Final

Screening-Level Ecological Risk Assessment TNT Area A to Waste Water Treatment Plant No. 1 Sewer Lines

Plum Brook Ordnance Works, Sandusky, Ohio

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Table of Contents

Page

Table of Contents *(Continued)*

Page

List of Appendices

List of Tables

List of Figures

List of Acronyms

ARP	assessment receptor profile
AUF	area use factor
BAF	bioaccumulation factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BSC	background screening concentration
COPEC	chemical of potential ecological concern
CT	central tendency
D&M	Dames and Moore, Inc.
DERP-FUDS	Defense Environmental Restoration Program-Formerly Used Defense Sites
DNT	dinitrotoluene
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESV	ecological screening value
HQ	hazard quotient
IAEA	International Atomic Energy Agency
IT	IT Corporation
K_{ow}	octanol-water partition coefficient
LOAEL	lowest-observed-adverse-effect level
MDC	maximum detected concentration
MDL	method detection limit
mg/kg	milligrams per kilogram
NASA	National Aeronautics and Space Administration
NOAEL	no-observed-adverse-effect level
NWI	National Wetland Inventory
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbons
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl
RI	remedial investigation
RME	reasonable maximum exposure
Shaw	Shaw Environmental, Inc.

List of Acronyms (continued)

SLERA	screening-level ecological risk assessment
SVOC	semivolatile organic compound
TNT	trinitrotoluene
TNTA	TNT Area A
TNTB	TNT Area B
TNTC	TNT Area C
TP	Test Pit
TRV	toxicity reference value
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WRS	Wilcoxon rank sum
WWTP1	Waste Water Treatment Plant 1

Executive Summary

A screening-level ecological risk assessment was performed to provide an estimate of current and future ecological risks associated with potential hazardous substance releases with the TNT Area A (TNTA) to Waste Water Treatment Plant 1 (WWTP1) sewer lines site at Plum Brook Ordnance Works in Sandusky, Ohio. The results of the screening-level ecological risk assessments contribute to the overall characterization of the site and serve as part of the baseline used to develop, evaluate, and select appropriate remedial alternatives, if necessary. The primary objective of the assessments was to determine the potential for unacceptable risks to ecological receptors as a result of exposure to chemicals detected at the site. This objective was met by characterizing the ecological communities in the vicinity of the site, determining the particular hazardous substances being released from the site, identifying pathways for receptor exposure, and estimating the magnitude and likelihood of potential risk to identified receptors. The assessment addresses the potential for adverse effects to the vegetation, wildlife, aquatic life, and endangered and threatened species.

Vegetative communities at the site were classified during several site reconnaissance trips. The TNTA/WWTP1 sewer lines site is a sewer line trace encompassing approximately 3 acres that primarily underlies an open upland old field and wet meadow in an approximately triangle-shaped area between WWTP1 and TNTA. One area of wet meadow approximately 200 feet east of Taylor Road and 500 feet north of Maintenance Road is classified as a wetland. The sewer line trace also crosses Plum Brook near its western terminus. Vegetative stress attributable to chemicals was not observed at the site during site reconnaissance trips. A northern harrier was spotted foraging over the TNTA/WWTP1 sewer lines site. Northern harriers are a state-endangered species in Ohio. No other state- or federally listed species were identified at TNTA/WWTP1 sewer lines. Based on the site reconnaissance information, there was no indication that ecological threats exist at the site, as there was no definitive absence of biota or animal life in areas expected to support these ecological components.

The maximum detected concentrations of chemicals detected in sampled media were compared with risk-based screening ecotoxicity values during an initial screening step. Chemicals that exceeded the screening values (or for which no screening values were available) and that failed additional screening criteria (e.g., comparison with background data, nutrient status, frequency of detection, etc.) were retained as chemicals of potential ecological concern (COPEC) and assessed further. The background screening protocol, which is based on Plum Brook Project Delivery Team agreements, differs somewhat from the current Ohio Environmental Protection Agency

guidance. For the TNTA/WWTP1 sewer lines, 16 chemicals in soil and 1 chemical in sediment were identified as COPECs for further evaluation. No chemicals were detected in surface water. Ninety-five percent upper confidence limits were calculated for concentrations of these chemicals (as appropriate) and selected as their exposure point concentrations during the subsequent stages of the risk assessment.

Eight representative receptor species that are expected to potentially reside at the site were selected as indicator species for estimating the potential effects of the COPECs. The eight species selected were the deer mouse, short-tailed shrew, Eastern cottontail rabbit, marsh wren, white-tailed deer, raccoon, red-tailed hawk, and muskrat. The raccoon and muskrat were evaluated for semiaquatic or aquatic exposure.

The assessment endpoints for the site were the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, and omnivorous aquatic mammals. Measurement assessment endpoints, or measurable responses to stressors, included lowest-observed-adverse-effect levels and no-observed-adverse-effect levels, collectively termed toxicity endpoint values.

Measurable responses to stressors, collectively termed toxicity reference values, were selected as measurement endpoints. The most appropriate measurement endpoints were chosen based on exposure pathways as well as ecotoxicity of the contaminant. An exposure analysis combining the spatial and temporal distribution of the assessment receptors and the COPECs was performed to evaluate potential exposure. The focus of the analysis was dependent on the assessment receptors evaluated and the assessment and measurement endpoints.

The intake estimates were combined with the toxicity reference values to derive estimates of potential adverse ecological effects. The uncertainties associated with the estimation of potential adverse ecological effects were identified, with the degree of uncertainty estimated qualitatively or quantitatively and the impact of the uncertainty estimated qualitatively (overestimate or underestimate, as appropriate).

Risk characterization integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. The result is an estimate of the likelihood, severity, and characteristics of adverse effects to ecological receptors resulting from exposure to environmental stressors present at the site. Qualitative and semiquantitative approaches were taken to estimate the likelihood of adverse effects occurring as a result of exposure of the selected site receptors to chemicals.

For the semiquantitative predictive assessment, toxicity reference values and exposure rates were calculated and used to generate hazard quotients by dividing the receptor exposure rate for each chemical by the calculated toxicity reference values. Hazard quotients are a means of estimating the potential for adverse effects to organisms at a contaminated site and for assessing the potential for toxicological effects to occur.

For soil, terrestrial invertebrates and plants may have slightly elevated hazard based upon the exceedance of ecological benchmarks. Ecological hazard from soil was primarily evaluated using food chain models for the selected terrestrial assessment receptors (i.e., deer mouse, short-tailed shrew, Eastern cottontail rabbit, marsh wren, white-tailed deer, raccoon, and red-tailed hawk). The red-tailed hawk was evaluated using only the more conservative no-effect toxicity reference values to achieve a higher level of protection for the species it represents, the state-endangered northern harrier. Aroclor 1016 (marsh wren), 1,3,5-trinitrobenzene (marsh wren), and 2,4,6-trinitrotoluene (TNT) (deer mouse, short-tailed shrew, cottontail rabbit, and marsh wren) in soil exceeded the threshold hazard quotient (HQ) of 1 at the TNTA/WWTP1 sewer lines. Uptake into terrestrial invertebrate prey items was the critical exposure pathway for these three chemicals. Based on comparisons of the modeled uptake factors of these three chemicals to empirical site-specific factors based on data collected at the installation for other organic compounds, uptake into terrestrial invertebrates was likely overestimated for Aroclor 1016, 1,3,5-trinitrobenzene, and 2,4,6-TNT. Further, only 1 out of 15 soil samples exceeded Aroclor 1016's conservative value, suggesting a very small potentially affected area, and for 1,3,5-trinitrobenzene, the only HQ exceedance was based on a no-effect toxicity level, which is highly conservative. Therefore, the potential for these two chemicals in soil to adversely affect ecological receptors is considered to be very low. 2,4,6-TNT was detected at elevated concentrations in two areas, Test Pit (TP) 33 and TP-27. Further sampling indicated that only one of these areas, TP-27, represents a hot spot of elevated concentrations. The impacted area within this hot spot is very small (approximately 0.04 acre), which reduces its potential to be a threat to local populations of ecological receptors. Therefore, the potential for adverse ecological impacts associated with 2,4,6-TNT is also considered to be low at this site; however, localized impacts of 2,4,6-TNT exposure to ecological receptors in the vicinity of TP-27 cannot be discounted. As previously noted, uptake of 2,4,6-TNT into terrestrial invertebrates was likely overestimated in the food chain models. A comparison of the site-specific uptake factor for the similar compound 2,4-dinitrotoluene (DNT) with the modeled uptake for 2,4,6-TNT reveals that the soil-to-invertebrate uptake was overestimated by approximately two orders of magnitude. If the HQs for 2,4,6-TNT are recalculated using the 2,4-DNT uptake factor as a surrogate, only the deer mouse and the cottontail rabbit HQs based on no-effect toxicity values exceed 1.

For sediment, benthic invertebrates may have slightly elevated hazard based upon the presence of one chemical (Aroclor 1254) at concentrations greater than its ecological benchmark. Ecological hazard from sediment was primarily evaluated using a food chain model for the selected aquatic assessment receptors (i.e., the raccoon and muskrat) at the TNTA/WWTP1 sewer lines. Based on the food chain model results, the aquatic receptors were not predicted to have elevated hazards from exposure to chemicals in sediment at the site.

Based on the findings of the screening-level ecological risk assessment, the potential for adverse effects to populations of ecological receptors exposed to chemicals in soil, surface water, and sediment at the TNTA/WWTP1 sewer lines is expected to be low, although localized impacts in the vicinity of TP-27 associated with exposure to 2,4,6-TNT in soil cannot be discounted. However, the area affected (0.04 acre) is likely too small to adversely affect ecological populations or communities at the site. Therefore, no chemicals at this site are recommended for further evaluation for ecological purposes alone.

1.0 Introduction

This screening-level ecological risk assessment (SLERA) evaluates the potential for adverse effects posed to ecological receptors from potential releases at the TNT Area A (TNTA) to Waste Water Treatment Plant 1 (WWTP1) sewer lines at the former Plum Brook Ordnance Works (PBOW). This SLERA was performed as described in the work plan for this site (Shaw Environmental, Inc. [Shaw], 2010a), with some modifications made to accommodate current practices in the field of ecological risk assessment. This document is consistent with the ecological risk assessment process described in U.S. Environmental Protection Agency (EPA) guidance (e.g., EPA [1997]), Ohio Environmental Protection Agency (OEPA) Division of Emergency and Remedial Response (OEPA, 2008) guidance, as well as with the procedures established in previous ecological risk assessments performed at PBOW (e.g., IT Corporation [IT], 2001a; Shaw, 2010b).

This work is being conducted by Shaw for the U.S. Army Corps of Engineers (USACE) under the Defense Environmental Restoration Program-Formerly Used Defense Sites (DERP-FUDS) and managed by the USACE Huntington District, with technical oversight provided by the USACE Nashville District. The TNTA/WWTP1 sewer lines are administered under the DERP-FUDS program as part of WWTP1, which is administratively grouped with Waste Water Treatment Plant No. 3 to comprise DERP-FUDS Project No. G05OH00187.

1.1 Facility Description and Location

PBOW is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland (Figure 1-1). Although located primarily in Perkins and Oxford Townships, the eastern edge of the facility extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by Patten Tract Road, and on the east by U.S. Highway 250. The areas surrounding PBOW are mostly agricultural and residential. The facility is currently surrounded by a chain-link fence, and the perimeter is regularly patrolled. Access by authorized personnel is limited to established checkpoints. Public access is restricted. Hunting is allowed by permit on portions of PBOW during the annual deer hunting season.

1.2 Facility History and Background

The PBOW facility was constructed on property comprising 9,009 acres in early 1941 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), and pentolite (USACE, 1995). Production of explosives at PBOW began in December 1941 and continued until 1945. It is estimated that more than 1 billion pounds of nitroaromatic explosives were manufactured during the 4-year operating period. The three explosive manufacturing areas were designated TNTA, TNT Area B (TNTB), and TNT Area C. Twelve process lines were used in the manufacture of TNT, including four lines at TNTA, three lines at TNTB, and five lines at TNTC.

After plant operations ceased, the manufacturing process lines were decontaminated by the War Department in late 1945. During decontamination, all structures, equipment, and manufacturing debris were either removed and salvaged or removed and burned. After decontamination, 3,230 acres of the property were initially transferred to the Ordnance Department, then to the War Assets Administration after it was certified by the U.S. Army to be decontaminated. In 1949, PBOW was transferred to the General Services Administration. This transfer did not include the Plum Brook depot areas, which consist of approximately 2,800 acres. The Department of the Army reacquired the 3,230 acres in 1954 and performed remedial efforts from the mid-1950s until 1963. In 1955, the Army completed further decontamination of manufacturing process lines. This effort included removal of contaminated surface and subsurface soil around the building and wooden and ceramic waste disposal lines containing TNT. Thousands of pounds of TNT were discovered in catch basins; this TNT was removed and burned at the burning grounds.

Two property use agreements were entered into by the Army and the National Advisory Committee of Aeronautics, the predecessor of the National Aeronautics and Space Administration (NASA), in 1956 and 1958, respectively. Accountability and custody of the entire portion of the former PBOW property (6,030 acres) that had been under the accountability and custody of the Department of the Army were transferred to NASA on March 15, 1963. NASA performed further decontamination efforts during 1964. The NASA decontamination process included removing contaminated surface soil above the drain tiles, flumes, etc.; destruction of all buildings by fire; and removal of all soil, debris, sumps, and above-grade portions of concrete foundations. Portions of the concrete foundations located below grade were left buried, and some that had been previously slightly above grade were likewise buried. All materials, including the soil in those areas, were flashed. The area was then rough-graded. The decontamination process was also to have included the burning of excavated nitroaromatic-filled flumes (Dames and Moore, Inc. [D&M], 1997).

NASA has operated and maintained the former PBOW property since 1963, and the facility is currently the NASA Glenn Research Center, Plum Brook Station. NASA operates the property as a space research facility in support of their John Glenn Research Center at Lewis Field, Cleveland, Ohio. Most of the aerospace testing facilities built in the 1960s at the facility are currently on standby or inactive status. On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. The Perkins Township Board of Education acquired 46 acres of the excess acreage and uses this area as a bus transportation area. The General Services Administration retains ownership of the remaining excess acreage and currently has a use agreement with the Ohio National Guard for 604 acres of this land. NASA currently controls approximately 6,400 acres. The details of land transactions are listed in the *Site Management Plan* (USACE, 1995).

1.3 TNTA/WWTP1 Sewer Lines Description and History

During TNT production in the 1940s, three waste water treatment plants were used to process production waste water from the three TNT manufacturing areas at PBOW. The wastes were accumulated in the settling basins of the TNT manufacturing areas. These wastes were transported to the waste water treatments plants via above- and below-ground wood stave sewer lines (USACE, 1995). The purpose of the treatment plants was to reduce the volume of waste water discharged from each of the manufacturing areas prior to incineration or disposal into the waste water ponds (i.e., West Area Red Water Pond and Pentolite Road Red Water Ponds). The waste water that was transferred and received from TNT manufacturing areas consisted of spent sulfuric and nitric acids and red water from the TNT purification process. Chemicals in the waste streams included sodium salts of sulfite, sulfate, nitrite, and nitrate; sulfonates of unwanted TNT isomers; trinitrobenzoic acid; trinitrobenzaldehyde; trinitrobenzyl alcohol; nitrotoluenes; and DNTs (D&M, 1996).

The waste water treatment plants were denoted WWTP1, Waste Water Treatment Plant 2, and Waste Water Treatment Plant 3. WWTP1 received waste water from TNTA to the east and from TNTB to the south. This SLERA evaluates the two sewer lines extending from the TNTA settling tanks to WWTP1. One line was a 4-inch-diameter line that extends due west from the TNTA settling basins (Building 187) for approximately 2,700 feet before angling southwest to WWTP1. A 1944 drawing indicates that a roughly 500-foot section of this wood stave line, just west of Taylor Road, is 4 inches in diameter. The other sewer line, 6 inches in diameter (or 5 inches, according to some sources), extended directly west-southwest from the TNTA settling basins for approximately 3,800 feet to WWTP1. Both lines are depicted on Figure 1-2. The evaluated area includes the sewer line traces and adjacent soil. Assuming the potentially affected area from sewer line releases extends perpendicular to the sewer line 10 feet in both directions, the sewer line traces comprises approximately 3 acres. Wood stave pipes were constructed of small wood slats (i.e., staves) joined together in a tongue-and-groove fashion and reinforced with steel banding. Use of wood stave pipes was not uncommon for water and sewage conveyance from the late 1800s until the 1950s (Shaw, 2008).

During PBOW operations, the sewer lines reportedly often became clogged with TNT residue, and in some instances were completely plugged. The plugged lines were abandoned, and larger-diameter bypass sewer lines were constructed around the blocked areas to provide continual drainage of the waste water (USACE, 1995). No definitive information regarding the TNTA/WWTP1 sewer lines could be found, although one historical drawing indicated that the northern line plugged and was replaced with the southern line. No intact former sewer lines were encountered at any of the test pit excavations, but metallic banding, terracotta piping pieces, and wood stave fragments were uncovered (Shaw, 2012).

During their site investigation activities, D&M (1997) reported that approximately 1,050 feet of the WWTP1 sewer line leading due west from the TNTA settling basins were removed and burned. It was also reported by D&M (1997) that the 6-inch wooden WWTP1 sewer line which extends several thousand feet west-southwest of the TNTA settling basins was intact.

No previous investigations concerning the TNTA/WWTP1 sewer lines have been conducted at PBOW. Review of aerial photographs indicates limited portions of the TNTA/WWTP1 sewer line trace are still visible based on ground scarring. Site walks conducted in the spring of 2009 confirmed linear depressions in the ground surface. During the 2009-2011 investigation, only small pieces of intact sewer line (e.g., several inches long) were observed, as were miscellaneous pieces of metal banding which had held the staves together (Shaw, 2012). No intact sewer line was found west-southwest of the site or anywhere else. Because the observed small pieces of wood stave lines were very well preserved, it is apparent that the wood stave sewer lines were previously removed and that their absence is not due to deterioration. Thus, it is likely that the majority of any residual contamination within the sewer lines was likewise removed during sewer line removal. The linear depressions are apparently the result of the backfill settling along the sewer line traces.

Remedial investigation (RI) activities were conducted by Shaw for the TNTA/WWTP1 sewer lines from December 2008 through November 2010. Field activities included a geophysical survey; test pit excavation; test pit soil sampling; direct-push drilling; direct-push soil and groundwater sampling; temporary piezometer installation; surface water and sediment sampling; permanent monitoring well installation in upgradient, source area, and downgradient locations; two rounds of groundwater sampling from the newly installed wells (one in the PBOW wet season and one in the dry season); surveying of sample locations; and investigation-derived waste management. Additional soil sampling was performed in 2011 to delineate elevated levels of nitrotoluenes discovered during earlier sampling events.

1.4 Scope and Objectives

The objective of this SLERA is to provide an estimate of the potential for adverse ecological effects associated with contamination resulting from former PBOW activities at the TNTA/WWTP1 sewer lines. The results of the SLERA will contribute to the overall characterization of the site and may be used to determine the need for additional investigations or to develop, evaluate, and select appropriate remedial alternatives. Guidance documents used to perform the SLERA include the general guidelines of the *Tri-Service Procedural Guidelines for Ecological Risk Assessments* (Wentsel, et al., 1996), *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1997), *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Guidance Bulletin No. 1* (EPA, 1996a), and *Ecological Risk Assessment Guidance Document* (OEPA, 2008). The SLERA fits into Steps 1 and 2 of the ecological risk assessment guidance for Superfund process (EPA, 1997), and Level I through a maximum of Level III evaluation using the OEPA (2008) process.

The goal of the SLERA is to evaluate the potential for adverse ecological effects to ecological receptors from site-related contaminants at the TNTA/WWTP1 sewer lines. This objective is met by characterizing the ecological communities in the vicinity of the site, determining the particular contaminants present, identifying pathways for receptor exposure, and estimating the magnitude of the likelihood of potential adverse effects to identified receptors. The SLERA addresses the potential for adverse effects to the vegetation, wildlife, aquatic life (e.g., sediment-dwelling organisms), threatened and endangered species, and wetlands or other sensitive habitats associated with the site.

Concentrations of chemicals measured in relevant environmental media were used to perform a SLERA, which includes a problem formulation (Chapter 2.0); exposure characterization (Chapter 3.0); ecological effects characterization (Chapter 4.0); risk characterization (Chapter 5.0); and summary and conclusions and recommendations (Chapter 6.0). These subtasks are described in greater detail in the following sections.

The chemicals of potential ecological concern (COPEC), the ecosystems and receptors at risk, the ecotoxicity of the contaminants known or suspected to be present, and observed or anticipated ecological effects are evaluated in this SLERA. This evaluation is conducted in two steps: (1) a screening assessment step and (2) a predictive assessment step. Ecological endpoints to be addressed in both steps are identified. The results and conclusions of the screening assessment determine whether a predictive assessment is needed. The criteria by which the need for a predictive assessment is measured are formalized as null hypotheses to be accepted (in which case a predictive assessment is not needed) or rejected (in which case a predictive assessment is needed).

2.0 Problem Formulation

The screening assessment null hypotheses are stated as follows:

- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of viable habitat for potential ecological receptors.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential ecological receptors.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential exposure pathways.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential chemical stressors.

If one or more of these null hypotheses are accepted, a predictive assessment is not triggered. All four null hypotheses must be rejected for a predictive assessment to be triggered. The first three null hypotheses are tested with the results of the ecological site description, the pre-assessment reconnaissance, the documentation of potential receptors of special concern and critical habitats, and the determination of significant ecological threats (Section 2.1). The fourth null hypothesis is tested with the results of COPEC selection (Section 2.2).

If a predictive assessment is triggered, terrestrial and aquatic ecological conceptual site models are developed, as appropriate, and additional problem formulation tasks are performed as described in Sections 2.3 through 2.5.

2.1 Ecological Site Description

This ecological site description section includes a general discussion of site background and the area of concern, surface water resources, wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area was based on a compilation of existing ecological information and site reconnaissance activities. A photographic record was made during the site reconnaissance visits (Figure 2-1). Information on the presence of state- and federally listed threatened and endangered species, species of special concern, and wildlife and fisheries resources was obtained. A botanist searched for threatened and endangered plant species. A checklist of biological species present at the site was developed using existing site investigation reports, environmental data sources mentioned previously, and information gathered during the site reconnaissance. Information on unique and special-concern habitats, preserves, wildlife refuge parks, and natural areas within the general vicinity was also obtained.

2.1.1 General Site Background

PBOW, approximately 6,400 acres in size, is located within the Eastern Lake Plains physiographic region of the Eastern Huron/Erie Lake Plain Ecoregion (Lafferty, 1979; Omernik, 1986). This region is generally characterized as containing flat plains as the predominant land-surface form and as having a dominant natural vegetation of elm and ash in undisturbed areas. Approximately two-thirds of Erie County was once covered by a glacial lake that produced features such as beach ridges and wave-cut cliffs. Much of the region is poorly drained due to the flat topography and low stream gradients. Many of the wetlands adjacent to Lake Erie in this region have been preserved by various federal, state, and private organizations (Peterjohn and Rice, 1991), thereby providing important wetland habitat for wildlife.

Across PBOW, the land slopes gently to the north-northeast towards Lake Erie. Elevations range from 675 feet above mean sea level at the southwest edge of the site to 625 feet above mean sea level in the northern portion of the property at Bogart Road, resulting in an average slope of approximately 0.3 percent. The Lake Plains region itself is over 69 percent cropland, 2.7 percent pasture land, and 10.5 percent forest (Ohio Department of Natural Resources [ODNR], 1985). However, since the U.S. Army acquired the site in 1941 and removed the land from agricultural production, undeveloped portions of the former PBOW have become second-generation forest and open fields. This has resulted in PBOW becoming an island of forest and open fields within a sea of agricultural land in north-central Ohio.

The TNTA/WWTP1 sewer lines consist of the two sewer line traces that connect the TNTA settling basins with WWTP1. One line extends due west from the TNTA settling basins for approximately 2,700 feet before angling southwest to WWTP1. The other sewer line extended directly west-southwest from the TNTA settling basin for approximately 3,800 feet to WWTP1. The topography along the sewer line trace is quite flat and has little gradient.

Five site reconnaissance visits were performed by Shaw ecologists in the spring, early summer, and late summer/early fall of 2009; late summer/early fall of 2010; and late summer/early fall of 2011. A photographic record of the site was prepared and is presented on Figure 2-1. Prior to arrival at the site, Shaw personnel obtained relevant information on the site, including topographic, township, county, or other appropriate maps, and determined the location of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. Additionally, biological inventories performed at PBOW in 1994 and 2001 (ODNR, 1995; NASA, 2002) that identify and indicate the locations of threatened and endangered species at the installation were reviewed. Shaw personnel completed a checklist similar to EPA's checklist for ecological assessment/sampling (EPA, 1997), and information from this checklist was used to complete Chapter 2.0. The location of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Shaw personnel also used the reconnaissance to search for any indication of potential effects from contaminant release.

2.1.2 Surface Water

PBOW lies in the eastern region of the Pickeral Creek-Pipe Creek Basin, which is part of the St. Lawrence River drainage basin (D&M, 1997). Eleven streams exist within PBOW and flow north-northeast toward Lake Erie, which is located approximately 3.5 miles north of the site. The site is part of four drainage areas: 1) Sawmill Creek (southern PBOW), 2) Plum Brook (central PBOW), 3) Pipe Creek (western PBOW), and 4) Storrs-Hemminger Ditch (north-central PBOW). Surface water of the TNTA/WWTP1 sewer lines site drains to two different PBOW creeks. Water of the western portion of the lines is interpreted to drain toward Plum Brook, while the majority of the water is thought to drain toward a small creek in the south portion of the site that drains into Lindsley Ditch. The TNTA/WWTP1 sewer lines traces cross Plum Brook in the western portion of the site, near WWTP1 (Figure 1-2; Figure 2-1, Photos 9 and 10). Surface water is typically present in Plum Brook. Other, shallower drainage channels that typically only contain water after significant rain events are present near the eastern and western boundaries of the site (see Photo 8 on Figure 2-1 for an example).

2.1.3 Wetlands

According to the National Wetland Inventory (NWI) Maps for the area (U.S. Fish and Wildlife Service [USFWS], 2011), the TNTA/WWTP1 sewer line traces do not intersect any designated wetlands. An area in the open field between the two sewer line traces, approximately 200 feet east of Taylor Road and 500 feet north of Maintenance Road, is classified as a palustrine, emergent, seasonally flooded wetland. It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes (such as PBOW), because minor depressions often contain isolated wetlands not easily identified through aerial photograph interpretation (the process used by the USFWS in preparing NWI maps). Two low-lying wet meadow areas that supported wetland indicator plant species were identified in the field between the sewer line traces during the ecological site reconnaissance visits as well (Figure 2-2). The wet meadow area further to the west roughly overlaps the NWI wetland. This area is also significant because one of the areas where elevated 2,4,6-TNT was identified may fall within this area. NASA is currently performing a wetland delineation study at PBOW that will more accurately identify the locations and extent of sensitive wetland habitat throughout the installation.

2.1.4 Vegetative Communities

Vegetative communities at the site were classified during the site reconnaissance trips. The early summer site vegetation trip occurred on June 2, 2009. The site was visited three times for the late summer vegetation survey, on September 9, 2009, September 8, 2010, and September 1, 2011. NASA personnel have indicated that the management goal for this area is to re-introduce a native prairie ecosystem on this parcel of land through management practices (PBOW, 2010). A controlled burn was instigated by NASA in the field between Taylor Road and Columbus Avenue in the spring of 2009 in order to encourage the growth of a prairie ecosystem, which relies on a regular burn cycle to stimulate seed germination and to eliminate invasive species that out-compete prairie species for sunlight and other resources. Prairie communities consist primarily of grasses and forbs, and the individual species that comprise prairie communities have a great amount of temporal variation in their flowering schedule, with some species flowering early in the growing season and others flowering much later in the season. Therefore, the late summer ecological visit in 2009 was intended to identify grasses and forbs that may not have been noticeable earlier in the growing season. However, the TNTA/WWTP1 area was mowed in 2009, immediately prior to the scheduled late summer vegetation survey (Photo 3 on Figure 2-1). The vegetation survey was performed anyway, but a second late summer reconnaissance was performed in September of 2010, which was anticipated by site wildlife biologists to be the first year following the controlled burns that the full prairie vegetation assemblage would be expressed. However, site personnel had mowed the area again (Photo 4 on Figure 2-1). Because of the less-than-ideal conditions of the first two late summer vegetation surveys, a third late summer vegetation survey was attempted in 2011. Although the site had not been mowed recently, it appeared that it had been mowed earlier in the year. During this survey, it was noted that most of the prairie indicator species that had been observed during some of the previous trips to the site had been replaced by ruderal/invasive species, and the vegetation communities were more accurately described as “old field” rather than “prairie” the last time the site was observed. Figure 2-2 presents a map of the vegetation communities at the TNTA/WWTP1 sewer lines, including the triangular field in between the sewer line traces.

A list of the plant species identified at the TNTA/WWTP1 sewer lines is presented in Table 2-1. During the site reconnaissance, the study area was examined for vegetative stress, including a search for plants displaying stunted growth, poor foliage growth, tissue discoloration, and a loss of leaf coverage. Vegetative stress attributable to chemicals was not observed at the TNTA/WWTP1 sewer lines, although the mowing activities had removed most of the above-ground vegetation present during the 2009 and 2010 late summer vegetation surveys. Based on site reconnaissance information, the TNTA/WWTP1 sewer lines area consists of a relatively undisturbed parcel of old field habitat that is capable of supporting ecological receptors. There was no evidence that significant ecological threats exist at the site.

2.1.5 Species Inventory

Based on information from ODNR (1995) and collected during the site reconnaissance, species lists were prepared for plants, mammals, birds, reptiles, amphibians, and fish (Tables 2-1 through 2-6). Unless noted on the tables, the species listed in Tables 2-1 through 2-6 apply to the former PBOW as a whole and are not necessarily specific to the TNTA/WWTP1 sewer lines.

The 170 plant species documented at the TNTA/WWTP1 sewer lines during the spring and fall vegetation surveys (Table 2-1) comprise approximately 41 percent of the total number of species documented at the installation either during the 1994 biological inventory (ODNR, 1995) or during vegetation surveys at other sites at the former PBOW (Appendix A).

Based on species range maps that were available, a total of 43 species of mammals may be found in the region, signs or evidence of four of which were observed at the site (Table 2-2). It is likely that other species are present but were not observed due to the short duration of the field visits.

A total of 130 species of birds are likely to be found in the region based on species range maps and field observations, and 105 species have been recorded at the former PBOW by ODNR during their multiyear studies (Table 2-3). PBOW lies within a major migratory corridor that is used by birds traveling between their southern wintering grounds and their breeding grounds in Canada. Of the species recorded by the ODNR, 49 are neotropical migrants and would not be expected to nest at the former PBOW. A bird survey was performed at the site during migratory and nesting periods as part of the site reconnaissance activities. Twenty-two bird species were documented at the TNTA/WWTP1 sewer lines during the site visits performed by Shaw, and 18 of these were identified as being present during the breeding season. One of the species identified at the site was a northern harrier (*Circus cyaneus*), which is a state-listed endangered species. This species was observed during both the spring and early summer surveys and likely breeds at or near the site.

Of the 14 species of reptiles that may be found in the region based on species range maps, 10 species (71 percent) have been observed at the former PBOW, including turtles and snakes (ODNR, 1995; Table 2-4). A reptile/amphibian survey was not performed at the site; however, a snapping turtle (*Chelydra serpentine*) was observed in the ditch adjacent to Columbus Avenue near the eastern terminus of the southern TNTA/WWTP1 sewer line trace during one of the fauna reconnaissance visits.

Of the 10 species of amphibians that may be found in the region based on species range maps, 9 species (90 percent) have been observed at the former PBOW (ODNR, 1995; Table 2-5), including salamanders, toads, and frogs. No amphibians were observed during the TNTA/WWTP1 sewer lines site reconnaissance.

According to ODNR (1995), a combination of electroshocking and seining was conducted during the field investigation that identified 14 species of fish at PBOW. Species observed included suckers, sunfish, minnows, sticklebacks, and bullheads (Table 2-6). Aquatic habitat sufficient to support fish populations at the TNTA/WWTP1 sewer lines site is limited to Plum Brook, which crosses the sewer lines trace near the western end of the site. A fish survey was not performed, and no fish were observed during site reconnaissance visits.

2.1.6 Threatened and Endangered Species Information

According to an Ohio Division of Natural Areas and Preserves review of their natural heritage maps and files (ODNR, 2010), there are records of State of Ohio threatened or endangered species within a 2-mile radius of the site (no species on the federal list were identified). These species include the following:

- Bushy aster (*Symphyotrichum dumosum*) - endangered
- Canada St. John’s wort (*Hypericum canadense*) – endangered
- Flat-leaved rush (*Juncus platyphyllus*) – endangered
- Rough rattlesnake-root (*Prenanthes aspera*) – endangered
- Ashy sunflower (*Helianthus mollis*) – threatened
- Dwarf bulrush (*Lipocarpha micrantha*) – threatened
- Field sedge (*Carex conoidea*) – threatened
- Greene’s rush (*Juncus greenei*) – threatened
- Slender spike-rush (*Eleocharis tenuis*) – threatened
- Southern hairy panic grass (*Panicum meridionale*) – threatened
- Thin-leaved sedge (*Carex cephaloidea*) – threatened
- Tufted fescue sedge (*Carex brevior*) – threatened
- Twisted yellow-eye-grass (*Xyris torta*) – threatened
- Upland sandpiper (*Bartramia longicauda*) – threatened.

In addition, based on information contained in ODNR (1995) and NASA (2002), several species of threatened or endangered plants, potentially threatened plants, and threatened or endangered birds have been recorded at PBOW, as follows (please note that the species status per the 1995 and 2002 species inventories provided below was verified in September 2011 using on-line State of Ohio threatened and endangered species resources. If the status of the species was different in 2011, that information is noted in parentheses):

- Grove sandwort (*Arenaria lateriflora*) – threatened (**not listed**)
- Purple triple-awned grass (*Aristida purpurenscens*) – potentially threatened
- Prairie false indigo (*Baptisia lactea*) - potentially threatened
- Broad-winged sedge (*C. alata*) - potentially threatened
- Round-fruited hedge-hyssop (*Gratiola virginiana*) - potentially threatened
- Tall St. John's wort (*H. majus*) - potentially threatened (**not listed**)
- Least St. John's Wort (*H. gymnanthum*) - endangered
- Rough pennyroyal (*Hedeoma hispidum*) – threatened (**potentially threatened**)
- Butternut (*Juglans cinerea*) – potentially threatened (**not listed**)
- Northern panic-grass (*Panicum boreale*) – threatened (**potentially threatened**)
- Virginia meadow beauty (*Rhexia virginica*) - potentially threatened
- Deer's tongue arrowhead (*Sagittaria rigida*) – threatened (**potentially threatened**)
- Tall nut rush (*Scleria triglomerata*) - potentially threatened
- Pale carrion flower (*Smilax herbacea*) – threatened (**not listed**)
- Lance-leaved violet (*Viola lanceolata*) - potentially threatened
- Cattle egret (*Bublucus ibis*) – endangered
- Bald eagle (*Haliaeatus leucocephalis*) – federally threatened (**state-threatened**)
- Black-crowned night heron (*Nycticorax nycticorax*) - threatened
- Trumpeter swan (*Cygnus buccinator*) - endangered
- Indiana bat (*Mytolis sodalis*) – endangered
- Moth, no common name (*Spartiniphaga inops*) – endangered.

The site reconnaissance performed at the TNTA/WWTP1 sewer lines as part of the current RI included detailed searches performed by a qualified botanist subcontractor during the June 2009 and September 2009, 2010, and 2011 site visits. Based on the results of the site reconnaissance, no threatened or endangered plant species were found at the TNTA/WWTP1 sewer lines.

None of the threatened or endangered bird species listed in the above list would typically be expected to be found at the TNTA/WWTP1 sewer lines. The cattle egret, trumpeter swan, and upland sandpiper are all considered rare visitors or migrants at the former PBOW (ODNR, 1995) and have not been documented nesting within 1 mile of the site (ODNR, 2010). Upland sandpipers have been historically documented as nesting approximately 2,000 feet to the southeast of TNTB/WWTP1 sewer lines (ODNR, 2010). However, breeding populations of this species are no longer present in this area (PBOW, 2010; NASA, 2002). The black-crowned night heron, an Ohio threatened species, is a regular visitor at ponds, streams, and ditches within the former PBOW; however, it does not nest at the former PBOW (ODNR, 1995; 2010). The species is typically found near water and wetlands, and since the early 1980s, there has been a nesting colony of approximately 100 pairs located on an island in Sandusky Bay, approximately 10 miles north northwest of the study area (Peterjohn and Rice, 1991).

As discussed in Section 2.1.5, a northern harrier was observed foraging over the grassy field at the TNTA/WWTP1 sewer lines site. The northern harrier is an Ohio endangered species. Harriers are long-winged, long-tailed hawks of open grassland or marshland and feed primarily on mice, other small mammals, and small birds. Northern harriers are migratory and have a large distribution in North America. Although populations throughout most of its range have remained relatively steady, harrier populations have declined in some areas in recent decades primarily due to the loss of their preferred habitat associated with wetland loss and changing farming practices.

The Indiana bat, the only mammal in the list, has not been documented at the site and is generally not expected at PBOW because its preferred habitat (e.g., caves along streams or trees with exfoliated bark) is not present at the TNTA/WWTP1 sewer lines. Trees with exfoliated bark, such as shagbark or shellbark hickory, are rare or not present at the site, respectively, thereby providing little bat roosting habitat (Appendix A).

With the exception of the Erie Sand Barrens State Nature Preserve, there are no existing or proposed state nature preserves or scenic rivers near the site, and ODNR is unaware of any unique ecological sites; geological features; breeding or nonbreeding animal concentrations; champion trees; or state parks, forests, or wildlife areas within a 2-mile radius of the site (ODNR, 2010). The Erie Sand Barrens State Nature Preserve is located southwest of PBOW. The 32-acre preserve is a remnant sand beach of Lake Warren, the fifth ancestral Lake Erie, that supports many threatened and endangered plant species such as field sedge, Least St. John's wort, dwarf bullrush, twisted yellow-eyed-grass, flat-leaved rush, bushy aster, and Virginia meadow beauty. Many of the preserve's rare plant species thrive in open windswept conditions such as those found on the sand barrens. The ODNR Division of Natural Areas and Preserves actively manages the preserve to ensure that the open wind-swept areas remain and do not become overgrown with woody vegetation.

2.1.7 Pre-Assessment Reconnaissance

As described in Section 2.1.4, Shaw ecological scientists performed site visits to the TNTA/WWTP1 sewer lines on April 29, June 2, and September 9, 2009; September 8, 2010; and September 1, 2011. The primary purpose of the April site visit was to perform a habitat assessment and fauna inventory at the site, and the visits were intentionally performed during the period when birds were migrating north to their breeding areas so that transient species could be observed. In early June, breeding birds are vocalizing as they establish and defend territories, while migrants that breed further to the north have moved on. A breeding bird survey was performed during the June site visit as a follow-up to the April visit to identify bird species that use the site during the breeding season. A vegetation survey (including threatened and endangered species) was also performed during the June site visit and again during the September site visits, when late-blooming species are more easily identifiable. Multiple September visits were performed due to the mowing of the open field area between the two sewer line transects (Section 2.1.4). The list of plant species observed during the early summer and fall site visits is presented in Table 2-1. The bird species observed at the TNTA/WWTP1 sewer lines are listed in Table 2-3.

Information obtained during the reconnaissance trips was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area. Reconnaissance personnel completed a checklist similar to that on EPA's checklist for ecological assessment/sampling (EPA, 1997) and OEPA's ecological risk assessment guidance (OEPA, 2008). The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visits to evaluate the site for more subtle clues of potential effects from contaminant release.

The methods used to characterize natural resources focused on aquatic and terrestrial resources at the site and within the immediate vicinity. General habitat maps showing the types and extent of vegetation communities present within the immediate vicinity of the site were prepared based on information collected during the site reconnaissance.

2.2 Selection of Chemicals of Potential Ecological Concern

A list of samples used for the TNTA/WWTP1 sewer lines SLERA is presented in Table 2-7, and sample locations are shown on Figure 2-3. Two general types of soil sampling were employed during the RI. Samples used for the SLERA consisted of soil, sediment, and surface water samples originally collected as part of the scoped RI sampling effort in 2008, supplemented with additional soil samples collected in 2009 through 2011. Two general types of soil sampling were employed during the RI: test pit sampling and direct-push sampling. The test pit samples were collected in December 2008 from 18 test pits excavated along and perpendicular to the sewer line trace. These were analyzed for nitroaromatics only. Each test pit sample was collected beginning at the base of the former sewer line (as interpreted from soil disturbance along the test pit walls associated with sewer line installation) to a depth of 0.25 foot to 0.5 foot below this interface. Direct-push soil samples were collected from 10 soil borings in January 2009 to augment the test pit soil results. These were analyzed for a more complete suite of chemicals, including metals, polychlorinated biphenyls (PCB), and semivolatile organic compounds

(SVOC). Additional soil samples were collected in 2010 and 2011 based on test kit results for nitroaromatics and to delineate elevated nitroaromatics detected in Test Pit (TP) 27 and TP-33, where 2,4,6-TNT was detected at concentrations of 3.35 and 1,380 milligrams per kilogram (mg/kg), respectively, in 2008. Although the TP-27 2,4,6-TNT concentration was relatively low (3.35 mg/kg), additional samples were collected from this area based on a reported 2,4,6-TNT concentration of 138 mg/kg in the surface soil sample from soil boring SL-SB12, which is located approximately 10 feet east of TP-27, along the sewer line trace. Eight composite soil samples were also collected in 2010 in areas offset by approximately 10 feet from the sewer lines. These composite samples were collected near test pit locations TP-27, TP-29, and TP-30. Because these samples were collected as composites, they were not used in the SLERA. Each of the composite sample areas were also characterized by grab samples, which were included in the risk assessment. Please see the site characterization report (Shaw, 2012) for additional details of the sampling efforts.

Sample SL-SB02 was collected in 2011 at the exact same location as TP-33 to try to replicate the high result. Because TP-33 and SL-SB02 were collected from the same sample location and depth, they were treated as duplicate samples in this SLERA. Two additional samples on the sewer line trace and in close proximity to TP-33 (SL-SB15 and SL-SB22) were collected to delineate the elevated concentrations horizontally. Six additional samples (SL-SB16 through SL-SB21) were collected from locations slightly offset from the sewer line to provide additional delineation. Because many of these samples were not collected for the purpose of identifying COPECs or estimating exposure concentrations to receptors in a risk assessment, the approach was adopted to include all soil samples (including the supplemental samples) that were collected along the transect in the SLERA, except for samples that were nondetect for nitrotoluenes, and that bounded another sample with nondetects. Such samples are considered to be from “clean” areas, and their inclusion in the data set could artificially lower estimated exposure concentrations. Also, delineation samples offset from the sewer line were not included in the SLERA data set either. The *a priori* hypothesis was that these samples would exhibit low or nondetect concentrations for explosives due to the low mobility of these samples, and their inclusion in the data set could also lower the estimated exposure concentrations. After chemical analysis, this was confirmed to be the case. A discussion of the analytical results of samples that were not included in the SLERA data set but that are within the relevant ecological depth interval (0 to 6 feet below ground surface [bgs], as discussed in Section 2.2.1) is provided in the uncertainty analysis (Section 5.2).

A similar approach was taken at sample location at TP-27, where 2,4,6-TNT was detected at a concentration of 3.35 mg/kg in 2008 at a depth of 3 to 3.5 feet bgs. Two surface soil (0 to 1 foot bgs) samples from location SL-SB05 were collected in 2010 and 2011 at the same location as TP-27. These two samples were treated as duplicate samples in the SLERA. Six additional samples (SL-SB23, SL-SB14, SL-SB12, SL-SB27, SL-SB30, and SL-SB32) were collected in 2011 along the sewer line trace, within 100 feet east and west of TP-27, to delineate the elevated concentrations along the sewer line trace. Eight additional samples (SL-SB13, SL-SB11, SL-SB24, SL-SB25, SL-SB26, SL-SB28, SL-SB29, and SL-SB31) were collected from locations slightly offset from the sewer line. These offset samples were not included in the SLERA because they were primarily collected for delineation purposes to determine if contamination had spread laterally from the sewer line, and the inclusion of the low detections and nondetections from these samples could nonconservatively "dilute" the 2,4,6-TNT concentrations in the rest of the data set. The samples placed on the sewer line trace were included in the SLERA, but SL-SB30 and SL-SB32 were not. These two samples were nondetect for 2,4,6-TNT and bounded another nondetect result at SL-SB27. SL-SB27 was included in the SLERA, but the other two samples were not, as it was judged that they might "dilute" the 2,4,6-TNT concentrations in the rest of the data set. The other two samples along the sewer line trace, SL-SB14 and SL-SB23, were included in the SLERA because SL-SB14 had detected concentrations of 2,4,6-TNT, and SL-SB23 was a nondetect sample bounding SL-SB14.

Sample locations are presented on Figure 2-3. The analytical data from the samples were evaluated using a COPEC selection process that resulted in a subset of detected chemicals that are not naturally occurring or associated with non-site-related sources. These chemicals are also present at sufficient frequency, concentration, and location to pose a potential risk to ecological receptors. Screening criteria that were used to identify COPECs are described in more detail in Section 2.2.3.

2.2.1 Data Organization

Chemical analytical data, as well as all previous and ongoing investigations, were reviewed and evaluated for quality, usefulness, and uncertainty. Data identified as being of acceptable quality for use in the SLERA were summarized in a manner that presents the pertinent information to be applied in the SLERA. Any data rejected during the data evaluation as a result of the data evaluation ("R"-qualified data) were identified along with the rejection rationale. Only validated data were used in the SLERA.

The data for each chemical were sorted by medium. For ecological impacts, soil from 0 to 6 feet bgs was used in the SLERA, including samples for which at least 50 percent of the sampling interval was below 6 feet bgs (e.g., soil samples collected at this site from a depth of 5 to 7 feet bgs were also included in the SLERA data set). Although the 0 to 6 feet depth interval encompasses soil at depths that are not typically experienced by many ecological receptors, the 0 to 6 feet depth interval was selected for three primary reasons: (1) to maintain consistency with other PBOW ecological risk assessments (e.g., IT [2001a]), (2) to include potential exposure to ecological receptors that may be exposed to deeper soil, and (3) to increase the size of the total soil database by including samples collected from depths up to 6 feet bgs. Chemicals that were not detected at least once in a medium were not included in the risk assessments. Available background data were determined for each medium. Potential sources of background information include data from previous and current investigations as well as monitoring wells in areas unaffected by site activities.

Some chemicals were evaluated using more than one analytical approach. In such cases, the data were reviewed and the results for only one of the analytical suites are selected. In this SLERA, 2,4-DNT and 2,6-DNT were analyzed and detected in soil using both the SVOC analytical method (Method 3540C/8270C) and the explosives analytical method (Method 3535/8330A). Using the explosives method, these DNT isomers were detected in 7 out of 39 and 5 out of 39 samples, respectively, compared with 6 out of 15 and 3 out of 15 samples using the SVOC method (Table 2-8). The SVOC method resulted in slightly lower (though comparable) reporting limits, and slightly higher (though comparable) maximum concentrations (Table 2-8). Samples that were analyzed for SVOCs were also analyzed for explosives; therefore, the data set composed of the 39 explosives samples provides greater coverage than the data set composed of the 15 SVOC samples for these compounds. For this SLERA, only the results for the explosives analysis were used for quantifying hazard to ecological receptors from the DNTs, because the greater coverage of the explosives samples provides a more accurate estimation of exposure. The potential for underestimating the ecological hazard to environmental receptors through the use of the slightly lower concentrations reported by the explosives method is discussed in the uncertainty analysis (Section 5.2).

The analytical data included qualifiers from the analytical laboratory quality control or from the data validation process that reflect the level of confidence in the data. Some of the more common qualifiers and their meanings are as follows (EPA, 1989):

- U - Chemical was analyzed for but not detected; the associated value is the sample quantitation limit.
- J - Value is estimated, probably below the contract-required quantitation limit.
- R - Quality control indicates that the data are unusable (chemical may or may not be present).

- B - Concentration of chemical in sample is not sufficiently higher than concentration in the blank (using the “5-times, 10-times” rule).

"J"-qualified data are used in the risk assessment; "R"- and "B"-qualified data are not. The handling of "U"-qualified data (nondetects) is described in the following sections.

2.2.2 Descriptive Statistical Calculations

Because of the uncertainty associated with characterizing contamination in environmental media, both the mean and the 95 percent upper confidence limit (UCL) of the mean are usually estimated for chemicals of interest. The EPA ProUCL software (Version 4.1 [EPA, 2011]) was used to calculate UCLs for the data sets of all chemicals represented by at least five samples. If the data set consisted of fewer than five data points, the maximum detected concentration (MDC) was selected as the exposure point concentration (EPC). Method detection limit (MDL) data were available for all samples. The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is detected. Thus, because it represents the lowest detectable concentration of a specific chemical by the analytical method employed, the MDL provides a more accurate maximum potential concentration for nondetected chemicals than other values (e.g., the reporting limit or half the reporting limit). Therefore, the MDL was used as the ProUCL input concentration for nondetects.

ProUCL generates a variety of UCL estimates for each data set. Generally, the results of one or two (sometimes more) of the UCL estimates are recommended. This recommendation is based on a variety of factors, including the statistical distribution (i.e., normal, lognormal, gamma, or nonparametric), number of nondetects, size of the data set, and skewness. Occasionally, ProUCL will recommend the 97.5 or 99 percent UCL on the arithmetic mean estimated by the Chebyshev method. In these cases, the 95 percent UCL estimated by the Chebyshev method was selected as the EPC because this is more consistent with the intent of the reasonable maximum exposure paradigm as defined by EPA (1989; 2002). The 95 percent UCL based on the Chebyshev method was selected over the ProUCL-recommended 97.5 or 99 percent UCL for 2,4-DNT, 2,4,6-TNT, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and pyrene in soil. In situations where two 95 percent UCLs using different methods (e.g., Student’s-t and Modified-t) are recommended by ProUCL, the higher (i.e., more conservative) of the two values was selected as the EPC.

Analytical data from field duplicates were joined with parent sample results to yield one result for use in the generation of mean and UCL concentrations, as follows:

- The average of field duplicate and parent sample was used if both were positive detections or if both were nondetects.

