropriate test species for which suitable toxicity data were available. The factors considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level,

and similarity of diet. The toxicological benchmarks for a test species were subsequently scaled to the receptor species based on relative body weights. This scaling factor approach is widely used in both human health and ecological risk assessment and is intended to further reduce the uncertainties associated with toxicological benchmark extrapolation. The basis is that smaller animals have higher metabolic rates and are therefore usually more resistant to chemical toxicity. If the test species is smaller than the receptor species, for example a laboratory mouse and a fox, the scaling factor results in a lower toxicological benchmark for the receptor species.

The uncertainties associated with the scaling factor approach relate primarily to the value selected for the allometric scaling factor. The currently recommended scaling factor (0.25) is based on the observed correlation of body weight with life span in mammals (USEPA 1995b).

- **Chemical Mixtures** - Information on the effects of chemical interactions on toxicity is generally lacking, which required that the chemicals be evaluated on a compound-by-compound basis during benchmark comparisons. The results from the site-specific benthic macroinvertebrate and fish surveys, however, do account for exposure to chemical mixtures.
- **Food Chain Exposure Modeling** - Chemical concentrations in food items (plants, earthworms, and small mammals) were modeled from measured soil concentrations, and not directly measured. The use of generic, literature-derived exposure models and bioaccumulation factors introduces some uncertainty into the resulting estimates. The values selected and methodology employed were intended to provide a generally conservative, but realistic, estimate of potential food chain exposure concentrations.
- **Mean Versus Maximum Media Concentrations** - As is typical in site risk assessment, a finite number of samples in environmental media form the basis of the exposure estimates. The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges are those based on the mean ECOC concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the *Wildlife Exposure Factors Handbook* (USEPA 1993), which specify the use of average media concentrations.

  Given the mobility of the four wildlife species chosen as receptors for the risk assessment, exposures based on the mean ECOC concentrations are most appropriate for characterization of true risk. Other components of the exposure modeling, for example assuming that 100 percent of an animals' diet would come from the site, were selected to provide a conservative risk estimate and to reduce the uncertainty of underestimating the true risk.

  While there is some possibility of prolonged exposure of wildlife to ECOCs in the range of the maximum measured concentrations, such exposure would be restricted to not

more than a few individuals of a species' population. Since there are no known occurrences of rare or endangered species on the site, and the habitat present is not likely to attract them, adverse effects to a few individuals of a species, should they occur, would not be expected to adversely affect the species' population.

- **Upper Trophic Level Receptor Selection** - Upper trophic level receptor species were selected for food chain modeling only for terrestrial habitats. Semi-aquatic upper trophic level receptors were not selected since surface water chemical concentrations were generally below ambient water quality criteria. Although there were some exceedances of sediment benchmarks, these were of low magnitude and frequency or were not site-related.

5.7 Risk Summary and Conclusions

The primary objectives of the ecological risk assessment were to: (1) determine the ecological resources present on the site and in adjacent water bodies; and (2) identify any potential risks or existing impacts to these resources from chemicals present at, or migrating from, the site.

The 13-acre site consists of an approximately five-acre solid waste monofill, which includes a one-acre area technically considered hazardous although it contains the same material as the rest of the monofill. Most of the site is covered by mowed lawn. Branch Brook is the only wetland/water body which occurs on-site, flowing through the extreme western edge of the site. The Naugatuck River occurs about 100 feet east of the site. No special resources or significant habitats occur within the site vicinity, although a state forest borders the site to the west. Although the site and surrounding area is utilized by a variety of aquatic and wildlife species, there are no known occurrences of rare and endangered species on the site.

Exposure of ecological receptors to site-related chemicals was evaluated using data from the 1994 RFI sampling program pertaining to chemical concentrations in surface water, sediment, and surface soil. Data on benthic macroinvertebrate communities and fish populations were also collected in Branch Brook and the Naugatuck River during RFI studies. Based on a screening process using maximum measured concentrations and conservative toxicological benchmark values, six inorganic and seven organic chemicals were retained for risk evaluation in sediments; no chemicals were retained in surface water. These 15 chemicals were evaluated for potential impacts to lower trophic level aquatic biota using a comparison to toxicological benchmark values, the results of benthic macroinvertebrate surveys, and the results of fish surveys in a weight-of-the-evidence approach. In addition, eleven chemicals (eight metals and three organics) were selected for risk evaluation in terrestrial habitats using a comparison to toxicological benchmark values and food chain modeling to determine if these chemicals pose a risk to terrestrial receptors.

Upper trophic level receptor species used in food chain modeling included the meadow vole, red fox, American robin, and red-tailed hawk. These receptor species represent the most likely and/or significant exposure groups and pathways that may be present in on-site habitats. Population-level risks to these receptors were characterized using the quotient method. Effects

were evaluated through a comparison of chronic toxicological benchmark values obtained from the literature for each selected receptor species to conservatively-derived benchmarks for ingestion exposure.

Based on the assessment endpoints evaluated and the weight-of-the evidence approach utilized in this assessment, significant adverse ecological effects are not likely to occur in Branch Brook and the Naugatuck River from site-related exposures. Based on the available assessment endpoints, there may be the potential for adverse impacts to lower trophic level soil biota in on-site terrestrial habitats. These potential risks are likely to have low ecological significance due to the limited nature and low quality of the habitats present on the monofill. In addition, the vegetation on the monofill was not visibly stressed. The risk evaluation indicates a low likelihood of adverse effects to populations of upper trophic level wildlife that might consume soil invertebrates, plants, and soil from the site.

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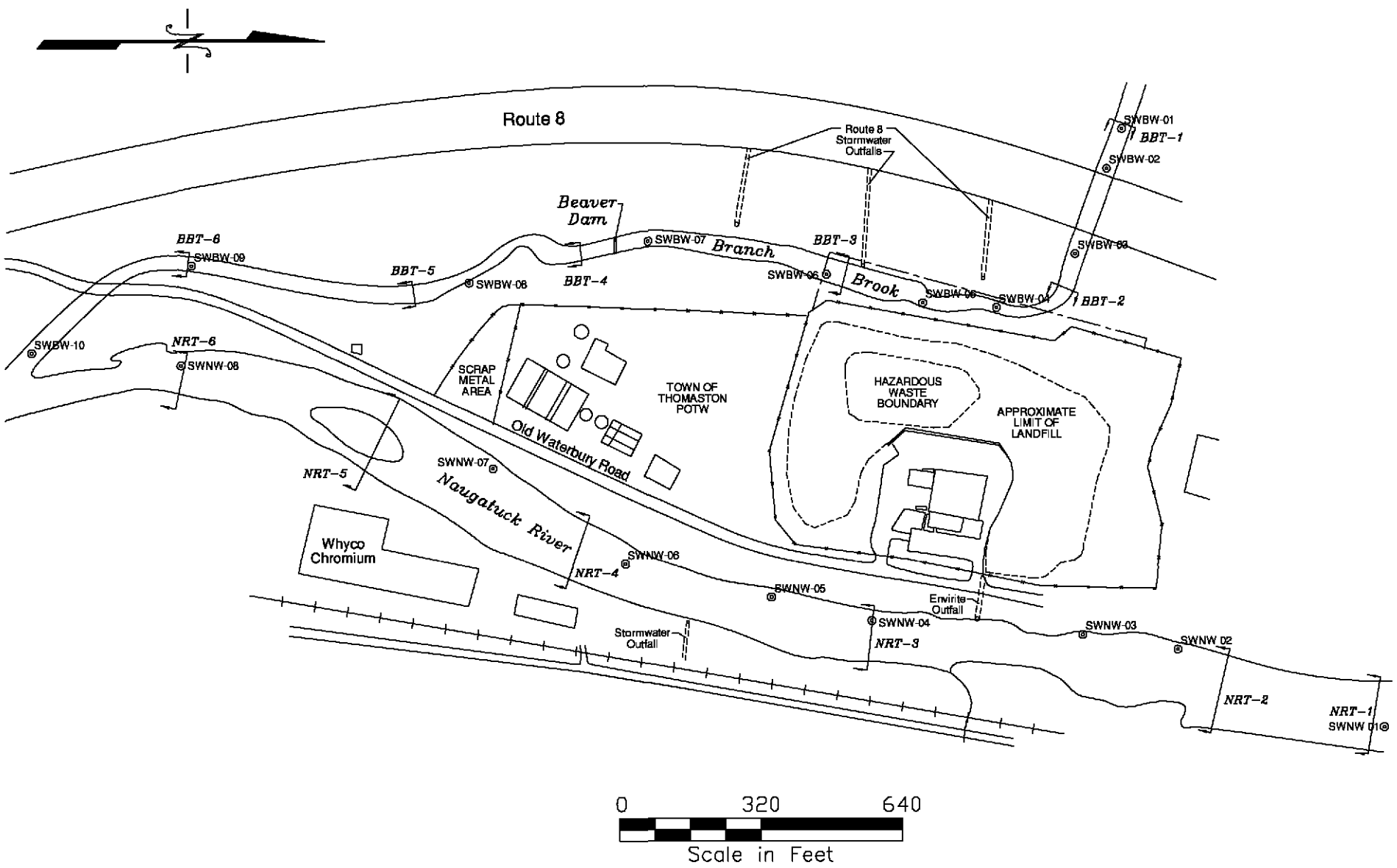

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SURFACE WATER SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
V-1

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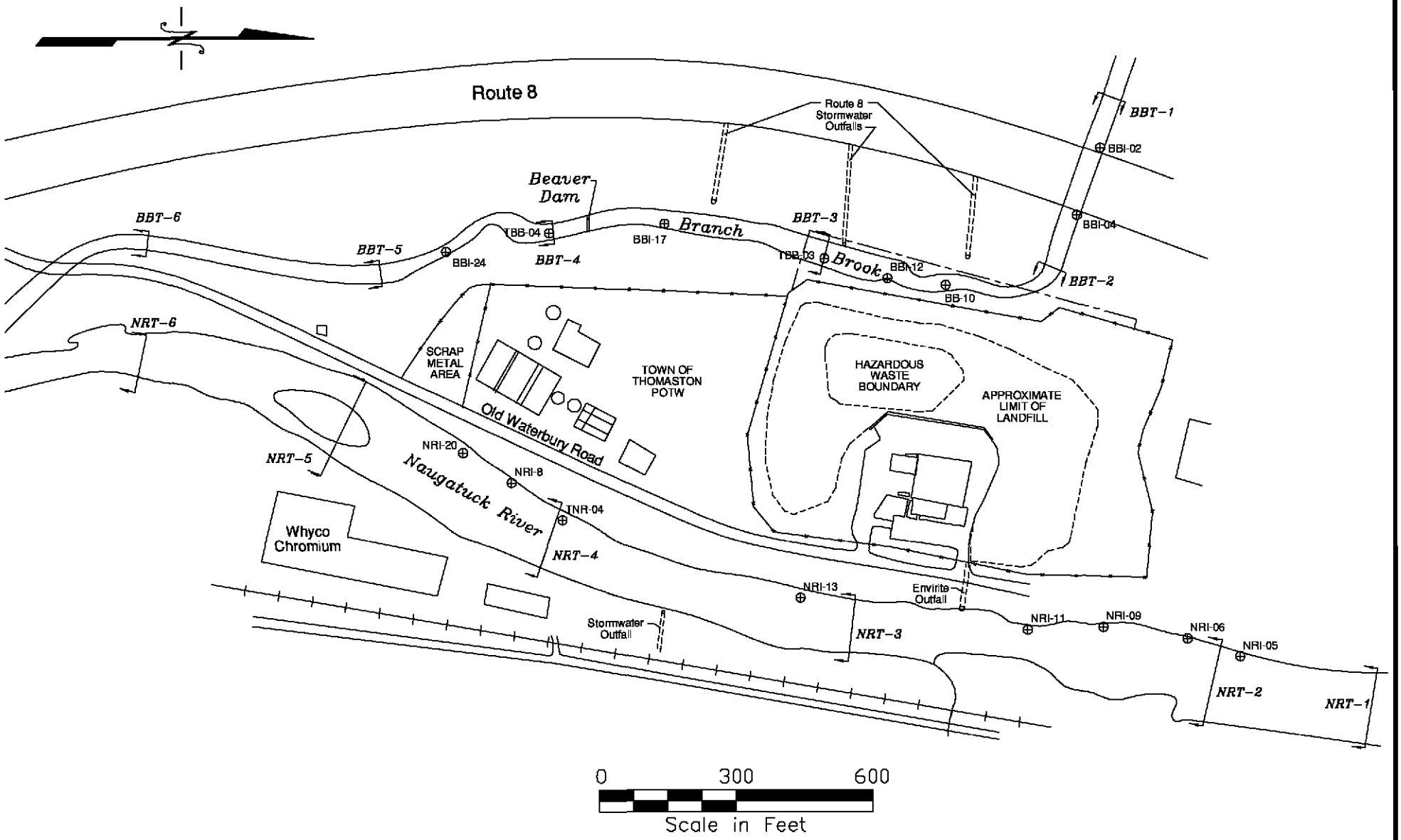

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SEDIMENT SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
V-2

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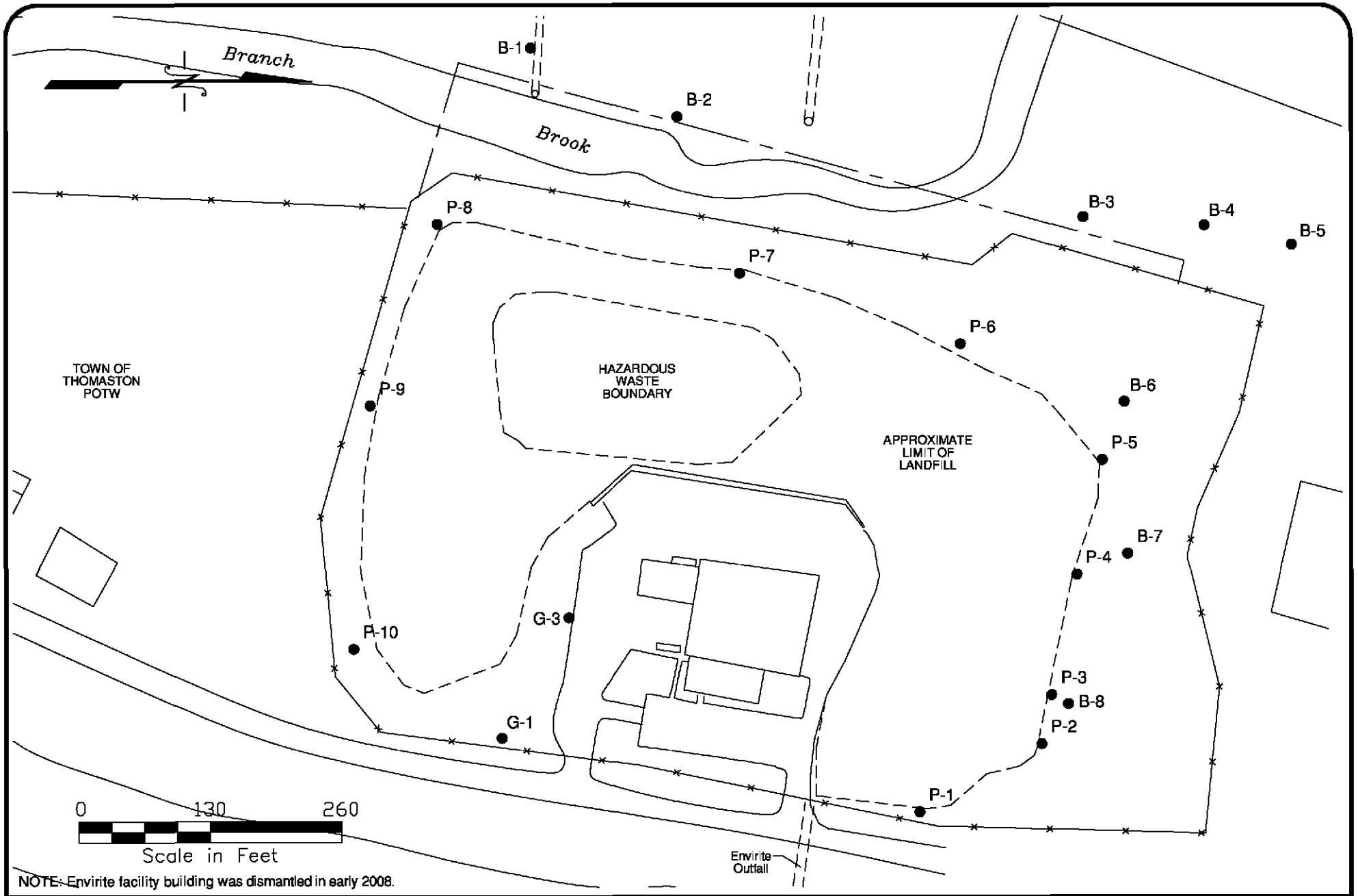

NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

SOIL SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
V-3

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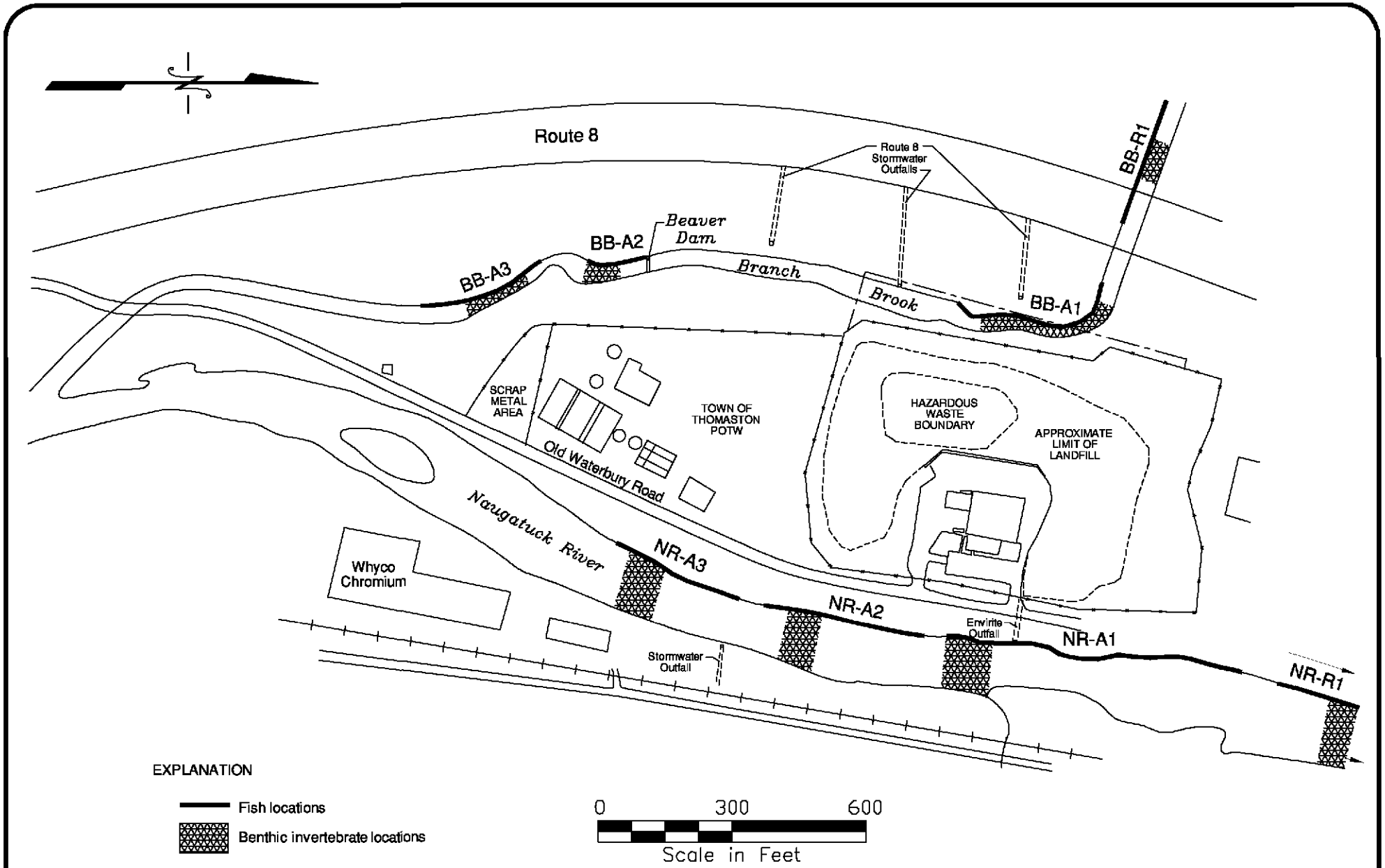
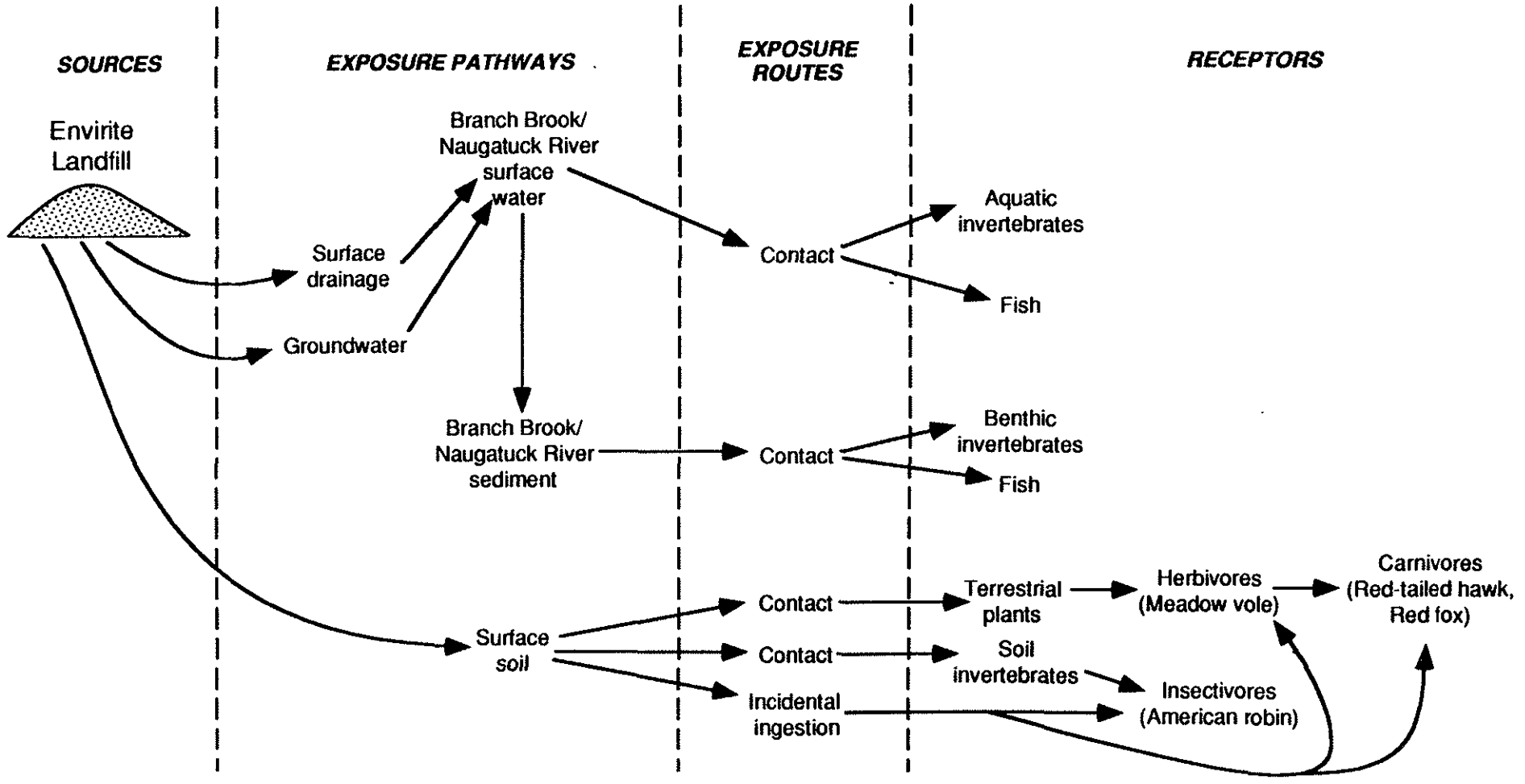


NOTE: Envirite facility building was dismantled in early 2008.

ENVIRON

BENTHIC INVERTEBRATE AND FISH SAMPLING LOCATIONS
ENVIRITE CORPORATION, THOMASTON, CONNECTICUT

Figure
V-4



DIAGRAMMATIC CONCEPTUAL SITE MODEL FOR THE ENVIRITE SITE

Figure V-5

TABLE V-1. Physical Description of Branch Brook and the Naugatuck River								
	Branch Brook				Naugatuck River			
	April 1994[a]		October 1994[a]		May 1994[a]		October 1994[a]	
Parameter	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Stream Width (feet)	36.8	33.0 - 40.0	38.4	31.4 - 46.6	107.8	100.5 - 112.0	106.7	100.0 - 111.0
Flow ($feet^3$/sec)	58.1	53.4 - 65.7	26.8	24.5 - 30.1	181.8	177.6 - 188.7	82.2	73.6 - 92.4
Velocity (feet/sec)	1.00	---	0.51	---	1.22	---	0.74	---
Water Depth (feet)	1.53	0.22 - 2.94	1.65	---	1.34	0.68 - 2.19	---	---
pH	7.13	6.95 - 7.42	---	---	8.49	8.34 - 8.79	---	---
Conductivity (µmhos/cm)	100.9	92 - 107	---	---	165.5	134 - 175	---	---
Water Temperature (°C)	12.08	11.09 - 13.21	---	---	13.48	12.73 - 14.48	---	---
Dissolved Oxygen (mg/L)	10.43	10.02 - 10.65	---	---	13.09	12.63 - 13.51	---	---

[a] Data were from three transects per water body located adjacent to the Site (GZA 1995).

TABLE V-2. Habitat Characteristics at Branch Brook and Naugatuck River Benthic Sampling Locations								
	Branch Brook[a]				Naugatuck River[a]			
Parameter	BB-R1	BB-A1	BB-A2	BB-A3	NR-R1	NR-A1	NR-A2	NR-A3
Stream Width (feet)	30	27	35	44	---	---	---	---
Stream Depth (feet)	1 - 2	0.5 - 3	1 - 3	1 - 2.5	0.5 - 2	0.5 - 2	0.5 - 1.5	1 - 2
Substrate (percent)								
- cobble	90	45	49	45	70	70	40	70
- gravel	8	45	49	45	25	20	30	20
- sand	2	10	2	10	5	10	30	10
Embeddedness (percent)	5 - 10	10 - 50	10 - 20	10 - 50	20 - 30	20 - 30	40 - 50	50 - 60
Bank Height (feet)								
- left	2.0	0.5	1.0	4.5	3.0	2.5	2.0	6.0
- right	1.5	1.0	2.0	2.5	3.0	1.5	1.5	1.5
Bank Vegetation								
- forbs	✓	✓	✓	✓		✓	✓	✓
- ferns					✓	✓		
- trees	✓	✓	✓	✓		✓	✓	
- shrubs	✓	✓				✓		
- unvegetated							✓	✓
Bank Veg. Overhang (feet)	30	13	28	0	2	20	20	0
Canopy Cover (percent)	25	10	20	75	0	0	0	0

[a] Data from GZA (1995).

TABLE V-3. Habitat Utilization of Representative Wildlife Species Potentially Present in the Site Vicinity[a]								
		Field/Scrub Habitats		Forested Habitats		Riverine Habitats		
Common Name	Scientific Name	Grass/ Pasture	Old Field/ Savannah	Northern Hardwood	Aspen	Riparian	River	Stream
Birds								
Great blue heron	*Ardea herodias*	w				w	w	w
Green heron	*Butorides virescens*					w	w	w
✓ Canada goose	*Branta canadensis*	b				b	b	b
Wood duck	*Aix sponsa*					B	b	b
American black duck	*Anas rubripes*					bw	b	b
Mallard	*Anas platyrhynchos*	bw				bw	bw	bw
✓ Turkey vulture	*Cathartes aura*	Bw	bw	bw				
Red-tailed hawk	*Buteo jamaicensis*	Bw	bw	bw	bw			
American kestrel	*Falco sparverius*	BW	bw					
✓ Wild turkey	*Meleagris gallopavo*			bW				
Killdeer	*Charadrius vociferus*	Bw				b		
Spotted sandpiper	*Actitis macularia*	b	b			b	B	B
American woodcock	*Scolopax minor*	B	b	B	B			
✓ Rock dove	*Columba livia*	B						
✓ Mourning dove	*Zenaida macroura*	BW	bw	bw	bw			
Chimney swift	*Chaetura pelagica*	b	b					
Ruby-throated hummingbird	*Archilochus colubris*		b	B	b			
Belted kingfisher	*Ceryle alcyon*					BW	bw	bw
Downy woodpecker	*Picoides pubescens*			BW	bw			

TABLE V-3. Habitat Utilization of Representative Wildlife Species Potentially Present in the Site Vicinity[a]								
		Field/Scrub Habitats		Forested Habitats		Riverine Habitats		
Common Name	Scientific Name	Grass/ Pasture	Old Field/ Savannah	Northern Hardwood	Aspen	Riparian	River	Stream
Hairy woodpecker	*Picoides villosus*			BW	bw	bw		
Northern flicker	*Colaptes auratus*	BW	bw	B	B			
✓ Pileated woodpecker	*Dryocopus pileatus*			BW	bw	bw		
Eastern wood-pewee	*Contopus virens*			b	b	B		
Least flycatcher	*Empidonax minimus*		b	B	b	b		
Eastern phoebe	*Sayornis phoebe*	b	b	b	b			
Great crested flycatcher	*Myiarchus crinitus*		b	b				
Eastern kingbird	*Tyrannus tyrannus*	b	b					
Tree swallow	*Tachycineta bicolor*	b	b			b	b	b
Barn swallow	*Hirundo rustica*	B	b			b	b	b
✓ Blue jay	*Cyanocitta cristata*		b	Bw	bw	bw		
✓ American crow	*Corvus brachyrhynchos*	BW	bw	bw	bw			
✓ Black-capped chickadee	*Parus atricapillus*		w	BW	bw	bw		
Tufted titmouse	*Parus bicolor*			bw		BW		
White-breasted nuthatch	*Sitta carolinensis*		w	BW	bw	bw		
House wren	*Troglodytes aedon*		b	b	b	b		
Wood thrush	*Hylocichla mustelina*			B	b	b		
✓ American robin	*Turdus migratorius*	B		b	b	bw		
Northern mockingbird	*Mimus polyglottos*	bw	Bw					
Gray catbird	*Dumetella carolinensis*	b	b	b	b	B		