- The detected value was used if one sample was a positive detection and the other was nondetect.

The UCL generated by ProUCL or the MDC, whichever is smaller, was selected as the EPC, and this value is understood to represent a conservative estimate of average for use in the risk assessment. Unusually high detected values were retained in the calculation of the UCL concentration. Inclusion of these high values increases the statistical variability and the overall conservativeness of the risk estimate.

2.2.3 COPEC Selection Criteria

The criteria used to identify COPECs in the SLERA are described in the following sections.

2.2.3.1 Comparison to Ecological Screening Values

MDCs of chemicals detected in various media were compared with ecological screening values (ESV) for ecological endpoints following recommendations received from OEPA and as discussed in *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Bulletin No. 1* (EPA, 1996a). Chemicals that exceed the ESVs, or for which no ESVs are available, were retained as COPECs if other COPEC selection criteria were also met. The following ESVs, or ESV hierarchy (as noted), were used for the ecological evaluation:

- ***Soil.*** Soil screening values were selected using the following hierarchy: (1) EPA ecological soil screening levels (EPA, 2008), (2) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et. al., 1997a), (3) EPA Region 5 ecological screening levels (note: these values were previously known as ecological data quality levels) (EPA, 2003), (4) *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process* (Efroymson, et al., 1997b), and (5) *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants* (Efroymson, et al., 1997c). It should be noted that effects on heterotrophic processes may not be relevant to ecological receptors of concern at the site.

- ***Surface Water.*** The lowest surface water screening value was selected from the following three sources: (1) OEPA Water Quality Criteria (OAC Chapter 3745-1) for the protection of aquatic life, (2) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et al., 1997a), and (3) EPA Region 5 ecological screening levels (EPA, 2003). Because OEPA water quality criteria do not consider food chain effects, a hierarchy could potentially eliminate important surface water COPECs.

- ***Sediment.*** Sediment screening values were selected using the following hierarchy: (1) Consensus-based threshold effect concentration values (MacDonald, et al., 2000), (2) EPA Region 5 ecological screening levels (EPA, 2003), (4) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et al., 1997a), and (5) *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* (Ontario Ministry of the Environment and Energy, 1993).

The development of the ESVs used for the PBOW SLERAs is presented in Appendix B.

2.2.3.2 Frequency of Detection

Chemicals that are detected infrequently may be artifacts in the data that may not reflect site-related activity or disposal practices. These chemicals are not evaluated further in the risk evaluation. Generally, chemicals that are detected only at low concentrations in less than 5 percent of the samples (if more than 20 samples were analyzed) are eliminated from further consideration, unless their presence is expected based on historical information about the site. Chemicals detected infrequently at elevated concentrations as compared with applicable risk-based thresholds may identify the existence of "hot spots" and have been retained in the evaluation, unless other information exists to suggest that their presence is unlikely to be related to site activities. No examples of infrequently detected samples indicative of potential hot spots were observed in the TNTA/WWTP1 sewer lines data set.

2.2.3.3 Background Evaluation

Chemical concentrations were compared to site-specific background concentrations (see next paragraph for details) as an indication of whether a chemical is present from site-related activity or as natural background. This comparison is generally valid for inorganic chemicals but not for organic chemicals, because inorganic chemicals are naturally occurring and most organic chemicals are not. Statistical techniques are used as tools to aid the exercise of professional judgment in resolving site-related issues for metals, because metals are naturally present in most environmental media. The statistical techniques generally involve comparing the site data with background data. Background data are only available for soil at PBOW. Background data do not exist for surface water; therefore, a statistical background evaluation for this medium cannot be performed.

The first statistical technique used for the background screen is the comparison of the MDC of the site data set to the PBOW background screening concentration (BSC). BSCs are considered representative concentrations of naturally occurring inorganic constituents; therefore, a comparison between the BSC and concentrations detected on site provides an indication of whether exposure to on-site media exceeds ambient levels. The background data set and derivation of soil BSCs for all PBOW soil investigations are described in IT (1998). It is noted that the method agreed upon for the development of BSCs, as recorded in the September 11, 2002 PBOW Team Meeting minutes, differs from that shown in current OEPA (2004) guidance. This PBOW Team agreement, which has been used for all PBOW risk assessments to date, takes precedence over the subsequent OEPA (2004) guidance. The background soil samples were collected from near the property boundary, away from any potential source areas. BSCs were calculated for use at PBOW based on concentrations found in these background soil samples. Each BSC is either the MDC of the concentrations found in these background soil samples or the calculated 95th percent upper tolerance limit of the background data set, whichever value is lower (Shaw, 2005). The upper tolerance limit is the concentration, with a probability of 0.95 (or a confidence of 95 percent), that would capture (or cover) 95 percent of background samples if a larger number of samples were collected. Chemicals with MDCs less than their respective BSCs are eliminated from further consideration. If the MDC exceeds the BSC, the chemical may be retained as a COPEC, or a different statistical analysis may be performed to determine if the background data and the site data are drawn from the same population. The Wilcoxon rank sum (WRS) test is used for this purpose.

The WRS test (also known as the Mann-Whitney U test) is described in Appendix M of Shaw (2005). WRS testing is performed for inorganic chemicals in soil whose MDCs exceed their respective BSCs, and when the site and background data sets each contain less than 50 percent nondetects. The WRS test is not performed on data sets containing 50 percent or more nondetects, because the medians of such data sets are unknown and the test lacks sufficient power to yield reliable results. Likewise, the WRS test is not performed on data sets with fewer than five samples; in such cases, the test lacks sufficient power to identify differences between the two populations. The WRS test was not performed for any chemicals at the TNTA/WWTP1 sewer lines site. Although cadmium and mercury were candidates for the test due to their failure to be eliminated using other background-or risk-based screening methods, neither chemical was detected in at least 50 percent of the background samples, and so neither metal qualified for WRS test analysis.

Chemicals that fail the background evaluation are assumed to be site related and are not eliminated at this point of the screening process.

2.2.3.4 Essential Nutrients

Evaluating essential nutrients is a special form of risk-based screening applied to certain ubiquitous elements that are generally considered to be required nutrients. Essential nutrients such as calcium, iron, magnesium, potassium, and sodium are usually eliminated as COPECs because they are generally considered to be innocuous in environmental media. Other essential nutrients, including chloride, iodine, and phosphorus, may be eliminated as COPECs, provided that their presence in a particular medium is shown to be unlikely to cause adverse effects to biological health.

2.2.4 Summary of COPEC Selection

The results of the COPEC screening are presented in Tables 2-8 and 2-9 for soil and sediment (no chemicals were detected in surface water). The tables present the following information for each medium:

- Chemical name
- Frequency of detection
- Range of detected concentrations
- Range of detection limits
- Arithmetic mean (average) of site concentrations
- Distribution type
- UCL of the mean of the concentration (only for chemicals selected as COPECs)
- Appropriate ESV
- BSC
- COPEC selection conclusion: NO (with rationale for exclusion), or YES (selected).

The selected EPC is also presented for each chemical identified as a COPEC. For soil, two EPC results are presented, including a total soil EPC that represents concentrations in the 0-6 feet bgs depth range, and a surface soil EPC that represents concentrations in the 0-1 foot bgs depth range. These two sets of EPCs are used to evaluate various ecological receptors that may be exposed to different soil depths associated with their various life history characteristics (Section 3.1). Footnotes in each table provide the rationale for selecting or rejecting a chemical as a COPEC. In some situations, it is appropriate to reinstate as COPECs chemicals that have been eliminated using one or more of the screening criteria. Examples of these exceptions include potential breakdown products, chemicals known to have been used on site historically, chemicals with detection limits greater than the ESV, and chemicals with high bioconcentration and/or bioaccumulation factors. Based on a qualitative evaluation of the COPEC tables for soil and sediment, no additional COPECs are recommended.

Sixteen chemicals were selected as COPECs in soil (Table 2-8) and one was selected in sediment (Table 2-9). No chemicals were detected in surface water; therefore, this medium is not of concern at the TNTA/WWTP1 sewer lines site and is not discussed further. As discussed at the beginning of Chapter 2.0, the SLERA null hypotheses are that potential for adverse ecological effects are minimal or nonexistent due to the lack of viable habitat, potential ecological receptors, potential exposure pathways, and/or potential chemical stressors. Given the selection of COPECs in multiple media and the finding that viable habitat, potential receptors, and potential exposure pathways exist at the site, a predictive assessment is triggered for the TNTA/WWTP1 sewer lines. Chemicals not eliminated using the screening procedures previously presented are considered COPECs and are quantitatively evaluated in the predictive SLERA.

2.3 Ecological Endpoint (Assessment and Measurement) Identification

The first step in a predictive SLERA is the identification of assessment and measurement endpoints. The protection of ecological resources, such as habitats and species of plants and animals, is a principal motivation for conducting the SLERA. Key aspects of ecological protection are presented as policy goals. These are general goals established by legislation or agency policy that are based on societal concern for the protection of certain environmental resources. For example, environmental protection is mandated by a variety of legislation and government agency policies (e.g., the Comprehensive Environmental Response, Compensation, and Liability Act and the National Environmental Policy Act). Other legislation includes the Endangered Species Act (16 U.S. Code 1531-1544) (1993, as amended) and the Migratory Bird Treaty Act 16 (U.S. Code 703-711) (1993, as amended). To determine whether these protection goals are met at the site, assessment and measurement endpoints have been formulated to define the specific ecological values to be protected and to define the degree to which each may be protected.

Unlike the human health risk assessment process, which focuses on individual receptors, the SLERA focuses on populations or groups of interbreeding nonhuman, nondomesticated receptors. This is accomplished by selecting measurement endpoints (discussed below) that are related to parameters most likely to result in population level effects (e.g., survival, growth, or reproduction) and consideration of lowest-observed-adverse-effect levels (LOAEL) in addition to no-observed-adverse-effect level (NOAEL) endpoints (Chapter 4.0). In the SLERA process, risks to individual receptors are assessed only if they are protected under the Endangered Species Act, are species that are candidates for protection, or are species of special concern.

Given the diversity of the biological world and the multiple values placed on it by society, there is no universally applicable list of assessment endpoints. Suggested criteria that may be considered in selecting assessment endpoints suitable for a specific ecological risk assessment are (1) ecological relevance, (2) susceptibility to the contaminant(s), (3) accessibility to prediction and/or measurement, and (4) definability in clear, operational terms (Suter, 1993). Selected assessment endpoints reflect environmental values that are protected by law, are critical resources, or have relevance to ecological functions that may be impaired. Both the entity and attribute are identified for each assessment endpoint.

Assessment endpoints are inferred from effects to one or more measurement endpoints. The measurement endpoint is a measurable response to a stressor that is related to the valued attribute of the chosen assessment endpoint. It serves as a surrogate attribute of the ecological entity of interest (or of a closely related ecological entity) that can be used to draw a predictive conclusion about the potential for effects to the assessment endpoint.

Measurement endpoints for this SLERA are based on toxicity values from the available literature and not statistical or arithmetic summaries of actual field or laboratory observations or measurements. When possible, receptors and endpoints have been concurrently selected by identifying those that are known to be adversely affected by chemicals at the site based on published literature. COPECs for those receptors and endpoints have been identified by drawing on the scientific literature to obtain information regarding potential toxic effects of site chemicals to site species. This process ensures that a conservative approach is taken in selecting endpoints and evaluating receptors that are likely to be adversely affected by the potentially most toxic chemicals at the site.

2.3.1 Assessment Endpoints

The assessment endpoints for the TNTA/WWTP1 sewer lines are stated as "the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, and omnivorous aquatic mammals." The corresponding null hypothesis for each of the assessment endpoints is stated as "the presence of site contaminants within soil, surface water, sediment, vegetation, and prey will have no effect on the survival or reproductive capabilities of terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, and omnivorous aquatic mammals."

Assessment receptor species were selected based on the likelihood of finding the species at the TNTA/WWTP1 sewer lines. Historical information, the site reconnaissance visits, and the availability of toxicological data were used to select terrestrial and aquatic assessment receptor species. These receptors species are depicted in food web models (Figures 2-4 and 2-5). Food web models are simplified versions of the possible movement of contaminants through the food chain present or potentially present at the site. Due to lack of data for all possible species, key species have been selected to represent broad classes or guilds.

The food web conceptual site models were developed to illustrate how the selected terrestrial and aquatic species are ecologically linked within food webs. One species was used to represent each of the major trophic levels and habitats at the site. The decision was made not to complicate the food web models with species names for organisms at the base of the food web (e.g., species names of terrestrial invertebrates). Thus, generic terrestrial invertebrates, benthic invertebrates, and aquatic invertebrates were used to represent the base of the food chain. For terrestrial invertebrates and plants, partitioning coefficients and simple empirical uptake models were employed to estimate COPEC concentrations within tissues (Chapter 3.0). Brief life history descriptions for the selected receptor species are provided in Appendix C.

All trophic levels may be exposed to COPECs, either by direct exposure to contaminated abiotic media or through ingestion of lower trophic level food items. Primary producers (plants) absorb COPECs (as well as nutrients) from soil and/or water. Through abiotic processes, COPECs can adsorb to the sediment and detritus particles. When these particles settle and become part of the benthic substrate, they may also become a source of COPECs to benthic communities. Various species of aquatic biota fulfill the role of aquatic herbivores (feeding on aquatic plants and suspended detritus) and predatory invertebrates (feeding on benthic invertebrate species). The combination of COPEC bioconcentration from water, ingestion of contaminated prey, and restricted ranges for aquatic organisms provides good conditions for significant bioaccumulation of COPECs. In terrestrial species, bioconcentration occurs in plants and invertebrates, and higher food chain receptors bioaccumulate COPECs through the ingestion of food items.

2.3.2 Measurement Endpoints

Measurement endpoints are frequently numerical expressions of observations (e.g., toxicity test results or community diversity indices) that can be compared statistically to detect adverse responses to a site contaminant. Examples of typical measurement endpoints include mortality, growth, or reproduction parameters in toxicity tests; individual abundance; and species diversity (EPA, 1997). Measurable responses to stressors may include LOAELs, NOAELs, lethal concentration to 50 percent of the test population, lethal dose to 50 percent of the test population, or effective concentration for 20 percent of the test population, collectively termed toxicity reference values (TRV). TRVs are discussed in greater detail in Chapter 4.0.

2.4 Selection of Assessment Receptors

In order to focus the exposure characterization portion of the SLERA on species or components that are the most likely to be affected and on those that, if affected, are most likely to result in significant impacts to the on-site ecosystem, the selection of assessment receptors focuses on species, groups of species, or functional groups that are directly related to the assessment endpoints previously identified (Section 2.3.1).

Site biota were organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds. For aquatic and/or wetland communities, the major groups are flora and fauna, including vertebrates (water fowl and fish), aquatic invertebrates, and wetland/terrestrial mammals. Species presence and relative abundance were partly determined during the site reconnaissance visits.

Primary criteria for selecting appropriate assessment receptors include, but are not limited to, the following:

- The assessment receptor has a relatively high likelihood of contacting chemicals via direct or indirect exposure.
- The assessment receptor exhibits marked sensitivity to chemicals.
- The assessment receptor is a key component of ecosystem structure or function (e.g., importance in the food web, ecological relevance).
- The assessment receptor may be listed as rare, threatened, or endangered by a governmental organization, or the receptor consists of critical habitat for rare, threatened, or endangered species.

Additional criteria for selection of assessment receptors were used to identify species that offer the most favorable combination of characteristics for determining the implications of on-site contaminants. These criteria included (1) limited home range, (2) role in local nonhuman food chains, (3) potential high abundance and wide distribution at the site, (4) sufficient toxicological information available in the literature for comparative and interpretive purposes, (5) sensitivity to COPECs, (6) relatively high likelihood of occurrence on site following remediation (if required); (7) suitability for long-term monitoring, (8) importance to the stability of the ecological food chain or biotic community of concern, and (9) relatively high likelihood that species will be present at the site or that habitats present at the site could support the species. Assessment receptors are representative species that are modeled for exposure to contaminants via multiple exposure routes. Organisms at the base of the food chain (i.e., plants, invertebrates, etc.) are not evaluated for food chain effects because direct exposure is the primary exposure route of concern for these organisms, which is evaluated by the ecological benchmark comparison during the initial COPEC screening process. Therefore, these types of organisms are not selected as assessment receptors.

2.4.1 Terrestrial Receptors

Based on the ecological description of the site presented in Section 2.1, seven representative terrestrial receptor species that are expected or possible in the area of TNTA/WWTP1 sewer lines were selected as indicator species for the potential effects of COPECs. These indicator species represent two classes of vertebrate wildlife (mammals and birds) and a range of both body size and feeding habits, and include herbivores, omnivores, and carnivores. Terrestrial invertebrates and vegetation are not considered assessment receptors. The seven terrestrial species selected include the deer mouse (*Peromyscus maniculatus*) (small omnivorous mammal), short-tailed shrew (*Blarina brevicauda*) (small insectivorous mammal), Eastern cottontail rabbit (*Sylvilagus floridanus*) (medium-sized herbivorous mammal), marsh wren (*Cistothorus palustris*) (small insectivorous bird), white-tailed deer (*Odocoileus virginianus*) (large herbivorous mammal), raccoon (*Procyon lotor*) (medium-sized omnivorous mammal), and red-tailed hawk (*Buteo jamaicensis*) (large carnivorous bird).

A terrestrial food web for the TNTA/WWTP1 sewer lines is presented on Figure 2-4. Many of the species evaluated have limited home ranges, particularly the deer mouse, cottontail rabbit, short-tailed shrew, and marsh wren, which make them particularly vulnerable to exposure from site contaminants. All of the selected terrestrial receptor species have a potentially high abundance and wide distribution at the site; also, sufficient toxicological information (with the exception of some bird species) is available in the literature for comparative and interpretive purposes. All species are considered important to the stability of the local ecological food chain and biotic community. Finally, all the selected species have readily available exposure data, as summarized in the *Wildlife Exposure Factors Handbook* (EPA, 1993).

Larger mammal species were generally not selected as sensitive receptors due to their large home ranges; however, the red-tailed hawk was retained due to its unique role as a top predator in the food chain and the white-tailed deer was retained due to its high abundance at the site. Smaller birds were generally not included because most are migratory. The red-tailed hawk was also identified as a surrogate for the state-endangered northern harrier at the TNTA/WWTP1 sewer lines. The potential risk to species with larger home ranges and migratory avian species are included within the predicted risks to the selected terrestrial indicator receptors. Area use factors (AUF) were set to 100 percent for the mouse, shrew, rabbit, and wren, due to their relatively small home ranges (Section 3.1). However, for the deer, hawk, and raccoon, the AUF was set at 0.002, 0.001, and 0.008 (or 0.2, 0.1, and 0.8 percent), respectively, based on these species' relatively large home ranges (518, 842, and 156 hectares, or 1,280, 2,081, and 385 acres, respectively), compared with the size of the site being evaluated (approximately 3 acres).

Results of the assessment receptor selection process are presented in detailed biological and ecological descriptions called assessment receptor profiles (ARP). The biologically relevant criteria used to select the seven terrestrial assessment receptors are also discussed and summarized in the ARPs (Appendix C).

2.4.2 Aquatic Receptors

The aquatic habitat at the TNTA/WWTP1 sewer lines consists of Plum Brook, which is intersected by both traces of the sewer line in the western portion of the site (Photos 9 and 10 on Figure 2-1). Other small ditches and drainage channels that intersect the traces are shallow and only contain water during significant rain events (Photo 8 on Figure 2-1). Therefore, very limited aquatic habitat is present at the TNTA/WWTP1 sewer lines. Exposure to aquatic organisms is assumed to occur via direct exposure to contaminants in the water column, ingestion of surface water (via drinking and as a result of bioconcentration through direct contact) and sediment (while foraging, preening, etc.), and ingestion of food items (i.e., plants, benthic invertebrates, and prey) exposed to contaminants in surface water and sediment. Potential uptake through the aquatic food chain is evaluated for the raccoon (also considered as a terrestrial receptor). The muskrat (*Ondatra zibethicus*) (medium-sized aquatic herbivorous mammal) is also evaluated. The evaluation of a muskrat at the TNTA/WWTP1 sewer lines is conservative because Plum Brook may not have the sufficient depth or water velocity necessary to avoid freezing in the winter, which is a requirement for muskrat inhabitation. An avian aquatic omnivore such as the mallard (*Anas platyrhynchos*) is not evaluated because pooled water of sufficient depth to attract dabbling ducks is not present at the site.

Aquatic organisms represent some of the prey base for the raccoon and muskrat aquatic receptors. An aquatic food web is presented on Figure 2-4. The raccoon is a likely visitor to the site (Section 2.1) and has a potentially high abundance and wide distribution in the area, and sufficient toxicological information is available in the literature for comparative and interpretive purposes. The muskrat is also likely to be found at PBOW (Table 2-2). As mentioned previously, the aquatic habitat may be too limited to support muskrat populations in Plum Brook of the TNTA/WWTP1 sewer lines; however, this receptor is conservatively included in the evaluation to represent mammalian aquatic herbivores. Both the raccoon and muskrat have readily available exposure data, as summarized in the *Wildlife Exposure Factors Handbook* (EPA, 1993).

Results of the assessment receptor selection process, including a summary of the relevant biological criteria used, are presented in the ARPs (Appendix C).

2.5 Ecological Site Conceptual Model

Pictorial representations of the evaluated food webs at TNTA/WWTP1 sewer lines are presented on Figures 2-4 and 2-5. The accompanying text presented in Section 3.1 is intended to clarify the ecological site conceptual models (ESCM). The ESCMs trace the contaminant pathways through both abiotic components and biotic food web components of the environment. The ESCMs present all potentially complete exposure pathways. The ESCMs have been used as a tool for judging the appropriateness and usefulness of the selected measurement endpoints in evaluating the assessment endpoints and for identifying sources of uncertainty in the exposure characterization.

3.0 Exposure Characterization

An estimate of the nature, extent, and magnitude of potential exposure of assessment receptors to COPECs that are present at or migrating from the site is presented in this section, considering both current and reasonably plausible future use of the site. Exposure characterization is critical in further evaluating the risk of chemicals identified as COPECs during the screening process (Section 2.2). The exposure assessment has been conducted by linking the magnitude (concentration) and distribution (locations) of the contaminants detected in the media sampled during the investigation, evaluating pathways by which chemicals may be transported through the environment, and determining the points at which organisms found in the study areas may contact contaminants.

3.1 Exposure Analysis

An exposure analysis was performed that combines the spatial and temporal distribution of the ecological receptors with those of the COPECs to evaluate exposure. The exposure analysis focuses on the bioavailable chemicals and the means by which the ecological receptors are exposed (e.g., exposure pathways). The focus of the analysis is dependent on the assessment receptors being evaluated as well as the assessment and measurement endpoints.

Exposure pathways consist of four primary components: source and mechanism of contaminant release, transport medium, potential receptors, and exposure route. A chemical may also be transferred between several intermediate media before reaching the potential receptor. All of these components have been addressed within the SLERA. If any of these components is not complete, then contaminants in the affected media do not constitute an environmental risk at the site. The major fate and transport properties associated with typical site contaminants are described in subsequent sections. These properties directly affect a contaminant's behavior in each of the exposure pathway components.

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Examples of direct exposure include animals incidentally ingesting contaminated soil or sediment (e.g., during burrowing or dust-bathing activities), animals ingesting surface water, plants absorbing contaminants by uptake from contaminated sediment or soil, and dermal contact of aquatic organisms with contaminated surface water or sediment. Given the scarcity of available data for wildlife dermal and inhalation exposure pathways, potential risk from these pathways is not estimated in this

SLERA. In addition, these pathways are generally considered to be incidental for most species, with the possible exceptions of burrowing animals and dust-bathing birds.

Food web exposure can occur when terrestrial or aquatic fauna consume contaminated biota. Examples of food web exposure include animals at higher trophic levels consuming plants or animals that bioaccumulate contaminants.

Bioavailability is an important contaminant characteristic that influences the degree of chemical-receptor interaction. The bioavailability of a chemical refers to the degree to which a receptor is able to absorb a chemical from the environmental medium. A chemical's bioavailability is a function of several physical and chemical factors such as soil grain size, soil and sediment organic carbon content, water hardness, and pH.

Daily doses of COPECs for vertebrate receptors were calculated using standard exposure algorithms. These algorithms incorporate species-specific natural history parameters (i.e., feeding rates, water ingestion rates, dietary composition, etc.) and also use site-specific AUFs, as follows:

$$Total\ Daily\ Dose = \left(\frac{\left(\left[Soil_j * IR_{soil}\right] + \left[Water_j * IR_{water}\right] + \left[\sum_{i=1}^{N} B_{ji} * P_i * IR_{food}\right] \right)}{Body\,Weight} \right) * AUF \quad \text{Eq. 3.1}$$

where:

$Soil_j$	=	Concentration of COPEC "j" in soil
$Water_j$	=	Concentration of COPEC "j" in surface water
B_{ji}	=	Concentration of COPEC "j" in food type "i"
IR_{soil}	=	Soil ingestion rate
IR_{water}	=	Surface water ingestion rate
IR_{food}	=	Food ingestion rate
P_i	=	Proportion of food $type_i$ in receptor diet
AUF	=	Area use factor (equal to area of exposure unit/home range of receptor
Body Weight	=	Body weight of receptor.

Sediment may replace soil in Equation 3.1 for aquatic or semiaquatic receptors.

The first step in estimating exposure rates for terrestrial wildlife involves the calculation of feeding and drinking rates for site receptors. EPA (1993) includes a variety of exposure information for a number of avian, herptile, and mammalian species. Information regarding feeding and drinking rates and dietary composition are available for many species or may be estimated using allometric equations (Nagy, 1987). Data have also been gathered on incidental ingestion of soil and incorporated for the receptor species. Literature values for animal-specific sediment ingestion are used if available. However, such values generally are not available in the literature. Where sediment ingestion rates could not be found, the animal-specific incidental soil ingestion rate is used for sediment ingestion as well, if the receptor's life history profile suggests a significant aquatic component (e.g., raccoons' use of surface water in foraging activities). This information is summarized in Table 3-1.

To estimate dose associated with ingested food items, concentrations of COPECs in the vegetation or prey in the species' diet is estimated using bioaccumulation factors (BAF) (sometimes referred to as bioconcentration factors). BAFs are regression models or scalar variables that reflect the potential for the COPECs to be present in food items at concentrations different from (usually greater than) the ambient environment. Differences in concentration are due to chemical-specific properties of the COPEC that affect its tendency to bioaccumulate in tissue, balanced by the innate ability of the species to regulate body burden levels of the chemical via metabolic and excretory processes.

Selection of appropriate BAFs is a critical component to food chain modeling. General approaches for BAF selection have been discussed in Sample and Suter (1994), EPA (1999a), U.S. Army Environmental Center (2005), and EPA (2008). An approach that is consistent with these sources was followed in the selection of BAFs for PBOW. The general hierarchy for selection of BAFs based on types of sources is as follows:

1. Use of regression equations derived from paired field- or laboratory-based measurements

2. Ratio-derived BAFs developed based on paired data of tissue concentrations compared to media concentrations where the BAF is equal to the tissue concentration divided by the concentration in the abiotic medium

3. Modeled equilibrium partitioning-derived BAFs based on physical or chemical characteristics

4. Assumptions based on values common to chemical class.

Both U.S. Army Environmental Center (2005) and EPA (1999a) support the use of ratio BAFs in preference to equilibrium partitioning-based BAFs, which are typically calculated based on factors such as log octanol-water partition coefficient (K_{ow}) values, fraction of organic carbon in soil, and/or percent of lipids in invertebrates.

Other general recommendations provided in EPA (2008) were also followed, including the following:

- For selection of ratio-based BAFs, median values are selected over maximum or other high-end BAFs.
- BAFs for accumulation of polycyclic aromatic hydrocarbons (PAH) into mammalian prey are assumed to equal zero due to the high metabolic breakdown of PAHs in mammals.

Regression equations used to calculate prey tissue concentrations of a specific chemical typically take the following general equation form:

$$Ln\ (C_{food}) = \text{slope value} \times \ln\ (C_{abiotic\_media}) + \text{intercept value} \qquad \text{Eq. 3.2}$$

where:

C_{food} = Concentration of chemical in food type
$C_{abiotic\_media}$ = Concentration of chemical in abiotic media.

Ratio BAFs can be generally presented as follows:

$$C_{food} = BAF \times (C_{abiotic\_media}) \qquad \text{Eq. 3.3}$$

where:

C_{food} = Concentration of chemical in food type
$C_{abiotic\_media}$ = Concentration of chemical in abiotic media
BAF = Constant.

BAFs calculated based on equilibrium partitioning typically use a physical constant of a chemical to generate a BAF. A generalized form for this calculation would be as follows:

$$Log\ (BAF) = \text{slope value} \times Log\ (K_{ow}) + \text{intercept value} \qquad \text{Eq. 3.4}$$

where:

Log (BAF) = Log of the BAF for chemical in food type

BAFs calculated based on equilibrium partitioning are applied in the same fashion as ratio-based BAFs to generate a tissue concentration value. K_{ow} values needed for BAFs based on equilibrium partitioning were obtained from EPA's Estimation Program Interface Suite K_{ow}Win software program (available on-line).

Finally, where ratio-based BAFs are missing and where no equilibrium partitioning method has been developed for calculating BAFs, other methods, such as using BAFs for chemicals in the same class as surrogates, may be presented for establishing ratio-based BAFs.

For the current SLERA, PBOW-specific BAFs that were developed as part of the Red Water Ponds Phase II baseline ecological risk assessment (BERA) (IT, 2001b) were used for the TNTA/WWTP1 sewer lines food chain model, when available. Site-specific soil-to-earthworm and sediment-to-benthic invertebrate BAFs were developed in the Phase II BERA based on 28-day bioaccumulation studies performed using the earthworm species *Eisenia foetida* or the invertebrate species *Lumbriculus variegates*, respectively, and soil or sediment samples collected from the PBOW Red Water Ponds area. Both reasonable maximum exposure (RME) and central tendency (CT) BAFs were estimated in the Red Water Ponds risk assessment. The RME BAFs were based on all tissue concentration results, even if blank related, and the CT BAFs were based on blank-corrected tissue results. Although EPA recommends that median values be selected over maximum or other high-end BAFs, the RME sediment-to-aquatic invertebrate and soil-to-worm BAFs were conservatively selected over the CT BAFs as the selected BAFs for the TNTA/WWTP1 sewer lines SLERA, when available. The Red Water Ponds BERA also developed CT and RME BAFs for surface water-to-fish for two different PBOW sites, the West Area Red Water Ponds and Pentolite Road (IT, 2001b). These values were not used in the TNTA/WWTP1 sewer lines SLERA because no COPECs were identified in surface water.

The hierarchies used to select BAFs specific to the various types of biota are presented below. Chemical-specific BAFs (or the regression equation used to calculate COPEC concentrations) for COPECs selected using the respective hierarchies are presented in Tables 3-2 through 3-5.

Table 3-2 presents the soil-to-plants BAFs for COPECs at the TNTA/WWTP1 sewer lines. Soil-to-plants BAFs are also used to evaluate sediment-to-plant uptake at PBOW. Soil-to-plants BAFs are selected using the following specific hierarchy of sources:

1. EPA (2008) selected regressions
2. Efroymson, et al. (2001) regressions

3. EPA (2008) recommended median BAFs
4. International Atomic Energy Agency (IAEA) (1994) BAFs
5. Baes, et al. (1984) BAFs (these values were often updated in the more recent IAEA [1994] publication).

Table 3-3 presents the soil-to-invertebrates (earthworms) BAFs for COPECs at the TNTA/WWTP1 sewer lines. Soil-to-invertebrates BAFs are selected using the following hierarchy of sources:

1. PBOW site-specific BAFs (IT, 2001b)
2. EPA (2008) selected regressions
3. Sample, et al. (1998a) regressions
4. Sample, et al. (1998a) median BAFs
5. Equilibrium BAF calculation method in EPA (2008) based on Jager (1998).

Table 3-4 presents the soil-to-mammals BAFs for COPECs at the TNTA/WWTP1 sewer lines. Soil-to-mammals BAFs are selected using the following hierarchy or sources:

1. PBOW site-specific BAFs (IT, 2001b)

2. EPA (2008) or Sample, et al. (1998b) selected regressions

3. EPA (2008) referenced BAFs (Note: per EPA [2008], a BAF of zero is used for all PAHs, TNT, and RDX.)

4. Sample, et al. (1998b) median BAFs

5. IAEA (1994) BAFs

6. Baes, et al. (1984) BAFs (these values were often updated in the newer IAEA [1994] publication)

7. EPA (1999b) maximum calculated BAFs/bioconcentration factors for feeding guilds.

Table 3-5 presents the sediment-to-aquatic invertebrates BAFs for COPECs at the TNTA/WWTP1 sewer lines. Sediment-to-aquatic invertebrates BAFs are selected using the following hierarchy of sources:

1. PBOW site-specific BAFs (IT, 2001b)

2. Ratio BAFs from Bechtel Jacobs Company, LLC (1998)

3. Ratio BAFs from EPA (1999b)

4. Ratio BAFs from other literature sources

5. Conservative default based on median BAF for PCBs from Bechtel-Jacobs Corporation, LLC (1998).

Surface water to fish is an exposure pathway that is typically evaluated at sites with surface water bodies present. However, because no chemicals were detected in surface water (Section 2.2.4), BAFs estimating uptake in fish from surface water are not developed for this SLERA.

Ingestion rates for receptor species are typically developed as a quantity of wet weight material ingested. Soil analytical data results are typically reported on a dry weight basis. Literature-derived BAFs are often a mixture of dry weight-to-wet weight and dry weight-to-dry weight values. To avoid underestimating or overestimating food concentrations due to confusion over dry weight versus wet weight concentrations, final food concentrations are adjusted in the SLERA to report concentrations on a dry weight basis.

Exposure to four categories of environmental media are addressed in the SLERA, as discussed in the following subsections.

Soil Exposure Pathway. Soil exposure pathways are potentially important for terrestrial plants and animals at the site. For nonburrowing animals, exposure to soil from a depth of 0 to 1 foot bgs is typically considered appropriate, as this soil depth would represent the depth of regular exposure. For burrowing animals such as the shrew, exposure to soil from a depth of 0 to 6 feet bgs was considered. It is noted that although the shrew itself may not actually burrow to a depth of 6 feet, there may be other burrowing mammals that do burrow this deep. For plants and herbivores feeding on deep-rooted plants (e.g., the white-tailed deer, which is assumed to ingest leaves of trees translocating COPECs from subsoils), exposure to soil from a depth of 0 to 6 feet bgs (or the water table surface) was also evaluated because most feeder roots for vegetation that may be ingested by the white-tailed deer are located within this depth. Thus, the shrew and the white-tailed deer (Figure 2-4) were evaluated for exposure to deeper (0 to 6 feet bgs) soil. All other receptors exposed to soil were evaluated for exposure to concentrations in surface (0 to 1 foot bgs) soil.

Environmental conditions such as soil moisture, soil pH, and cation exchange capacities significantly influence whether potential soil contaminants remain chemically bound in the soil matrix or can be chemically mobilized (in a bioavailable form) and released for plant absorption. Generally, neutral to alkaline soils (soil pH of 6.5 or greater) restrict the absorption of toxic metals, making pathway completion to plants difficult.

Sediment Exposure Pathway. Sediment consists of materials precipitated or settled out of suspension in surface water or native soils underlying flowing or standing surface water bodies. Potential contaminant sources for sediment include over-ground transport from the TNTA/WWTP1 sewer lines area, and contaminated surface water, groundwater, and soil. The release mechanisms include surface water runoff, groundwater discharge, and airborne deposition. Potential receptors of chemicals in contaminated sediment include aquatic flora and fauna. Direct exposure routes for contaminated sediment include contact by benthic-dwelling organisms such as amphipod invertebrates, uptake by aquatic flora, and ingestion by aquatic fauna. Indirect exposure pathways from sediment include consumption of bioaccumulated contaminants by consumers in the food chain. Chemical bioavailability of many nonpolar organic compounds (e.g., PCBs and pesticides) decreases with increasing concentrations of total organic carbon in the sediment; however, these compounds can still bioaccumulate up the food chain (Landrum and Robbins, 1990).

Surface Water Exposure Pathway. Surface water represents a potential transport medium for COPECs. However, no chemicals were detected in surface water. Therefore, surface water exposure pathways are not quantified in this SLERA.

Groundwater Exposure Pathway. Groundwater represents a potential transport medium for COPECs. Potential contaminant sources for groundwater include contaminated soil and buried or stored waste. The release mechanism for contaminants into groundwater is direct transfer of contaminants from waste materials to water as water passes through the materials.

Groundwater itself is not an exposure point in ecological risk assessments, although contaminant transport along the shallow groundwater pathway may be considered an exposure route to aquatic life, wetlands, and some wildlife where the groundwater discharges to surface water. In such cases, an evaluation of concentrations present in the surface water medium provides a more realistic and accurate risk scenario, because target receptors are hypothetically exposed to the concentrations they actually experience in their immediate environment and habitat. Thus, groundwater was not directly evaluated in this SLERA, and the surface water evaluation considers potential impact from contaminants that may be present in groundwater, under exposure conditions in an aquatic habitat. Because the surface water samples at the TNTA/WWTP1 sewer lines were collected during the dry season in October 2009, a minor uncertainty exists: any cross-media contamination from groundwater to surface water that does occur during the wet season was not captured or observed during the fall sampling event. This uncertainty is reduced by the consideration that analytical results from the groundwater data indicate that groundwater is unimpacted by the TNTA/WWTP1 sewer lines (Shaw, 2012).

3.2 Exposure Characterization Summary

The estimated chemical intakes for each exposed receptor group under each exposure pathway and scenario are presented in the risk characterization spreadsheets in Appendix D. These intake estimates are combined with the COPEC toxicity values, discussed in the following section, to derive estimates and characterize potential ecological risk. The chemical data used in the SLERA are presented in Appendix E. The uncertainties associated with the estimation of chemical intake are discussed in Section 5.2.

4.0 Ecological Effects Characterization

TRVs focusing on the growth, survival, and reproduction of species and/or populations have been developed for the TNTA/WWTP1 sewer lines. Empirical data are available for the specific receptor-endpoint combinations in some instances. Data on surrogate species and/or on endpoints other than the NOAEL and LOAEL were considered as necessary. The NOAEL is a dose of each COPEC that will produce no known adverse effects in the test species. The NOAEL was judged to be an appropriate toxicological endpoint because it would provide the greatest degree of protection to the receptor species. In addition, the LOAEL was used as a point of comparison for risk management decisions. For the red-tailed hawk assessment receptor that represents the state-endangered northern harrier, no calculation based on a LOAEL is performed, and recommendations are based solely on the more conservative NOAEL. In instances where data for a site-associated COPEC are unavailable, toxicological information for surrogate chemicals or groups of chemical was used. Safety factors were used to adjust for these differences and extrapolate risks to the site's receptors at the NOAEL and/or LOAEL endpoint. This process is described in the following paragraphs.

Toxicity information pertinent to identified receptors has been gathered for those analytes identified as COPECs. Because the measurement endpoint ranges from the NOAEL to the LOAEL, preference has been given to chronic studies noting concentrations at which no adverse effects were observed and those for which the lowest concentrations associated with adverse effects were observed. As previously noted, where data are unavailable for the exposure of a receptor to a COPEC, data for a surrogate chemical or group of chemicals were considered for use in the SLERA.

Whenever possible, studies that use the site-specific target wildlife receptors were utilized. When studies for these species were not available, alternative species studies were used. TRVs are not applied across classes under any circumstances (e.g., a TRV for a bird species may not be used to estimate hazard for a mammal species). In instances where TRVs for multiple avian or mammalian species are supported, the TRV for the most similar species to the assessment receptor based on feeding strategy and physiological attributes was used in the SLERA. The following TRVs had values for multiple test species available, which were assigned to the various assessment receptors according to the following table:

COPEC	TRV Test Species	Assessment Receptor in SLERA
Mercury	Mink	Raccoon, Muskrat
	Mouse	Deer Mouse, Short-Tailed Shrew, Cottontail Rabbit, White-Tailed Deer
Aroclor 1254	Mink	Raccoon, Muskrat
	Mouse	Deer Mouse, Short-Tailed Shrew, Cottontail Rabbit, White-Tailed Deer

Using the relevant toxicity information, TRVs were calculated for each of the COPECs. TRVs represent NOAELs and LOAELs with the safety factors presented in Wentsel, et al. (1996), applied to toxicity information derived from studies other than no-observed effects or lowest-observed effects studies (Figure 4-1).

Because NOAELs and LOAELs for the selected wildlife receptor species are based on data from test species that are usually different from the species of concern, a mathematical adjustment to the TRVs has often been performed in the past (e.g., Sample, et al., 1996) using a power function of the ratio of body weights. This practice is often referred to as allometric scaling. Alternately, uncertainty factors have also been used to account for the differences in species' sensitivities to chemicals. However, in recent years, these practices have been discouraged by most scientific and regulatory groups. Recent reviews of these practices (e.g., EPA, 2008; Allard, et al., 2009) have concluded that the use of allometric scaling of TRVs does not reflect a sound application of toxicological or ecological risk practices because supporting data for this practice are limited, and the ratio relationships used for the mathematical conversions were developed based on acute (rather than chronic) toxicity data. These reviews further conclude that uncertainty factors to account for inter-species differences based on an arbitrary multiplier should not be used without a scientific basis for their application (Allard, et al., 2009). Therefore, the use of toxicity data without adjustments as reported in the literature is regarded as the most technically sound approach and is adopted for this SLERA. The TRVs used for this SLERA are summarized in Tables 4-1 and 4-2 for mammals and birds, respectively.

Exposure rate TRVs provide a reference point for the comparison of toxicological effects upon exposure to a contaminant and are compared against calculated receptor doses. TRVs are not used for evaluating community-based receptors such as plants or invertebrates.

5.0 Risk Characterization

The risk characterization phase integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. The result is a determination of the likelihood, severity, and characteristics of adverse effects to environmental stressors present at a site. Qualitative and semiquantitative approaches were used to estimate the likelihood of adverse effects occurring as a result of exposure of the selected site receptors to COPECs. Because potential adverse effects to terrestrial and aquatic plants and invertebrates have been qualitatively assessed during the initial COPEC screening step, the risk characterization focuses on potential impacts to assessment receptors (Section 2.3).

For the semiquantitative predictive assessment, TRVs and exposure rates have been calculated and are used to generate hazard quotients (HQ) (Wentsel, et al., 1996). HQs are calculated by summing intake doses across all exposure pathways for each chemical for a given receptor and dividing by the TRV. HQs for those chemicals that have a similar mode of toxicological action are typically summed to account for cumulative effects. For this evaluation, PCBs (Aroclor 1016 and Aroclor 1254) and nitrotoluenes (2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-dinitrotoluene, and 4-amino-2,6-dinitrotoluene) are COPECs that are assumed to have similar toxicity mechanisms, and HQs were summed for these chemical groups. HQs are a means of estimating the potential for adverse effects to organisms at a contaminated site and for assessing the potential that toxicological effects will occur among site receptors.

5.1 Hazard Estimation for Terrestrial and Aquatic Wildlife

The hazard estimation was performed through a series of quantitative HQ calculations that compare receptor-specific exposure values with TRVs. The HQs are compared to HQ guidelines for assessing the risk posed from contaminants. It should be noted that HQs are not measures of risk, are not population-based statistics, and are not linearly scaled statistics. Therefore, an HQ above 1, even exceedingly so, does not definitively indicate that there is even one individual expressing the toxicological effect associated with a given chemical to which it was exposed (Tannenbaum, 2005; Bartell, 1996).

Table 5-1 summarizes the NOAEL and LOAEL-based HQs for the eight evaluated assessment receptors at the TNTA/WWTP1 sewer lines. One PCB, Aroclor 1016, had an HQ greater than 1 for one receptor (marsh wren). The marsh wren also had a NOAEL-based HQ slightly greater than 1 for 1,3,5-trinitrobenzene (HQ = 1.79), but its LOAEL-based HQ was below 1. 2,4,6-TNT had HQs greater than 1 for four receptors (deer mouse, short-tailed shrew, cottontail rabbit, and marsh wren). Summed PCBs and summed nitrotoluenes also had HQs exceeding 1, but these exceedances were almost entirely associated with exposure to Aroclor 1016 and 2,4,6-TNT, respectively. Aroclor 1016, 1,3,5-trinitrobenzene, and 2,4,6-TNT are discussed in greater detail in the following paragraphs.

Aroclor 1016. Exposure to the PCB Aroclor 1016 in soil resulted in an estimated HQ of 20.5 using a NOAEL TRV and 2.05 using a LOAEL TRV for the marsh wren; all other assessment receptors had HQs less than 1 (Table 5-1). Out of the 15 soil samples of Aroclor 1016, only the MDC of 1.16 mg/kg exceeded its ESV of 0.371 mg/kg. The MDC was detected at sample location SL-SB05, which is also one of the two locations where elevated 2,4,6-TNT was identified. The critical exposure pathway for the marsh wren was the ingestion of terrestrial invertebrates, which comprised more than 99 percent of the total dose to the wren. The soil-to-earthworm BAF for this chemical was calculated using a model based on its K_{ow}, which resulted in a BAF several orders of magnitude greater than BAFs for other organic compounds that were developed at PBOW during previous investigations (Table 3-3). Although PCBs are highly lipophilic compounds and biomagnification in the fatty tissues of higher trophic level food chains is a concern for this class of chemicals, empirical data from uptake studies performed at PBOW suggests that the bioaccumulation potential for organic compounds in soil is substantially lower than estimated uptake values calculated using models based on a chemical's K_{ow}. This suggests that site conditions (e.g., soil pH, total organic carbon, etc.) may be acting to reduce the bioavailability of organic compounds at PBOW, which results in lower than expected exposure.

Aroclor 1016 was only detected in 1 out of 15 samples (SL-SB05) at a concentration that is within an order of magnitude of its conservative screening value. With the exception of threatened or endangered species, the ecological endpoints of concern are based on the protection of populations rather than individuals (OEPA, 2008; EPA, 1996b, 1999a). Soil sample from two locations approximately 175 feet to the east and west of SL-SB05 (SL-SB04 and SL-SB06 [Figure 2-3]) had concentrations of Aroclor 1016 that were an order of magnitude below the ESV. If it is assumed that the elevated PCB concentrations associated with SL-SB05 extend halfway to SL-SB04 and SL-SB06 (i.e., 87.5 feet in both directions), and assuming a 20-foot-wide area of influence around the trace of the sewer line, the area with elevated PCBs could be estimated to be 3,500 square feet, or 0.08 acre. The home range for a marsh wren is 0.13 acre (Table 3-1). Therefore, the area of concern is less than a single individual's home range, and adverse effects to populations are highly unlikely to occur. Given the likely overestimation of the soil-to-earthworm BAF and the small area affected, the potential for populations of invertivorous birds to be adversely affected by Aroclor 1016 in soil is very low.

1,3,5-Trinitrobenzene. The NOAEL-based HQ for the marsh wren marginally exceeded an HQ of 1. As described for Aroclor 1016, the hazard associated with 1,3,5-trinitrobenze was likely overestimated for the soil-to-earthworm pathway, which accounted for nearly the entire (greater than 99 percent) dose of this chemical to the wren. The soil-to-earthworm BAF for 1,3,5-trinitrobenzene of 13.22 (Table 3-3) was calculated using a model based on the K_{ow}. This BAF is approximately two orders of magnitude greater than BAFs for other organic compounds, including nitroaromatic compounds, as determined by field studies at PBOW. Concern regarding 1,3,5-trinitrobenze is further reduced by the fact that the LOAEL-based HQ did not exceed 1 for any receptor (Table 5-1). HQs generated using NOAEL TRVs are highly conservative, as they are based on a no-effect dose. For these reasons, the presence of 1,3,5-trinitrobenze in soil is not considered to be a concern at the TNTA/WWTP1 sewer lines and is not recommended for further study.

2,4,6-TNT. Exposure to 2,4,6-TNT resulted in estimated NOAEL- and LOAEL-based HQs greater than 1 for the deer mouse, short-tailed shrew, and marsh wren. The NOAEL-based HQ, but not the LOAEL-based HQ, exceeded 1 for the cottontail rabbit. Terrestrial invertebrates comprise a significant portion of the diet for the deer mouse, short-tailed shrew, and marsh wren, and ingestion of these prey items is the pathway resulting in the greatest dose of 2,4,6-TNT, representing 65 percent, 99 percent, and 99 percent of the total hazard for these three receptors, respectively. Similar to Aroclor 1016 and 1,3,5-trinitrobenzene, the soil-to-earthworm BAF for 2,4,6-TNT was calculated using a model based on the chemical's K_{ow}. This resulted in a soil-to-earthworm BAF for 2,4,6-TNT of 13.5, which is approximately two orders of magnitude greater than the BAF for 2,4-DNT (0.1) that was calculated using site-specific data in a previous uptake study performed at PBOW (Table 3-3). If the BAF for 2,4-DNT was modeled using the same equations used to estimate the 2,4,6-TNT BAF, the resulting BAF is 13.6. Because the log K_{ow} for 2,4-DNT is 2.18, it is more lipophilic than 2,4,6-TNT, which has a log K_{ow} of 1.99. This suggests that 2,4-DNT has a slightly greater tendency to bind to lipids in invertebrates than 2,4,6-TNT. Therefore, the site-specific BAF of 2,4-DNT of 0.1 is likely a conservative surrogate for estimating actual uptake for 2,4,6-TNT at the WWTP1/TNTA sewer lines. If the 2,4-DNT BAF of 0.1 is used instead of the modeled BAF, the HQs for most receptors are diminished considerably, and only the deer mouse (HQ = 4.5) and cottontail rabbit (HQ = 3.3) NOAEL-based HQs would exceed 1; all LOAEL-based HQs are below 1. These results are presented in Table 5-1 for informational purposes, but all subsequent discussions regarding 2,4,6-TNT HQs refer to HQs calculated using the original (modeled) BAF, unless otherwise noted. Although 2,4,6-TNT lacks a screening value, this chemical was detected at two TP locations at elevated concentrations. 2,4,6-TNT was detected at TP-27 at a concentration of 3.35 mg/kg and at TP-33 at a concentration of 1,300 mg/kg. If these "hot spot areas" (including all additional delineation samples collected in the vicinity of these locations, illustrated by the boxes with the magnified view on Figure 2-3) were removed from the SLERA data set and the HQs recalculated, the HQs for 2,4,6-TNT would not exceed 1 for any receptor except for a slight exceedance for the marsh wren (NOAEL-based HQ = 2.25, LOAEL-based HQ = below 1). Therefore, the focus of 2,4,6-TNT contamination is restricted to these two potential hot spot areas, which are discussed in greater detail in the following paragraphs.

During the initial TP excavations in 2008, 2,4,6-TNT was detected at TP-27 (3 to 3.5 feet bgs) at a concentration of 3.35 mg/kg. TP-27 is located on the southern branch of the TNTA/WWTP sewer lines trace, approximately 1,200 feet from the historical TNTA facility (Figure 2-3). A surface soil sample (0 to 1 foot bgs) collected in 2009 (sample SL0071) from SB05, which was placed at the TP-27 location, had a concentration of 2,4,6-TNT of 138 mg/kg. SB05 was re-sampled in 2011, which resulted in a concentration of 287 mg/kg of 2,4,6-TNT (note that the two SB05 samples were averaged in the SLERA data set, as described in Section 2.2). Additional delineation samples were also collected in 2011, including soil samples at 20-foot intervals along the sewer line trace to the east and west of TP-27 and offset samples that were placed 5 feet to the north and south of locations SB05, SB12, SB27, and SB30 (Figure 2-3). The offset samples 5 feet to the north and south of SB05 had relatively low, but detectable, 2,4,6-TNT concentrations (0.109 mg/kg at SB13 and 0.275 mg/kg at SB11). To the east of TP-27, a surface soil sample (0 to 1 foot bgs) from SB12 had an elevated 2,4,6-TNT concentration of 1,200 mg/kg. However, the paired offset samples from this location had very low (0.639 mg/kg at SB24) or nondetected (at SB25) concentrations of 2,4,6-TNT in the same surface soil depth interval. The next delineation sample on the sewer line, 20 feet further to the east (location SB27), was nondetect for 2,4,6-TNT. One of the two offset samples from this location, sample SB28, had a low but detectable 2,4,6-TNT concentration of 0.72 mg/kg. The next set of delineation samples to the east (location SB30), including the pair of offset samples (locations SB29 and SB31), were all nondetect. To the west of TP-27/SB05, a surface soil sample (0 to 1 foot bgs) collected from location SB14 had a concentration of 2,4,6-TNT of 18 mg/kg. No offset samples were collected from this location. However, the next delineation sample location 20 feet further to the west, SB23, was nondetect for nitrotoluenes.

These results indicate that a small area of soil around TP-27 appears to represent a hot spot for 2,4,6-TNT. The hot spot is bounded by sample location SB23 to the west of TP-27, which was nondetect for 2,4,6-TNT, and sample location SB30 to the east, which was nondetect for 2,4,6-TNT in both the sample placed on the sewer line trace as well as in its offset samples. Including the area represented by the offset samples to either side of the sewer line trace, the hot spot is considered to be 80 feet long by 20 feet wide, or 1,600 square feet, which is equal to 0.04 acre.

The range of detected concentrations of 2,4,6-TNT in this hot spot area was 0.109 to 1,200 mg/kg, with an average concentration (using the MDL as a surrogate concentration for nondetects) of 149.5 mg/kg. Although no ESVs are available for 2,4,6-TNT, the use of the average concentration as the input concentration of the food chain models would result in NOAEL-based HQs ranging from 1.6 (cottontail rabbit) to 54.3 (marsh wren) for the receptors with HQs exceeding 1 (note that if the alternate soil-to-earthworm BAF of 0.1-as discussed above-is used in the food chain modeling, only the deer mouse [NOAEL HQ = 2.2] and cottontail rabbit [NOAEL HQ = 1.6] have HQs greater than 1). The marsh wren, which is the terrestrial receptor with the smallest home range (0.13 acre), has a home range approximately one order of magnitude larger than the potential 2,4,6-TNT hot spot at TP-27. Therefore, although exposure to individual organisms to soil with elevated 2,4,6-TNT is a possibility, it is highly unlikely that populations of ecological receptors would encounter this area with sufficient frequency to be adversely affected. The northern harrier is a state endangered species, and as such, its surrogate receptor, the red-tailed hawk, is evaluated based on potential impacts to individuals rather than populations. The red-tailed hawk has a home range of 2,080 acres (Table 3-1); therefore, the TP-27 area represents only 0.001 percent of its total home range. As reflected by the food chain model results (Table 5-1), the AUF adjustment that accounts for this disparity between the area potentially affected by the TNTA/WWTP1 sewer lines reduces the NOAEL-based HQ for 2,4,6-TNT well below 1. Although northern harriers likely have smaller home ranges than red-tailed hawks, the difference is likely insignificant. This was confirmed by an on-line literature search, which indicated that harriers have a home range of approximately 420 to 37,000 acres, compared to 2,000 acres for red-tailed hawk; using an AUF based on a home range of 420 acres rather than 2,000 acres still results in HQs much lower than 1 for all chemicals. Also, northern harriers are migratory and would not be present at the TNTA/WWTP1 sewer lines site year-round. Therefore, hazard estimates using the red-tailed hawk may be slightly nonconservative with regards to the AUF adjustment, but are overly conservative for the assumption of year-round exposure.

The second elevated concentration of 2,4,6-TNT observed during test pit excavation activities was located at TP-33, which had a concentration of 1,380 mg/kg at 5 to 5.5 feet bgs. TP-33 is located on the northern branch of the TNTA/WWTP1 sewer lines trace, approximately halfway between Taylor Road and the historical TNTA facility (Figure 2-3). Sample location SB02 was placed at the TP-33 location in 2011, and a sample from a depth of 5 to 7 feet bgs was collected in an attempt to replicate the TP-33 sample result. 2,4,6-TNT was detected at SB02 at an estimated (“J”-qualified) concentration of only 0.0793 mg/kg (note that SB02 and TP-33 were collected from the same location and depth and therefore were averaged in the SLERA data set, as described in Section 2.2). An additional eight samples from locations SB15 through SB22, adjacent to the TP-33 location, were collected at the 5 to 7 feet bgs depth interval in 2011 to delineate 2,4,6-TNT in soil. These samples were spaced radially around TP-33 and within approximately 20 feet of that location (Figure 2-3). 2,4,6-TNT was detected in only four out of eight samples, with a range of detected concentrations of 0.101 to 0.549 mg/kg. These results indicate that the TP-33 concentration of 1,300 mg/kg was anomalous and nonrepresentative of 2,4,6-TNT concentrations in the vicinity of TP-33. With the anomalous concentration included, the average of this “hot spot area” is 138.15 mg/kg. If this concentration is used as the EPC concentration for the food chain model, the resulting NOAEL-based HQs range from 1.45 (cottontail rabbit) to 50.2 (marsh wren). Because no sample in the vicinity of TP-33 came close to replicating the initial concentration of 1,380 mg/kg, including a second sample collected at the same location and depth as the original TP-33 sample that resulted in the elevated concentration, it is determined that this area does not represent a true “hot spot.” Pervasive or widespread 2,4,6-TNT is not present at this area, and any elevated concentrations that might occur are sporadic and highly localized.

Adverse effects at a highly localized scale are potentially plausible near the TP-27 sample location due to the presence of elevated 2,4,6-TNT in several sampling locations surrounding the test pit. However, ecological hazard associated with 2,4,6-TNT is likely overestimated due to the use of a model that calculates uptake of this explosive compound into invertebrates from soil using the chemical’s K_{ow} value. This estimated uptake factor for 2,4,6-TNT is approximately two orders of magnitude higher than that for other nitrotoluenes that were observed during site-specific uptake studies previously performed at PBOW. Further, the area affected is only approximately 10 percent of the home range of the smallest-scale receptor evaluated in this SLERA. Therefore, adverse impacts to even a single individual at TP-27 are considered unlikely, and impacts to populations of receptors are considered implausible. Nevertheless, the removal of soil in the vicinity of TP-27 would reduce the potential for localized ecological impacts.

Adverse effects at TP-33 are considered unlikely. Although the initial detected concentration of 1,300 mg/kg of 2,4,6-TNT was highly elevated, extensive sampling was performed in the immediate vicinity and failed to replicate that finding, and detected concentrations were below 1 mg/kg. Additionally, the same caveats described for TP-27 apply to TP-33 as well (i.e., the overestimation of the soil-to-earthworm BAFs and the small area affected). It should be noted that the TP-33 area is very close to the jurisdictional wetland present between east of Taylor Road identified on USFWS wetland maps (Section 2.1.3). NASA is currently developing a wetland database for the installation, and this database should be consulted prior to any additional investigations performed in that area.

In summary, a small area with elevated 2,4,6-TNT may exist at the TP-27 location of the TNTA/WWTP1 sewer lines site, but exposure to this area is unlikely to represent a significant threat to ecological receptors. A second small area at TP-33 where 2,4,6-TNT was detected at an elevated concentration appears to be of less concern because follow-up sampling could not replicate the elevated concentration, and delineation sampling resulted in nondetects or very low detections. Therefore, the original sample was determined to be nonrepresentative.

5.2 Uncertainty Analysis

A number of factors contribute to the overall variability and uncertainty inherent in ecological risk assessments. Variability is due primarily to measurement error. Laboratory media analyses and receptor study design are the major sources of this kind of error. Uncertainty, on the other hand, is associated primarily with deficiency or irrelevancy of effects, exposure, or habitat data to actual ecological conditions at the site. Species physiology, feeding patterns, and nesting behavior are poorly predictable; therefore, all toxicity information derived from toxicity testing, field studies, or observation have uncertainties associated with them. Laboratory studies conducted to obtain site-specific, measured information often suffer from poor relevance to the actual exposure and uptake conditions on site (i.e., bioavailability, exposure, assimilation, etc., are generally greater under laboratory conditions than under field conditions). Calculating an estimated value based on a large number of assumptions is often the only alternative to the accurate, albeit costly, method of direct field or laboratory observation, measurement, or testing. Finally, habitat- or site-specific species may be misidentified if, for example, the observational assessment results are based on only one or even two brief site reconnaissance surveys. However, the multiple reconnaissance visits that were performed at the TNTA/WWTP1 sewer lines were considered sufficient to adequately assess the habitat present at this site and select appropriate representative receptors for the type of habitat available.

The uncertainty analysis lists:

- Many of the major assumptions made for the SLERA; the direction of bias caused by each assumption, i.e., whether the uncertainty results in an overestimate or underestimate of risk
- The likely magnitude of impact as high, medium, low, or unknown
- Where possible, a description of recommendations for minimizing the identified uncertainties if the SLERA progresses to higher level assessment phases.

The most important uncertainties associated with this SLERA are discussed in the following subsections.

Assumptions of Bioavailability. The assumption that COPECs are 100 percent bioavailable is a worst-case assumption and likely overestimates the potential for adverse effects. The time that has lapsed since the contaminant release affects bioavailability as the contaminant becomes sequestered or transformed within the environmental media. Sequestration, transformation, and bioavailability are influenced by medium characteristics including pH, temperature, and organic carbon content. Evidence that the assumption of 100 percent bioavailability is overly conservative can be observed in the uptake factors that were derived from observations in the field compared to calculated values based on predicted accumulation properties of a given chemical. For example, for the soil-to-earthworm BAFs presented in Table 3-3, the two explosives compounds and the one SVOC with BAFs calculated using a model were approximately two orders of magnitude greater than other chemicals within the explosives or SVOC groups that were based on empirical data from the site. A likely explanation for the discrepancy in modeled versus observed uptake is that site-specific characteristics are present that reduce the bioavailability of these chemicals in soil, which lowers overall exposure by limiting the amount of the chemical that accumulates in the tissue of invertebrate prey items.

Use of Laboratory-Derived or Empirically Estimated Partitioning and Transfer Factors. The use of laboratory-derived or empirically estimated partitioning and transfer factors to predict COPEC concentrations in plants, invertebrates, prey species, and sediment likely overestimates potential risks. As discussed previously, the incorporation of COPECs into the food chain is influenced by the characteristics of the exposure medium, which likely differs from that used in the laboratory to derive partitioning and transfer factors.

Use of Laboratory-Derived Toxicity Reference Values. TRVs were identified for all chemicals with the exception of benzoic acid for birds. Therefore, the potential for benzoic acid effects on the avian community represents an uncertainty in this risk evaluation. Because benzoic acid was only detected in 2 out of 15 samples at concentrations approximating the reporting limit, this uncertainty is considered small. The use of available laboratory-derived TRVs may overestimate or underestimate the potential for adverse effects. The method of administration of the contaminant in the laboratory is significantly different than that experienced in the wild by the receptors.

Use of the HQ Method to Estimate Risks to Populations or Communities. The calculation of HQs also introduces uncertainty. The following limitations associated with HQs (Tannenbaum, et al., 2003) are noted:

- HQs are not measures of risk.
- HQs are not population based.
- HQs are not linearly scaled.
- HQs are often produced that are unrealistically high and toxicologically impossible (e.g., estimated HQs greater than 1,000, although HQs generated for the TNTA/WWTP1 sewer lines SLERA do not fall into this category).
- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to HQ threshold exceedances.

Therefore, it should be understood that HQs greater than 1 do not mean that adverse ecological effects are occurring at the site or may occur in the future. Some potential for adverse hazard may exist for HQs that exceed 1, and the probability of health effects arising may increase with increasing HQ magnitude. A general rule that has been proposed to evaluate the potential for ecological impacts considering the highly conservative nature of the ecological risk assessment process is as follows: HQs less than or equal to 1 represent no probable risk, HQs from 1 up to but less than 10 represent a low potential for environmental effects, HQs from 10 up to but less than 100 represent a significant potential that effects could result from greater exposure, and HQs greater than 100 represent the highest potential for expected effects (Wentsel, et al., 1996). It should be noted that OEPA considers HQs greater than 1 to be potentially significant.

Samples Used in the SLERA. Some soil samples were collected at the TP-27 and TP-33 locations both along and offset from the sewer line trace in 2011, but these samples were collected for the purpose of delineating elevated detections of 2,4,6-TNT and were not intended to be a part of the original database used to estimate and quantify ecological hazards at the site. Only samples that were collected along the sewer line trace and that were not delineation samples that bounded a nondetect for the chemical of interest (i.e., 2,4,6-TNT) were included in the ecological risk data set used to estimate chemical concentrations present at the TNTA/WWTP1 sewer lines, as described in Section 2.2. This was considered a representative and appropriately conservative data set for estimating hazard to ecological receptors. Inclusion of these additional offset and nondetect samples where 2,4,6-TNT was not detected, or detected at low concentrations, may have introduced a less conservative bias.

Sampling and Analytical Limitations. It is not possible to completely characterize the nature and extent of contamination on any site. Uncertainties arise from limits on the number of locations that can be sampled. The sampling protocol used at the TNTA/WWTP1 sewer lines, however, was designed to optimize efficiency of the sampling effort and reduce uncertainty by providing coverage of the affected area using historical data and site knowledge to focus on the sewer line trace, which is most likely to be affected by historical PBOW-related contamination. This approach biases potential soil contaminant concentrations higher than if sampling were performed equally for all soils within the entire sewer lines area and provides a more conservative estimate of potential risk. The sampling and analytical data are considered sufficient to develop conclusions for the TNTA/WWTP1 sewer lines trace.

Treatment of Chemicals Analyzed by Multiple Methods. 2,4-DNT and 2,6-DNT were analyzed for in soil using both an SVOC analytical method (SW-846 3550C/82709C) and an explosives analytical method (Method SW-846 8330A). To avoid double counting and overestimation of these chemicals in soil, only one set of analytical suites was used in the SLERA. The data set based on the explosives analysis included the samples analyzed for SVOCs and also included additional samples collected for the delineation of 2,4,6-TNT. Therefore, the analytical results associated with the explosives method were used to quantify risk to ecological receptors. Although the explosives data set had greater spatial coverage, the SVOC data set had lower detection limits and higher EPCs for 2,4-DNT (1.72 mg/kg in 0 to 6 feet bgs soil and 4.42 mg/kg in 0 to 1 feet bgs soil compared to 0.858 and 1.93 mg/kg for the explosives data set) and 2,6-DNT (0 to 1 feet bgs soil only; 2.18 mg/kg compared to 1.48 mg/kg for the explosives data set). However, if the higher EPCs are entered into the food chain model, the results do not change; neither 2,4-DNT nor 2,6-DNT would exceed HQs of 1 for any receptor. Therefore, the uncertainty regarding the use of the explosives data as opposed to the SVOC data to quantify risk in the SLERA is considered minor.

Selection and Quantification of Chemicals of Potential Ecological Concern. Uncertainty associated with the processes used to identify COPECs and estimate EPCs arises from the following:

- ***Identifying background chemicals.*** Metals are judged to be present at concentrations comparable to background if the MDC does not exceed the BSC or if statistical testing demonstrates that the site data and background data are drawn from the same population. Statistical testing of site data versus background was not performed for this SLERA. Some organic chemicals, such as PAHs, may be considered to be anthropogenic background. The inclusion of ambient anthropogenic compounds in this SLERA may impart a conservative bias towards the risk assessment.

- ***Estimated EPCs are uncertain.*** Computed 95 percent UCL values are only estimates of the actual UCLs associated with each data set. Examples of factors affecting the uncertainty of these estimates include the number of samples, proportion of nondetects, conformance with an assumed mathematical distribution, imprecision of laboratory data, elevated detection limits (from dilutions, matrix interference, etc.), and statistical methodology. For some data sets (e.g., 1,3,5-trinitrobenzene in surface soil [0 to 1 foot bgs] [Table 2-8]), the MDC was used as the EPC. Uncertainties associated with the statistical determination of EPCs for the COPECs in each medium are as follows:

  – A limited number of samples may not completely characterize the site because they provide less information about the population from which they are drawn than do larger sample sets. Accordingly, small sets tend to have a greater variability, which results in the calculation of wide confidence intervals on the mean concentration and high EPCs. In some cases, the 95 percent UCL may be greater than the MDC, which results in the selection of the MDC as the EPC. This occurred for 2,4-DNT and 2,6-DNT in the surface soil (0 to 1 foot bgs) data set (Table 2-8). High confidence limits may introduce a conservative bias into the risk assessment.

  – Biased soil sampling is a common practice at contaminated sites to identify nature and extent of contamination and to reduce the potential for Type I errors when performing environmental investigations (i.e., concluding that a site is clean when it really is not). The biased sampling approach likely overestimates chemical concentrations, resulting in greater chemical concentrations and predicted risk. The TNTA/WWTP1 sewer lines sampling strategy was biased along the sewer line trace. Ecological receptors are likely to move randomly about the area, though, and not spend their entire time along the sewer line trace. The AUF used in the calculation of the HQs adjusts for the fact that organisms would only spend a portion of their daily activities on or near the sewer line trace, however, and this uncertainty is considered minor for this SLERA.

  – Laboratory analytical techniques have a degree of uncertainty associated with them. These uncertainties are documented by using data qualifiers to reflect the degree of certainty of measurement. For example, some data were estimated (e.g., J-qualified), while other data were rejected (i.e., R-qualified). The direction of bias introduced by J-qualified values is unclear.

The use of the 95 percent UCL as the EPC is likely to underestimate the EPC in 5 percent of the cases and overestimate exposure in 95 percent of cases, imparting an overall conservative bias to the risk assessment. It should be noted that some COPEC MDCs measured in soil were used as EPCs due to the limited number of samples; if COPECs considered to represent a plausible risk to terrestrial populations were identified in this medium, an additional sampling effort could reduce the hazard estimate. However, the chemicals with MDCs as their EPCs were not recommended for further evaluation, and no additional sampling is recommended.

6.0 Risk Summary and Conclusions and Recommendations

Chemicals detected in soil and sediment were screened against conservative benchmark values and other criteria to identify COPECs in media present at the TNTA/WWTP1 sewer lines. Surface water samples were collected from Plum Brook to determine potential impacts of the sewer lines to this water body, but no chemicals were detected, and surface water was not considered further. Sixteen chemicals in soil and one chemical in sediment were identified as COPECs for further evaluation. A food chain model was performed to evaluate the potential hazard associated with exposure to these chemicals by representative assessment receptors. The home range size and density characteristics of various ecological species of concern make it unlikely that multiple individuals of a given species (i.e., local populations) would be exposed on a regular basis to the small area (i.e., approximately 3 acres) potentially affected by the TNTA/WWTP1 sewer lines. In other words, the small size of the site precludes the possibility of population-level impacts at the TNTA/WWTP1 sewer lines, regardless of whether contamination is present. Nevertheless, hazard estimates were generated for a number of assessment receptors under the conservative assumption that impacts to populations is plausible.

The northern harrier, a state-listed endangered species, was present at the site and was evaluated using the red-tailed hawk as a surrogate receptor. The more conservative (i.e., no-effect-level) toxicity values were used to calculate the HQs for this species to reflect the increased concern for a listed species. No HQs exceeded 1 for the hawk.

Aroclor 1016, 1,3,5-trinitrobenzene, and 2,4,6-TNT in soil at the TNTA/WWTP1 sewer lines were responsible for HQs exceeding 1 for at least one receptor. Hazard estimates for all three of these chemicals were likely overestimated due to an overestimation of their uptake into invertebrate prey tissue. This was the primary exposure pathway of concern for all receptors that had both NOAEL- and LOAEL-based HQs exceeding 1 for these chemicals. These three organic chemicals were assigned a soil-to-earthworm BAF value calculated by a model that uses K_{ow} partitioning values to predict their incorporation into lipids of earthworms. Uptake into invertebrate prey items was approximately two orders of magnitude higher using the calculations based on the K_{ow} model compared to results obtained from site-specific uptake studies on similar organic chemicals that were previously performed at PBOW. Additional considerations for these three chemicals include the following:

- For 1,3,5-trinitrobenzene, the marsh wren was the only receptor with an HQ marginally exceeding 1 (HQ = 1.79), and only the NOAEL-based HQ exceeded 1. Because the NOAEL is based on a no-observed-effect dose, it is highly conservative.

Additionally, the marsh wren's diet consists entirely of ingestion of terrestrial invertebrates, which makes it sensitive to the overestimation of uptake into these types of organisms described above.

- Aroclor 1016 only exceeded an HQ of 1 for one receptor, the marsh wren. The marsh wren's diet consists entirely of ingestion of terrestrial invertebrates, which makes it sensitive to the overestimation of uptake into these types of organisms described above. Further, Aroclor 1016 was only detected in 1 out of 15 soil samples (location SB5) at a concentration exceeding its ESV. Therefore, the small area affected is likely insufficient to cause adverse effects at the population level.

- 2,4,6-TNT was detected at elevated concentrations during initial investigations at TP-27 and TP-33. The TP-33 concentration could not be replicated by additional sampling at and near the test pit location. The TP-27 area did have elevated concentrations of 2,4,6-TNT, but delineation samples indicated the hot spot affected area was very small (approximately 0.04 acre). Home range information for the assessment receptors used to represent various ecological guilds indicates that this area is likely too small to result in adverse effects to populations of ecological receptors or adverse effects at the individual level for the red-tailed hawk, which represents a state-endangered species (northern harrier).

  Also, the 2,4,6-TNT soil-to-earthworm BAF was shown to be likely overestimated by approximately two orders of magnitude based on comparisons to the site-specific BAF for a similar compound, 2,4-DNT. If the 2,4-DNT BAF is used as a surrogate, the HQs for TNT drop below 5 for all receptors using the NOAEL TRV and drop below 1 for all receptors using the LOAEL TRV.

Although 1,3,5-trinitrobenzene and Aroclor 1016 both had HQs greater than 1, adverse ecological effects associated with exposure to these chemicals is considered unlikely because of their limited distribution area of these chemicals and the likely overestimation in the food chain model of invertebrate prey tissue concentrations. Potential effects associated with 2,4,6-TNT are also likely overestimated, but small areas where a release of 2,4,6-TNT occurred does appear to be evident at the TP-27 location. Although elevated 2,4,6-TNT was also identified at TP-33, additional sampling indicates that the elevated detection is apparently anomalous. It should be noted that the TP-33 location is very close to the jurisdictional wetland between the two sewer line traces approximately 200 feet east of Taylor Road that is identified on USFWS wetland maps (Section 2.1.3). NASA is currently developing a wetland database for the installation, and this database should be consulted prior to any additional investigations performed in that area.

In conclusion, with the possible exception of some localized effects associated with 2,4,6-TNT in soil near the TP-27 area, the potential for adverse ecological impacts is considered to be very low at the TNTA/WWTP1 sewer lines site. A hot spot area at TP-27 does appear to have elevated 2,4,6-TNT, and localized adverse impacts in this hot spot area cannot be completely discounted.

However, neither the hot spot area nor the area potentially affected by the entire sewer line trace is large enough to warrant concern for adverse effects to local populations, even if contamination is present. Thus, ecological impacts are considered unlikely given the fact that the affected area is so small that impacts to local receptor populations (other than plants and invertebrates) are implausible and also given the previously discussed uncertainty regarding uptake of 2,4,6-TNT into invertebrate prey items that resulted in elevated HQs for some invertivores. Therefore, based on the results of the SLERA, no chemicals are identified for further evaluation for protection of the environment at the TNTA/WWTP1 sewer lines.

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TABLES

Table 2-1

Plant Species Observed at TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Vegetation observed during the spring and/or early summer site walks	
Acalypha rhomboidea	three-seeded mercury
Acer negundo	box elder
Acer rubrum	red maple
Acer saccharinum	silver maple
Acer saccharum	sugar maple
Achillea millefolium	yarrow
Agrimonia parviflora	small-flowered groovebur
Agropyron repens	quack grass
Agrostis alba	redtop
Alliaria petiolata	garlic mustard
Allium vineale	field garlic
Ambrosia artemesiifolia	annual ragweed
Ambrosia trifida	giant ragweed
Amphicarpa bracteata	hog peanut
Andropogon virginicus	broom sedge
Antennaria plantaginifolium	plantain-leaved pussytoes
Apios americana	groundnut
Apocynum androsaemifolium	spreading leaf dogbane
Apocynum cannabinum	dogbane
Apocynum cannabinum	Indian hemp
Arctium minus	burdock
Asclepias incarnata	swamp milkweed
Asclepias syriaca	common milkweed
Aster lateriflorus	calico aster
Bidens frondosa	devil’s beggar ticks
Boehmeria cylindrica	small-spike false nettle
Brassica nigra	mustard
Bromus inermis	smooth brome
Calystegia sepium	hedge bindweed
Carex frankii	Frank’s sedge
Carex granularis	limestone meadow sedge
Carex tribuloides	blunt broom sedge
Carex vulpinoidea	fox sedge
Carya glabra	pignut hickory
Chrysanthemum leucanthemum	oxeye daisy
Cicuta maculata	spotted cow parsnip
Cinna arundinacea	wood reed grass
Circaea lutetiana	southern broad-leaved enchanters nightshade
Cirsium arvense	creeping thistle
Cirsium muticum	swamp thistle
Cirsium vulgare	bull thistle
Convolvulus arvensis	hedge bindweed
Cornus amomum	silky dogwood
Cornus drummondii	rough dogwood
Coronilla varia	crownvetch
Cryptotaenia canadensis	honewort
Cyperus flavescens	yellow flatsedge
Cyperus strigosus	straw-colored flatsedge

Table 2-1

Plant Species Observed at TNT Area A/Waste Water Treatment Plant 1 Sewer Lines Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Dactylis glomerata	orchard grass
Daucus carota	Queen Anne's lace
Desmodium paniculatum	showy tick trefoil
Dichanthelium clandestinum	deer tongue witchgrass
Dipsacus sylvestris	teasel
Echinochloa muricata	barnyard grass
Eleagnus angustifolia	autumn olive
Eleagnus angustifolia	autumn olive
Eleocharis palustris	spike rush
Elymus sp.	ryegrass
Elymus virginicus	Virginia wild rye
Elytrigia repens	quack grass
Epilobium coloratum	purple-leaved willow-herb
Equisetum arvense	field horsetail
Equisetum hyemale	scouring rush
Erechtites hieraciifolia	fireweed
Erigeron philadelphicus	fleabane
Eupatorium maculatum	spotted Joe Pye weed
Eupatorium purpureum	purple Joe pye weed
Eupatorium rugosum	white snakeroot
Eupatorium sessilifolium	upland boneset
Euphorbia corollata	flowering spurge
Euphorbia maculata	spurge
Euphorbia supina	milk purslane
Euthamia graminifolia	fragrant flat-topped goldenrod
Festuca sp.	fescue
Fragaria virginiana	strawberry
Fraxinus pennsylvanica	green ash
Galium aparine	cleavers
Galium apsprellum	rough bedstraw
Gentiana clausa	closed gentian
Gentiana sp.	gentian
Gerardia tenuifolia	slender gerardia
Geum laciniatum	rough avens
Glyceria striata	fowl manna grass
Hackelia virginiana	Virginia stickseed
Impatiens capensis	jewelweed
Iris versicolor	blue flag
Juncus tenuis	Path rush
Leersia oryzoides	rice cutgrass
Leptochloa fascicularis	sprangetop
Lespedeza capitata	round headed bush clover
Lobelia siphilitca	great blue lobelia
Lolium perenne	perennial rye
Lonicera tatarica	Tartarian honeysuckle
Ludwigia alternifolia	seedbox
Ludwigia palustris	marsh purslane
Lycopus americana	American bugleweed
Lycopus virginicus	Virginia bugleweed

Table 2-1

Plant Species Observed at TNT Area A/Waste Water Treatment Plant 1 Sewer Lines Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Lysimachia ciliata	fringed loosestrife
Maclura pomifera	osage orange
Medicago lupulina	black medick
Mentha piperita	peppermint
Mentha spicata	spearmint
Mimulus ringens	monkeyflower
Monarda sp.	bee balm
Nepeta cataria	catnip
Oenothera biennis	evening primrose
Onoclea sensibilis	sensitive fern
Oxalis stricta	sorrel
Panicum clandestinum	deer tongue grass
Panicum dichotomum	witch grass
Panicum virgatum	switch grass
Parthenocissus quinquefolia	Virginia creeper
Penstemon digitalis	false foxglove
Phalaris arundinacea	reed canary grass
Phleum pratense	timothy
Phytolacca americana	pokeweed
Pilea pumila	clearweed
Plantago lanceolata	English plantain
Plantago major	common plantain
Poa compressa	Canada bluegrass
Podophyllum peltatum	mayapple
Polygonum cuspidatum	Japanese knotweed
Polygonum pennsylvanicum	Pennsylvania smartweed
Polygonum scandens	climbing false buckwheat
Populus deltoides	cottonwood
Potentilla simplex	old field cinquefoil
Prunella vulgaris	self-heal
Pycnanthemum tenuifolium	slender-leaved mountain mint
Pyrus coronaria	crabapple
Quercus palustris	pin oak
Ranunculus acris	tall buttercup
Rosa multiflora	multiflora rose
Rosa setigera	prairie rose
Rubus allegheniensis	Allegheny blackberry
Rubus flagellaris	dewberry
Rubus occidentalis	black raspberry
Rudbeckia hirta	black eyed susan
Rumex acetosella	sheep sorrel
Rumex crispus	curly dock
Salix amygdaloides	peachleaf willow
Salix exigua	narrowleaf willow
Sambucus canadensis	common elder
Scirpus atrovirens	green bulrush
Scutellaria lateriflora	mad dog skullcap
Setaria faberi	giant foxtail grass
Setaria glauca	yellow foxtail

Table 2-1

Plant Species Observed at TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Solanum carolinense	horse nettle
Solanum dulcamara	bittersweet nightshade
Solidago canadensis	Canada goldenrod
Solidago juncea	early goldenrod
Spartina pecitinata	prairie cordgrass
Spiranthes cernua var. cernua	nodding ladies' tresses
Taraxacum officinale	dandelion
Teucrium canadense	Germander
Thalictrum polygamum	tall meadow rue
Toxicodendron radicans	poison ivy
Tradescantia ohioensis	Ohio spiderwort
Trifolium repens	white clover
Triosteum perfoliatum	wild coffee
Tussilago farfara	coltsfoot
Typha angustifolia	narrow-leaved cattail
Typha sp.	cattail
Ulmus americana	American elm
Urtica dioicia	stinging nettle
Verbascum thapsus	woolly mullein
Verbena hastata	blue vervain
Verbena urticifolia	white vervain
Vernonia gigantea	ironweed
Viola sp.	violet
Vitis aestivalus	summer grape
Vitis riparia	riverbank grape

Table 2-2

Mammals Observed On Site and Likely to be Found in Erie County, Ohio Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

Family Name	Scientific Name	Common Name	Observed On Site [a]
Didelphidae	*Didelphis virginiana*	Virginia opossum	
Talpidae	*Condylura cristata*	star-nosed mole (**T**)	
	Parascalops breweri	hairy-tailed mole	
	Scalopus aquaticus	Eastern mole	
Verspertilionidae	*Myotis keenii*	Keen's bat	
	M. lucifugus	little brown bat	
	M. sodalis	Indiana bat **(E*)**	
	Eptesicus fuscus	big brown bat	
	Lasionycteris noctivagans	silver-haired bat	
	Lasiurus borealis	red bat	
	L. cinereus	hoary bat	
	Nycticeius humeralis	evening bat	
	Pipistrellus subflavus	Eastern pipistrelle	
Leporidae	*Sylvilagus floridanus*	cottontail rabbit	X
Sciuridae	*Glaucomys volans*	Southern flying squirrel	
	Marmota monax	woodchuck	
	Sciurus carolinensis	gray squirrel	
	S. niger	fox squirrel	
	Spermophilus tridecemlineatus	thirteen-lined ground squirrel	
	Tamias striatus	Eastern chipmunk	
	Tamiasciurus hudsonicus	red squirrel	
	Blarina brevicauda	short-tailed shrew	

Table 2-2

Mammals Observed On Site and Likely to be Found in Erie County, Ohio Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site [a]
Soricidae	*Cryptotis parva*	least shrew	
	Sorex cinereus	masked shrew	
Castoridae	*Castor canadensis*	beaver	
Cricetidae	*Microtus pennsylvanicus*	meadow vole	
	Mus musculus	house mouse	
	Ondatra zibethicus	muskrat	
	Peromyscus leucopus	white-footed mouse	
	P. maniculatus	deer mouse	
	Rattus norvegicus	Norway rat	
	Synaptomys cooperi	Southern bog lemming	
	Zapus hudsonius	meadow jumping mouse	
Procyonidae	*Procyon lotor*	raccoon	X
Mustelidae	*Mephitis mephitis*	striped skunk	
	Mustela frenata	long-tailed weasel	
	M. nivalis	least weasel	
	M. vison	mink	
	Taxidea taxus	Badger (**T**)	
Canidae	*Canis latrans*	coyote	
	Urocyon cinereoargenteus	gray fox	
	Vulpes vulpes	red fox	
Cervidae	*Odocoileus virginianus*	white-tailed deer	X

Mammals likely to be found in Erie County based on information presented in:
Gottschang, J. L., 1981, A Guide to the Mammals of Ohio, Ohio State University Press, 176 pages.
T = Ohio threatened species.; E* = Federally endangered species.
[a] Shaw Site Reconnaissance, June 2 and September 9, 2009.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Ardeidae	*Ardea herodias*	great blue heron	(1) Regular visitor at ponds, streams, and ditches.
	Bublucus ibis	cattle egret (**E**)	(1) Rare visitor in short grass areas
	Butorides striatus	green heron	(1) Confirmed breeder, rare at ponds, streams.
	Casmerodius albus	great egret	(1) Regular visitor at ponds, streams, and ditches.
	Nycticorax nycticorax	black-crowned night heron (**T**)	(1) Regular visitor at ponds, streams, and ditches.
Anserinae	*Branta canadensis*	Canada goose	(1) (2) Confirmed breeder; uncommon around ponds.
Anatinae	*Aix sponsa*	Wood duck	(1) Confirmed breeder, uncommon around ponds.
	Anas discors	blue-winged teal	Confirmed and/or probable breeder in county.
	A. platyrhynchos	mallard	(1) Confirmed breeder, uncommon at ponds, streams.
	A. rubripes	American black duck	(1) Possible breeder, rare at ponds, streams, ditches.
Merginae	*Lophodytes cucullatus*	hooded merganser	Confirmed and/or probable breeder in county.
Accipitrinae	*Accipiter striatus*	sharp-shinned hawk	Confirmed and/or probable breeder in county.
	Accipiter cooperii	Cooper's hawk	(2) Uncommon at fields, successional woods.
	Circus cyaneus	Northern harrier (**E**)	(2*) Uncommon at fields, grasslands, marshes.
Buteoninae	*Buteo jamaicensis*	red-tailed hawk	Confirmed and/or probable breeder in county.
	B. lineatus	red-shouldered hawk	Confirmed and/or probable breeder in county.
	B. platypterus	broad-winged hawk	Confirmed and/or probable breeder in county.
	Haliaeetus leucocephalus	bald eagle (**T**)	Confirmed and/or probable breeder in county.
Anatidae	*Cygnus buccinator*	Trumpeter swan (**E**)	(1) Rare migrant seen flying toward lake.
Falconinae	*Falco sparverius*	American kestrel	Confirmed and/or probable breeder in county.
Phasianidae	*Colinus virginianus*	Northern bobwhite quail	Confirmed and/or probable breeder in county.
	Phasianus colchicus	ring-necked pheasant	Confirmed and/or probable breeder in county.
Rallidae	*Gallinula chloropus*	common moorhen	Confirmed and/or probable breeder in county.
	Porzana carolina	Sora	Confirmed and/or probable breeder in county.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Cathartidae	*Cathartes aura*	turkey vulture	Possible breeder in county.
Charadriidae	*Charadrius vociferus*	killdeer	Confirmed and/or probable breeder in county.
Scolopacidae	*Actitis macularia*	spotted sandpiper	Confirmed and/or probable breeder in county.
	Bartramia longicauda	upland sandpiper (**T**)	(1) Confirmed breeder, rare in grassy areas.
	Gallinago gallinago	common snipe	(2) Confirmed and/or probable breeder in county.
	Scolopax minor	American woodcock	(1) Confirmed breeder, uncommon in moist woodlots.
	Tringa solitaria	solitary sandpiper	Occasional visitor to mud flats.
Larinae	*Larus argentatus*	herring gull	(1) Regular visitor.
	L. delawarensis	ring-billed gull	(1) Regular visitor.
Columbidae	*Columba livia*	rock dove	(1) Confirmed breeder, very common.
	Zenaida macroura	mourning dove	(1) Confirmed breeder, very common.
Cuculidae	*Coccyzus americanus*	yellow-billed cuckoo	(1) Confirmed breeder, uncommon in woodlots, shrubs.
	C. erythropthalmus	black-billed cuckoo	(1) Probable breeder, rare in woodlots & shruby areas.
Tytonidae	*Bubo virginianus*	great horned owl	(1) Confirmed breeder, uncommon in woodlots.
	Otus asio	Eastern screech-owl	(1) Confirmed breeder, common in woodlots, shrubs.
	Strix varia	barred owl	Confirmed and/or probable breeder in county.
Caprimulgidae	*Chordeiles minor*	common nighthawk	(1) Possible breeder, rare.
Apodidae	*Chaetura pelagica*	chimney swift	(1) Confirmed breeder, uncommon.
Trochilidae	*Archilochus colubris*	ruby-throated hummingbird	(1) Confirmed breeder, uncommon in woodlots, shrubs.
Alcedinidae	*Ceryle alcyon*	belted kingfisher	(1) Confirmed breeder, rare around ponds, streams.
Picidae	*Colaptes auratus*	Northern flicker	(1) Confirmed breeder, common in woodlots.
	Dryocopus pileatus	pileated woodpecker	Confirmed and/or probable breeder in county.
	Melanerpes carolinus	red-bellied woodpecker	(1) Confirmed breeder, common in mature woods.
	M. erythrocephalus	red-headed woodpecker	(1) Confirmed breeder, uncommon in mature woods.
	Picoides pubescens	downy woodpecker	(1) Confirmed breeder, common in woodlots.
	P. villosus	hairy woodpecker	(1) Confirmed breeder, uncommon in large woodlots.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Tyrannidae	*Contopus virens*	Eastern wood-pewee	(1) (2*) Confirmed breeder, very common in large woodlots.
	Empidonax alnorum	alder flycatcher	(1) Possible breeder, rare in shrubby wet areas.
	E. minimus	least flycatcher (**T**)	(1) Probable breeder, rare in shrubby areas.
	E. traillii	willow flycatcher	(1) (2*) Confirmed breeder, very common in shrubby areas.
	E. virescens	Acadian flycatcher	(1) Confirmed breeder, uncommon in mature woodlots.
	Myiarchus crinitus	great crested flycatcher	(1) Confirmed breeder, common in large woodlots.
	Sayornis phoebe	Eastern phoebe	(1) Confirmed breeder, common near stream bridges.
	Tyrannus tyrannus	Eastern kingbird	(1) (2*) Confirmed breeder, very common - open shrub area.
Alaudidae	*Eremophila alpestris*	horned lark	(1) Probable breeder, rare in grassland, cultiv. fields.
Hirundinidae	*Hirundo pyrrhonota*	cliff swallow	Confirmed and/or probable breeder in county.
	H. rustica	barn swallow	(1) (2*) Confirmed breeder, very common near vacant bldgs.
	Progne subis	purple martin	(1) Probable breeder, rare.
	Riparia riparia	bank swallow	(1) Rare migrant or visitor.
	Stelgidopteryx seripennis	Northern rough-winged swallow	(1) Confirmed breeder, rare along streams, ditches.
	Tachycineta bicolor	tree swallow	(1) (2*) Confirmed breeder, rare around ponds.
Corvidae	*Corvus brachyrhynchos*	American crow	(1) Confirmed breeder, very common in woodlots.
	Cyanocitta cristata	blue jay	(1) Confirmed breeder, abundant in woods.
Paridae	*Parus atricapillus*	black-capped chickadee	(1) Confirmed breeder, common in woodlots.
	P. bicolor	tufted titmouse	(1) Confirmed breeder, common in woodlots.
Sittidae	*Sitta carolinensis*	white-breasted nuthatch	(1) Confirmed breeder, uncommon in woodlots.
Troglodytidae	*Cistothorus palustris*	marsh wren	(1) Possible breeder, rare in wetlands with cattails.
	C. platensis	sedge wren	(1) Confirmed breeder, common in old grassy fields.
	Thryothorus ludovicianus	Carolina wren	(1) Probable breeder, rare in shrubby areas & woodlots.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
	Troglodytes aedon	house wren	(1) Confirmed breeder, abundant in shrubby areas.
	T. troglodytes	winter wren	(1) Rare migrant.
Mimidae	*Dumetella carolinensis*	gray catbird	(1) Confirmed breeder, abundant in shrubby areas.
	Mimus polyglottos	northern mockingbird	(1) Confirmed breeder, rare in shrubby areas.
	Toxostoma rufum	brown thrasher	(1) Confirmed breeder, common in shrubby areas.
Turdidae	*Catharus fuscescens*	veery	(1) Confirmed breeder, uncommon in large woodlots.
	Catharus minimus	gray-cheeked thrush	Uncommon in large woodlots, likely migratory.
	Hylocichla mustelina	wood thrush	(1) Confirmed breeder, very common in large woodlots.
	Sialia sialis	Eastern bluebird	(1) (2*) Confirmed breeder, common in openfields & edges.
	Turdus migratorius	American robin	(1) (2*) Confirmed breeder, abundant everywhere.
Sylviidae	*Polioptila caerulea*	blue-gray gnatcatcher	(1) Confirmed breeder, uncommon in woodlots.
	Regulus calendula	ruby-crowned kinglet	(1) Rare migrant.
Bombycillidae	*Bombycilla cedrorum*	cedar waxwing	(1) Confirmed breeder, very common everywhere.
Sturnidae	*Sturnus vulgaris*	European starling	(1) Confirmed breeder, abundant everywhere.
Vireonidae	*Vireo bellii*	Bell's vireo	Confirmed and/or probable breeder in county.
	V. flavifrons	yellow-throated vireo	(1) Confirmed breeder, uncommon in mature woodlots.
	V. gilvus	warbling vireo	(1) (2*) Confirmed breeder, common in large woodlots.
	V. griseus	white-eyed vireo	(1) Confirmed breeder, uncommon in shrubby areas.
	V. olivaceus	red-eyed vireo	(1) Confirmed breeder, very common in woodlots.
Parulidae	*Dendroica cerulea*	cerulean warbler	(1) Possible breeder, rare in mature woodlots.
	D. dominica	yellow-throated warbler	(1) Confirmed and/or probable breeder in county.
	D. pensylvanica	chestnut-sided warbler	(1) Probable breeder, uncommon in shrubby areas.
	D. petechia	yellow warbler	(1) (2*) Confirmed breeder, abundant in shrubby areas.
	D. virens	black-throated green warbler	(1) Possible breeder, rare in mature woodlots.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
	Geothylpis trichas	common yellowthroat	(1) (2*) Confirmed breeder, abundant in shrub areas, fields.
	Icteria virens	yellow-breasted chat	(1) Confirmed breeder, uncommon in shrubby areas.
	Mniotilta varia	black and white warbler	(1) Possible breeder, rare in mature woodlots.
	Oporornis formosus	Kentucky warbler	(1) Possible breeder, rare in mature woodlots.
	Protonotaria citrea	prothonotary warbler	Confirmed and/or probable breeder in county.
	Seiurus aurocapillus	overbird	(1) Probable breeder, rare in mature woodlots.
	S. motacilla	Louisiana waterthrush	Confirmed and/or probable breeder in county.
	Setophaga ruticilla	American redstart	(1) Probable breeder, rare in shrubby areas & woodlots.
	Vermivora leucobronchialis	Brewster's warbler	(1) Possible breeder, rare in shrubby areas and edges.
	V. pinus	blue-winged warbler	(1) Confirmed breeder, common in shrubby areas.
	V. chrysoptera	golden-winged warbler **(E)**	Possible breeder, rare in shrubby areas.
	Vermivora ruficapilla	Nashville warbler	(1) Probable migrant.
	Wilsonia citrina	hooded warbler	Confirmed and/or probable breeder in county.
Icteridae	*Agelaius phoeniceus*	red-winged blackbird	(1) (2*) Confirmed breeder, abund. in grasslands, streams.
	Dolichonyx oryzivorus	bobolink	(1) (2*) Confirmed breeder, uncommon in grasslands.
	Icterus galbula	Northern oriole	(1) Confirmed breeder, uncommon in open woods.
	I. spurius	orchard oriole	(1) Confirmed breeder, common in open woods & edges.
	Molothrus ater	brown-headed cowbird	(1) (2) Confirmed breeder, abundant everywhere.
	Quiscalus quiscula	common grackle	(1) Confirmed breeder, abundant everywhere.
	Sturnella magna	Eastern meadowlark	(1) (2*) Confirmed breeder, common in grasslands.
Ploceidae	*Passer domesticus*	house sparrow	(1) Confirmed breeder, uncommon near buildings.
Thraupidae	*Piranga olivacea*	scarlet tanager	(1) Possible breeder, rare on open woods.
	P. ruba ruba	summer tanager	(1) Confirmed breeder, common in mature woodlots.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Fringillidae	*Ammodramus henslowii*	Henslow's sparrow	(1) Probable breeder, rare in old fields.
	A. savannarum	grasshopper sparrow	(1) Confirmed breeder, common in grasslands.
	Carduelis tristis	American goldfinch	(1) (2*) Confirmed breeder, abundant in shrubby areas.
	Carpodacus mexicanus	house finch	(1) Confirmed breeder, uncommon around buildings.
Cardinalidae	*Cardinalis cardinalis*	Northern cardinal	(1) Confirmed breeder, abundant everywhere.
	Spiza amercana	dickcissel	Confirmed and/or probable breeder in county.
	Passerina cyanea	indigo bunting	(1) (2*) Confirmed breeder, abundant everywhere.
	Pheucticus ludovicianus	rose-breasted grosbeak	(1) Confirmed breeder, common in woodlots & edges.
Emberizidae	*M. melodia*	song sparrow	(1) (2*) Confirmed breeder, abundant everywhere.
	Melospiza georgiana	swamp sparrow	(1) Confirmed breeder, rare in wet fields and ditches.
	Passerculus sandwichensis	Savannah sparrow	(1) Confirmed breeder, common in grasslands.
	Pipilo erythrophthalmus	Eastern towhee	(1) Confirmed breeder, very common in woodlots, edges.
	Pooecetes gramineus	vesper sparrow	(1) Confirmed breeder, uncommon in grassland & fields.
	Spizella passerina	chipping sparrow	(1) Confirmed breeder, common in open woods & lawns.
	S. pusilla	field sparrow	(1) (2*) Confirmed breeder, abundant in grasslands, shrubs.
	Zonotrichia albicollis	white-throated sparrow	(1) Late migrant, rare.

[a] Family names from: Peterson, R. T., 1947, *A Field Guide to the Birds*, Sponsored by the National Audubon Society, Houghton Mifflin Company, Boston, Massachusetts.
[b] Peterjohn, B. G. and D. L. Rice, 1991, *The Ohio Breeding Bird Atlas*, The Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio, 416 pages.
[c] E = Ohio Endangered species; T = Ohio Threatened species.

Observation References:

(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1994).

(2) Observed during Shaw reconnaissance at the site on April 29, or June 2, 2009.
An asterisk (*) indicates the species was detected during the June site visit, and is likely using the site for breeding.

Table 2-4

Reptiles Observed On Site and Likely to be Found at Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site
Chelydridae	*Chelydra serpentina*	snapping turtle	(1)
Kinosternidae	*Sternotherus odoratus*	musk turtle	
Emydidae	*Chrysemys picta*	painted turtle	(1)
	Emys blandingii	Blanding's turtle	(1)
	Terrapene carolina	box turtle	(1)
Colubridae	*Elaphe vulpina*	fox snake	(1)
	Heterodon platyrhinos	hog-nosed snake	
	Nerodia septemvittata	queen snake	
	N. sipedon sipedon	water snake	(1)
	Opheodrys vernalis	green snake	(1)
	Storeria dekayi	Dekay's brown snake	(1)
	Thamnophis butleri	Butler's garter snake	(1)
	T. sauritus	ribbon snake	
	T. sirtalis	common garter snake	(1)

References:

Conant, R. and J. T. Collins, 1991, *Reptiles and Amphibians, Eastern/Central North America*, Peterson Field Guide, Third Edition, Houghton Mifflin Company, Boston.
Pfingsten, R. A. and F. L. Downs (eds.), 1989, *Salamanders of Ohio*, Ohio Biological Survey Bulletin, New Series, Vol. 7, No. 2, 315 pages, 29 pls.
Wright, A. H. and A. A. Wright, 1957, *Handbook of Snakes of the United States and Canada*, Volumes I and II, Comstock Publishing Associates, Ithaca and London, 1105 pages.
Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).