TABLE V-3. Habitat Utilization of Representative Wildlife Species Potentially Present in the Site Vicinity[a]								
		Field/Scrub Habitats		Forested Habitats		Riverine Habitats		
Common Name	Scientific Name	Grass/ Pasture	Old Field/ Savannah	Northern Hardwood	Aspen	Riparian	River	Stream
Cedar waxwing	*Bombycilla cedrorum*	bw	bw	w		bw		
✓ European starling	*Sturnus vulgaris*	bW	w	bw	bw	bw		
Warbling vireo	*Vireo gilvus*		b	b	b	b		
Red-eyed vireo	*Vireo olivaceus*			B	b	b		
Blue-winged warbler	*Vermivora pinus*	b	B					
Yellow warbler	*Dendroica petechia*	b	b			B		
Black-and-white warbler	*Mniotilta varia*		b	B	b	b		
American redstart	*Setophaga ruticilla*		b	B	b	b		
Ovenbird	*Seiurus aurocapillus*			B	b			
Louisiana waterthrush	*Seiurus motacilla*			b		B		
Common yellowthroat	*Geothlypis trichas*	B	b	b	b	B		
Scarlet tanager	*Piranga olivacea*			B	b			
Northern cardinal	*Cardinalis cardinalis*	w	bw			bw	w	w
Rose-breasted grosbeak	*Pheucticus ludovicianus*		b	B	b	b		
Indigo bunting	*Passerina cyanea*	B	b	b	b			
Rufous-sided towhee	*Pipilo erythrophthalmus*		b	b	b			
Chipping sparrow	*Spizella passerina*	b	B	b	b			
✓ Song sparrow	*Melospiza melodia*	BW	bw	bw	bw	Bw		
✓ White-throated sparrow	*Zonotrichia albicollis*			bw	bw	w		
Dark-eyed junco	*Junco hyemalis*	w	bw	bw	bw			

TABLE V-3. Habitat Utilization of Representative Wildlife Species Potentially Present in the Site Vicinity[a]								
		Field/Scrub Habitats		Forested Habitats		Riverine Habitats		
Common Name	Scientific Name	Grass/ Pasture	Old Field/ Savannah	Northern Hardwood	Aspen	Riparian	River	Stream
Common grackle	*Quiscalus quiscula*	BW	bw			bw		
Brown-headed cowbird	*Molothrus ater*	BW	bw	b	b	bw		
House finch	*Carpodacus mexicanus*		w					
✓ American goldfinch	*Carduelis tristis*	Bw	bw	w	b	bW		
✓ House sparrow	*Passer domesticus*	BW	bw					
Mammals								
Virginia opossum	*Didelphis virginiana*	w	bw	bw	bw	Bw		
Masked shrew	*Sorex cinereus*	bw	bw	bw	bw	bw		
Northern short-tailed shrew	*Blarina brevicauda*	bw	bw	bw	bw	BW		
Hairy-tailed mole	*Parascalops breweri*	bw	bw	bw	bw			
Little brown bat	*Myotis lucifugus*	b	b	bw	bw	B	B	B
Big brown bat	*Eptesicus fuscus*	b	b	b	b	B	B	B
✓ Eastern cottontail	*Sylvilagus floridanus*	B	BW			b		
✓ Eastern chipmunk	*Tamias striatus*	bw	bw	bw	bw			
✓ Woodchuck	*Marmota monax*	BW	BW	bw	bw			
Gray squirrel	*Sciurus carolinensis*			bw		bw		
Southern flying squirrel	*Glaucomys volans*			BW	bw			
✓ Beaver	*Castor canadensis*			bw	BW	BW	BW	BW
White-footed mouse	*Peromyscus leucopus*	bw	BW	BW	bw	bw		
Meadow vole	*Microtus pennsylvanicus*	BW	bw			bw		

TABLE V-3. Habitat Utilization of Representative Wildlife Species Potentially Present in the Site Vicinity[a]								
		Field/Scrub Habitats		Forested Habitats		Riverine Habitats		
Common Name	Scientific Name	Grass/ Pasture	Old Field/ Savannah	Northern Hardwood	Aspen	Riparian	River	Stream
House mouse	*Mus musculus*	bw	bw					
Meadow jumping mouse	*Zapus hudsonius*	BW	bw	w	w	bw		
Red fox	*Vulpes vulpes*	BW	bw	bw	bw	bw		
✓ Raccoon	*Procyon lotor*	B	b	bw	bw	Bw		
Short-tailed weasel	*Mustela erminea*	bw	BW	bw	bw	bw		
Mink	*Mustela vison*			bw	bw	BW	BW	BW
River otter	*Lutra canadensis*			bw	bw	BW	BW	BW
Striped skunk	*Mephitis mephitis*	Bw	bW	bw	bw	b		
✓ White-tailed deer	*Odocoileus virginianus*	bw	bw	bw	bw	b		
Amphibians - Salamanders								
Spotted salamander	*Ambystoma maculatum*			w	w	b		b
Red-spotted newt	*Notophthalmus v. viridescens*			w		w		bw
Northern dusky salamander	*Desmognathus f. fuscus*			w		bw		Bw
Redback salamander	*Plethodon cinereus*			bw	bw			
Northern two-lined salamander	*Eurycea bislineata*		w	bw		BW	bw	Bw
Amphibians - Frogs/Toads								
Eastern American toad	*Bufo a. americanus*	w	w	w	w	w		b
Fowler's toad	*Bufo woodhousei fowleri*	w				w		
Northern spring peeper	*Pseudacris c. crucifer*			w		w		b

TABLE V-3. Habitat Utilization of Representative Wildlife Species Potentially Present in the Site Vicinity[a]								
		Field/Scrub Habitats		Forested Habitats		Riverine Habitats		
Common Name	Scientific Name	Grass/ Pasture	Old Field/ Savannah	Northern Hardwood	Aspen	Riparian	River	Stream
Gray treefrog	*Hyla versicolor*			w		bw		
Bullfrog	*Rana catesbeiana*			w			bw	w
Green frog	*Rana clamitans melanota*					Bw	w	bw
Wood frog	*Rana sylvatica*			w	w	bw		b
Pickerel frog	*Rana palustris*			b	b			w
Reptiles - Turtles								
Common snapping turtle	*Chelydra s. serpentina*	b	b			bw	w	w
Painted turtle	*Chrysemys picta*	b				b		w
Reptiles - Snakes								
Northern water snake	*Nerodia s. sipedon*					bw	b	b
Northern brown snake	*Storeria d. dekayi*	bw	bw	bw	bw			
Eastern garter snake	*Thamnophis s. sirtalis*	bw	bw	bw	bw	w		w
Northern ringneck snake	*Diadophis punctatus edwardsii*	bw	bw	bw				
Northern black racer	*Coluber c. constrictor*	Bw		bw	bw	bw		
Smooth green snake	*Opheodrys vernalis*	Bw	bw		bw	b		
Eastern milk snake	*Lampropeltis t. triangulum*	bw		bw	bw		b	

[a] Lower case = occurrence; upper case = preferred habitat. B = Breeding season; W = Winter (non-breeding) season (adapted from DeGraaf and Rudis [1987]).

✓ Observed during October 1996 site reconnaissance survey.

TABLE V-4. Results of Benthic Macroinvertebrate Community Surveys in Branch Brook								
	Number of Taxa (Percentage of Total Individuals in the Sample)							
	Spring 1994[a]				Fall 1994[a]			
Taxonomic Group	Upstream	BB-A1	BB-A2	BB-A3	Upstream	BB-A1	BB-A2	BB-A3
Coleoptera (beetles)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.0)	0 (0.0)	2 (2.4)	1 (0.8)
Diptera (flies and midges)	1 (3.4)	2 (2.1)	1 (5.0)	4 (6.4)	2 (4.8)	1 (0.8)	1 (1.2)	1 (3.4)
Ephemeroptera (mayflies)	5 (48.7)	5 (66.3)	3 (72.3)	5 (67.9)	2 (7.1)	3 (20.3)	2 (11.8)	2 (14.4)
Megaloptera (dobsonflies)	0 (0.0)	1 (2.1)	1 (5.7)	1 (4.6)	1 (2.4)	1 (3.3)	1 (14.3)	1 (5.9)
Odonata (damselflies)	0 (0.0)	0 (0.0)	1 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.4)	0 (0.0)
Plecoptera (stoneflies)	1 (10.1)	1 (4.2)	0 (0.0)	1 (0.9)	1 (12.7)	1 (8.1)	1 (4.8)	1 (5.2)
Trichoptera (caddisflies)	3 (36.1)	4 (23.2)	4 (15.6)	3 (18.4)	3 (65.0)	5 (66.7)	3 (59.5)	3 (68.7)
TOTAL INSECT TAXA	10 (98.3)	13 (97.9)	10 (99.3)	14 (98.2)	11 (96.0)	11 (99.2)	11 (96.4)	9 (98.4)
Annelida (worms)	0 (0.0)	1 (1.1)	0 (0.0)	1 (1.8)	1 (0.8)	1 (0.8)	1 (1.2)	1 (0.8)
Mollusca (clams/snails)	2 (1.7)	1 (1.0)	1 (0.7)	0 (0.0)	2 (3.2)	0 (0.0)	2 (2.4)	1 (0.8)
Crustacea (amphipods)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
TOTAL TAXA	12 (100)	15 (100)	11 (100)	15 (100)	14 (100)	12 (100)	14 (100)	11 (100)

[a] See Figure V-4 for sampling locations. Data from GZA (1995).

TABLE V-5. Results of Benthic Macroinvertebrate Community Surveys in the Naugatuck River								
	Number of Taxa (Percentage of Total Individuals in the Sample)							
	Spring 1994[a]				Fall 1994[a]			
Taxonomic Group	Upstream	NR-A1	NR-A2	NR-A3	Upstream	NR-A1	NR-A2	NR-A3
Coleoptera (beetles)	1 (9.3)	1 (1.6)	2 (1.9)	2 (1.4)	2 (4.6)	0 (0.0)	1 (1.2)	2 (1.6)
Diptera (flies and midges)	7 (28.9)	7 (28.7)	7 (32.9)	6 (29.1)	2 (5.5)	0 (0.0)	2 (4.8)	2 (19.4)
Ephemeroptera (mayflies)	7 (38.2)	7 (48.1)	6 (48.7)	6 (23.2)	4 (6.4)	3 (33.3)	3 (6.7)	4 (18.5)
Megaloptera (dobsonflies)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.4)	1 (0.9)	1 (0.9)	1 (0.6)	0 (0.0)
Odonata (damselflies)	1 (0.8)	2 (1.6)	0 (0.0)	1 (0.7)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)
Plecoptera (stoneflies)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.6)
Trichoptera (caddisflies)	2 (21.2)	2 (14.7)	4 (15.2)	3 (42.8)	3 (78.9)	3 (65.8)	3 (85.5)	3 (56.5)
TOTAL INSECT TAXA	18 (98.4)	19 (94.7)	19 (98.7)	19 (98.6)	13 (97.2)	7 (100)	10 (98.8)	12 (97.6)
Annelida (worms)	1 (0.8)	2 (3.8)	1 (1.3)	1 (1.4)	1 (0.9)	0 (0.0)	1 (0.6)	1 (1.6)
Mollusca (clams/snails)	1 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.9)	0 (0.0)	1 (0.6)	1 (0.8)
Crustacea (amphipods)	0 (0.0)	1 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
TOTAL TAXA	20 (100)	22 (100)	20 (100)	20 (100)	16 (100)	7 (100)	12 (100)	14 (100)

[a] See Figure V-4 for sampling locations. Data from GZA (1995).

TABLE V-6. Relative Abundance of Fish Species Collected From Branch Brook										
		Summer 1994[a]				Fall 1994[a]				
Common Name	Scientific Name	Upstream	A1	A2	A3	Upstream	A1	A2	A3	Total
Blacknose dace	*Rhinichthys atratulus*	26	14	7	6	27	28	1	12	121
Fallfish	*Semotilus corporalis*	4	22	0	2	6	0	2	21	57
White sucker	*Catostomus commersoni*	2	12	0	9	0	1	1	3	28
Bluegill	*Lepomis macrochirus*	0	9	1	9	0	0	1	2	22
Longnose dace	*Rhinichthys cataractae*	4	5	1	3	1	2	1	0	17
Tessellated darter	*Etheostoma olmstedi*	2	1	1	1	1	4	1	0	11
Pumpkinseed	*Lepomis gibbosus*	0	0	0	0	0	0	0	4	4
Golden shiner	*Notemigonus crysoleucas*	0	1	1	0	0	0	0	1	3
Rock bass	*Ambloplites rupestris*	0	1	0	0	0	0	0	1	2
Largemouth bass	*Micropterus salmoides*	0	0	0	0	0	0	1	1	2
Brown trout	*Salmo trutta*	0	0	0	0	1	0	0	0	1
Total Number Collected		38	65	11	30	36	35	8	45	268
Species Richness		5	8	5	6	5	4	7	8	11

[a] See Figure V-4 for sampling locations. Data from GZA (1995).

TABLE V-7. Relative Abundance of Fish Species Collected From the Naugatuck River										
		Summer 1994[a]				Fall 1994[a]				
Common Name	Scientific Name	Upstream	A1	A2	A3	Upstream	A1	A2	A3	Total
Fallfish	*Semotilus corporalis*	Present	2	2	--	30	15	24	2	75
Tesselated darter	*Etheostoma olmstedi*	0	0	0	--	10	10	11	11	42
Bluegill	*Lepomis macrochirus*	Present	2	4	--	6	4	16	3	35
Smallmouth bass	*Micropterus dolomieu*	0	1	1	--	7	9	6	5	29
White sucker	*Catostomus commersoni*	0	4	8	--	3	0	3	1	19
Rock bass	*Ambloplites rupestris*	3	4	3	--	3	1	0	1	15
Blacknose dace	*Rhinichthys atratulus*	0	0	0	--	6	0	7	0	13
American eel	*Anguilla rostrata*	1	0	4	--	0	0	0	0	5
Longnose dace	*Rhinichthys cataractae*	0	0	0	--	0	0	0	1	1
Largemouth bass	*Micropterus salmoides*	0	0	0	--	1	0	0	0	1
Brown bullhead	*Ameiurus nebulosus*	0	1	0	--	0	0	0	0	1
Redbreasted sunfish	*Lepomis auritus*	0	1	0	--	0	0	0	0	1
Redfin (grass) pickerel	*Esox americanus*	0	0	0	--	0	1	0	0	1
Cutlips minnow	*Exoglossum maxillingua*	0	0	0	--	0	0	1	0	1
Total Number Collected		4+	15	22	--	66	40	68	24	239
Species Richness		4	7	6	--	8	6	7	7	14

[a] See Figure V-4 for sampling locations. Data from GZA (1995).