Table 2-5

Amphibians Observed On Site and Likely to be Found at Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site
Ambystomatidae	*Ambystoma texanum*	smallmouth salamander	(1)
	Plethodon cinereus	redback salamander	(1)
Bufonidae	*Bufo americanus*	American toad	(1)
Hylidae	*Acris gryllus*	cricket frog	(1)
	Hyla versicolor	gray treefrog	(1)
	Pseudacris crucifer	spring peeper	(1)
	P. triseriata	chorus frog	(1)
Ranidae	*Rana catesbeiana*	bullfrog	(1)
	R. clamitans	green frog	(1)
	R. pipiens	Northern leopard frog	(1)

References:
Conant, R. and J. T. Collins, 1991, *Reptiles and Amphibians, Eastern/Central North America*, Peterson Field Guide, Third Edition, Houghton Mifflin Company, Boston.
Pfingsten, R. A. and F. L. Downs (eds.), 1989, *Salamanders of Ohio*, Ohio Biological Survey Bulletin, New Series, Vol. 7, No. 2, 315 pages, 29 pls.
Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).

Table 2-6

Fish Species Observed at Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site	Habitat[a]
Catostomidae	*Catostomus commersoni*	white sucker	(1)	lotic
Centrarchidae	*Lepomis cyanellus*	green sunfish	(1)	lentic, lotic
	Lepomis species	green sunfish hybrid	(1)	lentic
	L. gibbosus	pumpkinseed sunfish	(1)	lentic
	L. macrochirus	bluegill	(1)	lentic
	Micropterus salmoides	largemouth bass	(1)	lentic
Cyprinidae	*Campostoma anomalum*	central stoneroller	(1)	lotic
	Carassius auratus	goldfish	(1)	lentic
	Luxilus chrysocephalus	striped shiner	(1)	lotic
	Pimephales notatus	bluntnose minnow	(1)	lotic
	P. promelas	fathead minnow	(1)	lotic
	Semotilus atromaculatus	creek chub	(1)	lotic
Gasterosteidae	*Culaea inconstans*	brook stickleback	(1)	lotic
Ichtaluridae	*Ameiurus melas*	black bullhead	(1)	lentic

[a] Lotic - flowing water such as brooks, ditches, and creeks.
Lentic - still waters such as ponds and lakes.

Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1994).

Table 2-7

Summary of Samples Evaluated in the Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Location	Sample Number	Sample Purpose	Sample Date	Depth (ft)	Analyses
Soil Samples					
SL-SB01	SL0061	REG	13-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB01	SL0062	REG	13-Jan-09	4 - 6	Exp, Metals, PCB, SVOC
SL-SB02	SL0063	REG	12-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB02	SL0232	REG	22-Aug-11	5 - 7	Exp
SL-SB03	SL0067	REG	13-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB03	SL0068	REG	13-Jan-09	5 - 6	Exp, Metals, PCB, SVOC
SL-SB04	SL0069	REG	13-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB04	SL0070	REG	13-Jan-09	3.4 - 5.4	Exp, Metals, PCB, SVOC
SL-SB05	SL0071	REG	13-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB05	SL0233	REG	23-Aug-11	0 - 1	Exp
SL-SB06	SL0073	REG	13-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB06	SL0074	REG	13-Jan-09	5 - 6	Exp, Metals, PCB, SVOC
SL-SB07	SL0075	REG	14-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB07	SL0076	FD	14-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB07	SL0078	REG	14-Jan-09	5 - 6	Exp, Metals, PCB, SVOC
SL-SB08	SL0079	REG	14-Jan-09	0 - 1	Exp, Metals, PCB, SVOC
SL-SB09	SL0081	REG	12-Jan-09	5 - 6	Exp, Metals, PCB, SVOC
SL-SB10	SL0083	REG	12-Jan-09	5 - 6	Exp, Metals, PCB, SVOC
SL-SB12	SL0237	REG	23-Aug-11	0 - 1	Exp
SL-SB14	SL0239	REG	23-Aug-11	0 - 1	Exp
SL-SB15	SL0240	REG	22-Aug-11	5 - 7	Exp
SL-SB22	SL0247	REG	22-Aug-11	5 - 7	Exp
SL-SB23	SL0248	REG	22-Sep-11	0 - 1	Exp
SL-SB27	SL0252	REG	22-Sep-11	0 - 1	Exp
TNTA-SL-TP03	SL0003	REG	4-Dec-08	5 - 5.5	Exp
TNTA-SL-TP04	SL0004	REG	4-Dec-08	4 - 4.5	Exp
TNTA-SL-TP21	SL0025	REG	5-Dec-08	4 - 4.5	Exp
TNTA-SL-TP22	SL0026	REG	5-Dec-08	4 - 4.5	Exp
TNTA-SL-TP22	SL0027	FD	5-Dec-08	4 - 4.5	Exp
TNTA-SL-TP23	SL0029	REG	5-Dec-08	4 - 4.5	Exp
TNTA-SL-TP24	SL0030	REG	5-Dec-08	4 - 4.25	Exp
TNTA-SL-TP25	SL0031	REG	5-Dec-08	4 - 4.25	Exp
TNTA-SL-TP26	SL0032	REG	4-Dec-08	4 - 4.3	Exp
TNTA-SL-TP27	SL0033	REG	4-Dec-08	3 - 3.5	Exp
TNTA-SL-TP28	SL0034	REG	4-Dec-08	3 - 3.25	Exp
TNTA-SL-TP28	SL0035	FD	4-Dec-08	3 - 3.25	Exp
TNTA-SL-TP29	SL0037	REG	4-Dec-08	5 - 5.5	Exp
TNTA-SL-TP30	SL0038	REG	4-Dec-08	5 - 5.25	Exp
TNTA-SL-TP32	SL0040	REG	4-Dec-08	5 - 5.5	Exp
TNTA-SL-TP33	SL0041	REG	4-Dec-08	5 - 5.5	Exp
TNTA-SL-TP34	SL0042	REG	4-Dec-08	5 - 5.5	Exp
TNTA-SL-TP35	SL0043	REG	4-Dec-08	5 - 5.25	Exp
TNTA-SL-TP36	SL0044	REG	4-Dec-08	5 - 5.5	Exp
TNTA-SL-TP37	SL0045	REG	4-Dec-08	4 - 4.25	Exp
Sediment Samples					
1SLA-SD01	SL1000	REG	30-Oct-09	0 - 0	Exp, PCBs
1SLA-SD02	SL1001	REG	30-Oct-09	0 - 0	Exp, PCBs
1SLA-SD03	SL1002	REG	30-Oct-09	0 - 0	Exp, PCBs
1SLA-SD04	SL1003	REG	30-Oct-09	0 - 0	Exp, PCBs
1SLA-SD05	SL1004	REG	30-Oct-09	0 - 0	Exp, PCBs
1SLA-SD06	SL1005	REG	30-Oct-09	0 - 0	Exp, PCBs
1SLA-SD06	SL1006	FD	30-Oct-09	0 - 0	Exp, PCBs
Surface Water Samples					
1SLA-SW01	SL2000	REG	30-Oct-09	0 - 0	Exp
1SLA-SW02	SL2001	REG	30-Oct-09	0 - 0	Exp
1SLA-SW03	SL2002	REG	30-Oct-09	0 - 0	Exp
1SLA-SW04	SL2003	REG	30-Oct-09	0 - 0	Exp
1SLA-SW05	SL2004	REG	30-Oct-09	0 - 0	Exp

Table 2-7

Summary of Samples Evaluated in the Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Location	Sample Number	Sample Purpose	Sample Date	Depth (ft)	Analyses
1SLA-SW06	SL2005	REG	30-Oct-09	0 - 0	Exp
1SLA-SW06	SL2006	FD	30-Oct-09	0 - 0	Exp

Exp - Explosives
FD = Field duplicate
NA - Not applicable
PCB = Polychlorinated biphenyls
SVOC = Semivolatile organic compounds

[a] Samples were collected for delineating 2,4,6-trinitrotoluene. See text for details.

Table 2-8

Statistical Summary and COPEC Selection of Chemicals Detected in Soil (0 to 6 Feet bgs)
TNT Area A/Waste Water Treatment Plant 1 Sewer Line
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Detected Concentrations Maximum	VQ	Reporting Limits Minimum	Reporting Limits Maximum	Mean (mg/kg)	BSC [b] (mg/kg)	ESV [c] (mg/kg)	COPEC? [d,e]	Distribution [f]	95% UCL [g] (mg/kg)	EPC [h] (mg/kg)	UCL 0-1' soil depth [f] (mg/kg)	MDC 0-1' soil depth [h] (mg/kg)	EPC 0-1' soil depth [h] (mg/kg)
Inorganics																		
Aluminum	15 / 15	100	7.04E+03		1.24E+04		8.77E-01	2.19E+00	8.94E+03	1.55E+04	pH Dependent	N (b)						
Antimony	10 / 15	67	2.94E-01	J	5.72E-01		2.05E-01	2.74E-01	3.79E-01	9.30E+00	0.27	N (b)						
Arsenic	15 / 15	100	4.80E+00	J	2.03E+01	J	4.10E-01	5.48E-01	1.08E+01	3.65E+01	18	N (b)						
Barium	15 / 15	100	3.78E+01		1.16E+02		8.20E-02	1.10E-01	5.72E+01	8.26E+02	330	N (a)						
Beryllium	15 / 15	100	5.22E+00	J	1.03E+01	J	8.20E-02	1.10E-01	7.31E+00	1.00E+00	21	N (a)						
Cadmium	6 / 15	40	2.34E-01	J	3.87E-01	J	2.05E-01	2.74E-01	2.70E-01	NA	0.36	Y	Normal	2.99E-01	2.99E-01	3.30E-01	3.87E-01	3.30E-01
Calcium	15 / 15	100	2.79E+03		3.21E+04		2.19E+00	5.48E+00	1.35E+04	5.23E+04	Nutrient	N (c)						
Chromium	15 / 15	100	1.70E+00		1.65E+01		2.05E-01	2.74E-01	1.26E+01	2.90E+01	26	N (a)						
Cobalt	15 / 15	100	4.19E+00		1.73E+01		8.20E-02	2.03E-01	8.84E+00	1.16E+02	13	N (b)						
Copper	15 / 15	100	1.54E+01		3.63E+01		2.05E-01	2.74E-01	2.68E+01	5.62E+01	28	N (b)						
Iron	15 / 15	100	1.46E+04		6.56E+04		8.98E-01	4.52E+00	2.65E+04	2.34E+05	pH Dependent	N (b)						
Lead	15 / 15	100	1.03E+01		2.83E+01		2.05E-01	2.74E-01	1.55E+01	4.86E+01	11	N (b)						
Magnesium	15 / 15	100	1.61E+03	J	9.98E+03	J	8.20E-01	1.10E+00	4.18E+03	1.04E+04	Nutrient	N (c)						
Manganese	15 / 15	100	1.37E+02		8.33E+02		8.20E-02	1.10E-01	3.17E+02	3.51E+03	220	N (b)						
Mercury	14 / 15	93	1.53E-02	J	4.43E-01		1.08E-02	1.29E-02	5.62E-02	8.50E-02	0.00051	Y	Nonparametric	1.78E-01	1.78E-01	3.10E-01	4.43E-01	3.10E-01
Nickel	14 / 15	93	2.68E+00	J	3.97E+01		1.23E-01	1.64E-01	1.35E+01	5.51E+01	38	N (b)						
Potassium	15 / 15	100	4.61E+02		1.13E+03		1.02E+01	1.37E+01	8.06E+02	3.39E+03	Nutrient	N (c)						
Selenium	7 / 15	47	4.53E-01	J	1.32E+00	J	4.10E-01	5.48E-01	5.82E-01	2.00E+00	0.52	N (b)						
Sodium	15 / 15	100	3.11E+01		1.22E+02		4.38E+00	1.10E+01	6.96E+01	NA	Nutrient	N (c)						
Thallium	8 / 15	53	2.92E-01	J	6.97E-01		2.05E-01	2.74E-01	3.48E-01	1.30E+00	1	N (a)						
Vanadium	15 / 15	100	1.55E+01		2.70E+01		8.20E-02	1.10E-01	2.10E+01	4.09E+01	7.8	N (b)						
Zinc	15 / 15	100	3.40E+01	J	9.94E+01		1.02E+00	1.37E+00	6.39E+01	3.22E+02	46	N (b)						
Polychlorinated biphenyls (PCB)																		
Aroclor 1016	7 / 15	47	1.91E-02	J	1.16E+00	J	7.68E-03	9.24E-03	1.09E-01		0.371	Y	Lognormal	2.88E-01	2.88E-01	8.14E-01	1.16E+00	8.14E-01
Aroclor 1260	1 / 15	7	1.47E-01	J/J	1.47E-01	J/J	7.68E-03	9.24E-03	1.76E-02		0.371	N (a)						
Explosives																		
1,3,5-Trinitrobenzene	7 / 39	18	1.96E-01	J	1.75E+00		7.30E-02	8.00E+00	5.13E-01		0.376	Y	Normal	8.73E-01	8.73E-01	NA	1.96E-01	1.96E-01
2,4,6-Trinitrotoluene	14 / 39	36	1.49E-01	J	1.20E+03		7.30E-02	3.89E+01	5.66E+01		NSV	Y	Nonparametric	2.14E+02	2.14E+02	3.11E+02	1.20E+03	3.11E+02
2,4-Dinitrotoluene	7 / 39	18	2.01E-01	J	3.25E+00		8.80E-02	9.70E+00	5.69E-01		1.28	Y	Normal	8.58E-01	8.58E-01	4.56E+00	1.93E+00	1.93E+00
2,6-Dinitrotoluene	5 / 39	13	2.17E-01	J	1.48E+00	/U	7.90E-02	8.70E+00	4.18E-01		0.0328	Y	Normal	5.53E-01	5.53E-01	4.06E+00	1.48E+00	1.48E+00
2-Amino-4,6-dinitrotoluene	9 / 39	23	1.49E-01	J	5.01E+01		7.30E-02	8.00E+00	2.22E+00		0.0328	Y	Gamma	4.61E+00	4.61E+00	2.17E+01	5.01E+01	2.17E+01
4-Amino-2,6-dinitrotoluene	10 / 39	26	1.63E-01	J/U	3.13E+01		7.30E-02	8.00E+00	1.57E+00		0.0328	Y	Gamma	3.17E+00	3.17E+00	1.10E+01	3.13E+01	1.10E+01
Semivolatile Organic Compounds																		
Acenaphthylene	1 / 15	7	1.11E-01	J	1.11E-01	J	4.62E-03	2.58E-02	1.34E-02		29	N (a)						
Anthracene	1 / 15	7	2.99E-01	J	2.99E-01	J	8.32E-03	4.65E-02	3.08E-02		29	N (a)						
Benzo(a)anthracene	3 / 15	20	4.70E-02	J	1.54E+00		2.53E-02	1.41E-01	1.39E-01		1.1	Y	Lognormal	6.60E-01	6.60E-01	1.17E+00	1.54E+00	1.17E+00
Benzo(a)pyrene	2 / 15	13	5.30E-02	J	1.18E+00		2.53E-02	1.41E-01	1.13E-01		1.1	Y	Nonparametric	5.76E-01	5.76E-01	1.01E+00	1.18E+00	1.01E+00
Benzo(b)fluoranthene	3 / 15	20	7.13E-02	J	2.00E+00		6.41E-02	3.58E-01	2.18E-01		1.1	Y	Lognormal	8.64E-01	8.64E-01	1.52E+00	2.00E+00	1.52E+00
Benzo(ghi)perylene	1 / 15	7	6.90E-01		6.90E-01		9.38E-02	5.24E-01	1.68E-01		1.1	N (a)						
Benzo(k)fluoranthene	1 / 15	7	5.40E-01		5.40E-01		1.17E-01	6.52E-01	1.88E-01		1.1	N (a)						
Benzoic acid	2 / 15	13	5.37E-01		6.39E-01	QJ	9.38E-02	5.24E-01	1.94E-01		NSV	Y	Nonparametric	5.60E-01	5.60E-01	5.82E-01	6.39E-01	5.82E-01
Bis(2-ethylhexyl)phthalate	1 / 15	7	8.69E-02	J	8.69E-02	J	3.56E-02	1.99E-01	5.21E-02		0.925	N (a)						
Chrysene	3 / 15	20	6.32E-02	J	1.36E+00		1.53E-02	8.53E-02	1.18E-01		1.1	Y	Lognormal	5.96E-01	5.96E-01	1.36E+00	1.36E+00	1.36E+00
Dibenz(a,h)anthracene	1 / 15	7	1.96E-01	J	1.96E-01	J	8.70E-02	4.86E-01	1.26E-01		1.1	N (a)						
2,4-Dinitrotoluene [i]	*6 / 15*	*40*	*5.63E-02*	*J*	*4.42E+00*		*1.35E-02*	*7.56E-02*	*3.53E-01*		*1.28*	*Y*	*Lognormal*	*1.72E+00*	*1.72E+00*	*3.33E+00*	*4.42E+00*	*3.33E+00*
2,6-Dinitrotoluene [i]	*3 / 15*	*20*	*4.11E-02*	*J*	*2.18E+00*		*9.24E-03*	*5.17E-02*	*1.65E-01*		*0.0328*	*Y*	*Normal*	*4.86E-01*	*4.86E-01*	*3.60E+02*	*2.18E+00*	*2.18E+00*
Fluoranthene	4 / 15	27	2.61E-02	J/U	3.05E+00		8.32E-03	4.65E-02	2.32E-01		1.1	Y	Gamma	6.37E-01	6.37E-01	1.20E+00	3.05E+00	1.20E+00
Indeno(1,2,3-cd)pyrene	1 / 15	7	1.06E+00		1.06E+00		1.25E-01	6.98E-01	2.33E-01		1.1	N (a)						
Nitroaniline, 3-	1 / 15	7	2.99E-01	J	2.99E-01	J	1.31E-02	7.30E-02	3.31E-02		3.16	N (a)						
Phenanthrene	4 / 15	27	4.27E-02	J	3.92E-01	J	9.36E-03	5.23E-02	4.92E-02		29	N (a)						
Pyrene	3 / 15	20	7.26E-02	J	2.22E+00		1.54E-02	8.59E-02	1.78E-01		1.1	Y	Lognormal	9.56E-01	9.56E-01	1.68E+00	2.22E+00	1.68E+00

BSC - Background screening concentration.
COPEC - Chemical of potential ecological concern.
EPC - Exposure point concentration.
ESV - Ecological screening value.

Table 2-8

Statistical Summary and COPEC Selection of Chemicals Detected in Soil (0 to 6 Feet bgs)
TNT Area A/Waste Water Treatment Plant 1 Sewer Line
Plum Brook Ordnance Works, Sandusky, Ohio

mg/kg - Milligrams per kilogram.
NA - Not available.
NSV - No screening value.
UCL - Upper confidence limit.
VQ - Validation qualifier (a "/" indicates combined VQs for a regular and field duplicate sample pair)
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed
QJ- Concentration estimated due to instrument response below method criteria.
U - Not detected.

[a] Samples greater than 6 feet in depth were included if at least half their sampling unterval was below 6 feet. See text for details.
[b] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas***, Plum Brook Ordnance Works, Sandusky, Ohio, August.
[c] ESVs and their sources are in Appendix B.
[d] N - Chemical is not chosen as a COPEC:
(a) - maximum detected concentration is less than the ESV.
(b) - maximum detected concentration is less than the BSC.
(c) - essential nutrient.
[e] Y - Chemical is chosen as COPEC.
[f] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1 (U.S. Environmental Protection Agency (EPA), 2011, ProUCL Version 4.1, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/software.htm.
[g] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower
[h] The EPC for the COPEC at the surface soil depth range is used as the exposure concentration for some ecological receptors.
[i] Results from the explosives analysis, rather than the semivolatiles analysis, were used in the risk assessment. See text for details

Table 2-9

Statistical Summary and COPEC Selection for Chemicals Detected in Sediment
TNT Area A to Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

			Range of Values, mg/kg											
			Detected Concentrations				Reporting Limits							
Chemical	Detection Frequency	Percent Detection	Minimum	VQ	Maximum	VQ	Minimum	Maximum	Mean mg/kg	ESV [a] mg/kg	COPEC? [b,c]	Distribution [d]	95% UCL [d] mg/kg	EPC [e] mg/kg
Polychlorinated biphenyls														
Aroclor 1254	5 / 6	83	4.09E-02		2.15E-01		1.00E-02	1.40E-02	9.92E-02	5.98E-02	Y	Normal	1.69E-01	1.69E-01

COPEC - Chemical of Potential Ecological Concern
EPC - Exposure point concentration
ESV - Ecological screening value
mg/kg - milligrams per kilogram
NA - Not available
NSV - No screening value available
VQ - Validation qualifier

[a] ESVs and their sources are in Appendix B.
[b] N = Chemical is not chosen as a COPEC:
(a) = maximum detected concentration is less than the ESV
[c] Y = Chemical is chosen as COPEC.
[d] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1 (U.S. Environmental Protection Agency (EPA), 2011, ProUCL Version 4.1 User Guide (Draft) Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, EPA/600/R-07/041, Office of Research and Development, Washington, DC, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/osp/hstl/tsc/ProUCL_v4.1_user.pdf.
[e] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.

Table 3-1

Data Used to Model Exposure in the Indicator Wildlife Species
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines, Plum Brook Ordnance Works
Sandusky, Ohio

Indicator Species	Class/ Order	Average Body Weight[a] (kg)	Average Home Range[a] (ha)	Dietary Intake[a] (kg[dw]/day)	Soil/Sed. Intake (kg[dw]/day)	Water Intake (L/day)[b]	Trophic Level	Dietary Composition[a] (percent)
Deer mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	0.0148	0.062	0.0028[d]	0.000056 (2%)	0.0022	Omnivore	Terr. Inverts. : 39 Plants: 61
Eastern cottontail (*Sylvilagus floridanus*)	Mammalia/ Lagomorpha	1.132	3.1	0.096[d]	0.006 (6.3%)	0.11	Herbivore	Plants: 100
Short-tailed shrew (*Blarina brevicauda*)	Mammalia/ Insectivora	0.015	0.39	0.0022[d]	0.00023 (10.4%)	0.0023	Insectivore	Terr. Inverts.: 100
White-tailed deer (*Odocoileus virginianus*)	Mammalia/ Artiodactyla	61[c]	518[c]	2.0[d]	0.04 (2%)	4	Herbivore	Plants: 100
Marsh wren (*Cistothorus palustris*)	Aves/ Passeriformes	0.01	0.054	0.0029[d]	0.000058 (2%)	0.0027	Insectivore	Terr. Inverts.: 100
Red-tailed hawk (*Buteo jamaicensis*)	Aves/ Falconiformes	0.957	842	0.057[d]	0.00114 (2%)	0.057	Carnivore	Rabbits: 25.3 Shrews: 25.3 Mice: 25.3 Birds: 24
Muskrat [e] (*Ondata zibethicus*)	Mammalia/ Rodentia	1.174	0.13	0.352	negligible	0.11	Herbivore	Aquatic plants: 100
Raccoon (*Procyon lotor*)	Mammalia/ Carnivora	5.1	156	0.26 [d]	0.024 (9.4%) (assumed 50% soil and 50% sediment)	0.43	Omnivore	Aq. Inverts.: 21 Terr. Inverts.: 30 Mice: 5 Plants: 42 (50% terrestrial, 50% aquatic) Fish: 2

[a] From EPA (1993), except as noted.
[b] Allometric equations for mammals and birds from EPA (1993), as follows:
Mammals: WI (water ingestion; L/day) = 0.099 $Wt^{0.90}$ (kg), where Wt = body weight.
Birds: WI (L/day) = 0.059 $Wt^{0.67}$ (kg).
[c] Information is from *A Guide to the Mammals of Ohio* (Gottschang, 1981).
[d] Allometric equation for mammals: FI (kg/day) = 0.0687 $Wt^{0.822}$ for shrew, deer, and raccoon; FI (g/day) = 0.621 $Wt^{0.564}$ for rodents (deer mouse); and FI (g/day) = 0.577 $Wt^{0.727}$ for small herbivores (cottontail).
Allometric equation for birds: FI (kg/day) = 0.0582 Wt0.651 (EPA, 1993), where FI = food ingestion (dry weight) and Wt = body weight. Allometric equations from EPA (1993).
[e] Exposure parameters obtained from OEPA-DERR (2008) Ecological Risk Assessment Guidance Document, Revised April 2008, On line: http://www.epa.ohio.gov/portals/30/rules/RR-031.pdf.

References

U.S. Environmental Protection Agency (EPA), 1993, *Wildlife Exposure Factors Handbook* , Vols. I and II, Office of Research and Development, Washington, DC, EPA/600/R-93/187a.

Table 3-2

Bioaccumulation Factors or Regression Equations Utilized for the Soil-to-Plant and Sediment-to-Aquatic Plant Pathway
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

COPEC in Soil	EPA, 2008	Efroymson et al., 2001 Minimum BAF/BCF	Median BAF/BCF	90th Percentile BAF/BCF	Maximum BAF/BCF	Other BAF/BCF		Regression Equation (1)	Recommended BAF/BCF (2)	Source
Inorganics										
Cadmium	ln (AGP)=0.546(ln[soil])-0.475	0.0087	0.59	3.3	23	0.35	a	ln (AGP)=0.55(ln[soil])-0.48	Eco-SSL Regression	EPA (2008), Table 4a
Mercury	--	0.0015	0.65	5	12	0.55	a	ln (AGP)=0.54(ln[soil])-1.00	Regression Equation	Efroymson et al. (2001)
Polychlorinated biphenyls (PCB)										
Aroclor 1016	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.02	Travis & Arms Kow Regression Eq.
Aroclor 1254	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.0036	Travis & Arms Kow Regression Eq.
Explosives										
1,3,5-Trinitrobenzene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	5.62	Travis & Arms Kow Regression Eq.
2,4,6-Trinitrotoluene	4.23	--	--	--	--	--		--	4.23	EPA (2008), Table 4b
2,4-Dinitrotoluene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.44	Travis & Arms Kow Regression Eq.
2,6-Dinitrotoluene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.37	Travis & Arms Kow Regression Eq.
2-Amino-4,6-dinitrotoluene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	3.35	Travis & Arms Kow Regression Eq.
4-Amino-2,6-dinitrotoluene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	3.35	Travis & Arms Kow Regression Eq.
Semivolatile Organic Compounds										
Benzo(a)anthracene	ln (AGP)=0.5944(ln[soil])-2.7078	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Benzo(a)pyrene	ln(AGP) = 0.975(ln[soil])-2.0615	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Benzo(b)fluoranthene	0.31	--	--	--	--	--		--	0.31	EPA (2008), Table 4b
Benzoic Acid	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	3.2	Travis & Arms Kow Regression Eq.
Chrysene	ln (AGP)=0.5944(ln[soil])-2.7078	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Fluoranthene	0.5	--	--	--	--	--		--	0.5	EPA (2008), Table 4b
Pyrene	0.72	--	--	--	--	--		--	0.72	EPA (2008), Table 4b

-- indicates that a BAF/BCF or regression equation is not available.
BAF - Bioaccumulation factor.
BCF - Bioconcentration factor.
Kow - Octanol-water partitioning coefficient.

Notes:

1. Equation taken from Efroymson, R.A., et. al., 2001, *Uptake of Inorganic Chemicals from Soil by Plant Leaves: Regressions of Field Data*, Environ. Tox. Chem., 20:2561-2571 for AGP (above ground plant tissue concentration) or regression equation obtained from Travis and Arms (1988) regression model using the chemical's Kow to calculate the BAF.
2. For the values estimated using Travis and Arms (1988) Kow regression equation, the BAF was calculated using Kow values obtained from the Kow WIN application in EPA's EPI Suite software (http://www.epa.gov/oppt/exposure/pubs/episuite.htm).

[a] Average of the vegetative and reproductive transfer factors presented in Baes et al. (1984); note: value from this reference used if no appropriate value available from IAEA (1994).

References:

Baes, C. F., R.D. Sharp, A.L. Sjoreen and R. W. Shor, 1984, *A review and analysis of parameters for assessing transport of environmentally released radionuclides through agriculture,* ORNL-5786, September.
Efroymson, R.A., et. al., 2001, *Uptake of Inorganic Chemicals from Soil by Plant Leaves: Regressions of Field Data*, Environ. Tox. Chem., 20:2561-2571
EPA, 2008, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)*, Office of Solid Waste and Emergency Response, OSWER 9285.7-55, November.
Travis, C.C., and A.D. Arms, 1988, *Bioconcentration of Organics in Beef, Milk, and Vegetation*, Enironmental Science and Technology 22(3): 271-274.

Table 3-3

Bioaccumulation Factors or Regression Equations
Utilized for the Soil-to-Earthworm Pathway
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Constituent	PBOW Site-Specific BCF [a]	Sample, et al. 1998 Median BAF/BCF	Sample, et al. 1998 90th Percentile BAF/BCF	Sample, et al. 1998 Maximum BAF/BCF	Beyer, 1990 BAF/BCF	Regression Equation	Recommended BAF/BCF	Source of BAF/BCF	Rationale for BAF/BCF
Inorganics									
Cadmium	--	7.708	40.69	190	--	ln (EW)=0.795(ln[soil])+2.114	Regression Equation	EPA 2008, Table 4a	Chemical-specific regression equation
Mercury	--	1.693	20.625	33	--	ln (EW)=0.33(ln[soil])+0.078	Regression Equation	Sample et al. 1998	Chemical-specific regression equation
Polychlorinated biphenyls (PCB)									
Aroclor 1016		--	--	--	--	Calculated; see footnote b	15.6	See footnote b	
Explosives									
1,3,5-Trinitrobenzene	--	--	--	--	--	Calculated; see footnote b	13.22	See footnote b	
2,4,6-Trinitrotoluene	--	--	--	--	--	Calculated; see footnote b	13.5	See footnote b	
2,4-Dinitrotoluene	0.1	--	--	--	--	--	0.1	Site field study	Plum Brook site-specific BAF (IT, 2001)
2,6-Dinitrotoluene	--	--	--	--	--	--	0.1	Site field study	Use 2,4-Dinitrotoluene as surrogate
2-Amino-4,6-dinitrotoluene	--	--	--	--	--	--	0.1	Site field study	Use 2,4-Dinitrotoluene as surrogate
4-Amino-2,6-dinitrotoluene	--	--	--	--	--	--	0.1	Site field study	Use 2,4-Dinitrotoluene as surrogate
Semivolatile Organic Compounds									
Benzo(a)anthracene	0.58	--	--	--	0.13	--	0.58	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzo(a)pyrene	0.46	--	--	--	0.3421	--	0.46	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzo(b)fluoranthene	0.21	--	--	--	0.319	--	0.21	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzoic Acid	Benzoic Acid	--	--	--	--	--	13.44	Kow Regression Equation	
Chrysene	0.55	--	--	--	0.18	--	0.55	Site field study	Plum Brook site-specific BAF (IT, 2001)
Fluoranthene	0.21	--	--	--	0.079	--	0.21	Site field study	Plum Brook site-specific BAF (IT, 2001)
Pyrene	0.45	--	--	--	0.092	--	0.45	Site field study	Plum Brook site-specific BAF (IT, 2001)

-- indicates that a BAF/BCF or regression equation is not available.
BAF - Bioaccumulation factor.
BCF - Bioconcentration factor.
Kow - Octanol-water partitioning coefficient.

[a] IT Corporation (IT), 2001, *Redwater Pond Areas Baseline Ecological Risk Assessment, Plum Brook Ordnance Works, Sandusky, Ohio*, prepared for U.S. Army Corps of Engineers, Nashville District, April.

[b] For Organics: Ecological Soil Screening Level (SSL) Guidance, EPA, 2008 (Section 3.2.2 in Appendix 4-1, given site-specific soil total organic carbon [TOC]).
The biota/soil water partitioning coefficient of $10^{(logKow-0.6)}$ was replaced with Equation 3 from Jager (1998) of F_{lipid} x Kow. The F_{water} variable of Equation 3 was not included, since it only improves the model fit for extremely hydrophilic compounds (i.e. chemicals with log Kow < 2, approximately).

$$BAF - \frac{Flipid * Kow}{FOC * 10^{(0.983 * logKow + 0.00028)}}$$

Flipid = 0.079 The lipid content in insects was estimated at 3.1 percent fresh weight (Taylor, 1975), which is 7.9 percent of dry weight, using a value of 61 percent water content in beetles (EPA, 1993), calculated as follows: 0.031/(1-0.61) = 0.079, or 7.9 percent.

Kow values obtained from EPA EPI Suite Version 4.0, http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm

References:

Beyer, W. N., 1990, *Evaluating Soil Contamination, Biological Report 90(2)*, U.S. Department of the Interior, U.S. Fish and Wildlife Service.
EPA, 2008, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)*, Office of Solid Waste and Emergency Response, Directive 92857.7-55, Washington, D.C.
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IT Corporation (IT), 2001, *Redwater Pond Areas Baseline Ecological Risk Assessment, Plum Brook Ordnance Works, Sandusky, Ohio*, prepared for U.S. Army Corps of Engineers, Nashville District, April.
Jager, T., 1998, *Mechanistic Approach for Estimating Bioconcentration of Organic Chemicals in Earthworms (Oligochaeta)*, Environmental Toxicology and Chemistry 17: 2080-2090.
Sample, B. E, et. al., 1998, *Development and Validation of Bioaccumulation Models for Earthworms*, ES/ER/TM-220.
Taylor, R. L., 1975, Butterflies in My Stomach, Woodbridge Press Publishing Company, Santa Barbara, California.

Table 3-4

Bioaccumulation Factors or Regression Equations Utilized for the Soil-to-Mammal/Bird[a] Pathway
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, OH

Constituent	Sample et al., (1998) Insectivore Median BAF	Herbivore Median BAF	Omnivore Median BAF	General [b] Median BAF	General [b] Maximum BAF	General [b] 90th percentile BAF	EPA (1999) Maximum BAF Avian or Mammal	Other BAF	Regression Equation	Recommended BAF	Rationale for Recommended BAF
Inorganics											
Cadmium	2.105	0.1258	0.1217	0.3333	69.561	3.9905	4.40E-03	--	ln (M)=0.4723(ln[soil]) -1.2571	Regression Equation	EPA (2008)-Attach 4-1, Table 4a
Mercury	1.046	0.0239 [d]	0.0543	0.0543	1.046	0.192	--	--	--	0.192	"General: 90th Percentile" used because of uncertainties regarding the type of mammalian prey items.
Polychlorinated biphenyls (PCB)											
Aroclor 1016	--	--	--	--	--	--	1.32E-03	--	--	1.32E-03	EPA (1999), max for any taxa in Table D-3
Explosives											
1,3,5-Trinitrobenzene	--	--	--	--	--	--	--	--	--	1.1	See Footnote c
2,4,6-Trinitrotoluene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for TNT
2,4-Dinitrotoluene	--	--	--	--	--	--	8.14E-08	--	--	8.14E-08	EPA, 1999
2,6-Dinitrotoluene	--	--	--	--	--	--	6.34E-08	--	--	6.34E-08	EPA (1999), max for any taxa in Table D-3
2-Amino-4,6-dinitrotoluene	--	--	--	--	--	--	7.24E-08	--	--	7.24E-08	Average of 2,4- and 2,-6 dinitrotoluene
4-Amino-2,6-dinitrotoluene	--	--	--	--	--	--	7.24E-08	--	--	7.24E-08	Average of 2,4- and 2,-6 dinitrotoluene
Semivolatile Organic Compounds											
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzoic Acid	--	--	--	--	--	--	--	--	--	1.1	See Footnote c
Chrysene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Fluoranthene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Pyrene	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs

-- indicates that a BAF is not available.
BAF = Bioaccumulation factor.
PAH - Polycyclic aromatic hydrocarbon.

[a] Bird BAF values were based on the recommended small mammal BAF values, as bird uptake values are not readily available
[b] "General" indicates that the combination dataset used for insectivore, herbivore, and omnivore receptors was used to estimate a "general" receptor BAF value
[c] The median BAF of 1.1 for dioxin (TCDD) from Sample et al. (1998) is used as a conservative surrogate for organic chemicals lacking BAFs
[d] Only one BAF value available for exposure to mercury in soil (median is also 90th percentile value and maximum value)

REFERENCES
EPA, 2008, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)* , Office of Solid Waste and Emergency Response, Directive 92857.7-55, Washington, D.C.
EPA, 1999, *Screening level ecological risk assessment protocol for hazardous waste combustion facilities* , August, EPA530-D-99-001A.
Sample et al., 1998, *Development and Validation of Bioaccumulation Models for Small Mammals,* ES/ER/TM-219.

Table 3-5

Bioaccumulation Factors Utilized
for the Sediment-to-Benthic Invertebrate Pathway
TNT Area 1 to Waste Water Treatment Plant 1
Plum Brook Ordnance Works, Sandusky, Ohio

Constituent	PBOW Site-Specific BCFs [a]	Bechtel Jacobs (1998)			EPA (1999) BAF/BCF	Other BAF/BCF	Recommended BAF/BCF	Rationale for Recommended BAF/BCF
		Median BAF/BCF (dry weight)	90th Percentile BAF/BCF (dry weight)	Maximum BAF/BCF (dry weight)	(dry weight)	(dry weight)	(dry weight)	
Polychlorinated biphenyls								
Aroclor 1254	--	4.67	21.89	51.31	3.2	--	3.2	EPA (1999) BAF based on empirical data

-- indicates that a BAF/BCF or regression equation is not available.
BAF = Bioaccumulation factor
BCF = Bioconcentration factor

[a] Empirical data not available in EPA, 1999. Value presented is based on the mean of 6 recommended values for metals with empirical data as presented in Table C-6 (EPA, 1999).

References:

Bechtel Jacobs Company LLC, 1998, *Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation* , BJC/OR-112. (Depurated and nondepurated results used).

EPA, 1999, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* , EPA530-D-99-001A (Peer Review Draft). **Note:** Only values based on empirical studies were used. Values were reported on a wet weight basis. Values were multiplied by 5.99 to convert to a dry-weight basis (see EPA, 1999).

Table 4-1

Toxicity Reference Values for Mammals
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Reference	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Reference
Inorganics								
Cadmium	--	1	rat	Sample, et al. (1996)	--	10	rat	Sample, et al. (1996)
Mercury (mink)	--	1	mink	Sample, et al. (1996)	1.0 (NOAEL)	5	mink	Sample, et al. (1996)
Mercury (mouse)	--	13.2	mouse	Sample, et al. (1996)	--	132	mouse	Sample, et al. (1996)
Polychlorinated biphenyls (PCB)								
Aroclor 1016	--	1.37	mink	Sample, et al. (1996)	--	3.43	mink	Sample, et al. (1996)
Aroclor-1254 (mink)	--	0.140	mink	Sample, et al. (1996)	--	0.69	mink	Sample, et al. (1996)
Aroclor-1254 (mouse)	--	0.068	mouse	Sample, et al. (1996)	--	0.68	mouse	Sample, et al. (1996)
Explosives								
1,3,5-Trinitrobenzene	--	13.4	rat	LANL (2010)	--	67	rat	LANL (2010)
2,4,6-Trinitrotoluene	--	34.7	rat	LANL (2010)	--	173.5	rat	LANL (2010)
2,4-Dinitrotoluene	--	0.2	beagle dog	IRIS on-line (2001)	--	1.5	beagle dog	IRIS on-line (2001)
2,6-Dinitrotoluene	--	0.2	beagle dog	2,4-DNT as surrogate	--	1.5	beagle dog	2,4-DNT as surrogate
2-Amino-4,6-dinitrotoluene	--	9	mouse/rat	USACHPPM (2005)	--	48	mouse/rat	USACHPPM (2005)
4-Amino-2,6-dinitrotoluene	--	9	mouse/rat	USACHPPM (2005)	--	48	mouse/rat	USACHPPM (2005)
Semivolatile Organic Compounds								
Benzo(a)anthracene	--	0.17	mouse	LANL (2010)	--	0.85	mouse	LANL (2010)
Benzo(a)pyrene	--	1	mouse	Sample, et al. (1996)	--	10	mouse	Sample, et al. (1996)
Benzo(b)fluoranthene	40 (Chronic LOAEL)	4	rodent	LANL (2010)	--	20	rodent	LANL (2010)
Benzoic Acid	40 (Chronic LOAEL)	4	mouse	LANL (2010)	--	40	mouse	LANL (2010)
Chrysene	--	0.17	mouse	LANL (2010)	--	0.85	mouse	LANL (2010)
Fluoranthene	125 (subchronic NOAEL)	12.5	mouse	LANL (2010)	--	62.5	mouse	LANL (2010)
Pyrene	75 (subchronic NOAEL)	7.5	mouse	LANL (2010)	--	37.5	mouse	LANL (2010)

COPEC - Chemical of potential ecological concern.
LOAEL - Lowest-observed-adverse-effect level.
mg/kg/d - Milligrams per kilogram body weight per day.
NOAEL - No-observed-adverse-effect level.

REFERENCES

Los Alamos National Laboratory (LANL), 2010, *ECORISK Database (Release 2.5)*, Environmental Restoration Project, Los Alamos National Laboratory, Los Alamos, NM, September.

Sample, B. E., D. M. Opresko, and G. W. Suter II, 1996, *Toxicological Benchmarks for Wildlife, 1996 Revision*, Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Talmage, S.S., D.M. Opresko, and C.J. Maxwell et al., 1999, *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values*, Rebs. Environ. Contam. Toxicolog. 161: 1-156.

USACHPPM, 2005, *Wildlife Toxicity Aseessment for 2-Amino-4,6-Dinitrotoluene and 4,-Amino-2,6-Dinitrotoluene*, Environmental Health Risk Assessment Program and Health Effects Research Program, Aberdeen Proving Ground, Maryland, December.

Table 4-2

Toxicity Reference Values for Birds
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

COPEC	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Reference	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Reference
Inorganics								
Cadmium	--	1.45	mallard duck	Sample, et al. (1996)	--	20	mallard duck	Sample, et al. (1996)
Mercury	--	0.45	Japanese quail	Sample, et al. (1996)	--	0.90	Japanese quail	Sample, et al. (1996)
Polychlorinated biphenyls (PCB)								
Aroclor 1016	--	0.18	ring neck pheasant	Aroclor-1254 as surrogate; Sample, et al. (1996)	--	1.80	ring neck pheasant	Aroclor-1254 as surrogate; Sample, et al. (1996)
Aroclor-1254	--	0.18	ring neck pheasant	Sample, et al. (1996)	--	1.80	ring neck pheasant	Sample, et al. (1996)
Explosives								
1,3,5-Trinitrobenzene	42 (LD_{50})	0.42	red-winged blackbird	USACHPPM (2000) 1,3-Dinitrobenzene as surrogate	42 (LD_{50})	2.10	red-winged blackbird	USACHPPM (2000) 1,3-Dinitrobenzene as surrogate
2,4,6-Trinitrotoluene	--	9.75	Bobwhite quail	LANL (2010)	--	48.75	Bobwhite quail	LANL (2010)
2,4-Dinitrotoluene	--	9.75	Bobwhite quail	2,4,6-TNT as surrogate	--	48.75	Bobwhite quail	2,4,6-TNT as surrogate
2,6-Dinitrotoluene	--	9.75	Bobwhite quail	2,4,6-TNT as surrogate	--	48.75	Bobwhite quail	2,4,6-TNT as surrogate
2-Amino-4,6-dinitrotoluene	--	9.75	Bobwhite quail	2,4,6-TNT as surrogate	--	48.75	Bobwhite quail	2,4,6-TNT as surrogate
4-Amino-2,6-dinitrotoluene	--	9.75	Bobwhite quail	2,4,6-TNT as surrogate	--	48.75	Bobwhite quail	2,4,6-TNT as surrogate
Semivolatile Organic Compounds								
Benzo(a)anthracene	7 (subchronic NOAEL)	0.70	Bobwhite quail	LANL (2010)	--	3.5	Bobwhite quail	LANL (2010)
Benzo(a)pyrene	--	1	chicken	EPA (1999)	--	5	chicken	EPA (1999)
Benzo(b)fluoranthene	--	0.14	chicken	EPA (1999)	--	0.7	chicken	EPA (1999)
Benzoic Acid	NA							
Chrysene	--	1	chicken	BaP as surrogate; EPA (1999)	--	5	chicken	BaP as surrogate; EPA (1999)
Fluoranthene	--	39.5	chicken	Rigdon and Neal, 1963	--	395	chicken	Rigdon and Neal, 1963
Pyrene	--	39.5	chicken	Rigdon and Neal, 1963	--	395	chicken	Rigdon and Neal, 1963

COPEC - Chemical of potential ecological concern.
LOAEL - Lowest-observed-adverse-effect level.
mg/kg/d - Milligrams per kilogram body weight per day.
NA - No toxicity value available.
NOAEL - No-observed-adverse-effect level.

REFERENCES

EPA, 1999, *Screening level ecological risk assessment protocol for hazardous waste combustion facilities*, August, EPA530-D-99-001A.

Los Alamos National Laboratory (LANL), 2010, *ECORISK Database (Release 2.5)*, Environmental Restoration Project, Los Alamos National Laboratory, Los Alamos, NM, October.

Sample, B. E., D. M. Opresko, and G. W. Suter II, 1996, *Toxicological Benchmarks for Wildlife, 1996 Revision*, Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Rigdon, RH and J Neal, 1963, *Absorption and Excretion of Benzo(a)pyrene, Observation in the Duck, Chicken, Mouse, and Dog*, Texas Rep. Biol. And Med. 21(2):247-261.

USACHPPM, 2000, *Standard Practice for Wildlife Toxicity Reference Values*, Environmental Health Risk Assessment Program and Health Effects Research Program, Aberdeen Proving Ground, Maryland, October.

Table 5-1

Wildlife Hazard Quotients for all Assessment Receptors
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

	Deer Mouse		Short-tailed Shrew		Cottontail Rabbit		Marsh Wren		White-tailed Deer		Raccoon		Red-Tailed Hawk		Muskrat	
COPEC	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals																
Cadmium	2.94E-01	2.94E-02	4.70E-01	4.70E-02	3.06E-02	3.06E-03	6.87E-01	4.98E-02	2.52E-05	2.52E-06	4.47E-04	4.47E-05	1.04E-05	NA[1]	0.00E+00	0.00E+00
Mercury	5.90E-03	5.90E-04	7.00E-03	7.00E-04	1.38E-03	1.38E-04	4.77E-01	2.39E-01	8.64E-07	8.64E-08	1.11E-04	2.22E-05	1.25E-05	NA[1]	0.00E+00	0.00E+00
Polychlorinated biphenyls (PCB)																
Aroclor 1016	6.88E-01	2.75E-01	4.84E-01	1.93E-01	4.18E-03	1.67E-03	***2.05E+01***	***2.05E+00***	6.46E-07	2.58E-07	1.12E-03	4.46E-04	8.28E-06	NA[1]	0.00E+00	0.00E+00
Aroclor 1254	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-05	4.65E-06	0.00E+00	NA[1]	1.45E-03	2.94E-04
All PCBs (summed)	***6.88E-01***	***2.75E-01***	***4.84E-01***	***1.93E-01***	***4.18E-03***	***1.67E-03***	***2.05E+01***	***2.05E+00***	***6.46E-07***	***2.58E-07***	***1.14E-03***	***4.51E-04***	***8.28E-06***	***NA[1]***	***1.45E-03***	***2.94E-04***
Nitroaromatics																
1,3,5-Trinitrobenzene	2.38E-02	4.76E-03	1.27E-01	2.55E-02	7.05E-03	1.41E-03	***1.79E+00***	3.58E-01	2.82E-05	5.65E-06	3.05E-05	6.10E-06	4.49E-05	NA[1]	0.00E+00	0.00E+00
2,4,6-Trinitrotoluene	***1.33E+01***	***2.67E+00***	***1.23E+01***	***2.46E+00***	***3.27E+00***	6.53E-01	***1.25E+02***	***2.50E+01***	2.02E-03	4.03E-04	1.78E-02	3.55E-03	5.49E-05	NA[1]	0.00E+00	0.00E+00
2,4,6-Trinitrotoluene [a]	***4.48E+00***	*8.96E-01*	*1.85E-01*	*3.69E-02*	***3.27E+00***	*6.53E-01*	*1.11E+00*	*2.22E-01*	*2.02E-03*	*4.03E-04*	*3.44E-03*	*6.88E-04*	*5.49E-05*	*NA[1]*	*0.00E+00*	*0.00E+00*
2,4-Dinitrotoluene	6.02E-01	8.02E-02	1.28E-01	1.71E-02	4.15E-01	5.53E-02	6.89E-03	1.38E-03	1.53E-04	2.04E-05	6.52E-04	8.70E-05	3.40E-07	NA[1]	0.00E+00	0.00E+00
2,6-Dinitrotoluene	4.01E-01	5.34E-02	8.27E-02	1.10E-02	2.73E-01	3.65E-02	5.26E-03	1.05E-03	8.38E-05	1.12E-05	4.56E-04	6.08E-05	2.60E-07	NA[1]	0.00E+00	0.00E+00
2-Amino-4,6-dinitrotoluene	9.57E-01	1.79E-01	1.53E-02	2.87E-03	6.96E-01	1.31E-01	7.74E-02	1.55E-02	1.32E-04	2.48E-05	7.46E-04	1.40E-04	3.82E-06	NA[1]	0.00E+00	0.00E+00
4-Amino-2,6-dinitrotoluene	4.86E-01	9.11E-02	1.05E-02	1.98E-03	3.54E-01	6.63E-02	3.93E-02	7.86E-03	9.11E-05	1.71E-05	3.79E-04	7.10E-05	1.94E-06	NA[1]	0.00E+00	0.00E+00
All Nitrotoluenes (summed)	***1.58E+01***	***3.07E+00***	***1.25E+01***	***2.50E+00***	***5.00E+00***	***9.42E-01***	***1.25E+02***	***2.51E+01***	***2.48E-03***	***4.76E-04***	***2.00E-02***	***3.91E-03***	***6.12E-05***	***NA[1]***	***0.00E+00***	***0.00E+00***
Semivolatile Organics																
Benzo(a)anthracene	3.69E-01	7.38E-02	3.89E-01	7.79E-02	7.31E-02	1.46E-02	2.90E-01	5.80E-02	2.95E-05	5.90E-06	6.38E-04	1.28E-04	2.86E-06	NA[1]	0.00E+00	0.00E+00
Benzo(a)pyrene	5.27E-02	5.27E-03	4.76E-02	4.76E-03	1.62E-02	1.62E-03	1.40E-01	2.80E-02	6.60E-06	6.60E-07	8.46E-05	8.46E-06	1.73E-06	NA[1]	0.00E+00	0.00E+00
Benzo(b)fluoranthene	2.09E-02	4.18E-03	9.95E-03	1.99E-03	1.20E-02	2.40E-03	7.23E-01	1.45E-01	5.48E-06	1.10E-06	2.64E-05	5.28E-06	1.86E-05	NA[1]	0.00E+00	0.00E+00
Benzoic Acid	1.99E-01	1.99E-02	2.78E-01	2.78E-02	4.03E-02	4.03E-03	NA	NA	3.46E-05	3.46E-06	2.78E-04	2.78E-05	NA	NA[1]	0.00E+00	0.00E+00
Chrysene	4.09E-01	8.19E-02	3.36E-01	6.73E-02	8.27E-02	1.65E-02	2.25E-01	4.50E-02	2.75E-05	5.51E-06	7.13E-04	1.43E-04	2.34E-06	NA[1]	0.00E+00	0.00E+00
Fluoranthene	7.38E-03	1.48E-03	2.35E-03	4.69E-04	4.58E-03	9.15E-04	2.02E-03	2.02E-04	2.04E-06	4.07E-07	8.19E-06	1.64E-06	5.21E-08	NA[1]	0.00E+00	0.00E+00
Pyrene	2.69E-02	5.39E-03	1.04E-02	2.07E-03	1.49E-02	2.98E-03	5.81E-03	5.81E-04	7.25E-06	1.45E-06	2.97E-05	5.94E-06	7.32E-08	NA[1]	0.00E+00	0.00E+00

COPEC - Chemical of potential ecological concern.
LOAEL - Lowest-observed-adverse-effect level.
NA - No toxicity data available; hazard quotients not calculated.
NA[1] - Because the Red-Tailed Hawk represents the northern harrier, a threatened and endangered species observed at the site, only hazard quotients based on the NOAEL are calculated.
NOAEL - No-observed-adverse-effect level.