TABLE V-8. Surface Water Concentrations - Branch Brook										
	Total (µg/L)					Dissolved (µg/L)				
	Adjacent/Downstream			Upstream		Adjacent/Downstream			Upstream	
Chemical	FOD	Maximum	Mean[a]	Maximum	Mean[a]	FOD	Maximum	Mean[a]	Maximum	Mean[a]
Inorganics										
Calcium	16/16	11,000	8,490	8,500	8,100	8/8	8,000	7,790	7,900	7,700
Copper	1/16	20.0	10.6	20.0	11.7	ND[b]	--	--	--	--
Iron	16/16	350	151	260	148	8/8	110	98.8	120	110
Magnesium	16/16	3,300	2,630	2,800	2,600	8/8	2,400	2,300	2,200	2,200
Manganese	13/16	63.0	46.4	60.0	28.6	ND	--	--	--	--
Mercury	6/16	5.0	3.31	5.0	3.8	ND	--	--	--	--
Potassium	16/16	2,700	1,870	2,000	1,780	8/8	1,900	1,840	1,800	1,770
Sodium	16/16	25,000	10,400	12,000	9,150	8/8	7,400	7,260	6,900	6,800
Zinc	14/16	14.0	10.2	12.0	7.0	7/8	22.0	13.5	14.0	8.0
Organics										
Di-n-butylphthalate	2/16	1.6	*[c]	2.3	*	--	--	--	--	--

[a] One-half the quantitation limit was used for nondetect samples when calculating the mean.
[b] ND - Not Detected.
[c] The calculated mean exceeded the maximum value.

TABLE V-9. Surface Water Concentrations - Naugatuck River										
	Total (µg/L)					Dissolved (µg/L)				
	Adjacent/Downstream			Upstream		Adjacent/Downstream			Upstream	
Chemical	FOD	Maximum	Mean[a]	Maximum	Mean[a]	FOD	Maximum	Mean[a]	Maximum	Mean[a]
Inorganics										
Calcium	12/12	13,000	10,400	12,000	10,600	6/6	9,600	9,200	10,000	9,700
Iron	12/12	390	278	390	268	6/6	190	182	190	187
Magnesium	12/12	3,700	3,340	3,600	3,330	6/6	3,000	2,920	3,000	2,970
Manganese	8/12	69.0	44	61.0	47.7	2/6	55.0	34.2	55.0	35.0
Potassium	12/12	4,700	3,290	3,700	2,950	6/6	3,000	2,670	2,700	2,630
Sodium	12/12	29,000	19,900	22,000	19,800	6/6	18,000	16,300	18,000	17,700
Zinc	10/12	21.0	15	18.0	13.2	6/6	19.0	16.0	18.0	15.7
Organics										
bis(2-ethylhexyl)phthalate	1/12	2.2	*[c]	ND[b]	ND	--	--	--	--	--
Di-n-butylphthalate	3/12	1.3	*	ND	ND	--	--	--	--	--
Lindane	1/6	0.015	*	0.008	*	--	--	--	--	--
Tetrachloroethene	3/12	0.70	*	ND	ND	--	--	--	--	--
Trichloroethene	11/12	0.73	*	0.92	0.68	--	--	--	--	--

[a] One-half the quantitation limit was used for nondetect samples when calculating the mean.
[b] ND - Not Detected.
[c] The calculated mean exceeded the maximum value.

TABLE V-10. Sediment Concentrations - Branch Brook						
	Adjacent/Downstream (mg/kg)			Upstream (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Inorganics						
Arsenic	2/10	1.2	0.62	ND[b]	--	--
Barium	10/10	38.0	26.5	2/2	400	215
Chromium	10/10	16.0	8.7	2/2	13.0	10.9
Cobalt	10/10	10.0	6.8	2/2	7.6	6.8
Copper	10/10	17.0	11.9	2/2	12.0	9.3
Lead	8/10	9.8	4.2	2/2	410	206
Nickel	10/10	13.0	10.1	1/2	12.0	6.2
Silver	1/10	0.60	0.33	ND	--	--
Zinc	10/10	44.0	27.2	2/2	170	96
Organics						
Acenaphthene	ND	--	--	1/4	0.062	*[c]
Acetone	12/17	0.037	0.0089	1/4	0.0064	0.00535
Aldrin	3/7	0.021	0.00608	1/2	0.0013	*
Anthracene	4/17	0.110	*	1/4	0.052	*
Benzo(a)pyrene	5/17	0.600	0.178	1/4	0.190	0.171
Benzo(b)fluoranthene	7/17	0.570	0.174	1/4	0.180	0.169
Benzo(k)fluoranthene	7/17	0.550	0.176	1/4	0.180	0.169
Bis(2-ethylhexyl)phthalate	1/17	0.460	0.182	1/4	0.130	*
2-Butanone	3/17	0.0083	0.00493	ND	--	--

TABLE V-10. Sediment Concentrations - Branch Brook						
	Adjacent/Downstream (mg/kg)			Upstream (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Butylbenzylphthalate	1/17	0.170	0.165	1/4	0.130	*
Chloroform	13/17	0.0017	*	3/4	0.001	*
4,4'-DDT	1/7	0.0079	*	ND	--	--
Dibenzofuran	ND	--	--	1/4	0.042	*
cis-1,2-Dichloroethene	1/17	0.0011	*	ND	--	--
Dieldrin	1/7	0.0267	0.0057	ND	--	--
Diethylphthalate	12/17	2.00	0.352	3/4	0.07	*
Di-n-butylphthalate	12/17	2.60	0.383	2/4	0.22	0.185
Fluoranthene	9/17	1.60	0.349	3/4	0.60	0.348
Fluorene	ND	--	--	1/4	0.05	*
Methoxychlor	2/7	0.0091	0.00375	ND	--	--
Methylene chloride	17/17	0.016	0.00774	4/4	0.012	0.00888
PCBs (total)	7/7	0.033	*	2/2	0.024	*
Phenanthrene	9/17	0.490	0.165	2/4	0.310	0.210
Pyrene	8/17	1.40	0.291	4/4	0.930	0.370
Tetrachloroethene	1/17	0.003	*	ND	--	--
Trichloroethene	1/17	0.0013	*	ND	--	--
m-Xylene	7/7	0.021	0.019	2/2	0.019	0.019

[a] One-half the quantitation limit was used for nondetect samples when calculating the mean.
[b] ND - Not Detected.
[c] The calculated mean exceeded the maximum value.

TABLE V-11. Sediment Concentrations - Naugatuck River						
	Adjacent/Downstream (mg/kg)			Upstream (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Inorganics						
Arsenic	1/5	0.43	*[c]	ND[b]	--	--
Barium	5/5	38.0	32.0	5/5	41.0	32.0
Cadmium	4/5	1.1	0.5	2/5	1.1	0.40
Chromium	5/5	78.3	32.3	5/5	25.0	16.6
Cobalt	5/5	7.4	4.2	5/5	5.6	4.8
Copper	5/5	101	71.4	5/5	92.0	48.4
Lead	5/5	21.0	17.6	5/5	29.0	16.6
Nickel	5/5	22.0	13.0	5/5	13.0	9.6
Potassium	1/1	770	770	ND	--	--
Silver	3/5	2.2	0.9	1/5	0.6	0.36
Vanadium	1/5	7.0	*	ND	--	--
Zinc	5/5	140	106	5/5	170	97.6
Organics						
Acenaphthene	1/8	0.034	*	2/9	0.064	*
Acetone	5/8	0.011	0.00632	7/10	0.037	0.0114
Anthracene	5/8	0.210	0.160	2/9	0.420	0.189
Benzo(a)pyrene	8/8	1.60	0.915	9/9	1.50	0.66
Benzo(b)fluoranthene	8/8	2.40	1.17	9/9	1.80	0.80
Benzo(k)fluoranthene	8/8	2.20	1.09	9/9	2.10	0.836

TABLE V-11. Sediment Concentrations - Naugatuck River						
	Adjacent/Downstream (mg/kg)			Upstream (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Bis(2-ethylhexyl)phthalate	3/8	0.480	0.209	2/9	0.220	0.176
Bromodichloromethane	1/8	0.0021	*	ND	--	--
2-Butanone	1/8	0.0012	*	5/10	0.0092	0.00476
Butylbenzylphthalate	ND	--	--	1/9	0.130	*
Chloroform	4/8	0.036	0.0084	5/10	0.0018	*
Dibenzofuran	1/8	0.027	*	2/9	0.033	*
Dieldrin	1/4	0.0036	0.00332	ND	--	--
Diethylphthalate	ND	--	--	1/9	0.038	*
Di-n-butylphthalate	5/8	0.150	0.142	3/9	0.200	0.157
Fluoranthene	8/8	5.60	3.09	9/9	8.00	2.76
Fluorene	7/8	0.057	*	6/9	0.150	0.111
Heptachlor	1/4	0.00031	*	2/5	0.00063	0.000243
Methoxychlor	1/4	0.0066	*	ND	--	--
Methylene chloride	8/8	0.04	0.0155	10/10	0.0094	0.00546
Naphthalene	1/8	0.021	*	ND	--	--
PCBs (total)	4/4	0.017	*	5/5	0.018	*
Phenanthrene	8/8	1.80	1.09	8/9	3.00	1.07
Pyrene	8/8	2.30	1.51	9/9	2.90	1.51
Tetrachloroethene	1/8	0.0015	*	ND	--	--
Toluene	ND	--	--	1/10	0.0044	*

TABLE V-11. Sediment Concentrations - Naugatuck River						
	Adjacent/Downstream (mg/kg)			Upstream (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
2,4,5-Trichlorophenol	ND	--	--	1/9	0.300	0.18
m-Xylene	4/4	0.019	0.0178	5/5	0.02	0.017

[a] One-half the quantitation limit was used for nondetect samples when calculating the mean.
[b] ND - Not Detected.
[c] The calculated mean exceeded the maximum value.

TABLE V-12. Surface Soil Concentrations						
	On-Site (mg/kg)			Background (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Inorganics						
Antimony	2/13	9.4	4.9	ND[b]	--	--
Arsenic	13/13	1.9	1.1	5/5	1.2	0.94
Barium	13/13	84.5	55.5	5/5	88.0	58.2
Beryllium	7/13	2.0	0.6	2/5	0.50	0.30
Cadmium	12/13	3.9	1.6	1/5	0.24	0.13
Chromium	13/13	260	104	5/5	28.0	19.6
Cobalt	13/13	14.0	7.4	5/5	10.0	7.9
Copper	13/13	670	248	5/5	40.0	24.8
Lead	13/13	38.5	20.9	5/5	140	37.8
Mercury	2/13	0.034	*[c]	2/5	0.038	0.027
Nickel	13/13	180	57.5	5/5	16.0	13.6
Selenium	1/8	0.43	0.15	ND	--	--
Silver	8/13	3.0	1.3	3/5	0.60	0.48
Thallium	1/13	0.33	*	ND	--	--
Tin	6/13	20.0	5.5	ND	--	--
Vanadium	11/13	42.0	23.3	3/5	31.0	21.2
Zinc	13/13	370	165	5/5	110	58.2
Organics						
Acenaphthene	1/15	0.042	*	ND	--	--

TABLE V-12. Surface Soil Concentrations						
	On-Site (mg/kg)			Background (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Anthracene	9/15	0.310	0.104	5/6	0.066	0.055
delta-BHC	1/15	0.00039	*	ND	--	--
Benzo(a)pyrene	14/15	1.50	0.184	6/6	0.148	0.148
Benzo(b)fluoranthene	14/15	1.40	0.186	6/6	0.400	0.168
Benzo(k)fluoranthene	14/15	1.60	0.189	6/6	0.420	0.153
bis(2-ethylhexyl)phthalate	1/15	0.200	*	ND	--	--
Bromodichloromethane	ND	--	--	1/6	0.0015	*
Butylbenzylphthalate	ND	--	--	1/6	0.015	*
Carbon disulfide	1/15	0.0012	*	ND	--	--
Carbon tetrachloride	1/15	0.0027	*	ND	--	--
4,4'-DDE	4/14	0.0036	0.00186	2/6	0.0022	0.00155
4,4'-DDT	12/15	0.010	0.00299	3/6	0.0063	0.00255
cis-1,2-Dichloroethene	2/15	0.0012	*	ND	--	--
Dibenzofuran	1/15	0.048	*	ND	--	--
Dieldrin	1/15	0.00097	*	ND	--	--
Diethylphthalate	1/15	0.010	*	2/6	0.023	*
Di-n-butylphthalate	2/15	0.048	*	ND	--	--
Di-n-octylphthalate	10/15	0.062	*	ND	--	--
Ethylbenzene	10/15	0.0045	0.00300	ND	--	--
Fluoranthene	13/15	3.80	0.415	6/6	0.690	0.320

TABLE V-12. Surface Soil Concentrations						
	On-Site (mg/kg)			Background (mg/kg)		
Chemical	FOD	Maximum	Mean[a]	FOD	Maximum	Mean[a]
Fluorene	2/15	0.055	*	1/6	0.008	*
Lindane	2/15	0.00045	*	1/6	0.00016	*
4-Methyl-2-pentanone	2/15	0.0059	0.00509	ND	--	--
Methylene chloride	ND	--	--	2/6	0.010	0.007
2-Methylnaphthalene	1/15	0.052	*	ND	--	--
Naphthalene	1/15	0.020	*	ND	--	--
PCBs (total)	12/15	0.078	0.061	2/6	0.070	*
Phenanthrene	13/15	1.50	0.190	6/6	0.320	0.147
Pyrene	14/15	3.90	0.409	6/6	0.690	0.282
Styrene	1/15	0.00064	*	ND	--	--
Tetrachloroethene	12/15	0.0030	0.00212	4/6	0.0014	*
Toluene	12/15	0.020	0.00527	3/6	0.0039	*
1,1,1-Trichloroethane	1/15	0.0004	*	5/6	0.0019	0.00167
Trichloroethene	7/15	0.0031	*	3/5	0.0011	*
Xylenes (total)	12/15	0.014	0.00517	4/6	0.0019	*

[a] One-half the quantitation limit was used for nondetect samples when calculating the mean.
[b] ND - Not Detected.
[c] The calculated mean exceeded the maximum value.

TABLE V-13. Surface Water Screening - Branch Brook							
Chemical	Frequency of Detection	Maximum (µg/L)	Benchmark Value (µg/L)		Reference[a]	Benchmark Exceedences[b]	
			Chronic	Acute		Chronic	Acute
Inorganics							
Calcium - Total	16/16	11,000	116,000	---	4	0	---
- Dissolved	8/8	8,000				0	---
Copper - Total	1/16	20.0	18.1	25.7	3	1	0
- Dissolved	0/8	---				0	0
Iron - Total	16/16	350	1,000	---	1,2	0	---
- Dissolved	8/8	110				0	---
Magnesium - Total	16/16	3,300	82,000	---	4	0	---
- Dissolved	8/8	2,400				0	---
Manganese - Total	13/16	63.0	80	1,470	1	0	0
- Dissolved	0/8	---				0	0
Mercury - Total	6/16	5.0	0.012	2.4	1,2	6	6
- Dissolved	0/8	---		2.1	1,3	0	0
Potassium - Total	16/16	2,700	53,000	---	4	0	---
- Dissolved	8/8	1,900				0	---
Sodium - Total	16/16	25,000	680,000	---	4	0	---
- Dissolved	8/8	7,400				0	---
Zinc[c] - Total	14/16	14.0	40	45	2	0	0
- Dissolved	8/8	22.0	39	44	1	0	0
Organics							
Di-n-butylphthalate	2/16	1.60	35	190	4	0	0

[a] 1 - USEPA (1994); 2 - USEPA (1996c); 3 - CTDEP (1997); 4 - Suter and Tsao (1996).
[b] The number of samples exceeding the benchmark value.
[c] Benchmark value based on a mean calculated hardness of 32 mg/L (see text).

TABLE V-14. Surface Water Screening - Naugatuck River							
Chemical	Frequency of Detection	Maximum (µg/L)	Benchmark Value (µg/L)		Reference[a]	Benchmark Exceedences[b]	
			Chronic	Acute		Chronic	Acute
Inorganics							
Calcium - Total	12/12	13,000	116,000	---	4	0	---
- Dissolved	6/6	9,600				0	---
Iron - Total	12/12	390	1,000	---	1,2	0	---
- Dissolved	6/6	190				0	---
Magnesium - Total	12/12	3,700	82,000	---	4	0	---
- Dissolved	6/6	3,000				0	---
Manganese - Total	8/12	69.0	80	1,470	1	0	0
- Dissolved	2/6	55.0				0	0
Potassium - Total	12/12	4,700	53,000	---	4	0	---
- Dissolved	6/6	3,000				0	---
Sodium - Total	12/12	29,000	680,000	---	4	0	---
- Dissolved	6/6	18,000				0	---
Zinc[c] - Total	10/12	21.0	49	54	1	0	0
- Dissolved	6/6	19.0	48	53	2	0	0
Organics							
Bis(2-ethylhexyl)phthalate	1/12	2.2	3.0	27	4	0	0
Di-n-butylphthalate	3/12	1.3	35	190	4	0	0
Lindane	1/6	0.015	0.08	1.0	1,2,3	0	0
Tetrachloroethene	3/12	0.70	98	830	4	0	0
Trichloroethene	11/12	0.73	47	440	4	0	0

[a] 1 - USEPA (1994); 2 - USEPA (1996c); 3 - CTDEP (1997); 4 - Suter and Tsao (1996).
[b] The number of samples exceeding the benchmark value.
[c] Benchmark value based on a mean calculated hardness of 40 mg/L (see text).

TABLE V-15. Sediment Screening - Branch Brook					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark Value (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Inorganics					
Arsenic - LEL[c] - SEL	2/10	1.2	6 33	2	0 0
Barium	10/10	38.0	500	6	0
Chromium - LEL - SEL	10/10	16.0	26 110	2	0 0
Cobalt	10/10	10.0	50	2	0
Copper - LEL - SEL	10/10	17.0	16 110	2	1 0
Lead - LEL - SEL	8/10	9.8	31 250	2	0 0
Nickel - LEL - SEL	10/10	13.0	16 75	2	0 0
Silver - LEL - SEL	1/10	0.6	1.0 3.7	3	0 0
Zinc - LEL - SEL	10/10	44.0	120 820	2	0 0
Organics					
Acetone	12/17	0.037	0.009	5	5
Aldrin	3/7	0.021	0.008	1	2
Anthracene	4/17	0.110	0.220	2,5	0
Benzo(a)pyrene	5/17	0.600	0.255	7	1
Benzo(b)fluoranthene - LEL - SEL	7/17	0.570	0.240 13.4	2	1 0

TABLE V-15. Sediment Screening - Branch Brook					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark Value (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Benzo(k)fluoranthene - LEL - SEL	7/17	0.550	0.240 13.4	2	1 0
Bis(2-ethylhexyl)phthalate	1/17	0.460	2.0	1	0
2-Butanone	3/17	0.0083	0.271	5	0
Butylbenzylphthalate	1/17	0.170	11.0	4	0
Chloroform	13/17	0.0017	0.099	5	0
4,4'-DDT	1/7	0.0079	0.010	1	0
cis-1,2-Dichloroethene	1/17	0.0011	0.400	5	0
Dieldrin	1/7	0.0267	0.052	4	0
Diethylphthalate	12/17	2.00	0.630	4	2
Di-n-butylphthalate	12/17	2.60	11.0	4	0
Fluoranthene	9/17	1.60	2.90	4	0
Methoxychlor	2/7	0.0091	0.019	4	0
Methylene chloride	17/17	0.016	0.375	5	0
PCBs (total) - LEL - SEL	7/7	0.033	0.07 5.30	2	0 0
Phenanthrene	9/17	0.489	0.850	4	0
Pyrene	8/17	1.40	5.45	7	0
Tetrachloroethene	1/17	0.003	0.416	5	0
Trichloroethene	1/17	0.0013	0.218	5	0
m-Xylene	7/7	0.021	0.025	4,5	0

TABLE V-15. Sediment Screening - Branch Brook					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark Value (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**

[a] 1 - NYSDEC (1994); 2 - MOE (1993); 3 - Long et al. (1995); 4 - USEPA (1996c); 5 - Jones et al. (1996); 6 - Beyer (1990); 7 - Equilibrium partitioning (1% TOC).

[b] The number of samples exceeding the benchmark value.

[c] LEL = Lowest Effect Level; SEL = Severe Effect Level.

TABLE V-16. Sediment Screening - Naugatuck River					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark Value (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Inorganics					
Arsenic - LEL[c] - SEL	1/5	0.43	6 33	2	0 0
Barium	5/5	38.0	500	6	0
Cadmium - LEL - SEL	4/5	1.1	0.6 10	2	2 0
Chromium - LEL - SEL	5/5	78.3	26 110	2	2 0
Cobalt	5/5	7.4	50	2	0
Copper - LEL - SEL	5/5	101	16 110	2	5 0
Lead - LEL - SEL	5/5	21.0	31 250	2	0 0
Nickel - LEL - SEL	5/5	22.0	16 75	2	1 0
Potassium	1/1	770	--	--	--
Silver - LEL - SEL	3/5	2.2	1.0 3.7	3	2 0
Vanadium	1/5	7.0	--	--	--
Zinc - LEL - SEL	5/5	140	120 820	2	1 0
Organics					
Acenaphthene	1/8	0.034	0.620	4	0
Acetone	5/8	0.011	0.009	5	1

TABLE V-16. Sediment Screening - Naugatuck River					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark Value (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Anthracene	5/8	0.210	0.220	2,5	0
Benzo(a)pyrene	8/8	1.60	0.446	7	7
Benzo(b)fluoranthene - LEL - SEL	8/8	2.40	0.240 13.4	2	7 0
Benzo(k)fluoranthene - LEL - SEL	8/8	2.20	0.240 13.4	2	7 0
Bis(2-ethylhexyl)phthalate	3/8	0.480	2.0	1	0
Bromodichloromethane	1/8	0.0021	2.40	7	0
2-Butanone	1/8	0.0012	0.271	5	0
Chloroform	4/8	0.036	0.099	5	0
Dibenzofuran	1/8	0.027	0.418	5	0
Dieldrin	1/4	0.0036	0.052	4	0
Di-n-butylphthalate	5/8	0.150	11.0	4	0
Fluoranthene	8/8	5.60	2.90	4	4
Fluorene	7/8	0.057	0.540	4	0
Heptachlor	1/4	0.00031	0.0003	1,2	1
Methoxychlor	1/4	0.0066	0.019	4	0
Methylene chloride	8/8	0.040	0.375	5	0
Naphthalene	1/8	0.021	0.242	5	0
PCBs (total) - LEL - SEL	4/4	0.017	0.07 5.30	2	0 0
Phenanthrene	8/8	1.80	0.85	4	6

TABLE V-16. Sediment Screening - Naugatuck River					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark Value (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Pyrene	8/8	2.30	9.53	7	0
Tetrachloroethene	1/8	0.0015	0.416	5	0
m-Xylene	4/4	0.019	0.025	4,5	0

[a] 1 - NYSDEC (1994); 2 - MOE (1993); 3 - Long et al. (1995); 4 - USEPA (1996c); 5 - Jones et al. (1996); 6 - Beyer (1990); 7 - Equilibrium partitioning (1% TOC).

[b] The number of samples exceeding the benchmark value.

[c] LEL = Lowest Effect Level; SEL = Severe Effect Level.

TABLE V-17. Surface Soil Screening					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Inorganics					
Antimony	2/13	9.4	5	1	2
Arsenic	13/13	1.9	10	1	0
Barium	13/13	84.5	500	1	0
Beryllium	7/13	2.0	10	1	0
Cadmium	12/13	3.9	3	1	3
Chromium	13/13	260	0.4	2	13
Cobalt	13/13	14.0	20	1	0
Copper	13/13	670	50	2	12
Lead	13/13	38.5	50	1	0
Mercury	2/13	0.034	0.1	2	0
Nickel	13/13	180	30	1	8
Selenium	1/8	0.43	1.0	1	0
Silver	8/13	3.0	2.0	1	4
Thallium	1/13	0.33	1.0	1	0
Tin	6/13	20.0	50	1	0
Vanadium	11/13	42.0	2.0	2	12
Zinc	13/13	370	50	1	13
Organics					
Acenaphthene	1/15	0.042	20	1	0
Anthracene	9/15	0.310	10	3	0

TABLE V-17. Surface Soil Screening					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Benzo(a)pyrene	14/15	1.50	1.0	3	1
Benzo(b)fluoranthene	14/15	1.40	--	--	--
Benzo(k)fluoranthene	14/15	1.60	--	--	--
Bis(2-ethylhexyl)phthalate	1/15	0.200	100	4	0
Carbon disulfide	1/15	0.0012	--	--	--
Carbon tetrachloride	1/15	0.0027	1,000	2	0
4,4'-DDE	4/14	0.0036	0.5	3	0
4,4'-DDT	12/15	0.010	0.5	3	0
Delta-BHC	1/15	0.00039	--	--	--
Di-n-butylphthalate	2/15	0.048	200	1	0
Di-n-octylphthalate	10/15	0.062	0.060	6	1
Dibenzofuran	1/15	0.048	600	1	0
cis-1,2-Dichloroethene	2/15	0.0012	1,000	6	0
Dieldrin	1/15	0.00097	--	--	--
Diethylphthalate	1/15	0.010	100	1	0
Ethylbenzene	10/15	0.0045	8	5	0
Fluoranthene	13/15	3.80	10	3	0
Fluorene	2/15	0.055	30	2	0
Lindane	2/15	0.00045	0.0008	6	0
4-Methyl-2-Pentanone	2/15	0.0059	--	--	--
2-Methylnaphthalene	1/15	0.052	--	--	--

TABLE V-17. Surface Soil Screening					
Chemical	**Frequency of Detection**	**Maximum (mg/kg)**	**Benchmark (mg/kg)**	**Reference[a]**	**Benchmark Exceedences[b]**
Naphthalene	1/15	0.020	10	1,6	0
PCBs (total)	10/15	0.078	1.7	7	0
Phenanthrene	13/15	1.50	5.0	3	0
Pyrene	14/15	3.90	10	3	0
Styrene	1/15	0.00064	300	1	0
Tetrachloroethene	12/15	0.0030	10	1	0
Toluene	12/15	0.020	10	5	0
1,1,1-Trichloroethane	1/15	0.0004	100	1	0
Trichloroethene	7/15	0.0031	51	5	0
Total xylenes	12/15	0.014	21	5	0

[a] 1 - Will and Suter (1995a); 2 - Will and Suter (1995b); 3 - Beyer (1990); 4 - IPCS (1992); 5 - Environment Canada (1994); 6 - Fitchko (1989); 7 - Beyer and Stafford (1993).

[b] The number of samples exceeding the benchmark value.

TABLE V-18. Ecological Chemicals of Concern (ECOCs)				
Chemical	Lower Trophic Level Organisms			Upper Trophic Level Organisms (Terrestrial Food Chain)
	Surface Water[a]	Sediment[a]	Surface Soil	
Inorganics				
Antimony			X	X
Cadmium		NR	X	X
Chromium		NR	X	X
Copper		NR	X	X
Nickel		NR	X	X
Silver		NR	X	X
Vanadium			X	X
Zinc		NR	X	X
Organics				
Aldrin		BB		
Benzo(a)pyrene		NR	X	X
Benzo(b)fluoranthene		BB,NR	X	X
Benzo(k)fluoranthene		BB,NR	X	X
Diethylphthalate		BB		
Fluoranthene		NR		
Phenanthrene		NR		

[a] BB - Branch Brook; NR - Naugatuck River.

TABLE V-19. Physical, Chemical, and Fate Characteristics of the ECOCs					
Chemical	**Water Solubility (mg/L)**	**Log K_{ow} (unitless)[a]**	**K_d (L/kg)[d]**	**Log K_{oc} (unitless)[c]**	**Half-Life (surface water [sw] and soil [s])[e]**
Antimony	Insoluble[b]	--	45	--	--
Cadmium	Insoluble[b]	--	6.5	--	--
Chromium	Insoluble[b]	--	850	--	--
Copper	Soluble under acidic conditions[b]	--	35	--	--
Nickel	Highly soluble[b]	--	150	--	--
Silver	Soluble under acidic conditions[b]	--	45	--	--
Vanadium	Insoluble[b]	--	1,000	--	--
Zinc	Soluble under acidic conditions[b]	--	40	--	--
Aldrin	0.017[c]	6.50	--	4.69	sw = 3 weeks - 1.6 years s = 3 weeks - 1.6 years
Benzo(a)pyrene	0.0038[c]	6.11	--	6.26	sw = 0.4 - 1.1 hours s = 57 days - 1.5 years
Benzo(b)fluoranthene	0.0012[c]	6.20	--	5.74	sw = 9 hours - 30 days s = 1 - 1.7 years
Benzo(k)fluoranthene	0.00055[c]	6.20	--	5.99	sw = 4 - 500 hours s = 2.5 - 5.9 years
Diethylphthalate	928[c]	2.50	--	1.84	sw = 3 days - 8 weeks s = 3 days - 8 weeks
Fluoranthene	0.166[c]	5.12	--	4.62	sw = 2.6 days s = 140 - 440 days
Phenanthrene	1.01[c]	4.55	--	4.43	sw = 3 - 25 hours s = 16 - 200 days

TABLE V-19. Physical, Chemical, and Fate Characteristics of the ECOCs					
Chemical	**Water Solubility (mg/L)**	**Log K_{ow} (unitless)[a]**	**K_d (L/kg)[d]**	**Log K_{oc} (unitless)[c]**	**Half-Life (surface water [sw] and soil [s])[e]**

[a] USEPA (1995a).
[b] HSDB (1996).
[c] Montgomery (1996).
[d] Baes et al. (1984).
[e] Howard et al. (1991).