[a] Hazard quotients calculated using a soil-to-terrestrial invertebrates uptake factor of 0.1; see text for details.

Shaded cells indicate a hazard quotient greater than 1, when rounded.

FIGURES

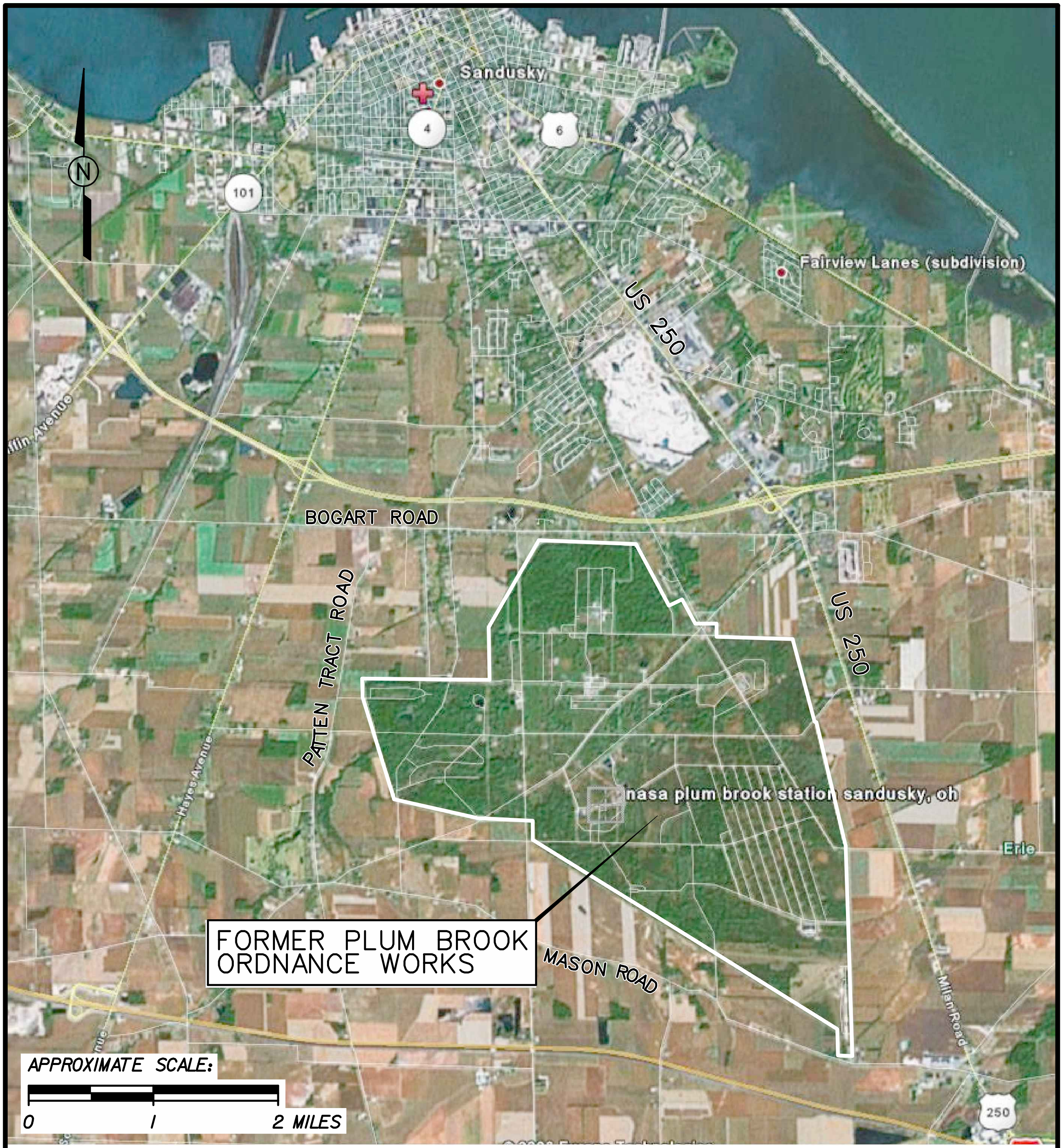

FIGURE 1-1

PBOW VICINITY MAP

TNTA/WWTP1 SEWER LINES SLERA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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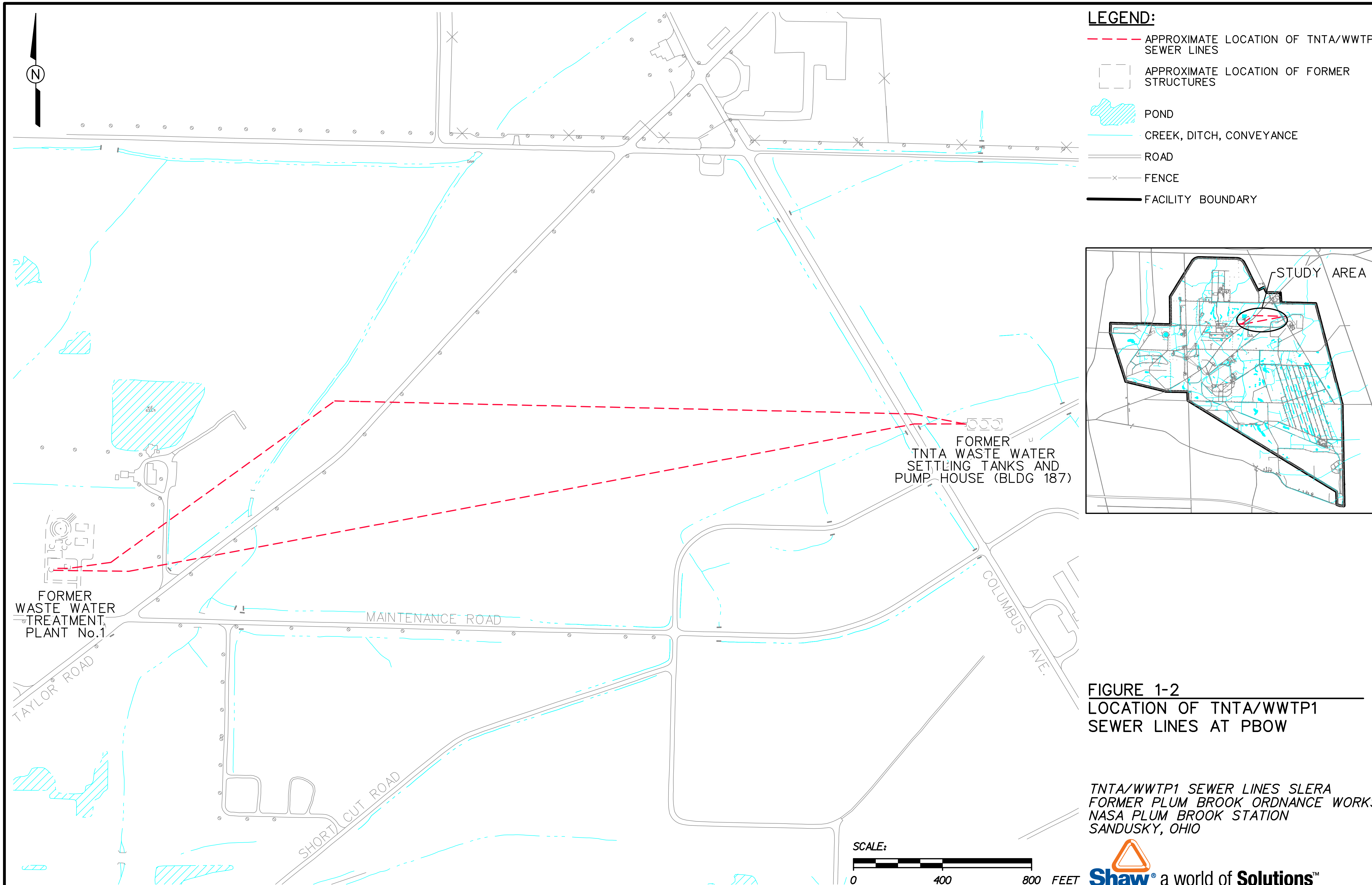

FIGURE 1-2
LOCATION OF TNTA/WWTP1 SEWER LINES AT PBOW

TNTA/WWTP1 SEWER LINES SLERA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Shaw® a world of Solutions™

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Figure 2-1

Photo Log of TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 1. Open field, Spring 2008

Photo 2. Open field, June, 2009

Figure 2-1

Photo Log of TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 3. Open field, September, 2009 (post mowing).

Photo 4. Open field, September 2010.

Figure 2-1

Photo Log of TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 5. Open field, September, 2011

Photo 6. Grasses and forbs, September, 2011.

Figure 2-1

Photo Log of TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 7. Old field habitat in western portion of sewer line trace, September 2009.

Photo 8. Shallow (dry) drainage channel near western edge of site.

Figure 2-1

Photo Log of TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 9. Ditch on western side of sewer line trace that flows under Taylor Road.

Photo 10. Water and stony substrate of ditch that flows under Taylor Road.

LEGEND:

APPROXIMATE LOCATION OF TNTA/WWTP1 SEWER LINES

APPROXIMATE LOCATION OF FORMER STRUCTURES

1 MOWED FIELD

2 WET MEADOW

3 SHRUB THICKET

4 UPLAND OLD FIELD

FIGURE 2-2
VEGETATION COMMUNITIES AT TNTA/WWTP1 SEWER LINES

TNTA/WWTP1 SEWER LINES SLERA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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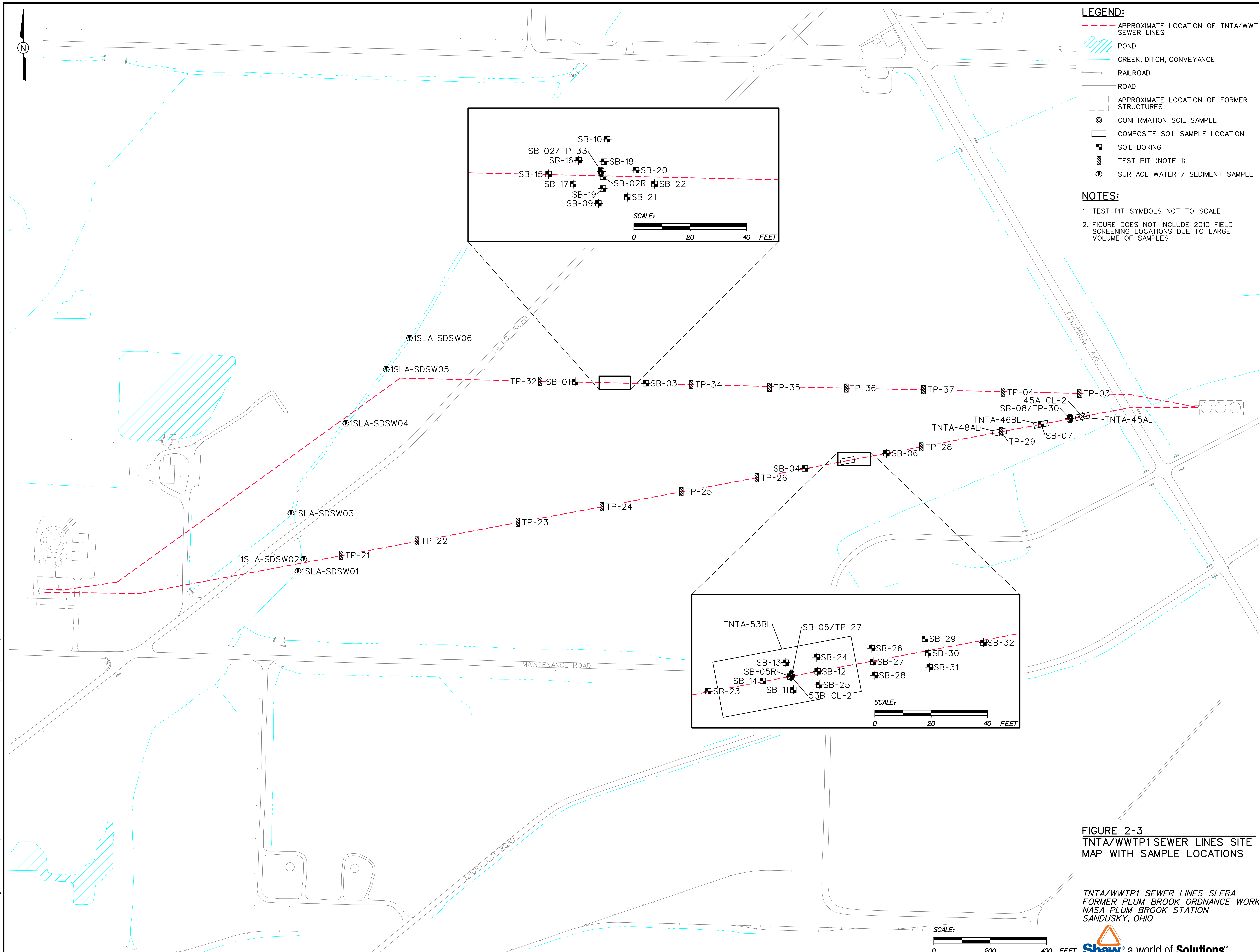
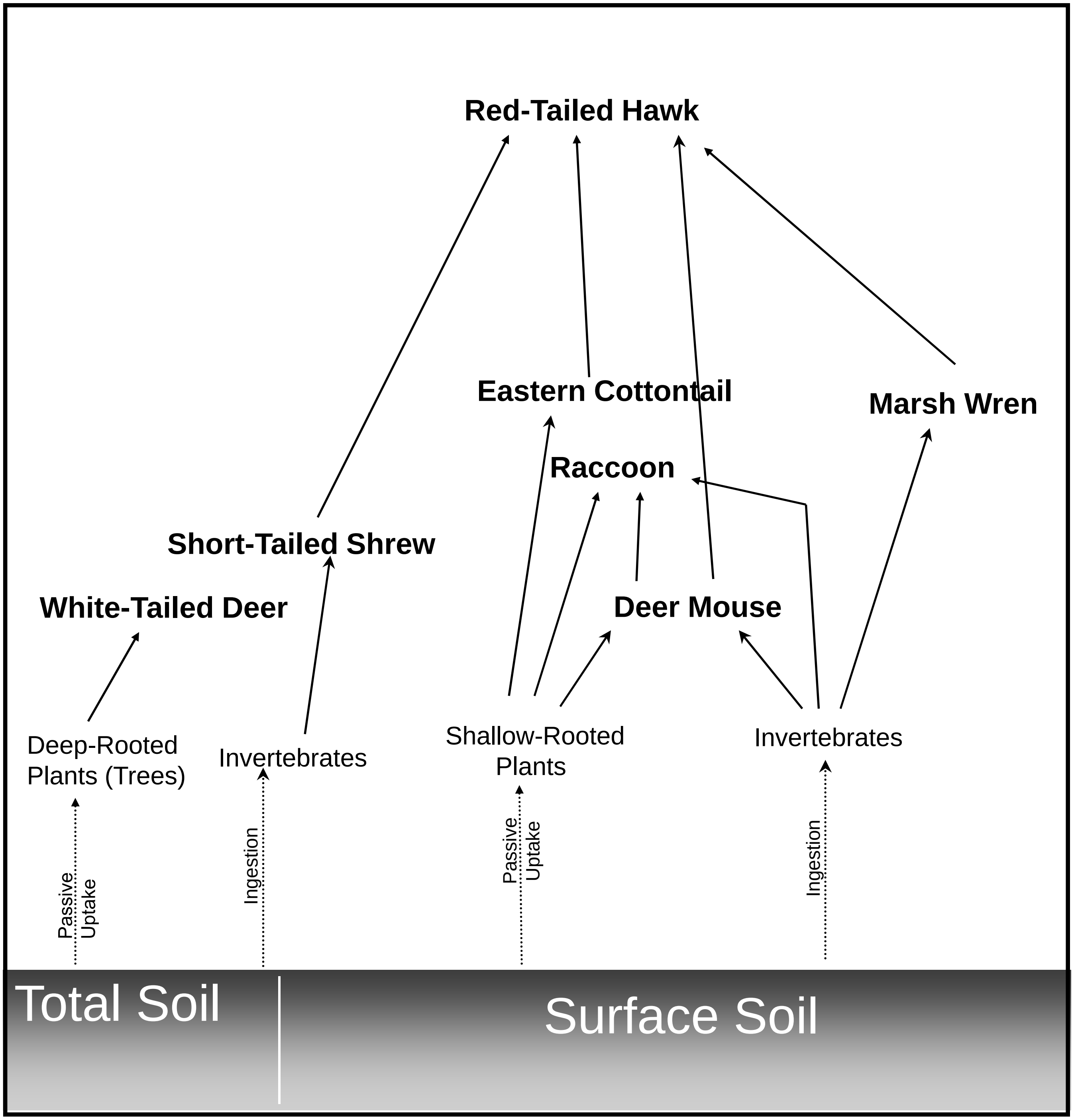

LEGEND:
APPROXIMATE LOCATION OF TNTA/WWTP1 SEWER LINES
POND
CREEK, DITCH, CONVEYANCE
RAILROAD
ROAD
APPROXIMATE LOCATION OF FORMER STRUCTURES
CONFIRMATION SOIL SAMPLE
COMPOSITE SOIL SAMPLE LOCATION
SOIL BORING
TEST PIT (NOTE 1)
SURFACE WATER / SEDIMENT SAMPLE
NOTES:
1. TEST PIT SYMBOLS NOT TO SCALE.
2. FIGURE DOES NOT INCLUDE 2010 FIELD SCREENING LOCATIONS DUE TO LARGE VOLUME OF SAMPLES.
N
SB-10
SB-02/TP-33
SB-16
SB-18
SB-15
SB-20
SB-17
SB-02R
SB-22
SB-19
SB-09
SB-21
SCALE:
0
20
40
FEET
TAYLOR ROAD
1SLA-SDSW06
1SLA-SDSW05
1SLA-SDSW04
1SLA-SDSW03
1SLA-SDSW02
1SLA-SDSW01
TP-32
SB-01
SB-03
TP-34
TP-35
TP-36
TP-37
TP-04
TP-03
45A CL-2
SB-08/TP-30
TNTA-46BL
TNTA-45AL
TNTA-48AL
SB-07
TP-29
TP-28
SB-06
SB-04
TP-26
TP-25
TP-24
TP-23
TP-22
TP-21
COLUMBUS AVE.
MAINTENANCE ROAD
SHORT CUT ROAD
TNTA-53BL
SB-05/TP-27
SB-29
SB-32
SB-26
SB-30
SB-24
SB-27
SB-13
SB-31
SB-05R
SB-12
SB-28
SB-14
SB-25
SB-23
SB-11
53B CL-2
SCALE:
0
20
40
FEET
FIGURE 2-3
TNTA/WWTP1 SEWER LINES SITE MAP WITH SAMPLE LOCATIONS
TNTA/WWTP1 SEWER LINES SLERA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO
SCALE:
0
200
400
FEET
Shaw® a world of Solutions™

Figure 2-4

Simplified Terrestrial Food Web Conceptual Site Model
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio



***** = The raccoon was not evaluated in the risk assessment because surface water is not evaluated at this site. See text for details.

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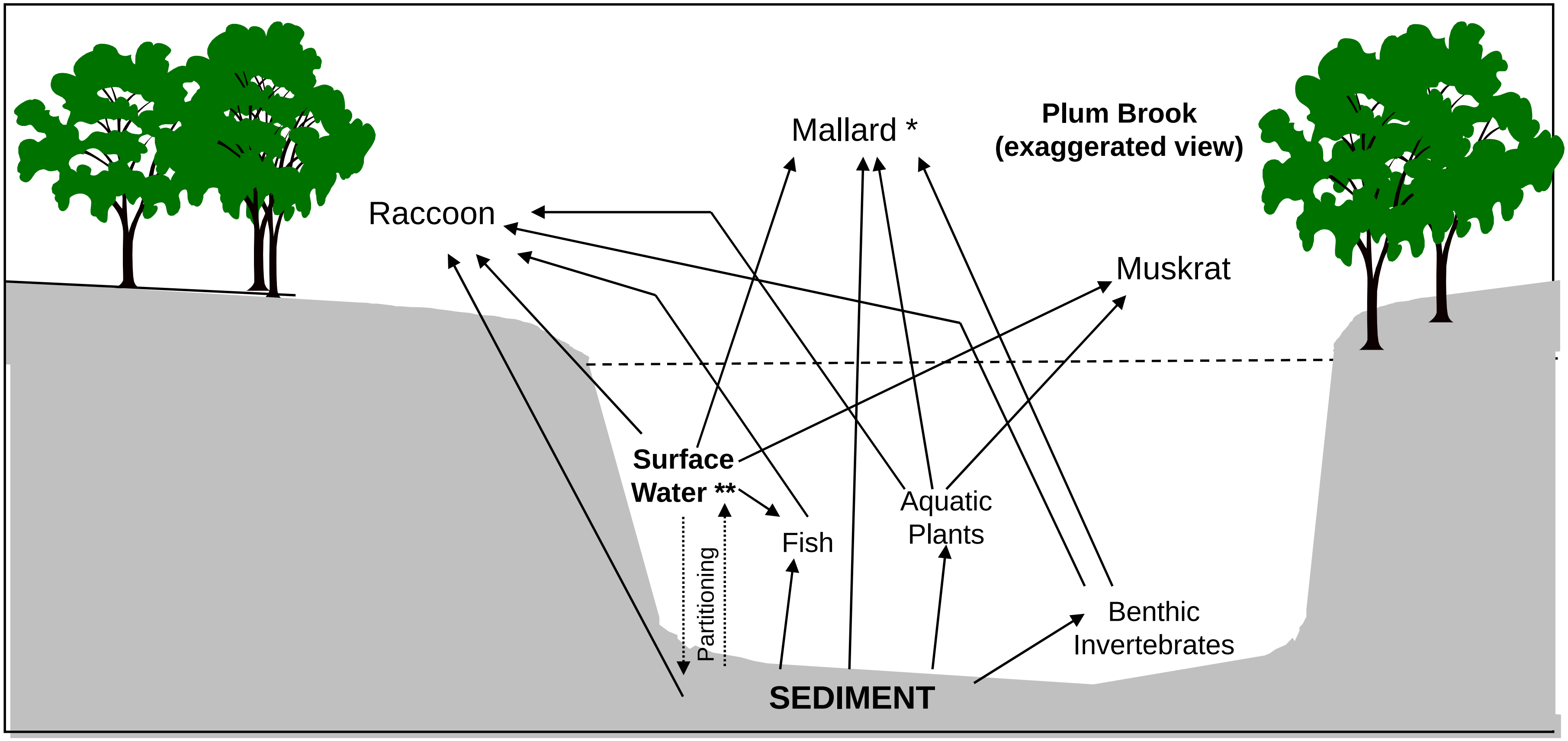
Figure 2-5

Simplified Aquatic Food Web Conceptual Site Model
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio



Note: The raccoon is also presented on terrestrial food web conceptual site model.

*** = The mallard is not evaluated in the risk assessment due to the limited aquatic habitat at the site.**
**** = No chemicals were detected in surface water. Therefore, this medium is not evaluated at this site.**

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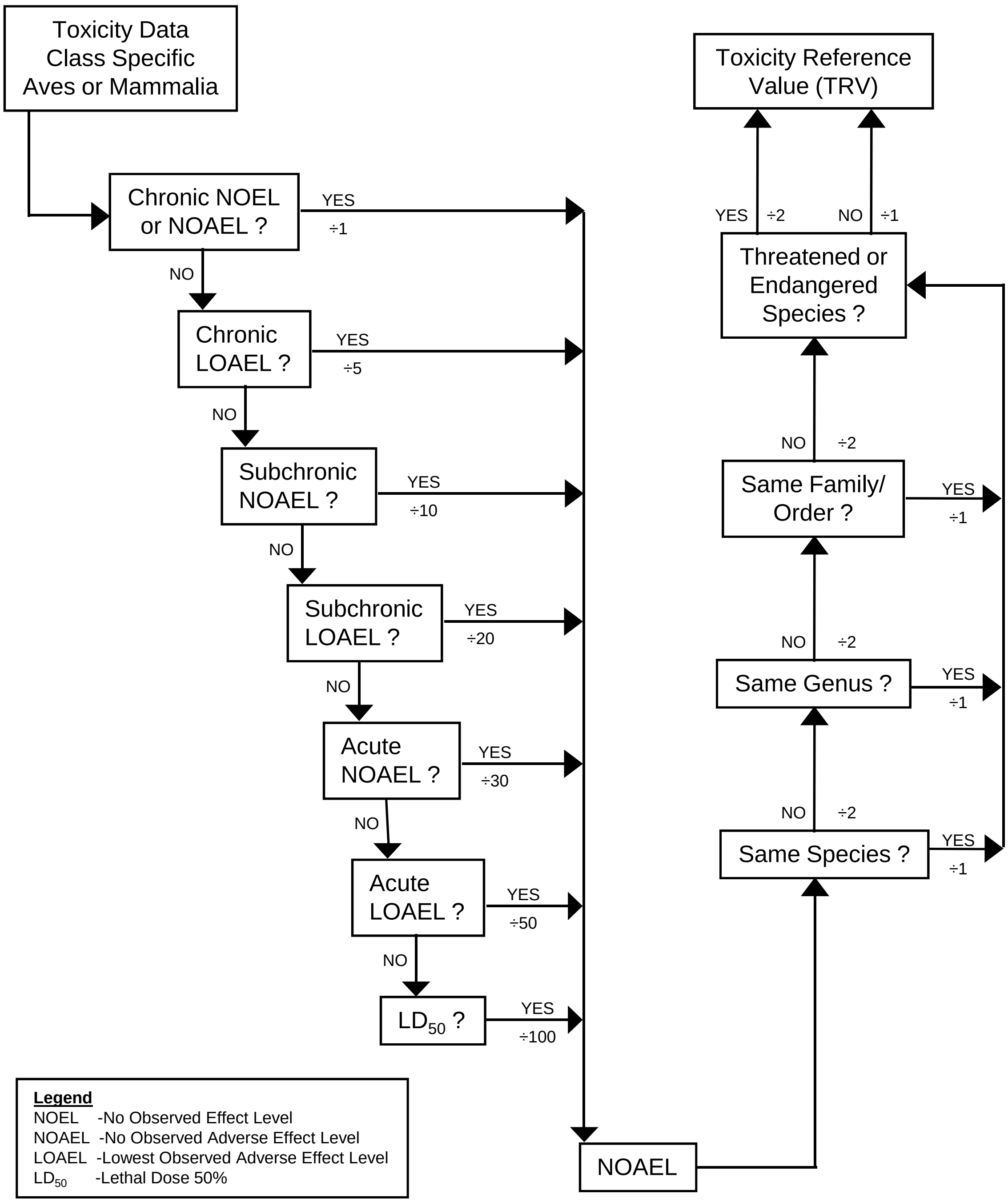
Figure 4-1

Procedural Flow Chart for Deriving Toxicity Reference Values from Class-Specific Toxicity Data Plum Brook Ordnance Works, Sandusky, Ohio



Credit: Adapted from Ford et al. (1992) in *Tri-Service Procedural Guidelines for Ecological Risk Assessments*, 1996

APPENDIX A

VASCULAR PLANT SPECIES DOCUMENTED ON SITE

Appendix A
Vascular Plant Species Documented On Site
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

	Scientific Name	Common Name	Relative Frequency[(a)]	Rank[(b)]	Habitat	Observed On Site[(c)]
	Acalypha rhomboidea	Three-seeded mercury	NA		NA	2
	Acer negundo	box-elder maple	Frequent		Stream banks, ditches, and moist woods	1,2
*	*Acer platanoides*	Norway maple	Occasional		Disturbed woods	1
	Acer rubrum	red maple	Common		Dry to moist woods	1,2
	Acer saccharinum	Silver maple	Rare		Dry to moist woods	2
	Acer saccharum	Sugar maple	Occasional		Dry to moist woods	2
*	*Achillea millefolium*	Yarrow	Frequent		Dry fields, roadsides, and about buildings	1,2
	Acorus calamus	Sweet flag	Rare		Wet ditches	3
	Agalinis purpurea	purple false-foxglove	Frequent		Moist openings and ditches	1
	Agrimonia gryposepala	agrimony	NA		NA	3
	Agrimonia parviflora	southern agrimony	Frequent		Moist fields and ditches	1,3
	Agrimonia parviflora	small-flowered groovebur	NA		NA	2
*	*Agropyron repens*	Quack grass	Frequent		Old fields and roadsides	2
	Agrostis alba	Redtop	NA		NA	2
*	*Agrostis gigantea*	Redtop	Common		Moist fields, ditches, and roadsides	1,3
	Agrostis hyemalis	Ticklegrass	Occasional		Dry, grassy fields and shaley openings	1
	Agrostis perennans	autumn bent-grass	Frequent		Dry woods and borders on shale	1
	Ailanthus altissima	tree of heaven	NA		NA	3
	Alisma subcordatum	water-plantain	Occasional		Ponds and ditches	1,3
*	*Alliaria petiolata*	garlic mustard	Frequent		Dry to moist wood lots	1,2
	Allium canadense	Wild garlic	Occasional		Successional woods	3
	Allium vineale	Field garlic	NA		NA	2
	Ambrosia artemisiifolia	common ragweed	Frequent, occasional		Dry fields and roadsides	1,2
	Ambrosia trifida	giant ragweed	Occasional		Dry fields and roadsides	1,2
	Ambrosia trifida	giant ragweed	NA		NA	1,2
	Amphicarpa bracteata	hog peanut	NA		NA	2
	Andropogon gerardii	big bluestem	Frequent, Occasional		Dry to moist fields and roadsides	1,3
*	*Andropogon virginicus*	broom-sedge	Occasional, frequent		Dry fields and roadsides	1,2
	Anemone virginiana	Thimbleweed	NA		NA	3
	Antennaria parlinii	pussy-toes	Occasional		Dry fields and openings, especially on shale	1
	Antennaria plantaginifolia	plantain leaved pussytoes	NA		NA	2
*	*Anthoxanthum odoratum*	vernal-grass	Occasional		Dry fields and openings, especially on shale	1,3
	Apios americana	Groundnut	NA		NA	2
	Apocynum androsaemifolium	spreading leaf dogbane	NA		NA	2
	Apocynum cannabinum	Dogbane	Frequent		Dry to moist fields and roadsides	1,2
	Apocynum cannabinum	Indian hemp	NA		NA	2
*	*Arabidopsis thaliana*	mouse-ear cress	Occasional		Road berms and about buildings	1
*	*Arctium minus*	Burdock	Occasional		Disturbed fields and about buildings	1
	Arctium minus	lesser burdock	NA		NA	2
	Arenaria lateriflora	grove sandwort	Rare	T	Woods along Ransom Brook north of reactor	1
	Arisaema triphyllum	Jack-in-the-pulpit	Rare		Moist to dry woods	3
	Aristida dichotoma	Churchmouse grass	Occasional		Dry fields and openings	1
	Aristida longespica	slimspike triple-awned grass	Common		Dry fields and openings	1
	Aristida oligantha	prairie triple-awned grass	Occasional		Dry openings and roadsides	1
*	*Artemisia ludoviciana var. gnaphaloides*	white sage	Occasional		Grassy roadsides	1
	Asclepias hirtella	prairie milkweed	Common		Dry to moist openings	1
	Asclepias incarnata	Swamp milkweed	Occasional		Wet ditches	2
	Asclepias sullivantii	Sullivant's milkweed	Rare		Moist field along Patrol Road south of Scheid Road	1
	Asclepias syriaca	common milkweed	Frequent		Dry to moist fields and roadsides	1,2
	Asclepias tuberosa	butterfly-weed	Occasional		Dry openings and roadsides	1
	Asparagus officinalis	asparagus	NA		NA	3
	Asplenium platyneuron	ebony spleenwort	NA		NA	3
	Aster ericoides	white heath aster	Rare, frequent		Grassy strip along Patrol Road southeast of Taft Road	1
	Aster laevis	smooth aster	Rare		White oak grove on Taft Road	1
	Aster lateriflorus	calico aster	Common, frequent		Moist woods and thickets	1,2
	Aster novae-angliae	New England aster	Occasional		Dry fields and roadsides	1,3
	Aster pilosus	common white aster	Common		Dry fields, roadsides, and about buildings	1
	Aster sagittifolius	Arrow-leaved aster	Frequent		Woods and fields	3
	Aster umbellatus	flat-top aster	Frequent, rare		Dry to moist fields and roadsides	1
	Atriplex patula	orach	NA		NA	3
	Baptisia lactea	prairie false indigo	Occasional	P	Dry openings in bunker area	1
	Baptisia tinctoria	yellow false indigo	Occasional		Dry openings in bunker area	1
	Berberis thunbergii	Barberry	NA		NA	3
*	*Berberis thunbergii*	Japanese barberry	Occasional, rare		Woodland borders	1,3
	Bidens coronata	northern tickseed-sunflower	Common		Moist fields and ditches	1
	Bidens frondosa	Beggar ticks	Rare		Ditches	2

	Scientific Name	Common Name	Relative Frequency[(a)]	Rank[(b)]	Habitat	Observed On Site[(c)]
	Blephilia sp.	wood mint	NA		NA	2
	Boehmeria cylindrica	false nettle	Occasional		Ponds and ditches	1,2
	Botrychium sp.	Grape fern	NA		NA	3
	Botrychium virginianum	Rattlesnake fern	Occasional		Successional woods	3
*	*Brassica nigra*	black mustard	Occasional		Roadsides	1
	Brassica nigra	mustard	NA		NA	2
*	*Bromus inermis*	smooth brome	Frequent		Dry to moist fields and roadsides	1,2
	Bromus pubescens	Brome	Occasional		Dry fields	3
*	*Bromus tectorum*	downy chess	Occasional		Dry openings and roadsides on shale	1
	Cacalia atriplicifolia	pale Indian-plantain	Occasional		Dry fields and roadsides; woods	1
	Calamagrostis canadensis	blue-joint	Occasional		Moist fields and ditches	1
	Callitriche heterophylla	water-starwort	Occasional		Pond margins and seasonally-moist depressions	1
	Calystegia sepium	Hedge bindweed	Occasional		Fields	2
*	*Campsis radicans*	trumpet-vine	Occasional		Disturbed openings and roadsides	1
*	*Capsella bursa-pastoris*	shepherd's-purse	Occasional		Roadsides and about buildings	1,3
*	*Cardamine hirsuta*	bitter-cress	Occasional		Roadsides and about buildings	1
	Cardamine pratensis	Cuckooflower	NA		NA	3
*	*Carduus nutans*	musk-thistle	Occasional, frequent		Dry fields and roadsides	1,3
	Carex aggregata	Glomerate sedge	NA		NA	3
	Carex aggregata	sedge	Occasional		Moist woods	3
	Carex alata	broad-winged sedge	Rare	P	Grassy field along Patrol Road south of Scheid Road, also in grassy strip between Patrol Road and artificial pond southeast of Taft Road	1
	Carex albursina	White bear sedge	NA		NA	3
	Carex amphibola	Eastern narrowleaf sedge	Occasional		Thickets and woods borders	3
	Carex annectens var. annectens	NA	Occasional		Moist, grassy fields	1
	Carex annectens var. xanthocarpa	yellow-fruited sedge	Occasional		Moist, grassy fields	1
	Carex blanda	eastern woodland sedge	Frequent		Moist woods	1,3
	Carex bromoides	Brome-like sedge	NA		NA	3
	Carex cephaloidea	thin-leaf sedge	Rare	E	Woods border along Pentolite Road west of reactor	1
	Carex complanata var. hirsutella	NA	Frequent		Dry fields and woods borders	1
	Carex conoidea	field sedge	Rare	T	Grassy depression along Taft Road south of North Magazine Road	1
	Carex cristatella	NA	Occasional		Moist fields and ditches	1
	Carex festucacea	fescue sedge	Occasional		Moist, grassy fields	1
	Carex frankii	Frank's sedge	NA		NA	2
	Carex gracillima	NA	Occasional		Moist woods	1
	Carex granularis	meadow sedge	Common		Moist, grassy fields and ditches	2
	Carex hirtifolia	NA	Rare		Disturbed oak woods along angling road	1
	Carex hystericina	Bottlebrush sedge	Rare		Moist depression along Taft Road	1
	Carex lurida	lurid sedge	NA		NA	3
	Carex pensylvanica	Pennsylvania sedge	Common		Dry woods	1
	Carex radiata	Eastern star sedge	NA		NA	3
	Carex rosea	NA	Frequent		Dry to moist woods	1
	Carex scoparia	NA	Frequent		Moist, grassy fields	1,3
	Carex shortiana	Short's sedge	NA		NA	3
	Carex sp.	sedges	NA		NA	3
	Carex sparganoides	Bur-reed sedge	NA		NA	3
	Carex stipata	NA	Frequent		Moist fields and ditches	1
	Carex stricta	tussock sedge	Occasional		Moist fields and ditches	1
	Carex swanii	Swan's sedge	Occasional		Dry, grassy fields	1
	Carex tribuloides	Blunt broom sedge	Occasional		Moist, grassy fields and ditches	1,2
	Carex umbellata	NA	Occasional		Well-drained, grassy fields on sandy soil	1
	Carex vulpinoidea	fox sedge	Common		Moist fields, ditches, and about ponds	1,2
	Carya cordiformis	Bitternut hickory	NA		NA	3
	Carya glabra	pignut hickory	NA		NA	2
	Carya ovata	shagbark hickory	Rare		Sandy soil along fence at far southeast boundary	1,3
	Catalpa speciosa	Catalpa	NA		NA	3
	Celastrus orbiculatus	Bittersweet	Occasional		Thickets and woods borders	3
	Celtis occidentalis	Hackberry	Occasional		dry to moist woods and borders	1,3
	Cephalanthus occidentalis	Buttonbush	Occasional		Moist depressions and ditches	1,3
	Cerastium arvense	field chickweed	Rare		White oak grove along Taft Road	1
*	*Cerastium fontanum*	mouse-ear chickweed	Frequent		Road berms and about buildings	1,3
*	*Cerastium semidecandrum*	NA	Occasional		Road berms and about buildings	1
*	*Chaenorrhinum minus*	dwarf snapdragon	Occasional		Road berms and about buildings	1
	Chamaecrista fasciculata	partridge-pea	Occasional		Dry openings on shale	1
	Chenopodium album	lamb's quarters	NA			3

Appendix A
Vascular Plant Species Documented On Site
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

	Scientific Name	Common Name	Relative Frequency[(a)]	Rank[(b)]	Habitat	Observed On Site[(c)]
*	*Chrysanthemum leucanthemum*	ox-eye daisy	Frequent		Dry to moist fields and roadsides	1,2
*	*Cichorium intybus*	Chicory	Occasional		Roadsides	1,3
	Cicuta maculata	spotted cow parsnip	NA		NA	2
	Cinna arundinacea	Wood reed grass	Occasional		Woods	2
	Circaea lutetiana	Southern broad-leaved enchanter's nightshade	Frequent		Woods	1,2
*	*Cirsium arvense*	Canada thistle	Common		Disturbed fields and roadsides	1,3
	Cirsium arvense	creeping thistle	NA		NA	2
	Cirsium discolor	prairie thistle	Frequent, occasional		Grassy fields and roadsides	1
	Cirsium muticum	Swamp thistle	NA		NA	2
*	*Cirsium vulgare*	bull thistle	Frequent		Disturbed fields and roadsides	1,2
	Clematis virginiana	Virgin's bower	NA		NA	3
	Clinopodium vulgaris	wild basil	Occasional		Dry roadsides and openings	1,3
*	*Confolvulus arvensis*	field bindweed	Occasional		Disturbed fields and roadsides	1,3
*	*Convallaria majalis*	lilly-of-the-valley	Rare		Grassy field along Columbus Avenue	1,3
	Convolvulus arvensis	Hedge bindweed	NA		NA	2
	Conyza canadensis	Horseweed	Frequent		Dry fields and roadsides	1,2
	Cornus amomum	swamp dogwood	Frequent, occasional		Moist fields and thickets	1,2
	Cornus drummondii	rough-leaved dogwood	Frequent		Moist borders, thickets, and roadsides	1,2
	Cornus florida	flowering dogwood	Occasional		Woodland borders and roadsides	1
	Cornus racemosa	gray dogwood	Frequent		Dry fields and roadsides	1,3
*	*Coronilla varia*	crown-vetch	Occasional, common		Grassy fields and roadsides	1,2
	Crataegus mollis	downy hawthorn	Frequent		Thickets and woodland borders	1
	Crataegus punctata	dotted hawthorn	Frequent		Thickets and woodland borders	1
	Cryptotaenia canadensis	honewort	Occasional, rare		Dry to moist woods	1,2
	Cuscuta gronovii	dodder	Frequent		Moist fields and ditches	1,3
	Cyperus erythrorhizos	redroot flatsedge	NA		NA	3
	Cyperus esculentus	Chufa	NA		NA	3
*	*Cyperus esculentus*	yellow nutgrass	Occasional, frequent		Moist, disturbed openings	1
	Cyperus flavescens	Umbrella sedge	occasional		Old fields and waste places	2
	Cyperus strigosus	umbrella-sedge	Frequent		Moist openings, ponds, and ditches	1,2
*	*Dactylis glomerata*	orchard-grass	Occasional		Dry to moist fields and roadsides	1,2
	Danthonia spicata	poverty-grass	Occasional		Dry openings over shale	1
	Datura stramonium	jimson-weed	Occasional		Disturbed openings and roadsides	1
*	*Daucus carota*	wild carrot	Frequent		Dry fields and roadsides	1,2
	Desmodium canescens	Tick trefoil	Occasional		Fields	3
*	*Dianthus armeria*	Deptford pink	Occasional, rare		Dry openings and roadsides on shale	1
	Dichanthelium clandestinum	Deertongue	NA		NA	2
	Dichanthelium dichotomum	cypress panic grass	NA		NA	3
	Digitaria cognatum (Leptoloma cognatum)	NA	Occasional		Old fields	3
	Digitaria ischaemum	smooth crabgrass	NA		NA	3
	Digitaria sanguinalis	Crabgrass	NA		NA	3
	Diodia teres	buttonweed	Occasional		Dry openings over shale	1
	Dioscorea villosa	Yam root	NA		NA	3
*	*Dipsacus fullonum*	common teasel	Frequent		Dry, disturbed openings and roadsides	1
	Dipsacus sylvestris	teasel	NA			2
*	*Draba verna*	early whitlow-wort	Occasional		Dry roadsides and about buildings	1
	Dryopteris carthusiana	spinulose woodfern	Frequent		Moist woods and shaded borders	1
	Dryopteris sp.	shield fern	NA		NA	3
	Echinochloa muricata	barnyard grass	NA		NA	2
	Echinocystis lobata	bur cucumber	NA		NA	3
*	*Eleagnus umbellata*	autumn-olive	Occasional		Roadsides and woodland borders	1,2
	Eleocharis acicularis	needle spikerush	Frequent		Margins of artificial pond	1
	Eleocharis calva	bald spikerush	NA		NA	3
	Eleocharis erythropoda	red-footed spikerush	Occasional		Moist openings and ditches	1
	Eleocharis obtusa	NA	Common		Moist openings and ditches	1
	Eleocharis smallii	Small's spikerush	Frequent		Margins of artificial pond	1
	Eleocharis sp.	Spike rush	NA		NA	3
	Eleocharis tenuis	NA	Frequent		Moist openings and ditches	1
	Elymus sp.	Rye grass	NA		NA	2
	Elymus virginica	Wild rye	Occasional		Moist to dry woods	2
*	*Elytrigia repens*	quack-grass	Frequent		Dry fields and roadsides	1,2
	Epilobium coloratum	purple-leaved willow herb	NA		NA	1,2
	Equisetum arvense	horsetail	Frequent		Moist openings, roadsides, and ditches	1,2
	Equisetum hyemale	scouring-rush	Occasional		Moist roadsides and ditches	1,2
	Eragrostis frankii	NA	Occasional		Moist openings and ditches	1
	Eragrostis spectabilis	showy lovegrass	Occasional		Dry to moist fields	1

	Scientific Name	Common Name	Relative Frequency[(a)]	Rank[(b)]	Habitat	Observed On Site[(c)]
	Erechtites hieracifolia	Pilewort	Common		Disturbed woods, borders, and roadsides	1,2
	Erigeron anuus	Fleabane	NA		NA	3
	Erigeron philadelphicus	Philadelphia fleabane	Frequent, occasional		Roadsides and borders	1,2
	Erigeron strigosus	smooth fleabane	Occasional		Dry openings and roadsides	1
	Eupatorium maculatum	spotted Joe Pye weed	NA		NA	2
	Eupatorium perfoliatum	Boneset	Occasional, frequent		Moist fields, ponds, and ditches	1,3
	Eupatorium purpureum	purple joe-pye-weed	Occasional		Borders of moist woods, fields	1,2
	Eupatorium rugosum	White snake root	Common		Woods and fields	2
	Eupatorium sessilifolium	Upland boneset				2
	Euphorbia corollata	Flowering spurge	Occasional		Dry fields	1,2
	Euphorbia maculata	Prostrate spurge	Occasional		Dry openings, road berms, and about buildings	1,2
	Euphorbia supina	Milk purslane	NA		NA	2
	Euthamia graminifolia	grass-leaved goldenrod	Common		Dry to moist fields and roadsides	1,2
*	*Festuca elatior*	tall fescue	Occasional		Roadsides and grassy fields	1
*	*Festuca obtusa*	Fescue	Common		Old fields	2
	Fragaria virginiana	wild strawberry	Frequent		Dry to moist fields and roadsides	1,2
	Fraxinus americana	white ash	Frequent		Dry to moist woods and borders	1
	Fraxinus pensylvanica	green ash	Frequent, common		Moist woods and stream banks	1,2
	Galine aparine	Cleavers	Occasional		Moist woods and borders	1,2
	Galium asperellum	Rough bedstraw	NA		NA	2
	Galium circaezans	wild licorice	Rare		Dry woods	1
	Galium tinctorium	Southern bedstraw	Rare		Moist depression along Taft Road	1,3
	Gentiana clausa	closed gentian	NA		NA	2
	Gentiana sp.	gentian	NA		NA	2
	Gentianopsis crinita	Fringed gentian	Occasional	P	Old fields along ditch banks, small groups and scattered individuals in northeast portion of TNT area A	3
	Geranium maculatum	Wild geranium	Occasional		Successional woods	3
	Gerardia tenuifolia	Slender gerardia	Frequent		Disturbed fields	2
	Geum laciniatum	Rough avens	NA		NA	2
	Geum vernum	spring avens	Occasional		Moist woods and borders	1
	Geum virginianum	white avens	Occasional		Woods borders and roadsides	1,3
*	*Glecoma hederacea*	ground-ivy	Frequent		Moist openings, roadsides, and about buildings	1,3
	Gleditsia triacanthos	honey-locust	Occasional, rare		Dry to moist woods and borders	1,3
	Glyceria striata	manna-grass	Occasional		Moist woods and about ponds	1,2
	Gnaphalium obtusifolium	Catfoot	NA		NA	3
	Gnaphalium obtusifolium	Cudweed	Frequent, occasional		Dry openings on shale, fields	1,3
	Gratiola virginiana	round-fruited hedge-hyssop	Rare	P	ca 20 plants; moist, shaded ground by pond west of Snake Road	1
	Hackelia virginiana	Virginia stickseed	Rare		Woods	2
	Hedyotis caerula	Bluets	Occasional		Dry openings and roadsides on shale	1
	Helenium autumnale	Sneezeweed	Occasional		Disturbed fields	3
	Helenium flexuosum	Southern sneezeweed	Occasional		Moist, open ground and ditches	1
	Helianthus mollis	ashy sunflower	Rare	T	ca 200 plants in grassy field south and southwest of junction of Fox and Patrol Roads; the exact number of individuals in this population is uncertain since excessive browsing by deer has reduced the plants to leafy tufts	1
	Helianthus tuberosus	Jerusalem artichoke	Occasional		Old fields	3
	Hemerocallus fulva	Daylily	NA		NA	3
	Hesperis matronalis	Dame's rocket	NA		NA	3
	Hibiscus moscheutos	rose-mallow	Rare		Moist swale along Ransom Road	1
*	*Hieracium piloselloides*	king-devil	Frequent		Dry openings on shale, fields	1
	Hieracium pratense	field hawkweed	NA		NA	3
	Hypericum gentianoides	orange-grass	Frequent		Dry openings	1
	Hypericum gymnanthum	least St. John's-wort	Rare	E	ca 50 plants; moist, open ground along Patrol Road south of Fox Road	1
	Hypericum majus	tall St. John's-wort	Rare	P	Moist, shaded ground by pond west of Snake Road	1
	Hypericum mutilum	little St. John's-wort	Frequent		Moist openings, ponds, and ditches	1,3
	Hypericum perforatum	common St. John's wort	NA			3
*	*Hypericum perforatum*	dotted St. John's-wort	Frequent		Disturbed fields and roadsides	1
	Hypericum punctatum	St. Johns wort	Rare		Fields	3
	Hypoxis hirsuta	yellow-eyed-grass	Occasional		Grassy fields	1
	Hystrix patula	Bottlebrush grass	Occasional		Woods	3
	Impatiens capensis	Jewelweed	NA		NA	2
*	*Inula helenium*	Elecampane	Rare		Moist roadside along Taft Road	1
	Ipomoea pandurata	wild sweet-potato	Occasional		Dry openings over shale	1
	Ipomoea purpurea	common morning glory	NA		NA	3
	Iris sp.	Iris	NA		NA	3
	Iris versicolor	Northern blue flag	Occasional		Moist woods and ditches	2