TABLE V-20. Assessment and Measurement Endpoints Selected for the Ecological Risk Assessment	
Assessment Endpoint	**Corresponding Measurement Endpoint**
Terrestrial Habitats	
Survival, growth, and reproduction of terrestrial plants and soil invertebrates	Benchmark values for surface soil exposures
Survival, growth, and reproduction of selected bird and mammal receptor species	Literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects from dietary exposures of selected avian and mammalian receptor species
Aquatic Habitats (Branch Brook and the Naugatuck River)	
Benthic macroinvertebrate community structure	Rapid Bioassessment Protocol III metric comparison between upstream and downstream locations within each water body
Fish community structure	Qualitative comparison of fish surveys in terms of species richness, species composition, and relative abundance between upstream and downstream locations within each water body
Survival, growth, and reproduction of fish and invertebrates	Acute and chronic surface water and sediment benchmarks for freshwater aquatic systems

TABLE V-21. Calculated Plant Tissue Concentrations for the Food Chain ECOCs				
Chemical	**Plant BCF**	**Source**	**Soil Concentration (mg/kg)**	**Plant Tissue Concentration (mg/kg ww)**
Inorganics				
Antimony	0.20	Baes et al. 1984	4.9	0.069
Cadmium	0.55	Baes et al. 1984	1.5	0.058
Chromium	0.0075	Baes et al. 1984	97.8	0.051
Copper	0.40	Baes et al. 1984	233	6.5
Nickel	0.06	Baes et al. 1984	54.2	0.228
Silver	0.40	Baes et al. 1984	1.3	0.036
Vanadium	0.0055	Baes et al. 1984	23.1	0.009
Zinc	1.50	Baes et al. 1984	160	16.8
Organics				
Benzo(a)pyrene	0.011	Calculated	0.195	0.00015
Benzo(b)fluoranthene	0.010	Calculated	0.194	0.00014
Benzo(k)fluoranthene	0.010	Calculated	0.207	0.00015

TABLE V-22. Calculated Earthworm Concentrations for the Food Chain ECOCs				
Chemical	**Earthworm BCF/BAF**	**Source**	**Soil Concentration (mg/kg)**	**Earthworm Tissue Concentration (mg/kg ww)**
Inorganics				
Antimony	1.0	No data - assumed value	4.9	1.2
Cadmium	4.6	Beyer and Stafford 1993	1.5	1.7
Chromium	0.49	Beyer and Stafford 1993	97.8	12.0
Copper	0.52	Beyer and Stafford 1993	233	30.3
Nickel	0.41	Beyer and Stafford 1993	54.2	5.6
Silver	1.0	No data - assumed value	1.3	0.33
Vanadium	1.0	No data - assumed value	23.1	5.8
Zinc	1.8	Beyer and Stafford 1993	160	72.0
Organics				
Benzo(a)pyrene	0.34	Beyer and Stafford 1993	0.195	0.017
Benzo(b)fluoranthene	0.21	Beyer and Stafford 1993	0.194	0.010
Benzo(k)fluoranthene	0.21	Beyer and Stafford 1993	0.207	0.011

TABLE V-23. Calculated Meadow Vole Tissue Concentrations for the Food Chain ECOCs	
Chemical	**Meadow Vole Tissue Concentration (mg/kg ww)**
Inorganics	
Antimony	0.055
Cadmium	0.028
Chromium	0.719
Copper	3.588
Nickel	0.457
Silver	0.020
Vanadium	0.169
Zinc	6.071
Organics	
Benzo(a)pyrene	0.0014
Benzo(b)fluoranthene	0.0014
Benzo(k)fluoranthene	0.0015

TABLE V-24. Food Chain Model Input Variables						
Species	Ingestion Rate (g food/day)	Dietary Composition (Percent)				Body Weight (g)
		Plants	Earthworms	Soil	Small Mammals	
Meadow vole	11.1	97.6	0	2.4	0	37.0
Red fox	315	6.2	0	2.8	91	4,540
American robin	15.2[a]	5.6	84	10.4[b]	0	77.3
Red-tailed hawk	120	0	0	0	100	1,220

Data from USEPA (1993) except where noted.

[a] Data from Levey and Karasov (1989).
[b] American woodcock value used.

TABLE V-25. Results of Benthic Macroinvertebrate Community Evaluations for Branch Brook								
	Spring 1994[a]				Fall 1994[a]			
Metric	BB-R1	BB-A1	BB-A2	BB-A3	BB-R1	BB-A1	BB-A2	BB-A3
Taxa Richness - SCORE	12 6	15 6	11 6	15 6	14 6	12 6	14 6	10 4
Hilsenhoff Biotic Index - SCORE	2.1 6	1.2 6	1.2 6	1.6 6	3.5 6	3.5 6	3.1 6	3.4 6
Ratio of Scrapers/Filtering Collectors - SCORE	1.2 6	3.0 6	3.3 6	2.1 6	0.5 6	1.0 6	1.0 6	0.7 6
EPT/Chironimid Ratio - SCORE	38 6	89 6	-- 6	32 6	31 6	117 6	64 6	26 6
Percent Contribution of Dominant Taxa - SCORE	39 2	60 0	65 0	55 0	75 0	76 0	49 0	78 0
EPT Index - SCORE	9 6	10 6	7 2	9 6	6 6	9 6	6 6	6 6
Community Similarity Index - SCORE	-- 6	0.20 6	0.55 4	0.20 6	-- 6	0.23 6	0.31 6	0.00 6
TOTAL SCORE	38	36	30	36	36	36	36	34
Percentage of Reference Score	--	95	79	95	--	100	100	94
Biological Condition Category	--	non-impaired	slightly impaired	non-impaired	--	non-impaired	non-impaired	non-impaired

[a] From GZA (1995).

TABLE V-26. Results of Benthic Macroinvertebrate Community Evaluations for the Naugatuck River								
	Spring 1994[a]				Fall 1994[a]			
Metric	NR-R1	NR-A1	NR-A2	NR-A3	NR-R1	NR-A1	NR-A2	NR-A3
Taxa Richness - SCORE	20 6	22 6	20 6	20 6	15 6	7 2	12 4	14 6
Hilsenhoff Biotic Index - SCORE	4.5 6	4.7 6	4.2 6	4.4 6	4.1 6	3.6 6	4.1 6	4.3 6
Ratio of Scrapers/Filtering Collectors - SCORE	1.1 6	1.8 6	1.9 6	0.4 4	4.0 6	2.0 4	3.0 6	4.0 6
EPT/Chironimid Ratio - SCORE	2.5 6	2.5 6	3.3 6	3.6 6	18.6 6	-- 6	21.9 6	4.3 0
Percent Contribution of Dominant Taxa - SCORE	15 6	16 6	22 4	31 2	80 0	66 0	86 0	57 0
EPT Index - SCORE	9 6	9 6	10 6	9 6	7 6	6 4	6 4	9 6
Community Similarity Index - SCORE	-- 6	0.27 6	0.40 6	0.45 6	-- 6	0.67 4	0.13 6	0.20 6
TOTAL SCORE	42	42	40	36	36	26	32	30
Percentage of Reference Score	--	100	95	86	--	72	89	83
Biological Condition Category	--	non-impaired	non-impaired	non-impaired	--	slightly impaired	non-impaired	non-impaired

[a] From GZA (1995).

TABLE V-27. Chronic Toxicological Benchmark Values for Ingestion				
	Ingestion Benchmark (mg/kg-BW/day)[a]			
Chemical	**Meadow vole**	**Red fox**	**American robin**	**Red-tailed hawk**
Inorganics				
Antimony	0.34	0.10	474	474
Cadmium	2.63	0.97	1.45	1.45
Chromium	5.75	1.73	1.00	1.00
Copper	29.4	8.8	47.0	47.0
Nickel	70.1	21.1	77.4	77.4
Silver	31.7	9.5	--	--
Vanadium	0.34	0.10	11.4	11.4
Zinc	281	32.3	31.0	31.0
Organics				
Benzo(a)pyrene	0.96	0.29	--	--
Benzo(b)fluoranthene	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--

[a] See Appendix V-6.

TABLE V-28. Hazard Quotients (HQs) and Frequency of Benchmark Exceedences for Sediment ECOCs - Branch Brook						
	Chronic/LEL		Acute/SEL		Consistent With Background?[b]	
ECOC	Frequency[a]	Maximum HQ	Frequency[a]	Maximum HQ	Maximum	Mean
Aldrin	2/7	2.6	--	--	No	No
Benzo(a)pyrene	1/17	2.4	--	--	No	Yes
Benzo(b)fluoranthene	1/17	2.4	0/17	--	No	Yes
Benzo(k)fluoranthene	1/17	2.3	0/17	--	No	Yes
Diethylphthalate	2/17	3.2	--	--	No	No

[a] Number of benchmark exceedences / total number of samples.
[b] See Section C.

TABLE V-29. Hazard Quotients (HQs) and Frequency of Benchmark Exceedences for Sediment ECOCs - Naugatuck River						
	Chronic/LEL		Acute/SEL		Consistent With Background?[b]	
ECOC	Frequency[a]	Maximum HQ	Frequency[a]	Maximum HQ	Maximum	Mean
Inorganics						
Cadmium	2/5	1.8	0/5	--	Yes	Yes
Chromium	2/5	3.0	0/5	--	No	Yes
Copper	5/5	6.3	0/5	--	Yes	Yes
Nickel	1/5	1.4	0/5	--	Yes	Yes
Silver	2/5	2.2	0/5	--	No	No
Zinc	1/5	1.2	0/5	--	Yes	Yes
Organics						
Benzo(a)pyrene	7/8	2.5	--	--	Yes	Yes
Benzo(b)fluoranthene	7/8	10.0	0/8	--	Yes	Yes
Benzo(k)fluoranthene	7/8	9.2	0/8	--	Yes	Yes
Fluoranthene	4/8	1.9	--	--	Yes	Yes
Phenanthrene	6/8	2.1	--	--	Yes	Yes

[a] Number of benchmark exceedences / total number of samples.
[b] See Section C.

TABLE V-30. Hazard Quotients (HQs) and Frequency of Benchmark Exceedences for Surface Soil				
			Consistent With Background?[b]	
ECOC	Frequency[a]	Maximum HQ	Maximum	Mean
Inorganics				
Antimony	2/13	1.9	No	No
Cadmium	3/13	1.3	No	No
Chromium	13/13	650	No	No
Copper	12/13	13.4	No	No
Nickel	2/13	6.0	No	No
Silver	4/13	1.5	No	No
Vanadium	12/13	21	Yes	Yes
Zinc	13/13	7.4	No	No
Organics				
Benzo(a)pyrene	1/15	1.5	No	Yes
Benzo(b)fluoranthene	NB[c]	--	No	Yes
Benzo(k)fluoranthene	NB	--	No	Yes

[a] Number of benchmark exceedences / total number of samples.
[b] See Section C.
[c] No benchmark available.

TABLE V-31. Hazard Quotients for Upper Trophic Level Receptor Species				
ECOC	**Meadow vole[a]**	**Red fox[a]**	**American robin[a]**	**Red-tailed hawk[a]**
Inorganics				
Antimony	0.16	0.13	0.0006	0.00001
Cadmium	0.01	0.01	0.22	0.002
Chromium	0.13	0.14	3.98	0.07
Copper	0.12	0.08	0.21	0.01
Nickel	0.01	0.01	0.03	0.0006
Silver	0.0006	0.0004	--	--
Vanadium	0.50	0.56	0.13	0.001
Zinc	0.02	0.02	0.50	0.02
Organics				
Benzo(a)pyrene	0.002	0.002	--	--
Benzo(b)fluoranthene	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--

[a] Mean media concentrations were used in the exposure modeling (see text).

6 MEDIA PROTECTION STANDARDS PROPOSAL

6.1 Introduction

This chapter presents proposed Media Protection Standards (MPS) for the primary chemicals of potential concern evaluated in this PHERE. These protection standards shall be used for measuring the necessity for and/or the degree of protection afforded by the corrective measures to be contemplated for the site. The MPS are based on numerical criteria listed in the CTDEP Remediation Standard Regulations.[30]

MPS based on the RSRs are proposed for each of the following environmental media – soil, ground water, surface water, sediment, soil gas, and the Pre-Envirite Waste Material. This chapter compares the proposed MPS with the data collected at the site, and identifies which locations are above the MPS and would need to be addressed in the Corrective Measures Study (CMS). This chapter also presents the human health and ecological risks calculated in Chapters 4 and 5, respectively, associated with the COPCs that were observed above the proposed MPS.

6.2 MPS for On-Site Surface Soil

For on site soils, the proposed MPS are based on the direct exposure criteria (DEC) and pollutant mobility criteria (PMC) as established in the RSRs. The DEC are the concentrations of chemicals that, if present in polluted soil at or below the established concentration, would not create a risk to public health even if that soil were ingested. The PMC are the established concentrations to prevent the pollution of ground water caused by soil contamination that is available to migrate into ground water. For VOCs, the PMCs are in units of mg/kg and are to be compared to soil concentrations, but for metals and PCBs, the PMCs are in units of mg/L and are to be compared to soil leachate concentrations. The direct exposure criteria were applied in the current use scenario (to trespassers and workers) to surface soils (0-1 foot), and in the future use scenario (to utility and construction workers) to soils from the ground surface to a depth of 15 feet. The PMCs generally apply to soil located above the seasonal low ground water table. The RSRs include criteria that would apply to both residential and commercial or industrial properties. An industrial/commercial direct exposure criteria (I/C DEC) may be used provided an Environmental Land Use Restriction (ELUR) is recorded to ensure that the site is not used for residential purposes in the future. Compliance with the RSRs is achieved when (1) the 95 percent upper confidence limits on the mean concentration (95% UCL) of all sample result of laboratory analyses of soil from the subject release area is equal to or less than the

[30] It should be noted that Envirite's legal counsel had advised that, according to the Regulations of Connecticut State Agencies (RCSA) Section 22a-133k-1(b), the RSRs do not apply to areas that are affected by discharges allowed under a ground water discharge permit issued pursuant to Section 22a-430. Envirite has held a ground water discharge permit since 1984 at the Thomaston facility. Thus, while compliance with RSRs is one indicator of potential need for remediation to CTDEP, USEPA, and Envirite, these regulations are not strictly applicable to ground water constituent levels at the Thomaston facility.

DEC and PMC, provided that the results of no single sample exceeds two times the PMC or DEC or (2) the results of all laboratory analyses of samples are equal to or less than the DEC and PMC. For those chemicals for which both a DEC and PMC have been established (i.e., VOCs), the lower of the two criteria is used as the MPS.

Among the COPCs evaluated for soil, the following COPCs have 95% UCL levels that exceed the DEC or PMC:

- The 95% UCL for chlordane (0.19 mg/kg in deep soil) exceeds the PMC (0.066 mg/kg). Chlordane was only detected in one deep soil sample out of 22, which was in the vicinity of the PEWM-R. Cancer risks associated with chlordane were calculated to be 3.2×10^{-10} and 1.7×10^{-8} for the utility worker (CTE) and construction worker (RME) populations, respectively.

- The 95% UCL for total chromium (124 mg/kg in surface soil) exceeds the DEC for hexavalent chromium (100 mg/kg) but is below the DEC for trivalent chromium (51,000 mg/kg). Chromium was detected in all 58 soil samples analyzed for total chromium and was identified in perimeter samples. Because no data were available from the RFI regarding the type of chromium present at the site, ENVIRON collected additional soil samples at each of the eight locations where total chromium exceeded the two times the DEC for hexavalent chromium. These samples were analyzed for hexavalent chromium were found to all be below the DEC (see Appendix VI-1). Therefore, the site soils are not considered to exceed the DEC for chromium.

The following COPCs were identified to have samples that exceeded two times the DEC or PMC; therefore, MPS were identified based on the DEC or PMC.

Contaminant	MPS (mg/kg)	Maximum Concentration	Locations
Benzene	0.2 mg/kg (PMC)	0.57 mg/kg	W-24
Bis(2-ethylhexyl phthalate)	11 mg/kg (PMC)	560 mg/kg	R-12
Chlordane	0.066 mg/kg (PMC)	0.19 mg/kg	W-25
Ethylbenzene	10.1 mg/kg (PMC)	69 mg/kg	W-01, W-24
PCBs (leachate)	0.005 mg/L (PMC)	9.0 mg/L	T-3, R-1
PCE	1.0 mg/kg (PMC)	41.0 mg/kg	W-24
TCE	1.0 mg/kg (PMC)	43.0 mg/kg	W-24
Xylenes (total)	19.5 mg/kg (PMC)	180 mg/kg	R-12, W-01

The benzene, bis(2-ethylhexyl phthalate), chlordane, ethylbenzene, PCE, TCE, and total xylenes concentrations that were greater than two times the CTDEP Criteria are associated with soils immediately adjacent to the PEWM R. PCBs were identified in the vicinity of the underground spill containment tanks.