Appendix A
Vascular Plant Species Documented On Site
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

	Scientific Name	Common Name	Relative Frequency[(a)]	Rank[(b)]	Habitat	Observed On Site[(c)]
	Isanthus brachiatus	false pennyroyal	Rare		Moist opening on limestone, west of Snake Road and south of North Magazine Road	1
	Juglans nigra	black walnut	Rare		A few young trees at edge of grassy field southwest of junction of Fox and Patrol Roads, woods (2b)	1,3
	Juncus acuminatus	NA	Common		Moist openings and ditches	1,3
	Juncus biflorus	NA	Occasional		Moist openings and ditches	1
	Juncus brachycarpus	NA	Occasional		Moist openings	1
	Juncus bufonius	toad rush	NA		NA	3
	Juncus canadensis	Canada rush	Frequent		Moist openings	1
	Juncus dudleyi	Dudley's rush	Frequent		Moist openings	1
	Juncus effusus	Common rush	Frequent		Moist openings, ponds, and ditches	1,3
	Juncus marginatus	NA	Occasional		Moist openings	1
	Juncus nodosus	rush	Occasional		Old fields and ditches	3
	Juncus tenuis	path rush	Frequent, occasional		Dry openings, road berms, and about buildings	1,2
	Juncus torreyi	Torrey's rush	Occasional		Moist fields	3
	Juniperus virginiana	Red cedar	NA		NA	3
*	*Lamium purpureum*	dead-nettle	Frequent		Disturbed fields, roadsides, and about buildings	1
	Laportea Canadensis	Wood nettle	NA		NA	3
	*Lathyrus latifolius**	Everlasting pea	Occasional		Old fields	3
	Leersia oryzoides	rice cutgrass	Occasional		Moist fields and ditches	1,2
	Leersia virginica	White grass	NA		NA	3
	Lemna minor	Lesser duckweed	Occasional		Ponds and standing water	1,3
	Lepidium campestre	field peppergrass	NA		NA	3
*	*Lepidium campestre*	field-cress	Occasional		Roadsides and about buildings	1
	Lepidium virginicum	poor man's pepper	Frequent		Roadsides, disturbed openings, and about buildings	1
	Leptochloa fascicularis	sprangetop	NA		NA	2
	Leptoloma cognatum	fall witch grass	NA		NA	3
	Lespedeza capitata	bush-clover	Occasional		Dry fields	1,2
	Leucospora multifida	NA	Rare		Moist opening on limestone, west of Snake Road and south of North Magazine Road	1
	Liatris scariosa var. novae-angliae	northern blazing-star	Rare		Dry ground along Patrol Road at Olemacher Ditch	1
	Liatris spicata	spiked blazing-star	Occasional		Moist openings	1
*	*Linaria vulgaris*	butter-and-eggs	Occasional		Roadsides and about buildings	1
	Lindernia dubia	false pimpernel	Occasional		Moist openings, ditches, and pond margins	1
	Linum medium	wild flax	Frequent		Dry to moist openings	1
	Linum virginianum	Virginia flax	Rare		About pond in northern bunker area	1
	Lobelia siphilitica	Great lobelia	Frequent		Moist fields	2
	Lolium perenne	perennial ryegrass	NA		NA	2
	Lonicera japonica	Japanese honeysuckle	Occasional		Fields and disturbed areas	3
*	*Lonicera maackii*	Amur honeysuckle	Rare		Roadsides and thickets along Columbus Avenue near Scheid Ditch	1
*	*Lonicera morrowii*	Asiatic honeysuckle	Frequent		Thickets, borders, and roadsides	1
*	*Lonicera tatarica*	Tatarian honeysuckle	Frequent, common		Thickets, borders, and roadsides	1,2
*	*Lotus corniculatus*	bird's-foot trefoil	Occasional		Grassy fields and road berms	1,3
	Ludwigia alternifolia	rattlebox	Occasional		Ponds and ditches	1,2
	Ludwigia palustris	water-purslane	Frequent, occasional		Ponds and ditches	1,2
	Ludwigia polycarpa	NA	Rare		Moist, shaded ground by pond on Snake Road	1
	Lychnis alba	White campion	NA		NA	3
	Lycopus americana	American bugleweed	NA		NA	2
	Lycopus americanus	American water-horehound	Frequent		Ponds and ditches	1,3
	Lycopus uniflorus	northern water-horehound	Frequent		Moist woods and shaded borders	1
	Lycopus virginicus	Virginia bugleweed	NA		NA	2
	Lysimachia ciliata	fringed loosestrife	NA		NA	2
	Lysimachia terrestris	swamp loosestrife	Occasional		Moist openings	1,3
	Lythrum alatum	prairie loosestrife	Occasional		Moist openings	1
	Lythrum salicaria	Purple loosestrife	NA		NA	3
	Maclura pomifera	osage-orange	Occasional		Disturbed woods and borders	1,2
*	*Matricaria matricarioides*	pineapple-weed	Occasional		Roadsides and about buildings	1
*	*Medicago lupulina*	Black medic	Occasional		Old fields and disturbed areas	2
*	*Melilotus alba*	white sweet-clover	Occasional, frequent		Disturbed fields and roadsides	1,3
*	*Melilotus officinalis*	yellow sweet-clover	Occasional		Disturbed fields and roadsides	1,3
	Melilotus sp.	Sweet clover	NA		NA	3
	Mentha piperita	peppermint	NA		NA	2
	Mentha spicata	Spearmint	Occasional		Moist fields	2
	Mimulus ringens	monkey-flower	Occasional, rare		Moist openings and ditches	1,2
	Monarda fistulosa	bergamont	Occasional		Grassy fields	1
	Monarda sp.	bee balm	NA		NA	2
	Morus alba	Mulberry	Occasional		Fields and thickets	3

Appendix A
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	Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
	Muhlenbergia frondosa	muhly grass	Frequent		Moist fields and ditches	1
	Myrica pensylvanica	Bayberry	Rare	E	One individual in old field in northern portion of area	3
	Najas flexilis	northern naiad	Occasional		Artificial ponds	1
*	*Najas minor*	Eurasian naiad	Frequent		Artificial ponds	1,3
*	*Nepeta cataria*	catnip	Occasional, frequent		Roadsides and weedy openings	1,2
	Nyssa sylvatica	blackgum	Occasional		Thickets and woods borders	1
	Oenothera biennis	evening-primrose	Frequent		Dry fields, roadsides, and about buildings	1,2
	Oenothera tetragona	northern sundrops	Frequent		Moist, grassy fields	1
	Onoclea sensibilis	Sensitive fern	frequent		Wet areas	2
	Osmunda cinnamomea	cinnamon fern	Rare		Depressions in moist woods along angling road	1
	Osmunda regalis	royal fern	Occasional		Depressions in moist woods	1,3
*	*Oxalis europea*	Sorrel	Common		Old fields and disturbed areas	2
	Oxalis violacea	purple wood-sorrel	Occasional		Drier oak woods and borders on shale	1
	Panicum capillare	witchgrass	NA		NA	3
	Panicum clandestinum	deer tongue grass	NA		NA	2
	Panicum dichotomiflorum	Panic grass	Frequent		Fields	3
	Panicum dichotomum	witch grass	NA		NA	2
	Panicum flexile	wiry witch-grass	Rare		Moist opening on limestone, west of Snake Road and south of North Magazine Road	1
	Panicum lanuginosum	hairy panic-grass	common		Dry, grassy fields and roadsides	1
	Panicum oligosanthes	sand panic-grass	Occasional		Dry, grassy fields	1
	Panicum rigidulum	stiff panic-grass	Frequent		Moist openings and ditches	1
	Panicum virgatum	switch-grass	Occasional		Dry fields	1,2
	Parietaria pensylvanica	pellitory	Occasional		Dry, disturbed wood lots and borders	1
	Paronychia fastigata	forked chickweed	Occasional		Dry woods and borders on shale	1
	Parthenocissus quinquefolia	Virginia-creeper	Occasional		Dry to moist woods borders and thickets	1,2
	Parthenocissus vitacea	grape-woodbine	Rare		Dry opening north of Center Magazine Road	1
*	*Pastinaca sativa*	wild parsnip	Occasional		Roadsides	1
	Penstemon digitalis	tall white beard-tongue	Frequent		Grassy fields and roadsides	1,2
	Penthorum sedoides	ditch stonecrop	NA		NA	3
	Phalaris arundinacea	reed canary-grass	Common		Moist fields and ditches	1,2
*	*Phleum pratense*	timothy	Frequent		Disturbed fields and roadsides	1,2
	Phragmites australis	reed-grass	Occasional, rare		Moist openings and ditches	1,3
	Phryma leptostachya	lopseed	Rare		Edge of woods along Scheid Ditch near Columbus Avenue; successional woods	1
	Phytolacca americana	pokeberry	Occasional, rare		Moist woods and borders	1,2
	Pilea pumila	clearweed	NA		NA	2
*	*Plantago lanceolata*	English plantain	Frequent		Disturbed openings and about buildings	1,2
*	*Plantago major*	broad-leaved plantain	Frequent		Road berms and about buildings (1) disturbed areas and old fields (2a)	1
	Plantago major	common plantain	NA		NA	2
	Platanthera lacera	ragged fringe-orchid	Rare		Ditch along south Patrol Road	1
	Platanus occidentalis	sycamore	Occasional, frequent		Moist woods and stream banks, fields and waste areas	1,3
*	*Poa annua*	early bluegrass	Common		Road berms and about buildings	1
*	*Poa compressa*	Canada bluegrass	Frequent		Dry openings, especially on shale, and roadsides	1,2
	Poa pratensis	Kentucky bluegrass	NA		NA	3
	Podophyllum peltatum	may-apple	Occasional		Dry to moist woods	1,2
	Polygala sanguinea	blood milkwort	Frequent		Moist openings	1
	Polygala verticillata	whorled milkwort	Occasional		Moist openings	1
*	*Polygonum caespitosum*	NA	Rare		Moist, shaded ground in bunker area	1,2
	Polygonum hydropiper	Smartweed	NA		NA	3
*	*Polygonum hydropiper*	water-pepper	Occasional		Margins of ponds	1,3
	Polygonum hydropiperoides	false water-pepper	Occasional		Wet ditches and pond margins	1
	Polygonum pennsylvanicum	Pennsylvania smartweed	NA		NA	2
	Polygonum sagittatum	arrow-leaved tearthumb	Occasional		Moist thickets and ditches	1
	Polygonum scandens	climbing false buckwheat	Occasional		Thickets and roadsides	1,2
	Polygonum sp.	Smartweed	NA		NA	3
	Polygonum virginianum	Virginia knotweed	Common		Moist to dry woods	3
	Populus deltoides	cottonwood	Frequent, common		Moist woods, borders, and stream banks	1,2
	Potamogeton diversifolius	snailseed pondweed	Frequent		Artificial ponds	1
	Potamogeton foliosus	leafy pondweed	Occasional		Artificial ponds	1
	Potamogeton nodosus	longleaf pondweed	Occasional		Artificial ponds	1,3
	Potamogeton pectinatus	Sago pondweed	NA		NA	3
	Potentilla norvegica	Norwegian cinquefoil	NA		NA	3
	Potentilla simplex	cinquefoil	Frequent		Dry openings and roadsides on shale	1,2
	Prunella vulgaris	self-heal	Occasional, frequent		Roadsides and about buildings	1,2
	Prunus americana	wild plum	Occasional		Thickets and roadsides	1
	Prunus serotina	wild black cherry	Frequent, common		Dry to moist woods and borders	1,3

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	Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
	Pycnanthemum tenuifolium	narrow-leaved mountain-mint	Frequent, common		Moist openings, especially on shale, old fields	1,2
	Pycnanthemum virginianum	Virginia mountain-mint	Occasional		Moist openings and ditches	1
	Pyrus coronaria	crab-apple	Frequent		Thickets and borders	1,2
	Quercus alba	white oak	Occasional		Dry woods and sandy ridges; a small grove on Taft Road has an unusually pure stand of this species	1
	Quercus bicolor	swamp white oak	Frequent		Moist woodlands	1
	Quercus imbricaria	shingle oak	Frequent, occasional		Moist to dry woodlands	1,3
	Quercus macrocarpa	bur oak	Rare		ca 5 trees on sandy ridge in bunker area south of North Magazine Road; a few trees in area 2a	1
	Quercus palustris	pin oak	Common, frequent		Moist woods	1,2
	Ranunculus acris	Field buttercup	NA		NA	2
	Ranunculus recurvatus	Hooked crowfoot	NA		NA	3
	Ranunculus sceleratus	cursed crowfoot	NA		NA	3
	Ratibida pinnata	green-headed coneflower	Occasional, frequent		Roadsides and dry fields	1
	Rhexia virginica	Virginia meadow-beauty	Occasional	P	Moist openings and pond margins, south of North Magazine Road and along the angling roac	1
	Ribes americanum	American currant	NA		NA	3
	Ribes cynosbati	Gooseberry	Rare		Woods	3
	Riccia sp.	liverwort	NA		NA	3
	Robinia pseudoacacia	Black locust	Rare		Old fields and thickets	3
	Rosa carolina	pasture rose	Occasional		Dry fields	1
*	*Rosa multiflora*	multiflora rose	Occasional		Disturbed openings, borders, and thickets	1,2
	Rosa setigera	prairie rose	Rare		Grassy roadside and thickets along Patrol Road at Olemacher Ditch	1,2
	Rotala ramosior	toothcup	Occasional		Moist openings and about ponds	1
	Rubus allegheniensis	blackberry	Common		Woods, fields, and borders	2
	Rubus flagellaris	dewberry	Frequent, common		Dry openings and roadsides on shale, old fields	1,2
	Rubus occidentalis	Black raspberry	common		Dry woods, and borders	2
	Rudbeckia hirta	black-eyed susan	Frequent		Dry fields and roadsides	1,2
*	*Rumex acetosella*	red sorrel	Occasional		Dry openings over shale	1
	Rumex acetosella	sheep sorrel	NA		NA	2
*	*Rumex crispus*	curly dock	Occasional		Roadsides and about buildings	1,2
	Rumex verticillatus	Swamp dock	Rare		Ditches	3
	Sagittaria latifolia	broad-leaved arrowhead	Occasional		Ponds and ditches	1
	Salix amygdaloides	peachleaf willow	Occasional		Ditches and about ponds	1,2
	Salix discolor	pussy willow	Occasional		Moist openings, ponds, and ditches	1,2
	Salix exigua	narrowleaf willow	NA		NA	3
	Salix exigua	sandbar willow	Frequent		Moist openings, stream banks, and ditches	1,3
	Salix nigra	black willow	Common		Moist woods, stream banks, and ditches	1,3
	Salix sp.	Willow				3
	Sambucus canadensis	elder-berry	Frequent, occasional		Moist openings, stream banks, and ditches	1,2
*	*Saponaria officinalis*	soapwort	Frequent, occasional		Dry fields, roadsides, and about buildings	1
	Sassafras albidum	sassafras	Occasional		Dry woods and borders	1
	Schizachyrium scoparium	little bluestem	Frequent		Dry fields and roadsides	1,3
	Scirpus acutus	hardstem bulrush	Rare		Moist depression west of Taft Road	1
	Scirpus americanus	Three square	rare		Ditches	3
	Scirpus atrovirens	dark green bulrush	Common, occasional		Moist openings, roadsides, and ditches	1,2
	Scirpus cyperinus	woolgrass	Occasional		About artificial ponds	1,3
	Scirpus fluviatilis	River bulrush	NA		NA	1,3
	Scirpus pendulus	NA	Occasional		Moist openings	1
	Scirpus polyphyllus	Leafy bulrush				3
	Scirpus validus	softstem bulrush	Occasional		Moist openings, ponds, and ditches	1,3
	Scleria triglomerata	tall nut-rush	Rare	P	Moist swale in northern bunker area	1
	Scutellaria lateriflora	mad-dog skullcap	Occasional		Moist depressions and ditches	1,2
	Senecio aureus	golden ragwort	Occasional		Moist woods borders	1
	Setaria faberi	foxtail	NA		NA	3
*	*Setaria faberi*	nodding foxtail-grass	Occasional, common		Grassy roadsides in the bunker area	1,2
	Setaria glauca	Yellow foxtail-grass	NA		NA	2
*	*Setaria viridis*	green foxtail-grass	Frequent, common		Dry roadsides and about buildings	1
	Silphium terebinthinaceum	prairie-dock	Rare		Dry openings at crossing of Patrol Road and Olemacher Ditch	1
	Sisirhynchium angustifolium	blue eyed grass	NA		NA	3
	Sisyrinchium albidum	prairie blue-eyed-grass	Frequent		Grassy fields	1
	Sisyrinchium angustifolium	common blue-eyed-grass	Frequent		Grassy fields	1
	Smilacina stellata	star-flowered solomon's seal	NA		NA	3
*	*Solanum caroliniense*	horse-nettle	Occasional, common		Dry openings and roadsides	1,2
*	*Solanum dulcamara*	bittersweet-nightshade	Occasional		Roadsides, ditches, thickets, and about buildings	1,2
	Solanum nigrum	Black nightshade	Occasional		Fields and waste areas	3
	Solidago canadensis	Canada goldenrod	Common		Grassy fields	1,2

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Solidago juncea	early goldenrod	Frequent		Dry to moist fields and roadsides	1
Solidago juncea	Early goldenrod	NA		NA	2
Solidago nemoralis	gray goldenrod	Common		Dry fields and roadsides	1
Solidago riddellii	Riddell's goldenrod	Rare		Moist opening over limestone, west of Snake Road and south of North Magazine Road	1
Solidago rugosa	rough leaved goldenrod	NA		NA	3
Sorghastrum nutans	Indian grass	NA		NA	3
Sparganium eurycarpum	giant bur-reed	Rare		Wet ditch along Ransom Road	1
Spartina pectinata	prairie cord-grass	Frequent, occasional		Moist depressions, fields, and ditches	1,2
Spenopholis intermedia	slender wedgescale	NA		NA	3
Spiranthes cernua var. *cernua*	nodding ladies' tresses	NA		NA	2
Spiranthes ochroleuca	creamy ladies'-tresses	Occasional, rare		Ditches and moist openings	1
Sporobolus asper	tall dropseed	Rare		A single stand in dry opening along angling road	1
Sporobolus neglectus	NA	Frequent		Dry openings and road berms	1
Stachys tenuifolia	Hedge nettle	Occasional		Fields	3
Stellaria longifolia	long-leaved stitchwort	Occasional		Moist, grassy fields	1,3
* *Stellaria media*	chickweed	Common		Road berms and about buildings	1
Symphoricarpos orbiculatus	coralberry	Occasional		Thickets, woods borders, and roadsides	1
Symphyotrichum pilosum	hairy white old field aster	NA		NA	3
* *Taraxacum officinalis*	dandelion	Frequent, occasional		Roadsides and about buildings	1,2
Teucrium canadense	American germander	Occasional		Moist openings	1,2
Thalictrum polygamum	tall meadow rue	NA		NA	2
Thelypteris palustris	marsh fern	Occasional, frequent		Moist depressions and roadsides	1
Toxicodendron radicans	Poison ivy	Frequent		Upland and facultative woods, old fields	2
Tradescantia ohioensis	Ohio spiderwort	Occasional		Old fields	2
* *Tragopogon pratensis*	Yellow goatsbeard	Rare		Old fields	3
Triadenum virgnianum	pink St. John's-wort	Rare		Moist swale in northern bunker area	1
Tridens flavus	purpletop	Occasional		Moist fields and roadsides	1
Trifolium hybridum	Alsike clover	Occasional		Fields	3
* *Trifolium pratense*	red clover	Occasional		Grassy fields and roadsides	1,3
* *Trifolium repens*	common white clover	Common		Grassy roadsides and about buildings	1,2
Triosteum perfoliatum	Wild coffee	Rare		Fields	2
Tussilago farfara	coltsfoot	NA		NA	2
Typha angustifolia	Narrow-leaved cattail	frequent		Ditches	2
Typha latifolia	broad-leaved cattail	Frequent		Moist openings, ponds, and ditches	1,2
Ulmus americana	American elm	Occasional		Moist woods and stream banks	1,2
Ulmus rubra	slippery elm	Occasional		Moist woods and stream banks	1
Urtica dioica var. procera	American stinging nettle	Occasional, common		Moist fields and openings	1
Urtica dioicia	stinging nettle	NA		NA	2
* *Verbascum blattaria*	moth-mullein	Occasional, rare		Disturbed fields and roadsides	1,3
* *Verbascum thapsus*	common mullein	Frequent, occasional		Disturbed fields	1,2
Verbena hastata	purple vervain	Frequent		Moist fields, stream banks, and ditches	1,2
Verbena simplex	prairie vervain	Rare		A single stand in dry opening along angling road	1
Verbena stricta	Vervain	Occasional		Fields	3
Verbena urticifolia	white vervain	Occasional, frequent		Moist woods borders and roadsides	1,2
Verbesina alternifolia	wingstem	Frequent, occasional		Moist woods borders, stream banks, and ditches	1,3
Vernonia gigantea	tall ironweed	Occasional, frequent		Dry to moist fields	1,2
* *Veronica officinalis*	common speedwell	Occasional		Dry openings on shale	1
* *Veronica serpyllifolia*	thyme-leaved speedwell	Occasional		Roadsides and about buildings	1
Viburnum lentago	nannyberry	Frequent		Moist thickets and borders	1
Vicia americana	American vetch	Rare		Old field	3
Vicia tetrasperma	vetch	NA		NA	3
Viola canadensis	Canada violet	NA		NA	3
Viola cucullata	violet	NA		NA	3
Viola lanceolata	lance-leaved violet	Frequent	P	Ditches and moist openings	1
Viola sagittata	arrow-leaved violet	Frequent		Grassy fields and dry banks	1
Viola sororia	common blue violet	Common, occasional		Grassy fields, roadsides, and about buildings	1,2
Vitis aestivalis	summer grape	NA		NA	2
Vitis riparia	riverbank grape	Frequent		Woods borders, thickets, and stream banks	1,2
Vitis vulpina	fox grape	Occasional		Woods borders and thickets	1
Wolffia columbiana	Columbian water meal	NA		NA	3
Xanthium strumarium	Cockle bur	NA		NA	3
Zanichellia palustris	horned pondweed	Rare		Artificial pond west of Snake Road	1
Zizia aurea	Golden alexanders	Rare		Old fields	3

[a] Common = Species which occur in large numbers throughout.
Frequent = Species regularly encountered, but occurring in lesser numbers than common ones.
Occasional = Species found in several places, but never present in large numbers.

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]

Rare = Species found in few places and in low numbers.

[b] T = Ohio Threatened Species. P = Ohio Potentially Threatened Species. E = Ohio Endangered Species.

[c] 1 = Biological Inventory of Plum Brook Station (Ohio Department of Natural Resources, 1994).
2 = Observed at TNT Area A/Waste Water Treatment Plant 1 Sewer Lines during at least one of the site reconnaissance trips.
3 = Observed during a site reconnaissance at another Plum Brook site.

NA – Not available

* Non-native species.

APPENDIX B

ECOLOGICAL SCREENING VALUES

Table B-1

Ecological Screening Values for Soil
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Inorganic Analytes							
Aluminum	7429-90-5	pH Dependent	NSV	NSV	NSV	50	pH Dependent
Antimony	7440-36-0	0.27	5	0.142	NSV	5	0.27
Arsenic	7440-38-2	18	9.9	5.7	60	10	18
Barium	7440-39-3	330	283	1.04	NSV	500	330
Beryllium	7440-41-7	21	10	1.06	NSV	10	21
Cadmium	7440-43-9	0.36	4	0.00222	20	4	0.36
Calcium	7440-70-2	NSV	NSV	NSV	NSV	NSV	Nutrient
Chromium	7440-47-3	26	0.4	0.4	0.4	1	26
Chromium, hexavalent	18540-29-9	81	NSV	NSV	NSV	NSV	81
Cobalt	7440-48-4	13	20	0.14	NSV	20	13
Copper	7440-50-8	28	60	5.4	50	100	28
Iron	7439-89-6	pH Dependent	NSV	NSV	NSV	NSV	pH Dependent
Lead	7439-92-1	11	40.5	0.0537	500	50	11
Magnesium	7439-95-4	NSV	NSV	NSV	NSV	NSV	Nutrient
Manganese	7439-96-5	220	NSV	NSV	NSV	500	220
Mercury	7439-97-6	NSV	0.00051	0.1	0.1	0.3	0.00051
Nickel	7440-02-0	38	30	13.6	200	30	38
Potassium	7440-09-7	NSV	NSV	NSV	NSV	NSV	Nutrient
Selenium	7782-49-2	0.52	0.21	0.0276	70	1	0.52
Silver	7440-22-4	4.2	2	4.04	NSV	2	4.2
Sodium	7440-23-5	NSV	NSV	NSV	NSV	NSV	Nutrient
Thallium	7440-28-0	NSV	1	0.0569	NSV	1	1
Vanadium	7440-62-2	7.8	2	1.59	NSV	2	7.8
Zinc	7440-66-6	46	8.5	6.62	200	50	46
Cyanide							
Cyanide, Total	57-12-5	NSV	NSV	1.33	NSV	NSV	1.33
Polychlorinated Biphenyls							
Aroclor 1016	12674-11-2	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1221	11104-28-2	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1232	11141-16-5	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1242	53469-21-9	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1254	11097-69-1	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1260	11096-82-5	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371

Table B-1

Ecological Screening Values for Soil
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Organochlorine Pesticides							
4,4'-DDE	72-55-9	0.021 [g]	NSV	0.596	NSV	NSV	0.021
4,4'-DDT	50-29-3	0.021 [g]	NSV	0.0035	NSV	NSV	0.021
Methoxychlor	72-43-5	NSV	NSV	0.0199	NSV	NSV	0.0199
Nitroaromatics							
Amino-2,6-dinitrotoluene, 4-	19406-51-0	NSV	NSV	0.0328 [i]	NSV	NSV	0.0328
Amino-4,6-dinitrotoluene, 2-	35572-78-2	NSV	NSV	0.0328 [i]	NSV	NSV	0.0328
Dinitrobenzene, 1,3-	99-65-0	NSV	NSV	0.655	NSV	NSV	0.655
Dinitrotoluene, 2,4-	121-14-2	NSV	NSV	1.28	NSV	NSV	1.28
Dinitrotoluene, 2,6-	606-20-2	NSV	NSV	0.0328	NSV	NSV	0.0328
RDX	121-82-4	NSV	NSV	NSV	NSV	NSV	NSV
Tetryl	479-45-8	NSV	NSV	NSV	NSV	NSV	NSV
Trinitrobenzene, 1,3,5-	99-35-4	NSV	NSV	0.376	NSV	NSV	0.376
Trinitrotoluene, 2,4,6-	118-96-7	NSV	NSV	NSV	NSV	NSV	NSV
Semivolatile Organic Compounds							
Acenaphthene	83-32-9	29	20	682	NSV	20	29
Acenaphthylene	208-96-8	29	NSV	682	NSV	NSV	29
Anthracene	120-12-7	29	NSV	1480	NSV	NSV	29
Benzo(a)anthracene	56-55-3	1.1	NSV	5.21	NSV	NSV	1.1
Benzo(a)pyrene	50-32-8	1.1	NSV	1.52	NSV	NSV	1.1
Benzo(b)fluoranthene	205-99-2	1.1	NSV	59.8	NSV	NSV	1.1
Benzo(ghi)perylene	191-24-2	1.1	NSV	119	NSV	NSV	1.1
Benzo(k)fluoranthene	207-08-9	1.1	NSV	148	NSV	NSV	1.1
Benzoic acid	65-85-0	NSV	NSV	NSV	NSV	NSV	NSV
bis(2-Ethylhexyl)phthalate	117-81-7	NSV	NSV	0.925	NSV	NSV	0.925
Carbazole	86-74-8	NSV	NSV	NSV	NSV	NSV	NSV
Chrysene	218-01-9	1.1	NSV	4.73	NSV	NSV	1.1
Dibenz(a,h)anthracene	53-73-3	1.1	NSV	18.4	NSV	NSV	1.1
Dibenzofuran	132-64-9	NSV	NSV	NSV	NSV	NSV	NSV
Di-n-butyl phthalate	84-74-2	NSV	200	0.15	NSV	200	200
Fluoranthene	206-44-0	1.1	NSV	122	NSV	NSV	1.1
Fluorene	86-73-7	1.1	NSV	122	30	NSV	1.1
Indeno(1,2,3-cd)pyrene	193-39-5	1.1	NSV	109	NSV	NSV	1.1
Methylnaphthalene, 2-	91-57-6	29	NSV	3.24	NSV	NSV	3.24
Naphthalene	91-20-3	29	NSV	0.0994	NSV	NSV	29
Nitroaniline, 3-	99-09-2	NSV	NSV	3.16	NSV	NSV	3.16
Phenanthrene	85-01-8	29	NSV	45.7	NSV	NSV	29

Table B-1

Ecological Screening Values for Soil
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Pyrene	129-00-0	1.1	NSV	78.5	NSV	NSV	1.1
Volatile Organic Compounds							
Acetone	67-64-1	NSV	NSV	2.5	NSV	NSV	2.5
Benzene	71-43-2	NSV	NSV	0.255	NSV	NSV	0.255
Bromomethane	74-83-9	NSV	NSV	0.235	NSV	NSV	0.235
Butanone, 2-	78-93-3	NSV	NSV	89.6	NSV	NSV	89.6
Carbon disulfide	75-15-0	NSV	NSV	0.0941	NSV	NSV	0.0941
Dichloroethane, 1,1-	75-34-3	NSV	NSV	20.1	NSV	NSV	20.1
Dichloroethene, 1,1-	75-35-4	NSV	NSV	8.28	NSV	NSV	8.28
Dichloroethene, cis-1,2-	156-59-2	NSV	NSV	0.784 [h]	NSV	NSV	0.784
Methylene chloride	75-09-2	NSV	NSV	4.05	NSV	NSV	4.05
Toluene	108-88-3	NSV	200	5.45	NSV	200	200
Trichloroethane, 1,1,1-	79-00-5	NSV	NSV	29.8	NSV	NSV	29.8
Trichloroethene	79-01-6	NSV	NSV	12.4	NSV	NSV	12.4
Trimethylbenzene, 1,2,4-	95-63-6	NSV	NSV	NSV	NSV	NSV	NSV
Xylene, Total	1330-20-7	NSV	NSV	10	NSV	NSV	10

EPA = U.S. Environmental Protection Agency
ESV = Ecological screening value
NSV = No screening value available
mg/kg = milligrams per kilogram

Priority for Selection of ESVs:
1) EPA Eco-SSL
2) PRG for Eco Endpoints, (Efroymson, et.al, 1997a)
3) EPA Region 5 Ecological Screening Levels
4) Efroymson, 1997b
5) Efroymson, 1997c

[a] EPA, 2008, Ecological Soil Screening Level (SSL) guidance. On-line at: http://www.epa.gov/ecotox/ecossl/index.htm
[b] Efroymson, 1997a, *Preliminary Remediation Goals for Ecological Endpoints*. www.esd.ornl.gov/programs/ecorisk/documents/tm162r2.pdf .
[c] Screening value based on: EPA , 2003, *Region 5 Ecological Screening Level (ESL)*, Website version last updated August 22, 2003: http://www.epa.gov/Region5/rcraca/edql.htm
[d] Efroymson, R.A., M.E. Will, G.W. Suter, 1997b, Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision, ES/ER/TM-126/R2 (microbial screening values are not included). http://www.esd.ornl.gov/programs/ecorisk/documents/tm126r21.pdf.

Table B-1

Ecological Screening Values for Soil
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)

[e] Efroymson, R.A., M.E. Will, G.W. Suter, 1997c, Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision, ES/ER/TM-85/R3. http://www.esd.ornl.gov/programs/ecorisk/documents/tm85r3.pdf

[f] Based on the screening value for total PCBs.

[g] Based on the screening value for DDT and metabolites.

[h] Based on the screening value for dichloroethylene [trans-1,2].

[i] Based on the screening value for 2,6-dinitrotoluene.

Table B-2

Ecological Screening Values for Sediment
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	TEC [a] mg/kg	EPA Region 5 ESV [b] mg/kg	Ecological PRG [c] mg/kg	Ontario Sediment Quality Guidelines [d] mg/kg	Selected ESV mg/kg
Inorganic Analytes						
Aluminum	7429-90-5	NSV	NSV	NSV	NSV	NSV
Antimony	7440-36-0	NSV	NSV	NSV	NSV	NSV
Arsenic	7440-38-2	9.79	9.79	42	6	9.79
Barium	7440-39-3	NSV	NSV	NSV	NSV	NSV
Beryllium	7440-41-7	NSV	NSV	NSV	NSV	NSV
Cadmium	7440-43-9	0.99	0.99	4.2	0.6	0.99
Calcium	7440-70-2	NSV	NSV	NSV	NSV	Nutrient
Chromium	7440-47-3	43.4	43.4	159	26	43.4
Cobalt	7440-48-4	NSV	50	NSV	50	50
Copper	7440-50-8	31.6	31.6	77.7	16	31.6
Iron	7439-89-6	NSV	NSV	NSV	NSV	Nutrient
Lead	7439-92-1	35.8	35.8	110	31	35.8
Magnesium	7439-95-4	NSV	NSV	NSV	NSV	Nutrient
Manganese	7439-96-5	NSV	NSV	NSV	460	460
Mercury	7439-97-6	0.18	0.174	0.7	0.2	0.18
Nickel	7440-02-0	22.7	22.7	38.5	16	22.7
Potassium	7440-09-7	NSV	NSV	NSV	NSV	Nutrient
Selenium	7782-49-2	NSV	NSV	NSV	NSV	NSV
Silver	7440-22-4	NSV	0.5	1.8	0.5	0.5
Sodium	7440-23-5	NSV	NSV	NSV	NSV	Nutrient
Thallium	7440-28-0	NSV	NSV	NSV	NSV	NSV
Vanadium	7440-62-2	NSV	NSV	NSV	NSV	NSV
Zinc	7440-66-6	121	121	270	120	121
Nitroaromatics						
2,4,6-Trinitrotoluene	118-96-7	NSV	NSV	NSV	NSV	NSV
2,6-Dinitrotoluene	606-20-2	NSV	0.0398	NSV	NSV	0.0398
Polychlorinated Biphenyls						
Aroclor 1254	11097-69-1	0.0598	0.0598	72	0.07	0.0598
Aroclor 1260	11096-82-5	0.0598	0.0598	63	0.07	0.0598
Semivolatile Organic Compounds						
Acenaphthylene	208-96-8	NSV	0.00587	0.13	NSV	0.00587
Benzo(a)anthracene	56-55-3	0.108	0.108	0.69	0.32	0.108
Benzo(a)pyrene	50-32-8	0.15	0.15	0.394	0.37	0.15
Benzo(b)fluoranthene	205-99-2	NSV	10.4	NSV	NSV	10.4
Benzo(ghi)perylene	191-24-2	NSV	0.17	6.3	0.17	0.17

Table B-2

Ecological Screening Values for Sediment
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	TEC [a] mg/kg	EPA Region 5 ESV [b] mg/kg	Ecological PRG [c] mg/kg	Ontario Sediment Quality Guidelines [d] mg/kg	Selected ESV mg/kg
Benzo(k)fluoranthene	207-08-9	NSV	0.24	NSV	0.24	0.24
Chrysene	218-01-9	0.166	0.166	0.85	0.34	0.166
Dibenzofuran	132-64-9	NSV	0.449	0.42	NSV	0.449
Di-n-butyl phthalate	84-74-2	NSV	1.114	240	NSV	1.114
Fluoranthene	206-44-0	NSV	0.423	0.834	0.75	0.423
Indeno(1,2,3-cd)pyrene	193-39-5	NSV	0.2	0.837	0.2	0.2
Methylnaphthalene, 2-	91-57-6	NSV	0.0202	NSV	NSV	0.0202
Naphthalene	91-20-3	0.176	0.176	0.39	NSV	0.176
Phenanthrene	85-01-8	0.204	0.204	0.54	0.56	0.204
Pyrene	129-00-0	0.195	0.195	1.4	0.49	0.195
Volatiles Organic Compounds						
Acetone	67-64-1	NSV	0.0099	0.0091	NSV	0.0099
Carbon disulfide	75-15-0	NSV	0.0239	0.00086	NSV	0.0239
Methylene chloride	75-09-2	NSV	0.159	18	NSV	0.159

ESV = Ecological screening value
mg/kg = milligrams per kilogram
NSV = No screening value available

Priority for Selection of ESVs:

1. Threshold effect concentrations (MacDonald et al., 2000)
2. EPA Region 5 ESLs (EPA, 2003)
3. Sediment PRGs (Efroymson, 1997)
4. Sediment quality criteria (OME, 1993)

[a] Threshold Effect Concentrations (TECs), MacDonald, et al., 2000, *Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems,* Arch Environ Contam Toxicol 39:20-31.

[b] Screening value based on: EPA , 2003, *Region 5 Ecological Screening Level*, Website version last updated August 22, 2003: http://www.epa.gov/Region5/rcraca/edql.htm.

[c] Efroymson,et. al., 1997, *Preliminary Remediation Goals for Ecological Endpoints*.

[d] Ontario Ministry of the Environment, 1993 (OME, 1993). Persaud, et al. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario,* August.

APPENDIX C

ASSESSMENT RECEPTOR PROFILES

Appendix C

Assessment Receptor Profiles

Eastern Cottontail (Sylvilagus floridanus). These medium-size grazing herbivores are found over most of the eastern half of the United States and southern Canada, and have been widely introduced into the western U.S. Environmental Protection Agency ([EPA], 1993). The eastern cottontail is unique to the genus because of the large variety of habitats that it occupies, including glades and woodlands, deserts, swamps, prairies, hardwood forests, rain forests, and boreal forests (EPA, 1993). Open grassy areas are generally are used for grazing at night, whereas dense, heavy cover typically is used for shelter during the day (EPA, 1993). During the summer seasons these rabbits consume herbaceous plants (e.g. grasses, clover, timothy, and alfalfa), whereas winter diet typically consists of woody vines, shrubs and trees (e.g.. birch, maple, and apple) (EPA, 1993). Home range is 3 to 20 acres, with larger ranges in the summer and smaller ranges in the winter (Burt and Grossenheider, 1980). Populations fluctuate from 1 to 4 cottontail per four acres to several per acre in winter conditions (Burt and Grossenheider, 1980). The eastern cottontail breeds from February through September and usually produces 3 to 4 litters per year of 1 to 9 young (usually 4 to 5); however, this rabbit's' death rate vies with its birth rate, and few rabbits live for more than one year (Whitaker, 1995). The average longevity is 1.25 years (EPA, 1993).

References:

Burt, W. H. and R. P. Grossenheider, 1980, "A Field Guide to Mammals," ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

Deer Mouse (Peromyscus maniculatus). This medium-sized mouse is found in the eastern United States from the Hudson Bay to Pennsylvania, the southern Appalachians, central Arkansas, and central Texas. In the west it is found from Mexico to the south Yukon and north-west territories (Whitaker, 1995). Deer mice habitat includes nearly every dry land habitat within its range, including forest, grasslands, or a mixture of the two (Burt and Grossenheider, 1980). Nocturnal and active year-round, these mice construct nests in the ground, trees, stumps, and buildings (Burt and Grossenheider, 1980). Omnivorous, the deer mouse feeds on nuts and seeds (e.g., jewel weed and black cherry pits), fruits, beetles, caterpillars, and other insects. Deer mice may cache their food during the fall and winter in the more northern parts of their range (EPA, 1993). Home range is 0.15 to 3 acres (Burt and Grossenheider, 1980; EPA, 1993). Density of populations is 4 to 12 mice per acre, and average life span is 2 years in the wild (Burt and Grossenheider, 1980). The breeding season is from February to November, depending on latitude. Three to five young are born in each of two to four litters per year (Burt and Grossenheider, 1980). They are greyish to reddish-brown with a white belly, with a distinctly short-haired, bicolor tail (Whitaker, 1995). Weight range is 14.8 (EPA, 1993) to 33 grams (Whitaker, 1995).

References:

Burt, W. H. and R. P. Grossenheider, 1980, "A Field Guide to Mammals," ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

Red-Tailed Hawk (Buteo jamacensis). This carnivorous hawk is one of the most common and widespread members of the genus *Buteo* in the continental United States and Canada (Brown and Amadon, 1968). Red-tailed hawks live in a variety of habitats, such as farmlands, woodlands, mountains, and deserts, as long as there is open country interdispersed with woods, bluffs, or streamside trees. They are primarily carnivorous, feeding on (greater than 85 percent) small rodents, as well as fish. Other prey items include amphibians, reptiles, crayfish, and other birds (Adamcik, et al., 1979; Ehrlich, et al., 1988). Home range has been reported as approximately 66.8 acres, with a population density of 0.16 pairs per acre (Janes, 1984), although EPA (1993) reports an average territory size of 842 hectares (2,080 acres). Breeding population density is one nest per 0.009 acre or one individual per 0.004 acre. Body weight for male red-tails is 1,028.6 to 1,142.9 grams, and for females 1,371.4 to 1,600 grams (Brown and Amadon, 1968), although EPA (1993) reports an average body weight of 957 grams. They typically mate for life or until one of the pair dies, with pairs clinging to territories year after year (Austing, 1964).

References:

Adamcik, R. S., A. W. Todd, and L. B. Keith, 1979, "Demographic and Dietary Responses of Red-Tailed Hawks During a Snowshoe Hare Fluctuation," ***Canadian Field Naturalist***, Vol. 93, pp. 16-27.

Austing, G. R., 1964, ***The World of the Red-Tailed Hawk***, J. B. Lippincott Co., Philadelphia.

Brown, L. and D. Amadon, 1968, ***Eagles, Hawks, and Falcons of the World***, Vol. 1, McGraw-Hill Book Company, New York.

Ehrlich, P. R., D. S. Dobkin, and D. Wheye, 1988, ***The Birder's Handbook: A field guide to the Natural History of North American Birds***, Simon and Shuster, Inc., New York.

Janes, S. W., 1984, "Influences of Territory Composition and Interspecific Competition on Red-Tailed Hawk Reproductive Success," ***Ecology***, 65:862-870.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Short-tailed Shrew (Blarina brevicauda). This shrew is the largest found in North America. It is solid grey above and below, with a short tail, and weighs between 15 and 29 grams (Whitaker, 1995). Total length of this shrew is 76 to 102 millimeters (Burt and Grossenheider, 1980). The range of this shrew extends from southeastern Canada and the northeastern U.S. to Nebraska, Missouri, Kentucky, and in the mountains to Alabama (Whitaker, 1995). Preferable habitat for the shrew includes forests, grasslands, marshes, and brushy areas. It will make a nest of dry leaves, grass, and hair beneath logs, stumps, rocks, or debris (Burt and Grossenheider, 1980). This underground tunneler may burrow as deep as 6 feet, and has a voracious appetite, eating one half of its own body weight per day of earthworms, other terrestrial vertebrates, and sometimes young mice (Whitaker, 1995). Mean population densities range from 5.7 in the winter, to 28 per acre in the summer (EPA, 1993). Their home range varies from 0.5 to 1 acre (Burt and Grossenheider, 1980). Longevity is typically around 20 months (EPA, 1993), with five to eight young born to each of two to three litters (Burt and Grossenheider, 1980).

References:

Burt, W. H. and R. P. Grossenheider, 1980, "A Field Guide to Mammals," ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

White-tailed Deer (Odocoileus virginianus). The white-tailed deer is a member of the Family Cervidae. They are large, even-toed, hoofed mammals with long legs. Their coat is predominantly light brown or chestnut colored, with the underparts being white. Deer are primarily herbivorous grazers and browsers, constantly moving from one food source to the next. The deer's diet changes seasonally. When available, farm crops such as winter wheat, corn, alfalfa, soy beans, and hay are important components of the species diet. Other top food items include wild crab apples, sumac, grasses, green briar, clover, jewelweed, acorns, and dogwood. In regions where the climate varies from season to season, deer may make annual migrations of 10 to 20 miles in the search for food. However, in Ohio, deer typically have rather small home ranges (2 to 3 square miles) and are reluctant to leave this range. The average weight for the species is 88 kilograms for males and 61 kilograms for females. Breeding season ranges from November through February, with the young offspring born in May and early June. Virtually all yearling and adult does conceive each year, and in Ohio usually carry twins. Triplets and quadruplets have also been recorded Gottschang (1981).

References:

Gottschang, J. L., 1981, ***A Guide to the Mammals of Ohio***, The Ohio State University Press, pp. 143-149.

Marsh Wren (Cistothorus palustris). The marsh wren is a small bird (4 to 4.5 inches in length) which inhabits freshwater cattail marshes and salt marshes. Nesting pairs are not likely to occupy other habitats and the species avoids the wet meadow and sedge meadow habitats preferred by sedge wrens. Marsh wrens breed throughout most of the northern half of the United States and in coastal areas as far south as Florida. The species eats mostly insects, and occasio-nally snails and other invertebrates. The average body weight is 0.01 kilograms, and the average home range for the species is 0.054 hectares. Because the species is polygamous, there may be more females than males inhabiting a breeding marsh. Densities as high as 120 birds per hectare have been recorded (EPA, 1993). Marsh wrens' nests are globular structures placed at heights of 2 to 5 feet in dense vegetation. The males commonly build dummy nests in addition to the one where the eggs will be laid (Peterjohn and Rice, 1991).

References:

U.S. Environmental Protection Agency (EPA), Office of Research and Development, 1993, ***Wildlife Exposure Factors Handbook***, EPA/600/R-93/187a.

Peterjohn, B. G., and Rice, D. L., 1991, ***The Ohio Breeding Bird Atlas***, The Ohio Department of Natural Resources.

Raccoon (Procyon lotor). Raccoons are native only in the Americas. Their range extends from the southern edge of the southern provinces of Canada and most of the United States, except for portions of the Rocky Mountain states, central Nevada, and Utah (Whitaker, 1995). The raccoon weighs from 3 to 15 kilograms (Merritt, 1987; EPA, 1993) and has a head and body length of 46 to 71 centimeters and a tail length of 20 to 30 centimeters (Burt and Grossenheider, 1980). The raccoon is nocturnal and solitary, except when breeding or caring for its young. During particularly cold spells, the raccoon may sleep for several days at a time but does not hibernate (Whitaker, 1995). The raccoon is found along lakes near wooded areas or rock cliffs (Burt and Grossenheider, 1980), but prefers wooded streams (Whitaker, 1995). The raccoon is highly omnivorous and is an opportunistic feeder, consuming virtually any animal or plant matter that is available (Merritt, 1987; EPA, 1993). Animal matter predominates the diet during the spring and early summer; plant matter predominates during late summer, autumn, and winter (Merritt, 1987; EPA, 1993). The home range of the raccoon extends up to 3.2 kilometers across, but usually it is less than 1.6 kilometers. Population densities range from one per acre (highest) to one per 15 acres (considered high) (Burt and Grossenheider, 1980). Captive raccoons live for approximately 14 years (Burt and Grossenheider, 1980). Average body weight is 5.1 kilograms (EPA, 1993).

References:

Burt, W. H., and R. P. Grossenheider, 1980, “A Field Guide to Mammals,” ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

Merritt, J. F., 1987, ***Guide to the Mammals of Pennsylvania***, University of Pittsburgh Press, Pennsylvania.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook, Volume I of II***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

Muskrat (Ondata zibethicus). The muskrat is a member of the Family Muridaee. Muskrats are the most aquatic of this family of rodents, and spend much of their lives in or near bogs, marshes, lakes or streams. Their diet consists primarily of aquatic vegetation (in particular the roots or basal portions of aquatic plants), although they can be omnivorous if other food sources are more common. Marsh grasses, sedges, and cattails are important muskrat food items. They are indigenous and common throughout most of the United States. Muskrats have relatively small home ranges that vary in configuration based on the physical attributes of their aquatic habitat. The average weight for the species is approximately 1.3 kilograms for males and 1.2 kilograms for females during the winter, and 0.9 kg for males and 0.8 kg for females during the spring. Muskrats typically breed during the first spring after birth, and typically produce 1-12 pups, with southern populations producing more litters, but fewer pups per litter compared with northern populations (EPA, 1993).

References:

U.S. Environmental Protection Agency (EPA), Office of Research and Development, 1993, ***Wildlife Exposure Factors Handbook***, EPA/600/R-93/187a.

APPENDIX D

FOOD CHAIN MODEL EXPOSURE DOSES AND HAZARD QUOTIENTS

Table D-1
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Deer Mouse
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF
							-----Unitless-----							
Metals														
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.30E-01	mg/kg	1.00E+00			1.04E+01		1.03E+00	5.11E-01	5.11E-01
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			2.37E+00		6.30E-01	1.92E-01	1.92E-01
PCBs														
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	8.14E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03			
Nitroaromatics														
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	1.96E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.11E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.93E+00	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.48E+00	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.17E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.10E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
Semivolatile Organics														
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	1.17E+00	mg/kg	1.00E+00			5.80E-01		6.27E-02	0.00E+00	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.01E+00	mg/kg	1.00E+00			4.60E-01		1.27E-01	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.82E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	1.36E+00	mg/kg	1.00E+00			5.50E-01		5.89E-02	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.20E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.68E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00

Chemical	EED Surface Water (mg/kg-d)	EED Sediment (mg/kg-d)	EED Soil (mg/kg-d)	EED Fish (mg/kg-d)	EED Aq. Invert. (mg/kg-d)	EED Terr. Invert. (mg/kg-d)	EED Aq. Plants (mg/kg-d)	EED Terr. Plants (mg/kg-d)	EED Mammals (mg/kg-d)	EED Birds (mg/kg-d)	Total EED (mg/kg-d)	TRV_{NOAEL} (mg/kg-d)	HQ_{NOAEL}	TRV_{LOAEL} (mg/kg-d)	HQ_{LOAEL}
Metals															
Cadmium	0.00E+00	0.00E+00	1.25E-03	0.00E+00	0.00E+00	2.53E-01	0.00E+00	3.92E-02	0.00E+00	0.00E+00	2.94E-01	1.00E+00	2.94E-01	1.00E+01	2.94E-02
Mercury	0.00E+00	0.00E+00	1.17E-03	0.00E+00	0.00E+00	5.42E-02	0.00E+00	2.26E-02	0.00E+00	0.00E+00	7.79E-02	1.32E+01	5.90E-03	1.32E+02	5.90E-04
PCBs															
Aroclor 1016	0.00E+00	0.00E+00	3.08E-03	0.00E+00	0.00E+00	9.37E-01	0.00E+00	1.88E-03	0.00E+00	0.00E+00	9.42E-01	1.37E+00	6.88E-01	3.43E+00	2.75E-01
Aroclor 1254	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.80E-02	0.00E+00	6.80E-01	0.00E+00
Nitroaromatics															
1,3,5-Trinitrobenzene	0.00E+00	0.00E+00	7.42E-04	0.00E+00	0.00E+00	1.91E-01	0.00E+00	1.27E-01	0.00E+00	0.00E+00	3.19E-01	1.34E+01	2.38E-02	6.70E+01	4.76E-03
2,4,6-Trinitrotoluene	0.00E+00	0.00E+00	1.18E+00	0.00E+00	0.00E+00	3.10E+02	0.00E+00	1.52E+02	0.00E+00	0.00E+00	4.63E+02	3.47E+01	1.33E+01	1.74E+02	2.67E+00
2,4-Dinitrotoluene	0.00E+00	0.00E+00	7.30E-03	0.00E+00	0.00E+00	1.42E-02	0.00E+00	9.88E-02	0.00E+00	0.00E+00	1.20E-01	2.00E-01	6.02E-01	1.50E+00	8.02E-02
2,6-Dinitrotoluene	0.00E+00	0.00E+00	5.58E-03	0.00E+00	0.00E+00	1.09E-02	0.00E+00	6.37E-02	0.00E+00	0.00E+00	8.02E-02	2.00E-01	4.01E-01	1.50E+00	5.34E-02
2-Amino-4,6-dinitrotoluene	0.00E+00	0.00E+00	8.20E-02	0.00E+00	0.00E+00	1.60E-01	0.00E+00	8.37E+00	0.00E+00	0.00E+00	8.61E+00	9.00E+00	9.57E-01	4.80E+01	1.79E-01
4-Amino-2,6-dinitrotoluene	0.00E+00	0.00E+00	4.17E-02	0.00E+00	0.00E+00	8.12E-02	0.00E+00	4.25E+00	0.00E+00	0.00E+00	4.37E+00	9.00E+00	4.86E-01	4.80E+01	9.11E-02
Semivolatile Organics															
Benzo(a)anthracene	0.00E+00	0.00E+00	4.41E-03	0.00E+00	0.00E+00	4.99E-02	0.00E+00	8.43E-03	0.00E+00	0.00E+00	6.27E-02	1.70E-01	3.69E-01	8.50E-01	7.38E-02
Benzo(a)pyrene	0.00E+00	0.00E+00	3.81E-03	0.00E+00	0.00E+00	3.41E-02	0.00E+00	1.48E-02	0.00E+00	0.00E+00	5.27E-02	1.00E+00	5.27E-02	1.00E+01	5.27E-03
Benzo(b)fluoranthene	0.00E+00	0.00E+00	5.74E-03	0.00E+00	0.00E+00	2.35E-02	0.00E+00	5.43E-02	0.00E+00	0.00E+00	8.35E-02	4.00E+00	2.09E-02	2.00E+01	4.18E-03
Benzoic Acid	0.00E+00	0.00E+00	2.20E-03	0.00E+00	0.00E+00	5.77E-01	0.00E+00	2.15E-01	0.00E+00	0.00E+00	7.94E-01	4.00E+00	1.99E-01	4.00E+01	1.99E-02
Chrysene	0.00E+00	0.00E+00	5.15E-03	0.00E+00	0.00E+00	5.52E-02	0.00E+00	9.24E-03	0.00E+00	0.00E+00	6.96E-02	1.70E-01	4.09E-01	8.50E-01	8.19E-02
Fluoranthene	0.00E+00	0.00E+00	4.53E-03	0.00E+00	0.00E+00	1.86E-02	0.00E+00	6.91E-02	0.00E+00	0.00E+00	9.22E-02	1.25E+01	7.38E-03	6.25E+01	1.48E-03
Pyrene	0.00E+00	0.00E+00	6.37E-03	0.00E+00	0.00E+00	5.59E-02	0.00E+00	1.40E-01	0.00E+00	0.00E+00	2.02E-01	7.50E+00	2.69E-02	3.75E+01	5.39E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0.61	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0.39	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.000056	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0028	kg/d
Body weight =	0.0148	kg
Home range =	0.153	acres
Water intake rate =	0.0022	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table D-2
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Short-Tailed Shrew
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Total Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$	HQ $_{NOAEL}$	TRV $_{LOAEL}$	HQ $_{LOAEL}$
								----------Unitless----------							mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals																													
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	2.99E-01	mg/kg	1.00E+00			1.06E+01		1.08E+00	5.38E-01	5.38E-01	0.00E+00	0.00E+00	4.56E-03	0.00E+00	0.00E+00	4.65E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E-01	1.00E+00	4.70E-01	1.00E+01	4.70E-02
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	1.78E-01	mg/kg	1.00E+00			3.44E+00		8.14E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.72E-03	0.00E+00	0.00E+00	8.97E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.24E-02	1.32E+01	7.00E-03	1.32E+02	7.00E-04
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	2.88E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	4.39E-03	0.00E+00	0.00E+00	6.59E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-01	1.37E+00	4.84E-01	3.43E+00	1.93E-01
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.80E-02	0.00E+00	6.80E-01	0.00E+00
Nitroaromatics																													
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	8.73E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00	0.00E+00	0.00E+00	1.33E-02	0.00E+00	0.00E+00	1.69E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E+00	1.34E+01	1.27E-01	6.70E+01	2.55E-02
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.14E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.27E+00	0.00E+00	0.00E+00	4.24E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.27E+02	3.47E+01	1.23E+01	1.74E+02	2.46E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	8.58E-01	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08	0.00E+00	0.00E+00	1.31E-02	0.00E+00	0.00E+00	1.26E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E-02	2.00E-01	1.28E-01	1.50E+00	1.71E-02
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	5.53E-01	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08	0.00E+00	0.00E+00	8.44E-03	0.00E+00	0.00E+00	8.11E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-02	2.00E-01	8.27E-02	1.50E+00	1.10E-02
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	4.61E+00	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	7.03E-02	0.00E+00	0.00E+00	6.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-01	9.00E+00	1.53E-02	4.80E+01	2.87E-03
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.17E+00	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	4.84E-02	0.00E+00	0.00E+00	4.65E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.48E-02	9.00E+00	1.05E-02	4.80E+01	1.98E-03
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	6.60E-01	mg/kg	1.00E+00			5.80E-01		7.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-02	0.00E+00	0.00E+00	5.61E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.62E-02	1.70E-01	3.89E-01	8.50E-01	7.79E-02
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.76E-01	mg/kg	1.00E+00			4.60E-01		1.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.79E-03	0.00E+00	0.00E+00	3.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.76E-02	1.00E+00	4.76E-02	1.00E+01	4.76E-03
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	8.64E-01	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-02	0.00E+00	0.00E+00	2.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-02	4.00E+00	9.95E-03	2.00E+01	1.99E-03
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.60E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00	0.00E+00	0.00E+00	8.54E-03	0.00E+00	0.00E+00	1.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E+00	4.00E+00	2.78E-01	4.00E+01	2.78E-02
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	5.96E-01	mg/kg	1.00E+00			5.50E-01		8.23E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.09E-03	0.00E+00	0.00E+00	4.81E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.72E-02	1.70E-01	3.36E-01	8.50E-01	6.73E-02
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	6.37E-01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.72E-03	0.00E+00	0.00E+00	1.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E-02	1.25E+01	2.35E-03	6.25E+01	4.69E-04
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	9.56E-01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-02	0.00E+00	0.00E+00	6.31E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.77E-02	7.50E+00	1.04E-02	3.75E+01	2.07E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	1	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.0002288	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0022	kg/d
Body weight =	0.015	kg
Home range =	0.96	acres
Water intake rate =	0.0023	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table D-3
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Cottontail Rabbit
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
							Unitless	Unitless	Unitless	Unitless	Unitless	Unitless	Unitless	Unitless	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals																													
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.30E-01	mg/kg	1.00E+00			1.04E+01		1.03E+00	5.11E-01	5.11E-01	0.00E+00	0.00E+00	1.76E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-02	0.00E+00	0.00E+00	3.06E-02	1.00E+00	3.06E-02	1.00E+01	3.06E-03
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			2.37E+00		6.30E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.66E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-02	0.00E+00	0.00E+00	1.82E-02	1.32E+01	1.38E-03	1.32E+02	1.38E-04
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	8.14E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	4.35E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-03	0.00E+00	0.00E+00	5.73E-03	1.37E+00	4.18E-03	3.43E+00	1.67E-03
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.80E-02	0.00E+00	6.80E-01	0.00E+00
Nitroaromatics																													
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	1.96E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00	0.00E+00	0.00E+00	1.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.34E-02	0.00E+00	0.00E+00	9.45E-02	1.34E+01	7.05E-03	6.70E+01	1.41E-03
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.11E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E+02	0.00E+00	0.00E+00	1.13E+02	3.47E+01	3.27E+00	1.74E+02	6.53E-01
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.93E+00	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08	0.00E+00	0.00E+00	1.03E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.26E-02	0.00E+00	0.00E+00	8.29E-02	2.00E-01	4.15E-01	1.50E+00	5.53E-02
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.48E+00	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08	0.00E+00	0.00E+00	7.88E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.68E-02	0.00E+00	0.00E+00	5.47E-02	2.00E-01	2.73E-01	1.50E+00	3.65E-02
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.17E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	1.16E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.15E+00	0.00E+00	0.00E+00	6.27E+00	9.00E+00	6.96E-01	4.80E+01	1.31E-01
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.10E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	5.88E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E+00	0.00E+00	0.00E+00	3.18E+00	9.00E+00	3.54E-01	4.80E+01	6.63E-02
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	1.17E+00	mg/kg	1.00E+00			5.80E-01		6.27E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.20E-03	0.00E+00	0.00E+00	1.24E-02	1.70E-01	7.31E-02	8.50E-01	1.46E-02
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.01E+00	mg/kg	1.00E+00			4.60E-01		1.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.37E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-02	0.00E+00	0.00E+00	1.62E-02	1.00E+00	1.62E-02	1.00E+01	1.62E-03
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.99E-02	0.00E+00	0.00E+00	4.80E-02	4.00E+00	1.20E-02	2.00E+01	2.40E-03
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.82E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00	0.00E+00	0.00E+00	3.11E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-01	0.00E+00	0.00E+00	1.61E-01	4.00E+00	4.03E-02	4.00E+01	4.03E-03
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	1.36E+00	mg/kg	1.00E+00			5.50E-01		5.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.27E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.79E-03	0.00E+00	0.00E+00	1.41E-02	1.70E-01	8.27E-02	8.50E-01	1.65E-02
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.20E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-02	0.00E+00	0.00E+00	5.72E-02	1.25E+01	4.58E-03	6.25E+01	9.15E-04
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.68E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.99E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-01	0.00E+00	0.00E+00	1.12E-01	7.50E+00	1.49E-02	3.75E+01	2.98E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	1	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.006048	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.096	kg/d
Body weight =	1.132	kg
Home range =	7.66	acres
Water intake rate =	0.11	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table D-4
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Marsh Wren
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF
							-----Unitless-----							
Metals														
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.30E-01	mg/kg	1.00E+00			1.04E+01		1.03E+00	5.11E-01	5.11E-01
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			2.37E+00		6.30E-01	1.92E-01	1.92E-01
PCBs														
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	8.14E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03			
Nitroaromatics														
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	1.96E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.11E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.93E+00	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.48E+00	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.17E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.10E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
Semivolatile Organics														
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	1.17E+00	mg/kg	1.00E+00			5.80E-01		6.27E-02	0.00E+00	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.01E+00	mg/kg	1.00E+00			4.60E-01		1.27E-01	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.82E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	1.36E+00	mg/kg	1.00E+00			5.50E-01		5.89E-02	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.20E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.68E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00

Chemical	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals															
Cadmium	0.00E+00	0.00E+00	1.91E-03	0.00E+00	0.00E+00	9.95E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.97E-01	1.45E+00	6.87E-01	2.00E+01	4.98E-02
Mercury	0.00E+00	0.00E+00	1.80E-03	0.00E+00	0.00E+00	2.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-01	4.50E-01	4.77E-01	9.00E-01	2.39E-01
PCBs															
Aroclor 1016	0.00E+00	0.00E+00	4.72E-03	0.00E+00	0.00E+00	3.68E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.69E+00	1.80E-01	2.05E+01	1.80E+00	2.05E+00
Aroclor 1254	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E-01	0.00E+00	1.80E+00	0.00E+00
Nitroaromatics															
1,3,5-Trinitrobenzene	0.00E+00	0.00E+00	1.14E-03	0.00E+00	0.00E+00	7.51E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.53E-01	4.20E-01	1.79E+00	2.10E+00	3.58E-01
2,4,6-Trinitrotoluene	0.00E+00	0.00E+00	1.81E+00	0.00E+00	0.00E+00	1.22E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E+03	9.75E+00	1.25E+02	4.88E+01	2.50E+01
2,4-Dinitrotoluene	0.00E+00	0.00E+00	1.12E-02	0.00E+00	0.00E+00	5.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.72E-02	9.75E+00	6.89E-03	4.88E+01	1.38E-03
2,6-Dinitrotoluene	0.00E+00	0.00E+00	8.56E-03	0.00E+00	0.00E+00	4.28E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.13E-02	9.75E+00	5.26E-03	4.88E+01	1.05E-03
2-Amino-4,6-dinitrotoluene	0.00E+00	0.00E+00	1.26E-01	0.00E+00	0.00E+00	6.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.54E-01	9.75E+00	7.74E-02	4.88E+01	1.55E-02
4-Amino-2,6-dinitrotoluene	0.00E+00	0.00E+00	6.39E-02	0.00E+00	0.00E+00	3.19E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.83E-01	9.75E+00	3.93E-02	4.88E+01	7.86E-03
Semivolatile Organics															
Benzo(a)anthracene	0.00E+00	0.00E+00	6.76E-03	0.00E+00	0.00E+00	1.96E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-01	7.00E-01	2.90E-01	3.50E+00	5.80E-02
Benzo(a)pyrene	0.00E+00	0.00E+00	5.83E-03	0.00E+00	0.00E+00	1.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-01	1.00E+00	1.40E-01	5.00E+00	2.80E-02
Benzo(b)fluoranthene	0.00E+00	0.00E+00	8.80E-03	0.00E+00	0.00E+00	9.24E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-01	1.40E-01	7.23E-01	7.00E-01	1.45E-01
Benzoic Acid	0.00E+00	0.00E+00	3.38E-03	0.00E+00	0.00E+00	2.27E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E+00	NA	NA	NA	NA
Chrysene	0.00E+00	0.00E+00	7.89E-03	0.00E+00	0.00E+00	2.17E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.25E-01	1.00E+00	2.25E-01	5.00E+00	4.50E-02
Fluoranthene	0.00E+00	0.00E+00	6.95E-03	0.00E+00	0.00E+00	7.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.99E-02	3.95E+01	2.02E-03	3.95E+02	2.02E-04
Pyrene	0.00E+00	0.00E+00	9.76E-03	0.00E+00	0.00E+00	2.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-01	3.95E+01	5.81E-03	3.95E+02	5.81E-04

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	1	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.000058	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0029	kg/d
Body weight =	0.01	kg
Home range =	0.13	acres
Water intake rate =	0.0027	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table D-5
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the White-Tailed Deer
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Total Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF
							----------Unitless----------							
Metals														
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	2.99E-01	mg/kg	1.00E+00			1.06E+01		1.08E+00	5.38E-01	5.38E-01
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	1.78E-01	mg/kg	1.00E+00			3.44E+00		8.14E-01	1.92E-01	1.92E-01
PCBs														
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	2.88E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03			
Nitroaromatics														
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	8.73E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.14E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	8.58E-01	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	5.53E-01	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	4.61E+00	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.17E+00	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
Semivolatile Organics														
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	6.60E-01	mg/kg	1.00E+00			5.80E-01		7.89E-02	0.00E+00	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.76E-01	mg/kg	1.00E+00			4.60E-01		1.29E-01	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	8.64E-01	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.60E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	5.96E-01	mg/kg	1.00E+00			5.50E-01		8.23E-02	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	6.37E-01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	9.56E-01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00

Chemical	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals															
Cadmium	0.00E+00	0.00E+00	4.60E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-05	0.00E+00	0.00E+00	2.52E-05	1.00E+00	2.52E-05	1.00E+01	2.52E-06
Mercury	0.00E+00	0.00E+00	2.74E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-05	0.00E+00	0.00E+00	1.14E-05	1.32E+01	8.64E-07	1.32E+02	8.64E-08
PCBs															
Aroclor 1016	0.00E+00	0.00E+00	4.43E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.43E-07	0.00E+00	0.00E+00	8.85E-07	1.37E+00	6.46E-07	3.43E+00	2.58E-07
Aroclor 1254	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.80E-02	0.00E+00	6.80E-01	0.00E+00
Nitroaromatics															
1,3,5-Trinitrobenzene	0.00E+00	0.00E+00	1.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-04	0.00E+00	0.00E+00	3.78E-04	1.34E+01	2.82E-05	6.70E+01	5.65E-06
2,4,6-Trinitrotoluene	0.00E+00	0.00E+00	3.29E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.96E-02	0.00E+00	0.00E+00	6.99E-02	3.47E+01	2.02E-03	1.74E+02	4.03E-04
2,4-Dinitrotoluene	0.00E+00	0.00E+00	1.32E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E-05	0.00E+00	0.00E+00	3.06E-05	2.00E-01	1.53E-04	1.50E+00	2.04E-05
2,6-Dinitrotoluene	0.00E+00	0.00E+00	8.50E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-05	0.00E+00	0.00E+00	1.68E-05	2.00E-01	8.38E-05	1.50E+00	1.12E-05
2-Amino-4,6-dinitrotoluene	0.00E+00	0.00E+00	7.08E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-03	0.00E+00	0.00E+00	1.19E-03	9.00E+00	1.32E-04	4.80E+01	2.48E-05
4-Amino-2,6-dinitrotoluene	0.00E+00	0.00E+00	4.87E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.15E-04	0.00E+00	0.00E+00	8.20E-04	9.00E+00	9.11E-05	4.80E+01	1.71E-05
Semivolatile Organics															
Benzo(a)anthracene	0.00E+00	0.00E+00	1.01E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-06	0.00E+00	0.00E+00	5.02E-06	1.70E-01	2.95E-05	8.50E-01	5.90E-06
Benzo(a)pyrene	0.00E+00	0.00E+00	8.85E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.71E-06	0.00E+00	0.00E+00	6.60E-06	1.00E+00	6.60E-06	1.00E+01	6.60E-07
Benzo(b)fluoranthene	0.00E+00	0.00E+00	1.33E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.06E-05	0.00E+00	0.00E+00	2.19E-05	4.00E+00	5.48E-06	2.00E+01	1.10E-06
Benzoic Acid	0.00E+00	0.00E+00	8.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-04	0.00E+00	0.00E+00	1.39E-04	4.00E+00	3.46E-05	4.00E+01	3.46E-06
Chrysene	0.00E+00	0.00E+00	9.16E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-06	0.00E+00	0.00E+00	4.68E-06	1.70E-01	2.75E-05	8.50E-01	5.51E-06
Fluoranthene	0.00E+00	0.00E+00	9.79E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-05	0.00E+00	0.00E+00	2.55E-05	1.25E+01	2.04E-06	6.25E+01	4.07E-07
Pyrene	0.00E+00	0.00E+00	1.47E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-05	0.00E+00	0.00E+00	5.44E-05	7.50E+00	7.25E-06	3.75E+01	1.45E-06

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	1	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.04	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	2	kg/d
Body weight =	61	kg
Home range =	1280	acres
Water intake rate =	4	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.00234375	unitless
Exposure Frequency (EF) =	1	unitless

Table D-6
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Raccoon
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF
								--------------------	Unitless	--------------------				
Metals														
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.30E-01	mg/kg	1.00E+00			1.04E+01		1.03E+00	5.11E-01	5.11E-01
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			2.37E+00		6.30E-01	1.92E-01	1.92E-01
PCBs														
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	8.14E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03			
Nitroaromatics														
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	1.96E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.11E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.93E+00	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.48E+00	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.17E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.10E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
Semivolatile Organics														
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	1.17E+00	mg/kg	1.00E+00			5.80E-01		6.27E-02	0.00E+00	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.01E+00	mg/kg	1.00E+00			4.60E-01		1.27E-01	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.82E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	1.36E+00	mg/kg	1.00E+00			5.50E-01		5.89E-02	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.20E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.68E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00

Chemical	EED Surface Water mg/kg-d	EED Sediment mg/kg-d	EED Soil mg/kg-d	EED Fish mg/kg-d	EED Aq. Invert. mg/kg-d	EED Terr. Invert. mg/kg-d	EED Aq. Plants mg/kg-d	EED Terr. Plants mg/kg-d	EED Mammals mg/kg-d	EED Birds mg/kg-d	Total EED mg/kg-d	TRV_{NOAEL} mg/kg-d	HQ_{NOAEL}	TRV_{LOAEL} mg/kg-d	HQ_{LOAEL}
Metals															
Cadmium	0.00E+00	0.00E+00	6.16E-06	0.00E+00	0.00E+00	4.09E-04	0.00E+00	2.83E-05	3.35E-06	0.00E+00	4.47E-04	1.00E+00	4.47E-04	1.00E+01	4.47E-05
Mercury	0.00E+00	0.00E+00	5.79E-06	0.00E+00	0.00E+00	8.75E-05	0.00E+00	1.63E-05	1.18E-06	0.00E+00	1.11E-04	1.00E+00	1.11E-04	5.00E+00	2.22E-05
PCBs															
Aroclor 1016	0.00E+00	0.00E+00	1.52E-05	0.00E+00	0.00E+00	1.51E-03	0.00E+00	1.36E-06	2.13E-08	0.00E+00	1.53E-03	1.37E+00	1.12E-03	3.43E+00	4.46E-04
Aroclor 1254	0.00E+00	3.16E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.64E-08	0.00E+00	0.00E+00	0.00E+00	3.21E-06	1.40E-01	2.29E-05	6.90E-01	4.65E-06
Nitroaromatics															
1,3,5-Trinitrobenzene	0.00E+00	0.00E+00	3.66E-06	0.00E+00	0.00E+00	3.09E-04	0.00E+00	9.19E-05	4.28E-06	0.00E+00	4.09E-04	1.34E+01	3.05E-05	6.70E+01	6.10E-06
2,4,6-Trinitrotoluene	0.00E+00	0.00E+00	5.81E-03	0.00E+00	0.00E+00	5.01E-01	0.00E+00	1.10E-01	0.00E+00	0.00E+00	6.17E-01	3.47E+01	1.78E-02	1.74E+02	3.55E-03
2,4-Dinitrotoluene	0.00E+00	0.00E+00	3.60E-05	0.00E+00	0.00E+00	2.30E-05	0.00E+00	7.14E-05	3.12E-12	0.00E+00	1.30E-04	2.00E-01	6.52E-04	1.50E+00	8.70E-05
2,6-Dinitrotoluene	0.00E+00	0.00E+00	2.75E-05	0.00E+00	0.00E+00	1.76E-05	0.00E+00	4.60E-05	1.86E-12	0.00E+00	9.12E-05	2.00E-01	4.56E-04	1.50E+00	6.08E-05
2-Amino-4,6-dinitrotoluene	0.00E+00	0.00E+00	4.05E-04	0.00E+00	0.00E+00	2.58E-04	0.00E+00	6.05E-03	3.12E-11	0.00E+00	6.71E-03	9.00E+00	7.46E-04	4.80E+01	1.40E-04
4-Amino-2,6-dinitrotoluene	0.00E+00	0.00E+00	2.06E-04	0.00E+00	0.00E+00	1.31E-04	0.00E+00	3.07E-03	1.58E-11	0.00E+00	3.41E-03	9.00E+00	3.79E-04	4.80E+01	7.10E-05
Semivolatile Organics															
Benzo(a)anthracene	0.00E+00	0.00E+00	2.18E-05	0.00E+00	0.00E+00	8.06E-05	0.00E+00	6.09E-06	0.00E+00	0.00E+00	1.08E-04	1.70E-01	6.38E-04	8.50E-01	1.28E-04
Benzo(a)pyrene	0.00E+00	0.00E+00	1.88E-05	0.00E+00	0.00E+00	5.51E-05	0.00E+00	1.07E-05	0.00E+00	0.00E+00	8.46E-05	1.00E+00	8.46E-05	1.00E+01	8.46E-06
Benzo(b)fluoranthene	0.00E+00	0.00E+00	2.83E-05	0.00E+00	0.00E+00	3.80E-05	0.00E+00	3.92E-05	0.00E+00	0.00E+00	1.06E-04	4.00E+00	2.64E-05	2.00E+01	5.28E-06
Benzoic Acid	0.00E+00	0.00E+00	1.09E-05	0.00E+00	0.00E+00	9.32E-04	0.00E+00	1.55E-04	1.27E-05	0.00E+00	1.11E-03	4.00E+00	2.78E-04	4.00E+01	2.78E-05
Chrysene	0.00E+00	0.00E+00	2.54E-05	0.00E+00	0.00E+00	8.91E-05	0.00E+00	6.68E-06	0.00E+00	0.00E+00	1.21E-04	1.70E-01	7.13E-04	8.50E-01	1.43E-04
Fluoranthene	0.00E+00	0.00E+00	2.24E-05	0.00E+00	0.00E+00	3.00E-05	0.00E+00	5.00E-05	0.00E+00	0.00E+00	1.02E-04	1.25E+01	8.19E-06	6.25E+01	1.64E-06
Pyrene	0.00E+00	0.00E+00	3.14E-05	0.00E+00	0.00E+00	9.03E-05	0.00E+00	1.01E-04	0.00E+00	0.00E+00	2.23E-04	7.50E+00	2.97E-05	3.75E+01	5.94E-06

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0.21	unitless
Aquatic plant diet fraction =	0.21	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0.02	unitless
Aq. Invert diet fraction =	0.21	unitless
Terr. Invert diet fraction =	0.3	unitless
Mammal diet fraction =	0.05	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.01222	kg/d
Sediment ingestion rate =	0.01222	kg/d
Food ingestion rate =	0.26	kg/d
Body weight =	5.1	kg
Home range =	385	acres
Water intake rate =	0.43	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.00779221	unitless
Exposure Frequency (EF) =	1	unitless

Table D-7
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Red-Tailed Hawk
Waste Water Treatment Plant 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF
							---Unitless---							
Metals														
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.30E-01	mg/kg	1.00E+00			1.04E+01		1.03E+00	5.11E-01	5.11E-01
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			2.37E+00		6.30E-01	1.92E-01	1.92E-01
PCBs														
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	8.14E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03			
Nitroaromatics														
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	1.96E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.11E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.93E+00	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.48E+00	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.17E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.10E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08
Semivolatile Organics														
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	1.17E+00	mg/kg	1.00E+00			5.80E-01		6.27E-02	0.00E+00	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.01E+00	mg/kg	1.00E+00			4.60E-01		1.27E-01	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.82E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	1.36E+00	mg/kg	1.00E+00			5.50E-01		5.89E-02	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.20E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.68E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00

Chemical	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$	HQ $_{NOAEL}$	TRV $_{LOAEL}$	HQ $_{LOAEL}$
	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals															
Cadmium	0.00E+00	0.00E+00	5.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-05	3.47E-06	1.50E-05	1.45E+00	1.04E-05	NA	NA
Mercury	0.00E+00	0.00E+00	5.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E-06	1.23E-06	5.65E-06	4.50E-01	1.25E-05	NA	NA
PCBs															
Aroclor 1016	0.00E+00	0.00E+00	1.40E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.02E-08	2.22E-08	1.49E-06	1.80E-01	8.28E-06	NA	NA
Aroclor 1254	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E-01	0.00E+00	NA	NA
Nitroaromatics															
1,3,5-Trinitrobenzene	0.00E+00	0.00E+00	3.37E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-05	4.45E-06	1.89E-05	4.20E-01	4.49E-05	NA	NA
2,4,6-Trinitrotoluene	0.00E+00	0.00E+00	5.35E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-04	9.75E+00	5.49E-05	NA	NA
2,4-Dinitrotoluene	0.00E+00	0.00E+00	3.32E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-11	3.24E-12	3.32E-06	9.75E+00	3.40E-07	NA	NA
2,6-Dinitrotoluene	0.00E+00	0.00E+00	2.53E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.11E-12	1.93E-12	2.53E-06	9.75E+00	2.60E-07	NA	NA
2-Amino-4,6-dinitrotoluene	0.00E+00	0.00E+00	3.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-10	3.24E-11	3.72E-05	9.75E+00	3.82E-06	NA	NA
4-Amino-2,6-dinitrotoluene	0.00E+00	0.00E+00	1.89E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.20E-11	1.64E-11	1.89E-05	9.75E+00	1.94E-06	NA	NA
Semivolatile Organics															
Benzo(a)anthracene	0.00E+00	0.00E+00	2.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-06	7.00E-01	2.86E-06	NA	NA
Benzo(a)pyrene	0.00E+00	0.00E+00	1.73E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-06	1.00E+00	1.73E-06	NA	NA
Benzo(b)fluoranthene	0.00E+00	0.00E+00	2.61E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-06	1.40E-01	1.86E-05	NA	NA
Benzoic Acid	0.00E+00	0.00E+00	1.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.18E-05	1.32E-05	5.60E-05	NA	NA	NA	NA
Chrysene	0.00E+00	0.00E+00	2.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-06	1.00E+00	2.34E-06	NA	NA
Fluoranthene	0.00E+00	0.00E+00	2.06E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.06E-06	3.95E+01	5.21E-08	NA	NA
Pyrene	0.00E+00	0.00E+00	2.89E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E-06	3.95E+01	7.32E-08	NA	NA

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0.76	unitless
Bird diet fraction =	0.24	unitless
Soil ingestion rate =	0.00114	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.057	kg/d
Body weight =	0.957	kg
Home range =	2080	acres
Water intake rate =	0.057	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.00144231	unitless
Exposure Frequency (EF) =	1	unitless

Table D-8
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Muskrat
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
							---Unitless---								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals																													
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.30E-01	mg/kg	1.00E+00			1.04E+01		1.03E+00	5.11E-01	5.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	1.00E+01	0.00E+00
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			2.37E+00		6.30E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	5.00E+00	0.00E+00
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	8.14E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E+00	0.00E+00	3.43E+00	0.00E+00
Aroclor 1254	0.00E+00	mg/L	1.69E-01	mg/kg	0.00E+00	mg/kg	1.00E+00				4.00E-03				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-04	0.00E+00	0.00E+00	0.00E+00	2.03E-04	1.40E-01	1.45E-03	6.90E-01	2.94E-04
Nitroaromatics																													
1,3,5-Trinitrobenzene	0.00E+00	mg/L	0.00E+00	mg/kg	1.96E-01	mg/kg	1.00E+00			1.32E+01		5.62E+00	1.10E+00	1.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E+01	0.00E+00	6.70E+01	0.00E+00
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	3.11E+02	mg/kg	1.00E+00			1.35E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.47E+01	0.00E+00	1.74E+02	0.00E+00
2,4-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.93E+00	mg/kg	1.00E+00			1.00E-01		4.44E-01	8.14E-08	8.14E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-01	0.00E+00	1.50E+00	0.00E+00
2,6-Dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.48E+00	mg/kg	1.00E+00			1.00E-01		3.74E-01	6.34E-08	6.34E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-01	0.00E+00	1.50E+00	0.00E+00
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.17E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E+00	0.00E+00	4.80E+01	0.00E+00
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.10E+01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E+00	0.00E+00	4.80E+01	0.00E+00
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	1.17E+00	mg/kg	1.00E+00			5.80E-01		6.27E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-01	0.00E+00	8.50E-01	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.01E+00	mg/kg	1.00E+00			4.60E-01		1.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	1.00E+01	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E+00	0.00E+00	2.00E+01	0.00E+00
Benzoic Acid	0.00E+00	mg/L	0.00E+00	mg/kg	5.82E-01	mg/kg	1.00E+00			1.34E+01		3.20E+00	1.10E+00	1.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E+00	0.00E+00	4.00E+01	0.00E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	1.36E+00	mg/kg	1.00E+00			5.50E-01		5.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-01	0.00E+00	8.50E-01	0.00E+00
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.20E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E+01	0.00E+00	6.25E+01	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.68E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.50E+00	0.00E+00	3.75E+01	0.00E+00

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	1	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.352	kg/d
Body weight =	1.174	kg
Home range =	0.3	acres
Water intake rate =	0.11	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

APPENDIX E

DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		SL-SB01					SL-SB01					SL-SB03					SL-SB03					SL-SB04				
SAMPLE_NO		SL0061					SL0062					SL0067					SL0068					SL0069				
SAMPLE_DATE		13-Jan-09					13-Jan-09					13-Jan-09					13-Jan-09					13-Jan-09				
FK_DEPTH		0 - 1 Ft					4 - 6 Ft					0 - 1 Ft					5 - 6 Ft					0 - 1 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.471	0.296	0.148			0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.605	0.296	0.148			0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Dinitrobenzene, 1,3-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Dinitrotoluene, 2,4-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Dinitrotoluene, 2,6-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	Q1,U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
HMX	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Nitrobenzene	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Nitrotoluene, 2-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Nitrotoluene, 3-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Nitrotoluene, 4-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
RDX	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Tetryl	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.148	0.296	0.148	U	U	0.15	0.3	0.15	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U	0.15	0.3	0.15	U	U
METALS (UNFILTERED)																										
Aluminum	mg/kg	8710	4.3	2.15			7040	3.28	1.64			9090	4.16	2.08			7740	3.61	1.81			8870	4.26	2.13		
Antimony	mg/kg	0.269	0.538	0.269	U	UJ	0.391	0.41	0.205	J	J	0.357	0.52	0.26	J	J	0.448	0.452	0.226	J	J	0.266	0.532	0.266	U	UJ
Arsenic	mg/kg	4.8	1.08	0.538		J	13.8	0.82	0.41		J	12.2	1.04	0.52		J	12.6	0.903	0.452		J	5.76	1.06	0.532		J
Barium	mg/kg	52.3	0.215	0.108			41.7	0.164	0.082			51.7	0.208	0.104			70.2	0.181	0.0903			52.2	0.213	0.106		
Beryllium	mg/kg	5.22	0.215	0.108		J	6.99	0.164	0.082		J	7.87	0.208	0.104		J	10.3	0.181	0.0903		J	5.95	0.213	0.106		J
Cadmium	mg/kg	0.269	0.538	0.269	U	U	0.234	0.41	0.205	J	J	0.26	0.52	0.26	U	U	0.275	0.452	0.226	J	J	0.266	0.532	0.266	U	U
Calcium	mg/kg	4090	10.8	5.38			27800	8.2	4.1			7330	10.4	5.2			23200	9.03	4.52			5630	10.6	5.32		
Chromium	mg/kg	11.2	0.538	0.269			10.8	0.41	0.205			14.1	0.52	0.26			12.7	0.452	0.226			13.2	0.532	0.266		
Cobalt	mg/kg	4.19	0.215	0.108			9.15	0.164	0.082			8.65	0.208	0.104			8.57	0.181	0.09			5.36	0.213	0.106		
Copper	mg/kg	15.4	0.538	0.269			36.3	0.41	0.205			27.8	0.52	0.26			30.4	0.452	0.226			20.9	0.532	0.266		
Iron	mg/kg	14600	2.15	1.08			26600	3.28	1.64			25200	2.08	1.04			65600	9.03	4.52			16400	2.13	1.06		
Lead	mg/kg	14	0.538	0.269			14	0.41	0.205			13.9	0.52	0.26			14.1	0.452	0.226			11.9	0.532	0.266		
Magnesium	mg/kg	1610	2.15	1.08		J	5470	1.64	0.82		J	3500	2.08	1.04		J	5040	1.81	0.903		J	2350	2.13	1.06		J
Manganese	mg/kg	156	0.215	0.108			326	0.164	0.082			306	0.208	0.104			499	0.181	0.0903			153	0.213	0.106		
Mercury	mg/kg	0.443	0.0236	0.0118			0.0164	0.0216	0.0108	J	J	0.0419	0.0252	0.0126			0.0153	0.0245	0.0123	J	J	0.0406	0.0232	0.0116		
Nickel	mg/kg	2.68	0.323	0.161		J	14.6	0.246	0.123		J	11.8	0.312	0.156		J	0.135	0.271	0.135	U	U	9.5	0.319	0.16		J
Potassium	mg/kg	480	26.9	13.5			775	20.5	10.2			900	26	13			1020	22.6	11.3			633	26.6	13.3		
Selenium	mg/kg	0.538	1.08	0.538	U	UJ	0.41	0.82	0.41	U	UJ	0.52	1.04	0.52	U	UJ	1.32	0.903	0.452		J	0.532	1.06	0.532	U	UJ
Silver	mg/kg	0.269	0.538	0.269	U	U	0.205	0.41	0.205	U	U	0.26	0.52	0.26	U	U	0.226	0.452	0.226	U	U	0.266	0.532	0.266	U	U
Sodium	mg/kg	48.1	21.5	10.8			82.7	16.4	8.2			76.7	20.8	10.4			122	18.1	9.03			51.6	21.3	10.6		
Thallium	mg/kg	0.269	0.538	0.269	U	U	0.414	0.41	0.205			0.366	0.52	0.26	J	J	0.496	0.452	0.226			0.266	0.532	0.266	U	U
Vanadium	mg/kg	20.4	0.215	0.108			15.5	0.164	0.082			20.2	0.208	0.104			27	0.181	0.0903			21.1	0.213	0.106		
Zinc	mg/kg	34	2.69	1.35		J	88.1	2.05	1.02		J	65.2	2.6	1.3		J	65	2.26	1.13		J	46.9	2.66	1.33		J
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.0478	0.0427	0.00855	P	J	0.00802	0.0401	0.00802	U	U	0.0191	0.0437	0.00874	J,P	J
Aroclor 1221	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.00855	0.0427	0.00855	U	U	0.00802	0.0401	0.00802	U	U	0.00874	0.0437	0.00874	U	U
Aroclor 1232	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.00855	0.0427	0.00855	U	U	0.00802	0.0401	0.00802	U	U	0.00874	0.0437	0.00874	U	U
Aroclor 1242	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.00855	0.0427	0.00855	U	U	0.00802	0.0401	0.00802	U	U	0.00874	0.0437	0.00874	U	U
Aroclor 1248	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.00855	0.0427	0.00855	U	U	0.00802	0.0401	0.00802	U	U	0.00874	0.0437	0.00874	U	U
Aroclor 1254	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.00855	0.0427	0.00855	U	U	0.00802	0.0401	0.00802	U	U	0.00874	0.0437	0.00874	U	U
Aroclor 1260	mg/kg	0.00846	0.0422	0.00846	U	U	0.00796	0.0398	0.00796	U	U	0.00855	0.0427	0.00855	U	U	0.00802	0.0401	0.00802	U	U	0.00874	0.0437	0.00874	U	U
SEMIVOLATILES																										
Acenaphthene	mg/kg	0.00769	0.427	0.00769	U	U	0.00716	0.398	0.00716	U	U	0.00784	0.435	0.00784	U	U	0.00719	0.399	0.00719	U	U	0.00781	0.434	0.00781	U	U
Acenaphthylene	mg/kg	0.00512	0.427	0.00512	U	U	0.00478	0.398	0.00478	U	U	0.00523	0.435	0.00523	U	U	0.0048	0.399	0.0048	U	U	0.00521	0.434	0.00521	U	U
Anthracene	mg/kg	0.00922	0.427	0.00922	U	U	0.0086	0.398	0.0086	U	U	0.00941	0.435	0.00941	U	U	0.00863	0.399	0.00863	U	U	0.00938	0.434	0.00938	U	U
Benzo(a)anthracene	mg/kg	0.047	0.427	0.0281	J	J	0.0261	0.398	0.0261	U	U	0.0286	0.435	0.0286	U	U	0.0263	0.399	0.0263	U	U	0.0285	0.434	0.0285	U	U
Benzo(a)pyrene	mg/kg	0.0281	0.427	0.0281	U	U	0.0261	0.398	0.0261	U	U	0.0286	0.435	0.0286	U	U	0.0263	0.399	0.0263	U	U	0.0285	0.434	0.0285	U	U
Benzo(b)fluoranthene	mg/kg	0.0713	0.427	0.0711	J	J	0.0663	0.398	0.0663	U	U	0.0725	0.435	0.0725	U	U	0.0665	0.399	0.0665	U	U	0.0723	0.434	0.0723	U	U
Benzo(ghi)perylene	mg/kg	0.104	0.427	0.104	U	U	0.0969	0.398	0.0969	U	U	0.106	0.435	0.106	U	U	0.0974	0.399	0.0974	U	U	0.106	0.434	0.106	U	U
Benzo(k)fluoranthene	mg/kg	0.129	0.427	0.129	U	U	0.121	0.398	0.121	U	U	0.132	0.435	0.132	U	U	0.121	0.399	0.121	U	U	0.132	0.434	0.132	U	U
Benzoic acid	mg/kg	0.639	0.427	0.104		QJ	0.0969	0.398	0.0969	U	U	0.106	0.435	0.106	U	U	0.0974	0.399	0.0974	U	U	0.106	0.434	0.106	U	U
Benzyl alcohol	mg/kg	0.104	0.427	0.104	U	U	0.0969	0.398	0.0969	U	U	0.106	0.435	0.106	U	U	0.0974	0.399	0.0974	U	U	0.106	0.434	0.106	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.00897	0.427	0.00897	U	U	0.00836	0.398	0.00836	U	U	0.00915	0.435	0.00915	U	U	0.00839	0.399	0.00839	U	U	0.00912	0.434	0.00912	U	U
Bis(2-chloroethyl)ether	mg/kg	0.0109	0.427	0.0109	U	U	0.0101	0.398	0.0101	U	U	0.0111	0.435	0.0111	U	U	0.0102	0.399	0.0102	U	U	0.0111	0.434	0.0111	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.0186	0.427	0.0186	U	U	0.0173	0.398	0.0173	U	U	0.0189	0.435	0.0189	U	U	0.0174	0.399	0.0174	U	U	0.0189	0.434	0.0189	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.0395	0.427	0.0395	U	U	0.0368	0.398	0.0368	U	U	0.0402	0.435	0.0402	U	U	0.0369	0.399	0.0369	U	U	0.0401	0.434	0.0401	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.0152	0.427	0.0152	U	U	0.0142	0.398	0.0142	U	U	0.0155	0.435	0.0155	U	U	0.0143	0.399	0.0143	U	U	0.0155	0.434	0.0155	U	U
Butyl benzyl phthalate	mg/kg	0.0173	0.427	0.0173	U	U	0.0161	0.398	0.0161	U	U	0.0176	0.435	0.0176	U	U	0.0162	0.399	0.0162	U	U	0.0176	0.434	0.0176	U	U
Carbazole	mg/kg	0.0427	0.427	0.0427	U	U	0.0398	0.398	0.0398	U	U	0.0435	0.435	0.0435	U	U	0.0099	0.399	0.0099	U	U	0.0434	0.434	0.0434	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.0105	0.427	0.0105	U	U	0.00979	0.398	0.00979	U	U	0.0107	0.435	0.0107	U	U	0.00983	0.399	0.00983	U	U	0.0107	0.434	0.0107	U	U
Chloroaniline, 4-	mg/kg	0.037	0.427	0.037	U	U	0.0345	0.398	0.0345	Q1,U	UJ	0.0378	0.435	0.0378	Q1,U	UJ	0.0347	0.399	0.0347	Q1,U	UJ	0.0376	0.434	0.0376	Q1,U	UJ
Chloronaphthalene, 2-	mg/kg	0.00679	0.427	0.00679	U	U	0.00633	0.398	0.00633	U	U	0.00692	0.435	0.00692	U	U	0.00636	0.399	0.00636	U	U	0.0069	0.434	0.0069	U	U
Chlorophenol, 2-	mg/kg	0.00525	0.427	0.00525	U	U	0.00489	0.398	0.00489	U	U	0.00536	0.435	0.00536	U	U	0.00492	0.399	0.00492	U	U	0.00534	0.434	0.00534	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.0327	0.427	0.0327	U	U	0.0304	0.398	0.0304	U	U	0.0333	0.435	0.0333	U	U	0.0306	0.399	0.0306	U	U	0.0332	0.434	0.0332	U	U
Chrysene	mg/kg	0.0632	0.427	0.0169	J	J	0.0158	0.398	0.0158	U	U	0.0172	0.435	0.0172	U	U	0.0158	0.399	0.0158	U	U	0.0172	0.434	0.0172	U	U