6.3 MPS for Soil Gas

No soil gas samples were measured at levels that exceed the CTDEP volatilization criteria for soil gas.[31] Therefore, soil gas levels were determined to be within an acceptable range and no MPS were developed for soil gas constituents. These results should be taken into consideration when comparing ground water data to the volatilization criteria (discussed in Chapter 6.7).

6.4 MPS for Pre-Envirite Waste Material

The PMC are applicable for all of the PEWM-R soils and leachate samples from the soils. Among the COPCs evaluated for PEWM-R, COPCs listed as having 95% UCL levels that exceeded the PMC are included in the table below, as well as the risks associated with these COPCs for the construction worker (RME) and utility worker (CTE) scenarios. The noncancer hazard quotients were evaluated using acute minimal risk levels (applicable for exposures of 1-14 days) for the utility worker (assumed five-day exposure) and the intermediate minimal risk level (applicable for exposures of 15-365 days) for the construction worker (assumed 30 day exposure).

Contaminant	MPS (mg/kg)	95% UCL (mg/kg)	Construction Worker		Utility Worker	
			Cancer	Noncancer	Cancer	Noncancer
Benzene	0.2	30	$1.26x10^{-4}$	4.5E+03	$6.32x10^{-5}$	2.5E+03
2-Butanone (MEK)	80	2,100	NT	NT	NT	NT
Bis(2-ethylhexyl)phthalate	11	6,500	$6.11x10^{-8}$	3.7E-02	$1.27x10^{-8}$	NT
Cadmium (leachate)	0.05 mg/L	5.7 mg/L	NA	NA	NA	NA
Dibutyl phthalate	140	3,100	NT	NT	NT	4.4E-03
cis-1,2-DCE	14	70	NT	1.3E-04	NT	5.0E-05
trans-1,2-DCE	20	70	NT	7.8E+02	NT	6.5E+02
Ethylbenzene	10	3,100	NT	4.9E+00	NT	2.8E-01
Lead	1,000	5,900	NT	NT	NT	NT
Lead (leachate)	0.15 mg/L	11 mg/L	NA	NA	NA	NA
Naphthalene	56	160	NT	1.5E-04	NT	1.9E-04
Styrene	20	2,300	NT	NT	NT	1.0E+00
PCE	1	3,100	$3.51x10^{-6}$	NT	$1.75x10^{-6}$	4.4E+01
Toluene	67	15,000	NT	4.3E-01	NT	7.4E+00
TCE	1	3,300	$3.40x10^{-5}$	3.5E+02	$1.70x10^{-5}$	1.5E+01
Xylenes	20	16,000	NT	7.3E+00	NT	1.8E+00
		TOTAL	$1.64x10^{-4}$	5.6E+03	$8.20x10^{-5}$	3.2E+03

NT – No toxicity value, NA – Not applicable

[31] Appendix F to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

The following COPCs were identified in PEWM-R to have samples that exceeded two times the PMC; therefore, MPS were identified based on the PMC.

Contaminant	MPS (mg/kg)	Maximum Conc. (mg/kg)	Locations
1,2-Dichloroethylene (cis)	14	70	W-25
1,2-Dichloroethylene (trans)	20	70	W-25
2-Butanone (MEK)	80	2,100	W-25
Benzene	0.20	30	W-25
Bis(2-ethylhexyl)phthalate	11	6,500	W-25, W-30
Dibutyl phthalate	140	3,100	W-25
Ethylbenzene	10.1	3,100	W-25, W-30
Naphthalene	56	160	W-25
Styrene	20	2,300	W-25, W-30
Tetrachloroethylene (PCE)	1.0	3,100	W-25, W-30
Toluene	67	15,000	W-25, W-30
Trichloroethene	1.0	3,300	W-25, W-30
Xylenes (total)	19.5	16,000	W-25, W-30

6.5 MPS for Surface Water

For surface water, the proposed MPS are based on the CTDEP Class A Surface Water Criteria. Among the COPCs evaluated for surface water, the following COPCs have 95% UCL levels that exceeded the aquatic life criteria or human health criteria in surface water.

Contaminant	CTDEP Class A Surface Water Criteria (mg/L)				95% UCL (mg/L)	Cancer Risk	Non-cancer HQ
	Aquatic Life Criteria		Human Health Criteria				
	Acute	Chronic	Consumption of Organisms Only	Consumption of Water and Organisms			
PCBs (total)	NE	0.014	0.0002	0.0002	0.0003	2.9×10^{-7}	NT
Copper	0.0143	0.0148	NA	1.3	0.0153	NT	7.1×10^{-5}
Mercury	0.0014	0.00077	4.6	0.61	0.005	NT	9.8×10^{-3}

NT – No toxicity value
NE – Not established

The cancer and noncancer risks were evaluated for the dermal contact and ingestion pathways for a recreational visitor population. It should also be noted that all of these chemicals were detected in both upstream and downstream surface water samples, and they are unlikely to be site-related. In 2003, additional surface water samples were collected during each of the four quarters at locations upstream and downstream of the Envirite facility. No VOCs were detected in any of the surface water samples. Five metals were detected in both upstream and downstream samples including barium, iron, manganese, sodium, and zinc.

6.6 MPS for Sediment

No RSR criteria currently apply directly to sediment; however, for this evaluation the proposed MPS are based on the DEC and PMC developed for soil. The 95% UCL concentration for these COPCs are below the I/C DEC. Among the COPCs evaluated in the PHERE for sediment, the following COPCs were listed in the PHERE as having 95% UCL levels that exceed the PMC:

Contaminant	MPS (mg/kg)	95% UCL (mg/kg)	Cancer Risk
Upstream			
Benzo(a)pyrene	1	1.5	1.2×10^{-6}
Benzo(b)fluoranthene	1	1.8	1.4×10^{-7}
Benzo(k)fluoranthene	1	1.83	1.4×10^{-8}
Downstream			
Benzo(a)pyrene	1	1.6	1.3×10^{-6}
Benzo(b)fluoranthene	1	2.4	1.9×10^{-7}
Benzo(k)fluoranthene	1	2.2	1.7×10^{-8}

The risks for benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene were evaluated for the scenario of ingestion of sediment by a recreational visitor, and are presented above for the RME scenario. It should be noted that all of these COPCs were detected in both upstream and downstream sediment samples, and they are unlikely to be site-related.

6.7 MPS for Ground Water

The MPS for ground water include volatilization criteria, ground water protection criteria, and surface water protection criteria. The site also includes two ground water areas including 1) ground water within the area of existing private water supply wells or an area with the potential to provide water to public or private water supply wells (GA) and 2) ground water within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available (GB). Ground water in GA areas at the site is potentially subject to three remediation criteria:

- Residential Volatilization Criteria (RVC)[32] – the 95% UCL of all sample locations must be less than the RVC for at least four consecutive quarterly sampling periods and each sample must be less than two times the RVC; if the ground water data exceed the RVC for ground water, the facility also has the option of meeting the RVC for soil vapor.[33, 34]

- Ground Water Protection Criteria (GWPC)[35] – each sample from four consecutive quarterly samples must be less than the GWPC; or the 95% UCL of all samples collected from all sampling locations over 12 consecutive monthly sampling periods must be less than the GWPC and each sample must be less than two times the GWPC.

- Surface Water Protection Criteria (SWPC)[36] – the average concentration from all sample locations must be less than the SWPC for at least four consecutive quarterly sampling periods.

Ground water in GB areas at the site (which will not be used for drinking purposes) is potentially subject to two remediation criteria:

- Industrial Volatilization Criteria (IVC)[37] – the 95% UCL of all sample locations must be less than the IVC for at least four consecutive quarterly sampling periods and each sample must be less than two times the IVC; if the ground water data exceed the IVC for ground water, the facility also has the option of meeting the IVC for soil vapor.[3,4]

- Surface Water Protection Criteria (SWPC)[38] – the average concentration from all sample locations must be less than the SWPC for at least four consecutive quarterly sampling periods.

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[32] Appendix E to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies; Volatilization Criteria for Ground Water

[33] Appendix F to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies; Volatilization Criteria for Soil Vapor

[34] According to Section 22a-133k-3(c)(3)(A), remediation of a volatile organic substance to the volatilization criterion for ground water shall not be required if the concentration of such substance in soil vapors below a building is equal to or less than the applicable volatilization criterion for soil vapor

[35] Appendix C to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies; Ground Water Protection criteria for GA and GAA Areas

[36] Appendix D to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies; Surface Water Protection Criteria for Substances in Ground Water

[37] Appendix E to Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies; Volatilization Criteria for Ground Water

[38] See Note 36

The ground water data used in the first revision of the PHERE were collected in 1994 and are described in the 1995 RFI Report. In a memorandum dated November 25, 2002, ENVIRON compared these data with the numerical criteria provided by CTDEP's RSRs. Based on this comparison, a subset of 31 chemicals was identified that had concentrations that exceeded the RSR criteria. Due to the age of the ground water data used in the PHERE, Envirite requested additional time to conduct ground water monitoring in order to evaluate current conditions at the site. In a letter dated January 22, 2003, USEPA agreed to allow Envirite sufficient time to conduct four rounds of quarterly monitoring, the results of which would be used to determine whether concentrations of ground water constituents continued to exceed the RSR criteria. The 2003 ground water sampling included an expanded number of target analytes than are included in the regular quarterly monitoring being performed at the site under post-closure requirements. Additional post closure monitoring for a limited analyte list and reduced number of monitoring locations was conducted from 2004 to 2007.

Appendix VI-2 provides a memo in which the 2003 analytical results are compared with numerical criteria provided by CTDEP's RSRs. Compliance with the RSRs is evaluated by comparing ground water concentration data collected over four consecutive quarters with each applicable criteria. The CTDEP proposed revisions to the RSRs in March 2003, which included changes to the volatilization criteria for ground water and soil vapor for certain compounds based on updated toxicity data. The discussion and conclusions provided below are based on the proposed revised RSR criteria. Based on the results of the 2003 sampling and subsequent post-closure monitoring, the only chemicals of potential concern that remain with respect to ground water are vinyl chloride, TCE, copper, zinc, phenanthrene, heptachlor epoxide, and polychlorinated biphenyls.

6.7.1 GA Wells

Among the three GA wells monitored in 2003 (MW-36, MW-37B, and MW-37D), only two VOCs were detected in 2003, bis(2-ethylhexyl)phthalate and bromoform. Bromoform was only detected during one of the four quarters (1Q03), at concentrations that are below the RSR criteria. Bis(2-ethylhexyl)phthalate was also only detected during one of the four quarters (3Q03), with the sample from one well (MW-37D) at a concentration of 4.6 μg/L, which is slightly higher than two times the GWPC (4 μg/L). Several metals were also detected, also at levels that are below the RSR criteria. Additional data from 2004 to 2007 indicates compliance with the RSRs.

6.7.2 GB Wells

Among the 15 GB wells monitored in 2003 (MW-30, MW-31B, MW-31D, MW-31S, MW-41B, MW-41D, MW-41S, MW-42S, MW-43D, MW-43S, MW-44B, MW-44D, MW-51B, MW-52D, and MW-53D), the following two constituents exceeded the Industrial Volatilization Criteria:

- Vinyl chloride: The 95% UCL of the data collected over the four quarters in 2003 (195 μg/L) exceeds the proposed IVC (52 μg/L). In addition, data from MW-30 and MW-31S (ranging from 120 to 460 μg/L) exceed two times the IVC (104 μg/L). The ground water data from 2007 indicates that data from MW-31S (ranging from 150 μg/L to 630 μg/L) continues to exceed two times the IVC. Although the ground water data exceed the IVC, the soil gas data collected in 1996 indicate that the soil gas concentrations are below the volatilization criteria for soil gas (see Chapter 6.3). Since soil gas data are a better indicator of the potential for vapor intrusion issues, these data suggest that volatilization of vinyl chloride is not considered to be a significant risk to human health.

- Trichloroethylene: The 95% UCL of the data collected over the four quarters in 2003 (139 μg/L) exceeds the proposed IVC (67 μg/L). In addition, data collected from MW-30, MW-31B, and MW-52D (ranging from 300 to 970 μg/L) exceed two times the IVC (134 μg/L). The ground water data from 2007 indicates that data from MW-30 (500 μg/L) continues to exceed two times the IVC. Although the ground water data exceed the IVC, the soil gas data collected in 1996 indicate that the soil gas concentrations are below the volatilization criteria for soil gas (see Chapter 6.3). Since soil gas data are a better indicator of the potential for vapor intrusion issues, these data suggest that volatilization of TCE is not considered to be a significant risk to human health.

The following five constituents exceeded the Surface Water Protection Criteria:

- Phenanthrene: The average of the data collected over the four quarters in 2003 (0.2 μg/L) slightly exceeds the SWPC (0.1 μg/L). Phenanthrene was detected in only two out of 53 samples collected. This "exceedance" is strongly influenced by the method detection limits used in the analysis (0.3 μg/L), which exceeds the SWPC at both the MDL and one half the MDL. Phenanthrene was only detected in two monitoring wells (MW-31S and MW-43S) at levels that exceeded the SWPC, and all other wells were nondetect. On the basis of a highly conservative assumption that surface water concentrations have a phenanthrene concentration equivalent to the average ground water concentration (i.e., no dilution), the noncancer hazard quotient for exposures to phenanthrene through dermal contact and incidental ingestion by a recreational visitor is 1.1×10^{-6}, which is well below the health benchmark of one.

- Heptachlor epoxide: The average of the data collected over the four quarters in 2003 (0.06 μg/L) slightly exceeds the SWPC (0.05 μg/L). Heptachlor epoxide was detected in only two out of 54 samples collected. This "exceedance" is strongly influenced by the method detection limits used in the analysis (0.05 μg/L for most samples, but 2 μg/L for one sample). If the detection limit for the one sample had been 0.05 μg/L instead of 2 μg/L, and assuming a nondetect for that sample, the average would have been 0.045 μg/L, which is below the SWPC. Furthermore, heptachlor epoxide was only detected in one well (MW-31S) at levels that exceeded the SWPC; all other wells were either nondetect or at levels below the SWPC, including wells downgradient of MW-31S (e.g., MW-41S, MW-42S). On the basis of a highly conservative assumption that

surface water concentrations have a heptachlor epoxide concentration equivalent to the average ground water concentration (i.e., no dilution), the noncancer hazard quotient for exposures to heptachlor epoxide through dermal contact and incidental ingestion by a recreational visitor is 1.0×10^{-3}, which is well below the health benchmark of one, and the cancer risk for exposures to heptachlor epoxide through dermal contact and incidental ingestion by a recreational visitor is 2.0×10^{-8}, which is below the health benchmark of 1×10^{-6}..

- Polychlorinated biphenyls: The average of the data collected over the four quarters in 2003 (0.98 μg/L) slightly exceeds the SWPC (0.5 μg/L). PCBs were only detected in one well (MW-31S) at levels that exceeded the SWPC; all other wells were either nondetect or at levels below the SWPC, including wells downgradient of MW-31S (e.g., MW-41S, MW-42S). PCBs were not included in the sampling parameters for the 2004 through 2007 post-closure monitoring. On the basis of a highly conservative assumption that surface water concentrations have a PCB concentration equivalent to the average ground water concentration (i.e., no dilution), the cancer risk for exposures to PCBs through dermal contact and incidental ingestion by a recreational visitor is 1.5×10^{-7}, which is below the health benchmark of 1×10^{-6}.

- Copper: The average of the data collected over the four quarters in 2003 (88 μg/L) exceeds the SWPC (48 μg/L). The highest concentrations were observed in MW-43D and MW-43S, on the southern (downgradient) border of the site. An average of the data collected over the four quarters in 2007 is 66 μg/L, which is above the SWPC, driven largely by a high values ranging from 334 μg/L to 889 μg/L observed in one well (MW-43D), as shown in Figure VI-3 and VI-4. Although the average of the data is statistically influenced by monitoring wells MW-43D, Figures VI-3 and VI-4 demonstrate a continued and steady decline of dissolved phase copper concentrations in all site monitoring wells. On the basis of a highly conservative assumption that surface water concentrations have a copper concentration equivalent to the average ground water concentration (i.e., no dilution), the noncancer hazard quotients for exposures to copper through dermal contact and incidental ingestion by a recreational visitor are 3.6×10^{-4}, which is well below the health benchmark of one.

- Zinc: The average of the data collected over the four quarters in 2003 (244 μg/L) exceeds the SWPC (123 μg/L). The highest concentrations were observed in MW-42S, MW-43D, and MW-43S, on the southern (downgradient) border of the site. An average of the data collected over the four quarters in 2007 is 232 μg/L, which remains above the SWPC. However, the data is driven largely by high values ranging from 76 μg/L to 2,370 μg/L observed in one well (MW-31S) located in the immediate vicinity of the PEWM-R (a known source area), as shown in Figure VI-1 and VI-2. Excluding this well, the average zinc concentration is 145 μg/L, which is slightly above the SWPC. However, as discussed below, zinc was detected in upgradient background wells that were sampled in 2003, and half of the background samples had zinc concentrations that exceed the SWPC. On the basis of a highly conservative assumption that surface water

concentrations have a zinc concentration equivalent to the average ground water concentration (i.e., no dilution), the noncancer hazard quotients for exposures to copper through dermal contact and incidental ingestion by a recreational visitor are 1.7×10^{-4}, which is well below the health benchmark of one.

As discussed in Section 6.8, based on the assessment endpoints evaluated and the weight-of-the-evidence approach utilized in this assessment, significant adverse ecological effects are not likely to occur in Branch Brook and the Naugatuck River from site-related exposures to the COCs discussed above.

6.7.3 Background Wells

Among the four background wells monitored in 2003 (MW-32D, MW-32S, MW-55B, and MW-63), three VOCs (bis(2-ethylhexyl)phthalate, bromoform, and dibromochloromethane) and three metals (copper, lead, and zinc) were detected. It should be noted that half of the background samples in which zinc was detected were at concentrations that exceed the SWPC.

6.7.4 Ground Water Summary

Based on the above discussion, and considering the site to be industrial, the main chemicals of potential concern in ground water are vinyl chloride, TCE, zinc, and copper. In accordance with the RSRs, phenanthrene, heptachlor epoxide, and PCBs have also been conservatively retained as COCs in ground water for further analysis in the CMS.

The most likely source of the vinyl chloride and TCE is the PEWM-R. The source of the zinc and copper is unknown; however, some of the elevated zinc concentrations also appear to be related to the PEWM-R. The vinyl chloride and TCE exceedances were generally observed in monitoring wells MW-30 and MW-31, which are adjacent to or downgradient of the two below-ground deposits of Pre-Envirite Waste Material. The volatilization criteria are only applicable if ground water is less than 30 feet below ground surface and a building is present within 30 feet of the VC exceedance area. The site building has been removed in 2008. Furthermore, soil gas measurements of vinyl chloride and TCE were below the volatilization criteria for soil gas, which support a conclusion that no significant risks are present associated with these two compounds.

The phenanthrene, heptachlor epoxide, and PCB exceedances of the SWPC were generally observed in monitoring well MW-31, which is downgradient of the PEWM-R.

The SWPC were exceeded for copper and zinc in past years. However, based on the four most recent quarters of sampling data, the site is approaching the SWPC for copper and zinc. It should be noted that zinc was detected in background wells, suggesting the presence of upgradient sources. Half of the background samples in which zinc was detected were at concentrations that exceed the SWPC. On the basis of a highly conservative assumption that these two metals are present in surface water at the same concentrations as in ground water

(i.e., no dilution), the noncancer risks associated with exposures to these two metals range from 0.0002 to 0.0004, which are three orders of magnitude below the health benchmark of one.

6.8 Ecological Risks

As discussed in Chapter 5 of this PHERE, based on the assessment endpoints evaluated and the weight-of-the-evidence approach utilized in this assessment, significant adverse ecological effects are not likely to occur in Branch Brook and the Naugatuck River from site-related exposures. There may be the potential for adverse impacts to lower trophic level soil biota in on-site terrestrial habitats. However, these potential risks are likely to have low ecological significance due to the limited nature and low quality of the habitats present on the monofill. In addition, the vegetation on the monofill is not visibly stressed. Thus, the risk evaluation indicates a low likelihood of adverse effects to populations of upper trophic level wildlife that might consume soil invertebrates, plants, and soil from the site. This conclusion includes those compounds that exceed the proposed MPS.

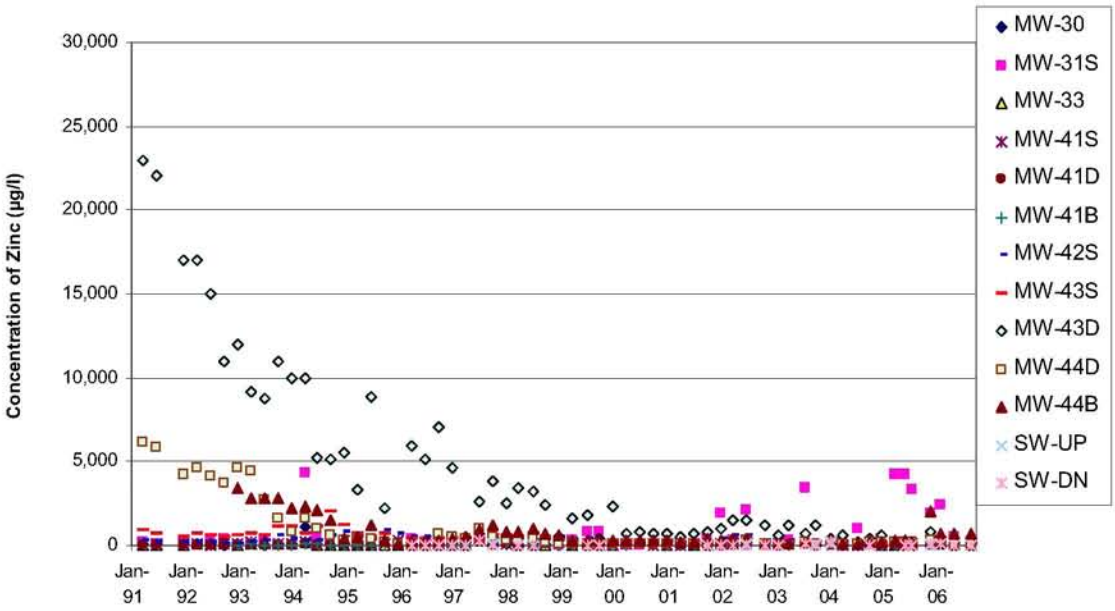

Figure VI-1. Historical ground water concentrations of zinc in monitoring wells

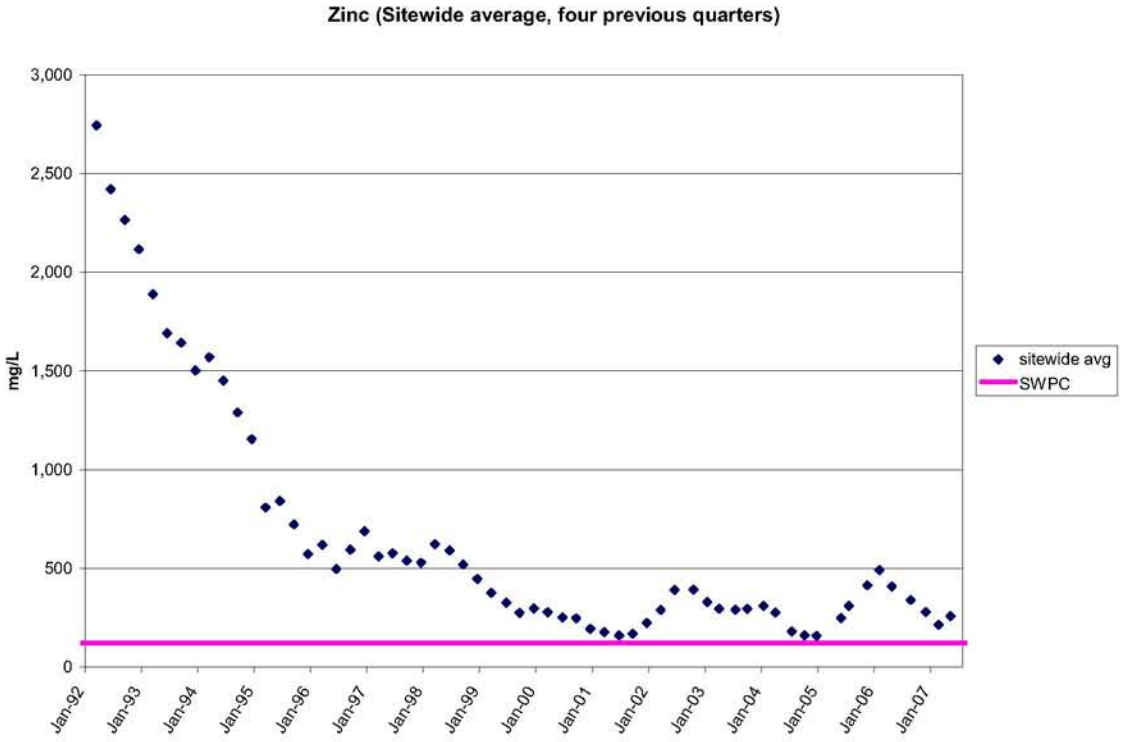

Figure VI-2. Historical site-wide average zinc concentrations in ground water

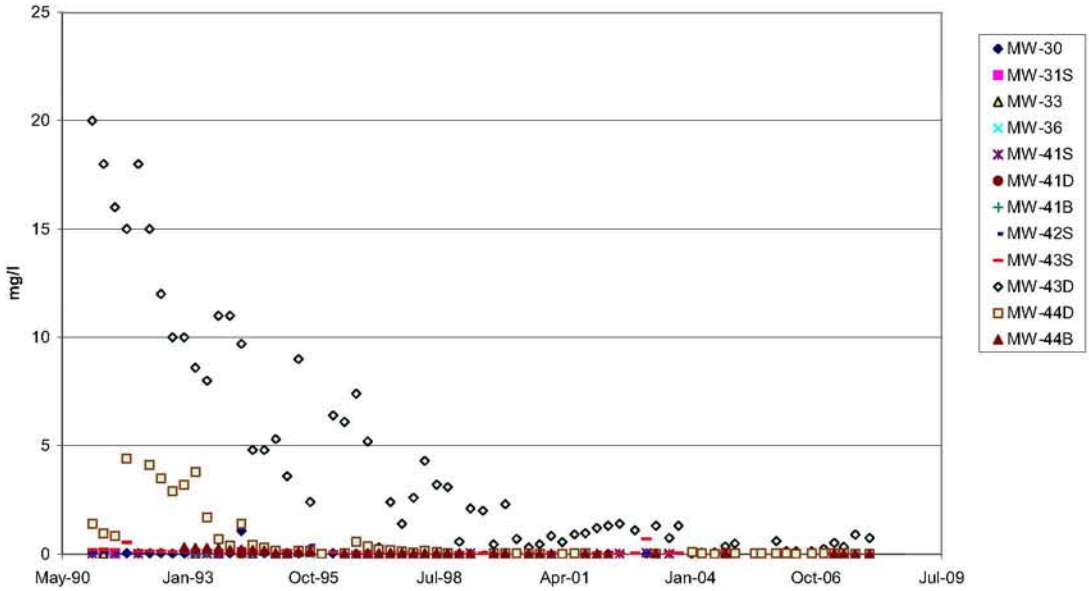

Figure VI-3. Historical ground water concentrations of copper in monitoring wells

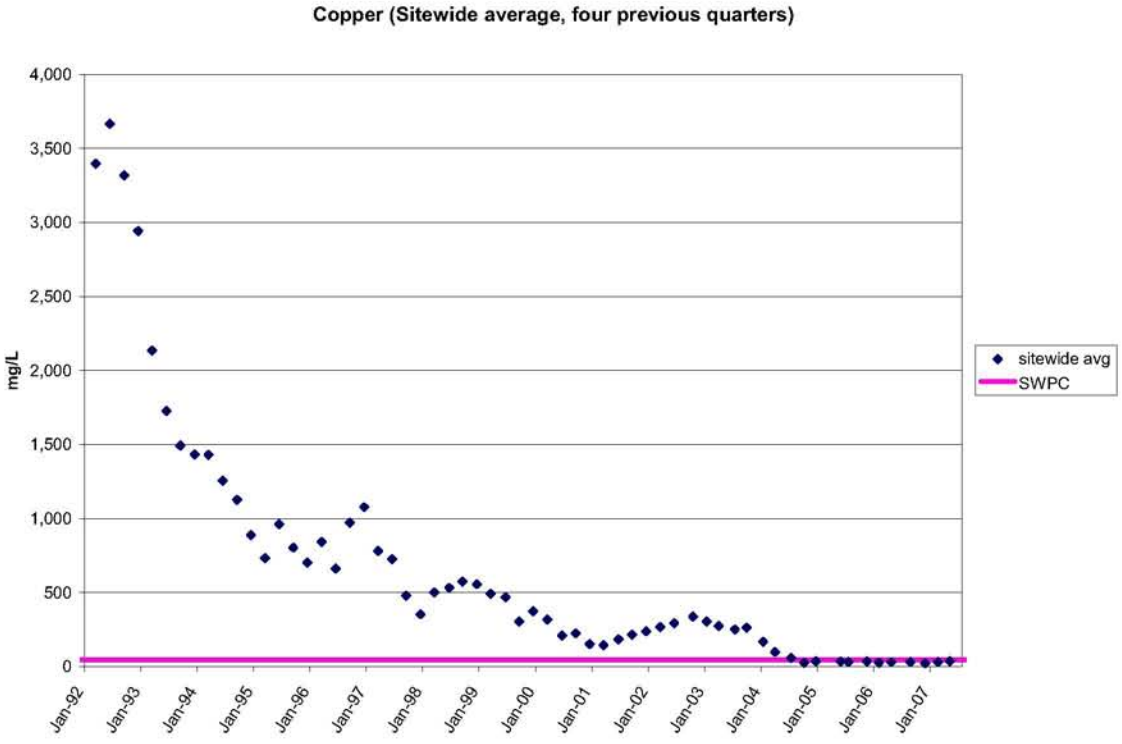

Figure VI-4. Historical site-wide average copper concentrations in ground water