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		SL-SB01					SL-SB01					SL-SB03					SL-SB03					SL-SB04				
SAMPLE_NO		SL0061					SL0062					SL0067					SL0068					SL0069				
SAMPLE_DATE		13-Jan-09					13-Jan-09					13-Jan-09					13-Jan-09					13-Jan-09				
FK_DEPTH		0 - 1 Ft					4 - 6 Ft					0 - 1 Ft					5 - 6 Ft					0 - 1 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg	0.0965	0.427	0.0965	U	U	0.0899	0.398	0.0899	U	U	0.0984	0.435	0.0984	U	U	0.0903	0.399	0.0903	U	U	0.0981	0.434	0.0981	U	U
Dibenzofuran	mg/kg	0.00717	0.427	0.00717	U	U	0.00669	0.398	0.00669	U	U	0.00732	0.435	0.00732	U	U	0.00671	0.399	0.00671	U	U	0.00729	0.434	0.00729	U	U
Dichlorobenzene, 1,2-	mg/kg	0.00986	0.427	0.00986	U	U	0.00919	0.398	0.00919	U	U	0.0101	0.435	0.0101	U	U	0.00923	0.399	0.00923	U	U	0.01	0.434	0.01	U	U
Dichlorobenzene, 1,3-	mg/kg	0.0155	0.427	0.0155	U	U	0.0144	0.398	0.0144	U	U	0.0158	0.435	0.0158	U	U	0.0145	0.399	0.0145	U	U	0.0158	0.434	0.0158	U	U
Dichlorobenzene, 1,4-	mg/kg	0.00833	0.427	0.00833	U	U	0.00776	0.398	0.00776	U	U	0.00849	0.435	0.00849	U	U	0.00779	0.399	0.00779	U	U	0.00846	0.434	0.00846	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.0423	0.427	0.0423	U	U	0.0394	0.398	0.0394	Q1,U	UJ	0.0431	0.435	0.0431	Q1,U	UJ	0.0396	0.399	0.0396	Q1,U	UJ	0.043	0.434	0.043	Q1,U	UJ
Dichlorophenol, 2,4-	mg/kg	0.0152	0.427	0.0152	U	U	0.0142	0.398	0.0142	U	U	0.0155	0.435	0.0155	U	U	0.0143	0.399	0.0143	U	U	0.0155	0.434	0.0155	U	U
Diethyl phthalate	mg/kg	0.0173	0.427	0.0173	U	U	0.0161	0.398	0.0161	U	U	0.0176	0.435	0.0176	U	U	0.0162	0.399	0.0162	U	U	0.0176	0.434	0.0176	U	U
Dimethyl phthalate	mg/kg	0.0131	0.427	0.0131	U	U	0.0122	0.398	0.0122	U	U	0.0133	0.435	0.0133	U	U	0.0122	0.399	0.0122	U	U	0.0133	0.434	0.0133	U	U
Dimethylphenol, 2,4-	mg/kg	0.0113	0.427	0.0113	U	U	0.0105	0.398	0.0105	U	U	0.0115	0.435	0.0115	U	U	0.0106	0.399	0.0106	U	U	0.0115	0.434	0.0115	U	U
Di-n-butyl phthalate	mg/kg	0.00922	0.427	0.00922	U	U	0.0086	0.398	0.0086	U	U	0.00941	0.435	0.00941	U	U	0.00863	0.399	0.00863	U	U	0.00938	0.434	0.00938	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.0429	0.427	0.0429	U	U	0.04	0.398	0.04	U	U	0.0438	0.435	0.0438	U	U	0.0402	0.399	0.0402	U	U	0.0436	0.434	0.0436	U	U
Dinitrophenol, 2,4-	mg/kg	0.068	0.427	0.068	U	U	0.0634	0.398	0.0634	U	U	0.0694	0.435	0.0694	U	U	0.0637	0.399	0.0637	U	U	0.0691	0.434	0.0691	U	U
Dinitrotoluene, 2,4-	mg/kg	0.015	0.427	0.015	U	U	0.014	0.398	0.014	U	U	0.0153	0.435	0.0153	U	U	0.014	0.399	0.014	U	U	0.0152	0.434	0.0152	U	U
Dinitrotoluene, 2,6-	mg/kg	0.0102	0.427	0.0102	U	U	0.00955	0.398	0.00955	U	U	0.0105	0.435	0.0105	U	U	0.00959	0.399	0.00959	U	U	0.0104	0.434	0.0104	U	U
Di-n-octyl phthalate	mg/kg	0.0803	0.427	0.0803	U	U	0.0749	0.398	0.0749	U	U	0.0819	0.435	0.0819	U	U	0.0752	0.399	0.0752	U	U	0.0817	0.434	0.0817	U	U
DIPHENYLAMINE	mg/kg	0.0423	0.427	0.0423	U	U	0.0394	0.398	0.0394	U	U	0.0431	0.435	0.0431	U	U	0.0396	0.399	0.0396	U	U	0.043	0.434	0.043	U	U
Fluoranthene	mg/kg	0.111	0.427	0.00922	J	J	0.0086	0.398	0.0086	U	U	0.00941	0.435	0.00941	U	U	0.00863	0.399	0.00863	U	U	0.00938	0.434	0.00938	U	U
Fluorene	mg/kg	0.0181	0.427	0.0181	U	U	0.0168	0.398	0.0168	U	U	0.0184	0.435	0.0184	U	U	0.0169	0.399	0.0169	U	U	0.0184	0.434	0.0184	U	U
Hexachlorobenzene	mg/kg	0.0265	0.427	0.0265	U	U	0.0247	0.398	0.0247	U	U	0.027	0.435	0.027	U	U	0.0248	0.399	0.0248	U	U	0.027	0.434	0.027	U	U
Hexachlorobutadiene	mg/kg	0.0405	0.427	0.0405	U	U	0.0377	0.398	0.0377	U	U	0.0413	0.435	0.0413	U	U	0.0379	0.399	0.0379	U	U	0.0412	0.434	0.0412	U	U
Hexachlorocyclopentadiene	mg/kg	0.0136	0.427	0.0136	U	U	0.0127	0.398	0.0127	Q2,U	UJ	0.0138	0.435	0.0138	Q2,U	UJ	0.0127	0.399	0.0127	Q2,U	UJ	0.0138	0.434	0.0138	Q2,U	UJ
Hexachloroethane	mg/kg	0.0131	0.427	0.0131	U	U	0.0122	0.398	0.0122	U	U	0.0133	0.435	0.0133	U	U	0.0122	0.399	0.0122	U	U	0.0133	0.434	0.0133	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.138	0.427	0.138	U	U	0.129	0.398	0.129	U	U	0.141	0.435	0.141	U	U	0.13	0.399	0.13	U	U	0.141	0.434	0.141	U	U
Isophorone	mg/kg	0.00512	0.427	0.00512	U	U	0.00478	0.398	0.00478	U	U	0.00523	0.435	0.00523	U	U	0.0048	0.399	0.0048	U	U	0.00521	0.434	0.00521	U	U
Methylnaphthalene, 2-	mg/kg	0.112	0.427	0.112	U	U	0.104	0.398	0.104	U	U	0.114	0.435	0.114	U	U	0.105	0.399	0.105	U	U	0.114	0.434	0.114	U	U
Methylphenol, 2-	mg/kg	0.0064	0.427	0.0064	U	U	0.00597	0.398	0.00597	U	U	0.00653	0.435	0.00653	U	U	0.006	0.399	0.006	U	U	0.00651	0.434	0.00651	U	U
Methylphenol, 4-	mg/kg	0.0133	0.427	0.0133	U	U	0.0124	0.398	0.0124	U	U	0.0136	0.435	0.0136	U	U	0.0125	0.399	0.0125	U	U	0.0135	0.434	0.0135	U	U
Naphthalene	mg/kg	0.0101	0.427	0.0101	U	U	0.00943	0.398	0.00943	U	U	0.0103	0.435	0.0103	U	U	0.00947	0.399	0.00947	U	U	0.0103	0.434	0.0103	U	U
Nitroaniline, 2-	mg/kg	0.0184	0.427	0.0184	U	U	0.0172	0.398	0.0172	U	U	0.0188	0.435	0.0188	U	U	0.0173	0.399	0.0173	U	U	0.0188	0.434	0.0188	U	U
Nitroaniline, 3-	mg/kg	0.0145	0.427	0.0145	U	U	0.0135	0.398	0.0135	U	U	0.0148	0.435	0.0148	U	U	0.0135	0.399	0.0135	U	U	0.0147	0.434	0.0147	U	U
Nitroaniline, 4-	mg/kg	0.151	0.427	0.151	U	U	0.141	0.398	0.141	U	U	0.154	0.435	0.154	U	U	0.141	0.399	0.141	U	U	0.154	0.434	0.154	U	U
Nitrobenzene	mg/kg	0.014	0.427	0.014	U	U	0.013	0.398	0.013	U	U	0.0142	0.435	0.0142	U	U	0.0131	0.399	0.0131	U	U	0.0142	0.434	0.0142	U	U
Nitrophenol, 2-	mg/kg	0.0151	0.427	0.0151	U	U	0.0141	0.398	0.0141	U	U	0.0154	0.435	0.0154	U	U	0.0141	0.399	0.0141	U	U	0.0154	0.434	0.0154	U	U
Nitrophenol, 4-	mg/kg	0.0346	0.427	0.0346	U	U	0.0322	0.398	0.0322	U	U	0.0353	0.435	0.0353	U	U	0.0324	0.399	0.0324	U	U	0.0352	0.434	0.0352	U	U
n-Nitrosodimethylamine	mg/kg	0.0128	0.427	0.0128	U	U	0.0119	0.398	0.0119	U	U	0.0131	0.435	0.0131	U	U	0.012	0.399	0.012	U	U	0.013	0.434	0.013	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.0152	0.427	0.0152	U	U	0.0142	0.398	0.0142	U	U	0.0155	0.435	0.0155	U	U	0.0143	0.399	0.0143	U	U	0.0155	0.434	0.0155	U	U
n-Nitrosodiphenylamine	mg/kg	0.00602	0.427	0.00602	U	U	0.00561	0.398	0.00561	U	U	0.00614	0.435	0.00614	U	U	0.00564	0.399	0.00564	U	U	0.00612	0.434	0.00612	U	U
Pentachlorophenol	mg/kg	0.0383	0.427	0.0383	U	U	0.0357	0.398	0.0357	U	U	0.0391	0.435	0.0391	U	U	0.0359	0.399	0.0359	U	U	0.0389	0.434	0.0389	U	U
Phenanthrene	mg/kg	0.0427	0.427	0.0104	J	J	0.00967	0.398	0.00967	U	U	0.0106	0.435	0.0106	U	U	0.00971	0.399	0.00971	U	U	0.0105	0.434	0.0105	U	U
Phenol	mg/kg	0.00512	0.427	0.00512	U	U	0.00478	0.398	0.00478	U	U	0.00523	0.435	0.00523	U	U	0.0048	0.399	0.0048	U	U	0.00521	0.434	0.00521	U	U
Pyrene	mg/kg	0.0726	0.427	0.017	J	J	0.0159	0.398	0.0159	U	U	0.0174	0.435	0.0174	U	U	0.0159	0.399	0.0159	U	U	0.0173	0.434	0.0173	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.0105	0.427	0.0105	U	U	0.00979	0.398	0.00979	U	U	0.0107	0.435	0.0107	U	U	0.00983	0.399	0.00983	U	U	0.0107	0.434	0.0107	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.0366	0.427	0.0366	U	U	0.0341	0.398	0.0341	U	U	0.0374	0.435	0.0374	U	U	0.0343	0.399	0.0343	U	U	0.0372	0.434	0.0372	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.0288	0.427	0.0288	U	U	0.0269	0.398	0.0269	U	U	0.0294	0.435	0.0294	U	U	0.027	0.399	0.027	U	U	0.0293	0.434	0.0293	U	U

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		SL-SB04					SL-SB06					SL-SB06					SL-SB07					SL-SB07				
SAMPLE_NO		SL0070					SL0073					SL0074					SL0075					SL0076				
SAMPLE_DATE		13-Jan-09					13-Jan-09					13-Jan-09					14-Jan-09					14-Jan-09				
FK_DEPTH		3_4 - 5_4 Ft					0 - 1 Ft					5 - 6 Ft					0 - 1 Ft					0 - 1 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.209	0.294	0.147	J	J	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.179	0.296	0.148	J	J	0.146	0.293	0.146	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.149	0.294	0.147	J	J	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Dinitrobenzene, 1,3-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Dinitrotoluene, 2,4-	mg/kg	0.201	0.294	0.147	J	J	0.15	0.3	0.15	U	U	0.404	0.299	0.149			0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Dinitrotoluene, 2,6-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
HMX	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Nitrobenzene	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Nitrotoluene, 2-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Nitrotoluene, 3-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Nitrotoluene, 4-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
RDX	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Tetryl	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.149	0.299	0.149	U	U	0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	1.31	0.299	0.149			0.148	0.296	0.148	U	U	0.146	0.293	0.146	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.147	0.294	0.147	U	U	0.15	0.3	0.15	U	U	0.21	0.299	0.149	J	J	0.868	0.296	0.148			0.196	0.293	0.146	J	J
METALS (UNFILTERED)																										
Aluminum	mg/kg	9430	3.86	1.93			9020	3.69	1.85			9100	3.59	1.8			7890	2.09	1.05		J	7110	1.94	0.972		J
Antimony	mg/kg	0.517	0.482	0.241		J	0.231	0.462	0.231	U	UJ	0.294	0.449	0.224	J	J	0.67	0.523	0.261		J	0.388	0.486	0.243	J	J
Arsenic	mg/kg	14.2	0.964	0.482		J	6.15	0.923	0.462		J	14.3	0.898	0.449		J	6.3	1.05	0.523			6.25	0.972	0.486		
Barium	mg/kg	57.7	0.193	0.0964			51.2	0.185	0.0923			38	0.18	0.0898			51.2	0.209	0.105			47.9	0.194	0.0972		
Beryllium	mg/kg	8.69	0.193	0.0964		J	5.88	0.185	0.0923		J	6.95	0.18	0.0898		J	5.94	0.209	0.105			5.43	0.194	0.0972		
Cadmium	mg/kg	0.285	0.482	0.241	J	J	0.231	0.462	0.231	U	U	0.224	0.449	0.224	U	U	0.297	0.523	0.261	J	J	0.273	0.486	0.243	J	J
Calcium	mg/kg	2790	9.64	4.82			4210	9.23	4.62			32100	8.98	4.49			4350	5.23	2.61			3630	4.86	2.43		
Chromium	mg/kg	15.3	0.482	0.241			13.5	0.462	0.231			13.4	0.449	0.244			11.9	0.523	0.261			10.7	0.486	0.243		
Cobalt	mg/kg	16.4	0.193	0.096			6.09	0.185	0.092			9.25	0.18	0.0898			5.52	0.418	0.209			5.16	0.389	0.194		
Copper	mg/kg	31	0.482	0.214			17.1	0.462	0.231			34.2	0.449	0.244			17.5	0.523	0.261		J	14.7	0.486	0.243		J
Iron	mg/kg	33900	3.86	1.93			17800	1.85	0.923			24200	1.8	0.898			16300	4.18	2.09		J	15000	3.89	1.94		J
Lead	mg/kg	15	0.482	0.241			10.3	0.462	0.231			13.8	0.449	0.224			20.7	0.523	0.261			20.6	0.486	0.243		
Magnesium	mg/kg	3600	1.93	0.964		J	2260	1.85	0.923		J	7810	1.8	0.898		J	2000	2.09	1.05		J	1780	1.94	0.972		J
Manganese	mg/kg	504	0.193	0.0964			190	0.185	0.0923			371	0.18	0.0898			180	0.209	0.105			225	0.194	0.0972		
Mercury	mg/kg	0.02	0.0227	0.0114	J	J	0.0348	0.0232	0.0116			0.0174	0.0221	0.011	J	J	0.0352	0.0264	0.0132			0.0276	0.0216	0.0108		
Nickel	mg/kg	19.2	0.289	0.145		J	7	0.277	0.139		J	14.1	0.269	0.135		J	17.3	0.314	0.157			15.5	0.291	0.146		
Potassium	mg/kg	986	24.1	12			485	23.1	11.5			1130	22.4	11.2			489	26.1	13.1			433	24.3	12.1		
Selenium	mg/kg	0.818	0.964	0.482	J	J	0.51	0.923	0.462	J	J	0.449	0.898	0.449	U	UJ	0.523	1.05	0.523	U	U	0.486	0.972	0.486	U	U
Silver	mg/kg	0.241	0.482	0.241	U	U	0.231	0.462	0.231	U	U	0.224	0.449	0.224	U	U	0.261	0.523	0.261	U	U	0.243	0.486	0.243	U	U
Sodium	mg/kg	71.5	19.3	9.64			53.9	18.5	9.23			99.1	18	8.98			46.7	10.5	5.23			32	9.72	4.86		
Thallium	mg/kg	0.484	0.482	0.241			0.231	0.462	0.231	U	U	0.295	0.449	0.224	J	J	0.261	0.523	0.261	U	U	0.243	0.486	0.243	U	U
Vanadium	mg/kg	21.7	0.193	0.0964			22.5	0.185	0.0923			17.6	0.18	0.0898			20.6	0.209	0.105			19	0.194	0.0972		
Zinc	mg/kg	80.3	2.41	1.2		J	43.7	2.31	1.15		J	64.1	2.24	1.12		J	58.3	2.61	1.31			54.1	2.43	1.21		
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg	0.0553	0.0398	0.00797	P	J	0.0828	0.041	0.00821	P	J	0.00768	0.0384	0.00768	U	U	0.00879	0.0439	0.00879	U	U	0.00823	0.0411	0.00823	U	U
Aroclor 1221	mg/kg	0.00797	0.0398	0.00797	U	U	0.00821	0.041	0.00821	U	U	0.00768	0.0384	0.00768	U	U	0.00879	0.0439	0.00879	U	U	0.00823	0.0411	0.00823	U	U
Aroclor 1232	mg/kg	0.00797	0.0398	0.00797	U	U	0.00821	0.041	0.00821	U	U	0.00768	0.0384	0.00768	U	U	0.00879	0.0439	0.00879	U	U	0.00823	0.0411	0.00823	U	U
Aroclor 1242	mg/kg	0.00797	0.0398	0.00797	U	U	0.00821	0.041	0.00821	U	U	0.00768	0.0384	0.00768	U	U	0.00879	0.0439	0.00879	U	U	0.00823	0.0411	0.00823	U	U
Aroclor 1248	mg/kg	0.00797	0.0398	0.00797	U	U	0.00821	0.041	0.00821	U	U	0.00768	0.0384	0.00768	U	U	0.00879	0.0439	0.00879	U	U	0.00823	0.0411	0.00823	U	U
Aroclor 1254	mg/kg	0.00797	0.0398	0.00797	U	U	0.00821	0.041	0.00821	U	U	0.00768	0.0384	0.00768	U	U	0.00879	0.0439	0.00879	U	U	0.00823	0.0411	0.00823	U	U
Aroclor 1260	mg/kg	0.00797	0.0398	0.00797	U	U	0.00821	0.041	0.00821	U	U	0.00768	0.0384	0.00768	U	U	0.0265	0.0439	0.00879	P,J	J	0.268	0.0411	0.00823		J
SEMIVOLATILES																										
Acenaphthene	mg/kg	0.00714	0.396	0.00714	U	U	0.00745	0.414	0.00745	U	U	0.00693	0.385	0.00693	U	U	0.00788	0.437	0.00788	U	U	0.0074	0.411	0.0074	U	U
Acenaphthylene	mg/kg	0.00476	0.396	0.00476	U	U	0.00497	0.414	0.00497	U	U	0.00462	0.385	0.00462	U	U	0.00525	0.437	0.00525	U	U	0.00494	0.411	0.00494	U	U
Anthracene	mg/kg	0.00857	0.396	0.00857	U	U	0.00895	0.414	0.00895	U	U	0.00832	0.385	0.00832	U	U	0.00945	0.437	0.00945	U	U	0.00888	0.411	0.00888	U	U
Benzo(a)anthracene	mg/kg	0.0261	0.396	0.0261	U	U	0.0272	0.414	0.0272	U	U	0.0253	0.385	0.0253	U	U	0.0288	0.437	0.0288	U	U	0.027	0.411	0.027	U	U
Benzo(a)pyrene	mg/kg	0.0261	0.396	0.0261	U	U	0.0272	0.414	0.0272	U	U	0.0253	0.385	0.0253	U	U	0.0288	0.437	0.0288	U	U	0.027	0.411	0.027	U	U
Benzo(b)fluoranthene	mg/kg	0.0661	0.396	0.0661	U	U	0.069	0.414	0.069	U	U	0.0641	0.385	0.0641	U	U	0.0729	0.437	0.0729	U	U	0.0685	0.411	0.0685	U	U
Benzo(ghi)perylene	mg/kg	0.0967	0.396	0.0967	U	U	0.101	0.414	0.101	U	U	0.0938	0.385	0.0938	U	U	0.107	0.437	0.107	U	U	0.1	0.411	0.1	U	U
Benzo(k)fluoranthene	mg/kg	0.12	0.396	0.12	U	U	0.125	0.414	0.125	U	U	0.117	0.385	0.117	U	U	0.133	0.437	0.133	U	U	0.125	0.411	0.125	U	U
Benzoic acid	mg/kg	0.0967	0.396	0.0967	U	U	0.101	0.414	0.101	U	U	0.0938	0.385	0.0938	U	U	0.107	0.437	0.107	U	U	0.1	0.411	0.1	U	U
Benzyl alcohol	mg/kg	0.0967	0.396	0.0967	U	U	0.101	0.414	0.101	U	U	0.0938	0.385	0.0938	U	U	0.107	0.437	0.107	U	U	0.1	0.411	0.1	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.00833	0.396	0.00833	U	U	0.0087	0.414	0.0087	U	U	0.00809	0.385	0.00809	U	U	0.00919	0.437	0.00919	U	U	0.00864	0.411	0.00864	U	U
Bis(2-chloroethyl)ether	mg/kg	0.0101	0.396	0.0101	U	U	0.0106	0.414	0.0106	U	U	0.00982	0.385	0.00982	U	U	0.0112	0.437	0.0112	U	U	0.0105	0.411	0.0105	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.0173	0.396	0.0173	U	U	0.018	0.414	0.018	U	U	0.0168	0.385	0.0168	U	U	0.019	0.437	0.019	U	U	0.0179	0.411	0.0179	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.0367	0.396	0.0367	U	U	0.0383	0.414	0.0383	U	U	0.0356	0.385	0.0356	U	U	0.0404	0.437	0.0404	U	U	0.038	0.411	0.038	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.0142	0.396	0.0142	U	U	0.0148	0.414	0.0148	U	U	0.0138	0.385	0.0138	U	U	0.0156	0.437	0.0156	U	U	0.0147	0.411	0.0147	U	U
Butyl benzyl phthalate	mg/kg	0.0161	0.396	0.0161	U	U	0.0168	0.414	0.0168	U	U	0.0156	0.385	0.0156	U	U	0.0177	0.437	0.0177	U	U	0.0167	0.411	0.0167	U	U
Carbazole	mg/kg	0.0396	0.396	0.0396	U	U	0.0414	0.414	0.0414	U	U	0.0385	0.385	0.0385	U	U	0.0437	0.437	0.0437	U	U	0.0411	0.411	0.0411	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.00976	0.396	0.00976	U	U	0.0102	0.414	0.0102	U	U	0.00948	0.385	0.00948	U	U	0.0108	0.437	0.0108	U	U	0.0101	0.411	0.0101	U	U
Chloroaniline, 4-	mg/kg	0.0344	0.396	0.0344	Q1,U	UJ	0.0359	0.414	0.0359	Q1,U	UJ	0.0334	0.385	0.0334	Q1,U	UJ	0.0379	0.437	0.0379	U	U	0.0357	0.411	0.0357	U	U
Chloronaphthalene, 2-	mg/kg	0.00631	0.396	0.00631	U	U	0.00658	0.414	0.00658	U	U	0.00612	0.385	0.00612	U	U	0.00696	0.437	0.00696	U	U	0.00654	0.411	0.00654	U	U
Chlorophenol, 2-	mg/kg	0.00488	0.396	0.00488	U	U	0.00509	0.414	0.00509	U	U	0.00474	0.385	0.00474	U	U	0.00538	0.437	0.00538	U	U	0.00506	0.411	0.00506	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.0304	0.396	0.0304	U	U	0.0317	0.414	0.0317	U	U	0.0295	0.385	0.0295	U	U	0.0335	0.437	0.0335	U	U	0.0315	0.411	0.0315	U	U
Chrysene	mg/kg	0.0157	0.396	0.0157	U	U	0.0164	0.414	0.0164	U	U	0.0153	0.385	0.0153	U	U	0.0173	0.437	0.0173	U	U	0.0163	0.411	0.0163	U	U

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		SL-SB04					SL-SB06					SL-SB06					SL-SB07					SL-SB07				
SAMPLE_NO		SL0070					SL0073					SL0074					SL0075					SL0076				
SAMPLE_DATE		13-Jan-09					13-Jan-09					13-Jan-09					14-Jan-09					14-Jan-09				
FK_DEPTH		3_4 - 5_4 Ft					0 - 1 Ft					5 - 6 Ft					0 - 1 Ft					0 - 1 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg	0.0896	0.396	0.0896	U	U	0.0936	0.414	0.0936	U	U	0.087	0.385	0.087	U	U	0.0989	0.437	0.0989	U	U	0.0929	0.411	0.0929	U	U
Dibenzofuran	mg/kg	0.00667	0.396	0.00667	U	U	0.00696	0.414	0.00696	U	U	0.00647	0.385	0.00647	U	U	0.00735	0.437	0.00735	U	U	0.00691	0.411	0.00691	U	U
Dichlorobenzene, 1,2-	mg/kg	0.00917	0.396	0.00917	U	U	0.00957	0.414	0.00957	U	U	0.0089	0.385	0.0089	U	U	0.0101	0.437	0.0101	U	U	0.0095	0.411	0.0095	U	U
Dichlorobenzene, 1,3-	mg/kg	0.0144	0.396	0.0144	U	U	0.015	0.414	0.015	U	U	0.014	0.385	0.014	U	U	0.0159	0.437	0.0159	U	U	0.0149	0.411	0.0149	U	U
Dichlorobenzene, 1,4-	mg/kg	0.00774	0.396	0.00774	U	U	0.00808	0.414	0.00808	U	U	0.00751	0.385	0.00751	U	U	0.00854	0.437	0.00854	U	U	0.00802	0.411	0.00802	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.0393	0.396	0.0393	Q1,U	UJ	0.041	0.414	0.041	Q1,U	UJ	0.0381	0.385	0.0381	Q1,U	UJ	0.0433	0.437	0.0433	U	U	0.0407	0.411	0.0407	U	U
Dichlorophenol, 2,4-	mg/kg	0.0142	0.396	0.0142	U	U	0.0148	0.414	0.0148	U	U	0.0138	0.385	0.0138	U	U	0.0156	0.437	0.0156	U	U	0.0147	0.411	0.0147	U	U
Diethyl phthalate	mg/kg	0.0161	0.396	0.0161	U	U	0.0168	0.414	0.0168	U	U	0.0156	0.385	0.0156	U	U	0.0177	0.437	0.0177	U	U	0.0167	0.411	0.0167	U	U
Dimethyl phthalate	mg/kg	0.0121	0.396	0.0121	U	U	0.0127	0.414	0.0127	U	U	0.0118	0.385	0.0118	U	U	0.0134	0.437	0.0134	U	U	0.0126	0.411	0.0126	U	U
Dimethylphenol, 2,4-	mg/kg	0.0105	0.396	0.0105	U	U	0.0109	0.414	0.0109	U	U	0.0102	0.385	0.0102	U	U	0.0116	0.437	0.0116	U	U	0.0109	0.411	0.0109	U	U
Di-n-butyl phthalate	mg/kg	0.00857	0.396	0.00857	U	U	0.00895	0.414	0.00895	U	U	0.00832	0.385	0.00832	U	U	0.00945	0.437	0.00945	U	U	0.00888	0.411	0.00888	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.0399	0.396	0.0399	U	U	0.0416	0.414	0.0416	U	U	0.0387	0.385	0.0387	U	U	0.044	0.437	0.044	U	U	0.0413	0.411	0.0413	U	U
Dinitrophenol, 2,4-	mg/kg	0.0632	0.396	0.0632	U	U	0.066	0.414	0.066	U	U	0.0614	0.385	0.0614	U	U	0.0697	0.875	0.0697	U	U	0.0655	0.822	0.0655	U	U
Dinitrotoluene, 2,4-	mg/kg	0.104	0.396	0.0139	J	J	0.0563	0.414	0.0145	J	J	0.434	0.385	0.0135			0.0154	0.437	0.0154	U	U	0.0144	0.411	0.0144	U	U
Dinitrotoluene, 2,6-	mg/kg	0.00952	0.396	0.00952	U	U	0.00994	0.414	0.00994	U	U	0.128	0.385	0.00924	J	J	0.0105	0.437	0.0105	U	U	0.00987	0.411	0.00987	U	U
Di-n-octyl phthalate	mg/kg	0.0746	0.396	0.0746	U	U	0.0779	0.414	0.0779	U	U	0.0725	0.385	0.0725	U	U	0.0823	0.437	0.0823	U	U	0.0774	0.411	0.0774	U	U
DIPHENYLAMINE	mg/kg	0.0393	0.396	0.0393	U	U	0.041	0.414	0.041	U	U	0.0381	0.385	0.0381	U	U	0.0433	0.437	0.0433	U	U	0.0407	0.411	0.0407	U	U
Fluoranthene	mg/kg	0.00857	0.396	0.00857	U	U	0.00895	0.414	0.00895	U	U	0.00832	0.385	0.00832	U	U	0.0433	0.437	0.00945	J	J	0.00888	0.411	0.00888	U	U
Fluorene	mg/kg	0.0168	0.396	0.0168	U	U	0.0175	0.414	0.0175	U	U	0.0163	0.385	0.0163	U	U	0.0185	0.437	0.0185	U	U	0.0174	0.411	0.0174	U	U
Hexachlorobenzene	mg/kg	0.0246	0.396	0.0246	U	U	0.0257	0.414	0.0257	U	U	0.0239	0.385	0.0239	U	U	0.0272	0.437	0.0272	U	U	0.0255	0.411	0.0255	U	U
Hexachlorobutadiene	mg/kg	0.0376	0.396	0.0376	U	U	0.0393	0.414	0.0393	U	U	0.0365	0.385	0.0365	U	U	0.0415	0.437	0.0415	U	U	0.039	0.411	0.039	U	U
Hexachlorocyclopentadiene	mg/kg	0.0126	0.396	0.0126	Q2,U	UJ	0.0132	0.414	0.0132	Q2,U	UJ	0.0122	0.385	0.0122	Q2,U	UJ	0.0139	0.437	0.0139	U	U	0.0131	0.411	0.0131	U	U
Hexachloroethane	mg/kg	0.0121	0.396	0.0121	U	U	0.0127	0.414	0.0127	U	U	0.0118	0.385	0.0118	U	U	0.0134	0.437	0.0134	U	U	0.0126	0.411	0.0126	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.129	0.396	0.129	U	U	0.134	0.414	0.134	U	U	0.125	0.385	0.125	U	U	0.142	0.437	0.142	U	U	0.133	0.411	0.133	U	U
Isophorone	mg/kg	0.00476	0.396	0.00476	U	U	0.00497	0.414	0.00497	U	U	0.00462	0.385	0.00462	U	U	0.00525	0.437	0.00525	U	U	0.00494	0.411	0.00494	U	U
Methylnaphthalene, 2-	mg/kg	0.104	0.396	0.104	U	U	0.109	0.414	0.109	U	U	0.101	0.385	0.101	U	U	0.115	0.437	0.115	U	U	0.108	0.411	0.108	U	U
Methylphenol, 2-	mg/kg	0.00595	0.396	0.00595	U	U	0.00621	0.414	0.00621	U	U	0.00578	0.385	0.00578	U	U	0.00657	0.437	0.00657	U	U	0.00617	0.411	0.00617	U	U
Methylphenol, 4-	mg/kg	0.0124	0.396	0.0124	U	U	0.0129	0.414	0.0129	U	U	0.012	0.385	0.012	U	U	0.0137	0.437	0.0137	U	U	0.0128	0.411	0.0128	U	U
Naphthalene	mg/kg	0.00941	0.396	0.00941	U	U	0.00982	0.414	0.00982	U	U	0.00913	0.385	0.00913	U	U	0.0104	0.437	0.0104	U	U	0.00975	0.411	0.00975	U	U
Nitroaniline, 2-	mg/kg	0.0171	0.396	0.0171	U	U	0.0179	0.414	0.0179	U	U	0.0166	0.385	0.0166	U	U	0.0189	0.437	0.0189	U	U	0.0178	0.411	0.0178	U	U
Nitroaniline, 3-	mg/kg	0.0135	0.396	0.0135	U	U	0.014	0.414	0.014	U	U	0.0131	0.385	0.0131	U	U	0.0148	0.437	0.0148	U	U	0.0139	0.411	0.0139	U	U
Nitroaniline, 4-	mg/kg	0.14	0.396	0.14	U	U	0.147	0.414	0.147	U	U	0.136	0.385	0.136	U	U	0.155	0.437	0.155	U	U	0.146	0.411	0.146	U	U
Nitrobenzene	mg/kg	0.013	0.396	0.013	U	U	0.0135	0.414	0.0135	U	U	0.0126	0.385	0.0126	U	U	0.0143	0.437	0.0143	U	U	0.0135	0.411	0.0135	U	U
Nitrophenol, 2-	mg/kg	0.014	0.396	0.014	U	U	0.0147	0.414	0.0147	U	U	0.0136	0.385	0.0136	U	U	0.0155	0.437	0.0155	U	U	0.0146	0.411	0.0146	U	U
Nitrophenol, 4-	mg/kg	0.0321	0.396	0.0321	U	U	0.0335	0.414	0.0335	U	U	0.0312	0.385	0.0312	U	U	0.0355	0.437	0.0355	U	U	0.0333	0.411	0.0333	U	U
n-Nitrosodimethylamine	mg/kg	0.0119	0.396	0.0119	U	U	0.0124	0.414	0.0124	U	U	0.0116	0.385	0.0116	U	U	0.0131	0.437	0.0131	U	U	0.0123	0.411	0.0123	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.0142	0.396	0.0142	U	U	0.0148	0.414	0.0148	U	U	0.0138	0.385	0.0138	U	U	0.0156	0.437	0.0156	U	U	0.0147	0.411	0.0147	U	U
n-Nitrosodiphenylamine	mg/kg	0.0056	0.396	0.0056	U	U	0.00584	0.414	0.00584	U	U	0.00543	0.385	0.00543	U	U	0.00617	0.437	0.00617	U	U	0.0058	0.411	0.0058	U	U
Pentachlorophenol	mg/kg	0.0356	0.396	0.0356	U	U	0.0371	0.414	0.0371	U	U	0.0346	0.385	0.0346	U	U	0.0393	0.875	0.0393	U	U	0.0369	0.822	0.0369	U	U
Phenanthrene	mg/kg	0.00964	0.396	0.00964	U	U	0.0101	0.414	0.0101	U	U	0.00936	0.385	0.00936	U	U	0.0106	0.437	0.0106	U	U	0.01	0.411	0.01	U	U
Phenol	mg/kg	0.00476	0.396	0.00476	U	U	0.00497	0.414	0.00497	U	U	0.00462	0.385	0.00462	U	U	0.00525	0.437	0.00525	U	U	0.00494	0.411	0.00494	U	U
Pyrene	mg/kg	0.0158	0.396	0.0158	U	U	0.0165	0.414	0.0165	U	U	0.0154	0.385	0.0154	U	U	0.0175	0.437	0.0175	U	U	0.0164	0.411	0.0164	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.00976	0.396	0.00976	U	U	0.0102	0.414	0.0102	U	U	0.00948	0.385	0.00948	U	U	0.0108	0.437	0.0108	U	U	0.0101	0.411	0.0101	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.034	0.396	0.034	U	U	0.0355	0.414	0.0355	U	U	0.033	0.385	0.033	U	U	0.0376	0.437	0.0376	U	U	0.0353	0.411	0.0353	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.0268	0.396	0.0268	U	U	0.028	0.414	0.028	U	U	0.026	0.385	0.026	U	U	0.0295	0.437	0.0295	U	U	0.0278	0.411	0.0278	U	U

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		SL-SB07					SL-SB08					SL-SB09					SL-SB10					TNTA-SL-SB02				
SAMPLE_NO		SL0078					SL0079					SL0081					SL0083					SL0063				
SAMPLE_DATE		14-Jan-09					14-Jan-09					12-Jan-09					12-Jan-09					12-Jan-09				
FK_DEPTH		5 - 6 Ft					0 - 1 Ft					5 - 6 Ft					5 - 6 Ft					0 - 1 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Dinitrobenzene, 1,3-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Dinitrotoluene, 2,4-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Dinitrotoluene, 2,6-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	Q1,U	U	0.149	0.297	0.149	Q1,U	U	0.149	0.299	0.149	Q1,U	U
HMX	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Nitrobenzene	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Nitrotoluene, 2-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Nitrotoluene, 3-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Nitrotoluene, 4-	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
RDX	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Tetryl	mg/kg	0.144	0.287	0.144	U	U	0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Trinitrobenzene, 1,3,5-	mg/kg	1.75	0.287	0.144			0.149	0.297	0.149	U	U	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.144	0.287	0.144	U	U	0.271	0.297	0.149	J	J	0.147	0.294	0.147	U	U	0.149	0.297	0.149	U	U	0.149	0.299	0.149	U	U
METALS (UNFILTERED)																										
Aluminum	mg/kg	8920	1.75	0.877		J	8280	2.03	1.01		J	8870	3.73	1.86			10300	3.98	1.99			12400	4.38	2.19		
Antimony	mg/kg	0.572	0.438	0.219			0.33	0.507	0.253	J	J	0.487	0.466	0.233		J	0.468	0.498	0.249	J	J	0.274	0.548	0.274	U	UJ
Arsenic	mg/kg	14.9	0.877	0.438			7.71	1.01	0.507			20.3	0.932	0.466		J	16.8	0.996	0.498		J	5.93	1.1	0.548		J
Barium	mg/kg	116	0.175	0.0877			46	0.203	0.101			37.8	0.186	0.0932			58	0.199	0.0996			84	0.219	0.11		
Beryllium	mg/kg	8	0.175	0.0877			6.36	0.203	0.101			8.72	0.186	0.0932		J	9.71	0.199	0.0996		J	6.82	0.219	0.11		J
Cadmium	mg/kg	0.323	0.438	0.219	J	J	0.387	0.507	0.253	J	J	0.233	0.466	0.233	U	U	0.249	0.498	0.249	U	U	0.274	0.548	0.274	U	U
Calcium	mg/kg	25700	4.38	2.19			4510	5.07	2.53			31500	9.32	4.66			18800	9.96	4.98			6360	11	5.48		
Chromium	mg/kg	14	0.438	0.219			12.6	0.507	0.253			13.1	0.466	0.233			15.5	0.498	0.249			16.5	0.548	0.274		
Cobalt	mg/kg	17.3	0.351	0.175			6.24	0.405	0.203			11.2	0.186	0.0932			11.8	0.199	0.0996			5.97	0.219	0.11		
Copper	mg/kg	33.6	0.438	0.219		J	19.7	0.507	0.253		J	35.5	0.466	0.233			35.8	0.498	0.249			25.6	0.548	0.274		
Iron	mg/kg	30300	7.01	3.51		J	18300	4.05	2.03		J	33200	3.73	1.86			37200	3.98	1.99			19500	2.19	1.1		
Lead	mg/kg	16.4	0.438	0.219			28.3	0.507	0.253			14.4	0.466	0.233			14.4	0.498	0.249			20.2	0.548	0.274		
Magnesium	mg/kg	6600	1.75	0.877		J	2110	2.03	1.01		J	9980	1.86	0.932		J	5360	1.99	0.996		J	2840	2.19	1.1		J
Manganese	mg/kg	833	0.175	0.0877			286	0.203	0.101			285	0.186	0.0932			293	0.199	0.0996			137	0.219	0.11		
Mercury	mg/kg	0.0115	0.0229	0.0115	U	U	0.0437	0.0254	0.0127			0.0154	0.0216	0.0108	J	J	0.019	0.0235	0.0117	J	J	0.0483	0.0259	0.0129		
Nickel	mg/kg	39.7	0.263	0.131			19.6	0.304	0.152			16	0.28	0.14		J	14.5	0.299	0.149		J	9.06	0.329	0.164		J
Potassium	mg/kg	1070	21.9	11			682	25.3	12.7			1080	23.3	11.7			1060	24.9	12.4			718	27.4	13.7		
Selenium	mg/kg	0.453	0.877	0.428	J	J	0.517	1.01	0.507	J	J	0.536	0.932	0.466	J	J	0.498	0.996	0.498	U	UJ	0.608	1.1	0.548	J	J
Silver	mg/kg	0.219	0.438	0.219	U	U	0.253	0.507	0.253	U	U	0.233	0.466	0.233	U	U	0.249	0.498	0.249	U	U	0.274	0.548	0.274	U	U
Sodium	mg/kg	83.8	8.77	4.38			31.1	10.1	5.07			94.7	18.6	9.32			68.3	19.9	9.96			68.7	21.9	11		
Thallium	mg/kg	0.697	0.438	0.219			0.253	0.507	0.253	U	U	0.378	0.466	0.233	J	J	0.292	0.498	0.249	J	J	0.274	0.548	0.274	U	U
Vanadium	mg/kg	18.4	0.175	0.0877			21.4	0.203	0.101			18.7	0.186	0.0932			20.7	0.199	0.0996			26.3	0.219	0.11		
Zinc	mg/kg	99.4	2.19	1.1			72.3	2.53	1.27			67.3	2.33	1.17		J	75.7	2.49	1.24		J	50.9	2.74	1.37		J
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg	0.00783	0.0391	0.00783	U	U	0.0828	0.0461	0.00924	P	J	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.125	0.046	0.00922	P	J
Aroclor 1221	mg/kg	0.00783	0.0391	0.00783	U	U	0.00924	0.0461	0.00924	U	U	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.00922	0.046	0.00922	U	U
Aroclor 1232	mg/kg	0.00783	0.0391	0.00783	U	U	0.00924	0.0461	0.00924	U	U	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.00922	0.046	0.00922	U	U
Aroclor 1242	mg/kg	0.00783	0.0391	0.00783	U	U	0.00924	0.0461	0.00924	U	U	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.00922	0.046	0.00922	U	U
Aroclor 1248	mg/kg	0.00783	0.0391	0.00783	U	U	0.00924	0.0461	0.00924	U	U	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.00922	0.046	0.00922	U	U
Aroclor 1254	mg/kg	0.00783	0.0391	0.00783	U	U	0.00924	0.0461	0.00924	U	U	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.00922	0.046	0.00922	U	U
Aroclor 1260	mg/kg	0.00783	0.0391	0.00783	U	U	0.00924	0.0461	0.00924	U	U	0.00788	0.0393	0.00788	U	U	0.00806	0.0402	0.00806	U	U	0.00922	0.046	0.00922	U	U
SEMIVOLATILES																										
Acenaphthene	mg/kg	0.00705	0.391	0.00705	U	U	0.00836	0.464	0.00836	U	U	0.00709	0.393	0.00709	U	U	0.00723	0.401	0.00723	U	U	0.00832	0.462	0.00832	U	U
Acenaphthylene	mg/kg	0.0047	0.391	0.0047	U	U	0.00558	0.464	0.00558	U	U	0.00473	0.393	0.00473	U	U	0.00482	0.401	0.00482	U	U	0.111	0.462	0.00555	J	J
Anthracene	mg/kg	0.00846	0.391	0.00846	U	U	0.01	0.464	0.01	U	U	0.00851	0.393	0.00851	U	U	0.00867	0.401	0.00867	U	U	0.299	0.462	0.00999	J	J
Benzo(a)anthracene	mg/kg	0.0257	0.391	0.0257	U	U	0.0581	0.464	0.0305	J	J	0.0259	0.393	0.0259	U	U	0.0264	0.401	0.0264	U	U	1.54	0.462	0.0304		
Benzo(a)pyrene	mg/kg	0.0257	0.391	0.0257	U	U	0.053	0.464	0.0305	J	J	0.0259	0.393	0.0259	U	U	0.0264	0.401	0.0264	U	U	1.18	0.462	0.0304		
Benzo(b)fluoranthene	mg/kg	0.0652	0.391	0.0652	U	U	0.0962	0.464	0.0774	J	J	0.0656	0.393	0.0656	U	U	0.0669	0.401	0.0669	U	U	2	0.462	0.077		
Benzo(ghi)perylene	mg/kg	0.0954	0.391	0.0954	U	U	0.113	0.464	0.113	U	U	0.0959	0.393	0.0959	U	U	0.0978	0.401	0.0978	U	U	0.69	0.462	0.113		
Benzo(k)fluoranthene	mg/kg	0.119	0.391	0.119	U	U	0.141	0.464	0.141	U	U	0.119	0.393	0.119	U	U	0.122	0.401	0.122	U	U	0.54	0.462	0.14		
Benzoic acid	mg/kg	0.0954	0.391	0.0954	U	U	0.113	0.464	0.113	U	U	0.0959	0.393	0.0959	U	U	0.0978	0.401	0.0978	U	U	0.537	0.462	0.113		
Benzyl alcohol	mg/kg	0.0954	0.391	0.0954	U	U	0.113	0.464	0.113	U	U	0.0959	0.393	0.0959	U	U	0.0978	0.401	0.0978	U	U	0.113	0.462	0.113	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.00822	0.391	0.00822	U	U	0.00976	0.464	0.00976	U	U	0.00827	0.393	0.00827	U	U	0.00843	0.401	0.00843	U	U	0.00971	0.462	0.00971	U	U
Bis(2-chloroethyl)ether	mg/kg	0.00998	0.391	0.00998	U	U	0.0118	0.464	0.0118	U	U	0.01	0.393	0.01	U	U	0.0102	0.401	0.0102	U	U	0.0118	0.462	0.0118	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.017	0.391	0.017	U	U	0.0202	0.464	0.0202	U	U	0.0171	0.393	0.0171	U	U	0.0175	0.401	0.0175	U	U	0.0201	0.462	0.0201	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.0362	0.391	0.0362	U	U	0.0429	0.464	0.0429	U	U	0.0364	0.393	0.0364	U	U	0.0371	0.401	0.0371	U	U	0.0869	0.462	0.0427	J	J
Bromophenyl phenyl ether, 4-	mg/kg	0.014	0.391	0.014	U	U	0.0166	0.464	0.0166	U	U	0.0141	0.393	0.0141	U	U	0.0143	0.401	0.0143	U	U	0.0165	0.462	0.0165	U	U
Butyl benzyl phthalate	mg/kg	0.0159	0.391	0.0159	U	U	0.0188	0.464	0.0188	U	U	0.0159	0.393	0.0159	U	U	0.0163	0.401	0.0163	U	U	0.0187	0.462	0.0187	U	U
Carbazole	mg/kg	0.0391	0.391	0.0391	U	U	0.0464	0.464	0.0464	U	U	0.0393	0.393	0.0393	U	U	0.0401	0.401	0.0401	U	U	0.0462	0.462	0.0462	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.00963	0.391	0.00963	U	U	0.0114	0.464	0.0114	U	U	0.00969	0.393	0.00969	U	U	0.00988	0.401	0.00988	U	U	0.0114	0.462	0.0114	U	U
Chloroaniline, 4-	mg/kg	0.0339	0.391	0.0339	U	U	0.0403	0.464	0.0403	U	U	0.0341	0.393	0.0341	Q1,U	UJ	0.0348	0.401	0.0348	Q1,U	UJ	0.0401	0.462	0.0401	Q1,U	UJ
Chloronaphthalene, 2-	mg/kg	0.00623	0.391	0.00623	U	U	0.00739	0.464	0.00739	U	U	0.00626	0.393	0.00626	U	U	0.00638	0.401	0.00638	U	U	0.00735	0.462	0.00735	U	U
Chlorophenol, 2-	mg/kg	0.00482	0.391	0.00482	U	U	0.00571	0.464	0.00571	U	U	0.00484	0.393	0.00484	U	U	0.00494	0.401	0.00494	U	U	0.00569	0.462	0.00569	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.03	0.391	0.03	U	U	0.0355	0.464	0.0355	U	U	0.0301	0.393	0.0301	U	U	0.0307	0.401	0.0307	U	U	0.0354	0.462	0.0354	U	U
Chrysene	mg/kg	0.0155	0.391	0.0155	U	U	0.0794	0.464	0.0184	J	J	0.0156	0.393	0.0156	U	U	0.0159	0.401	0.0159	U	U	1.36	0.462	0.0183		

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		SL-SB07					SL-SB08					SL-SB09					SL-SB10					TNTA-SL-SB02				
SAMPLE_NO		SL0078					SL0079					SL0081					SL0083					SL0063				
SAMPLE_DATE		14-Jan-09					14-Jan-09					12-Jan-09					12-Jan-09					12-Jan-09				
FK_DEPTH		5 - 6 Ft					0 - 1 Ft					5 - 6 Ft					5 - 6 Ft					0 - 1 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg	0.0884	0.391	0.0884	U	U	0.105	0.464	0.105	U	U	0.089	0.393	0.089	U	U	0.0907	0.401	0.0907	U	U	0.196	0.462	0.104	J	J
Dibenzofuran	mg/kg	0.00658	0.391	0.00658	U	U	0.00781	0.464	0.00781	U	U	0.00662	0.393	0.00662	U	U	0.00675	0.401	0.00675	U	U	0.00777	0.462	0.00777	U	U
Dichlorobenzene, 1,2-	mg/kg	0.00904	0.391	0.00904	U	U	0.0107	0.464	0.0107	U	U	0.0091	0.393	0.0091	U	U	0.00928	0.401	0.00928	U	U	0.0107	0.462	0.0107	U	U
Dichlorobenzene, 1,3-	mg/kg	0.0142	0.391	0.0142	U	U	0.0169	0.464	0.0169	U	U	0.0143	0.393	0.0143	U	U	0.0146	0.401	0.0146	U	U	0.0168	0.462	0.0168	U	U
Dichlorobenzene, 1,4-	mg/kg	0.00763	0.391	0.00763	U	U	0.00906	0.464	0.00906	U	U	0.00768	0.393	0.00768	U	U	0.00783	0.401	0.00783	U	U	0.00902	0.462	0.00902	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.0388	0.391	0.0388	U	U	0.046	0.464	0.046	U	U	0.039	0.393	0.039	Q1,U	UJ	0.0398	0.401	0.0398	Q1,U	UJ	0.0458	0.462	0.0458	Q1,U	UJ
Dichlorophenol, 2,4-	mg/kg	0.014	0.391	0.014	U	U	0.0166	0.464	0.0166	U	U	0.0141	0.393	0.0141	U	U	0.0143	0.401	0.0143	U	U	0.0165	0.462	0.0165	U	U
Diethyl phthalate	mg/kg	0.0159	0.391	0.0159	U	U	0.0188	0.464	0.0188	U	U	0.0159	0.393	0.0159	U	U	0.0163	0.401	0.0163	U	U	0.0187	0.462	0.0187	U	U
Dimethyl phthalate	mg/kg	0.012	0.391	0.012	U	U	0.0142	0.464	0.0142	U	U	0.012	0.393	0.012	U	U	0.0123	0.401	0.0123	U	U	0.0141	0.462	0.0141	U	U
Dimethylphenol, 2,4-	mg/kg	0.0103	0.391	0.0103	U	U	0.0123	0.464	0.0123	U	U	0.0104	0.393	0.0104	U	U	0.0106	0.401	0.0106	U	U	0.0122	0.462	0.0122	U	U
Di-n-butyl phthalate	mg/kg	0.00846	0.391	0.00846	U	U	0.01	0.464	0.01	U	U	0.00851	0.393	0.00851	U	U	0.00867	0.401	0.00867	U	U	0.00999	0.462	0.00999	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.0393	0.391	0.0393	U	U	0.0467	0.464	0.0467	U	U	0.0396	0.393	0.0396	U	U	0.0404	0.401	0.0404	U	U	0.0465	0.462	0.0465	U	U
Dinitrophenol, 2,4-	mg/kg	0.0624	0.782	0.0624	U	U	0.074	0.928	0.074	U	U	0.0627	0.393	0.0627	U	U	0.064	0.401	0.064	U	U	0.0736	0.462	0.0736	U	U
Dinitrotoluene, 2,4-	mg/kg	0.0818	0.391	0.0137	J	J	0.0163	0.464	0.0163	U	U	0.0138	0.393	0.0138	U	U	0.0141	0.401	0.0141	U	U	0.0615	0.462	0.0162	J	J
Dinitrotoluene, 2,6-	mg/kg	0.0411	0.391	0.0094	J	J	0.0112	0.464	0.0112	U	U	0.00945	0.393	0.00945	U	U	0.00964	0.401	0.00964	U	U	0.0111	0.462	0.0111	U	U
Di-n-octyl phthalate	mg/kg	0.0736	0.391	0.0736	U	U	0.0874	0.464	0.0874	U	U	0.0741	0.393	0.0741	U	U	0.0755	0.401	0.0755	U	U	0.087	0.462	0.087	U	U
DIPHENYLAMINE	mg/kg	0.0388	0.391	0.0388	U	U	0.046	0.464	0.046	U	U	0.039	0.393	0.039	U	U	0.0398	0.401	0.0398	U	U	0.0458	0.462	0.0458	U	U
Fluoranthene	mg/kg	0.00846	0.391	0.00846	U	U	0.163	0.464	0.01	J	J	0.00851	0.393	0.00851	U	U	0.00867	0.401	0.00867	U	U	3.05	0.462	0.00999		
Fluorene	mg/kg	0.0166	0.391	0.0166	U	U	0.0197	0.464	0.0197	U	U	0.0167	0.393	0.0167	U	U	0.017	0.401	0.017	U	U	0.0196	0.462	0.0196	U	U
Hexachlorobenzene	mg/kg	0.0243	0.391	0.0243	U	U	0.0289	0.464	0.0289	U	U	0.0245	0.393	0.0245	U	U	0.0249	0.401	0.0249	U	U	0.0287	0.462	0.0287	U	U
Hexachlorobutadiene	mg/kg	0.0371	0.391	0.0371	U	U	0.044	0.464	0.044	U	U	0.0373	0.393	0.0373	U	U	0.0381	0.401	0.0381	U	U	0.0438	0.462	0.0438	U	U
Hexachlorocyclopentadiene	mg/kg	0.0125	0.391	0.0125	U	U	0.0148	0.464	0.0148	U	U	0.0125	0.393	0.0125	Q2,U	UJ	0.0128	0.401	0.0128	Q2,U	UJ	0.0147	0.462	0.0147	Q2,U	UJ
Hexachloroethane	mg/kg	0.012	0.391	0.012	U	U	0.0142	0.464	0.0142	U	U	0.012	0.393	0.012	U	U	0.0123	0.401	0.0123	U	U	0.0141	0.462	0.0141	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.127	0.391	0.127	U	U	0.151	0.464	0.151	U	U	0.128	0.393	0.128	U	U	0.13	0.401	0.13	U	U	1.06	0.462	0.15		
Isophorone	mg/kg	0.0047	0.391	0.0047	U	U	0.00558	0.464	0.00558	U	U	0.00473	0.393	0.00473	U	U	0.00482	0.401	0.00482	U	U	0.00555	0.462	0.00555	U	U
Methylnaphthalene, 2-	mg/kg	0.103	0.391	0.103	U	U	0.122	0.464	0.122	U	U	0.103	0.393	0.103	U	U	0.105	0.401	0.105	U	U	0.121	0.462	0.121	U	U
Methylphenol, 2-	mg/kg	0.00587	0.391	0.00587	U	U	0.00697	0.464	0.00697	U	U	0.00591	0.393	0.00591	U	U	0.00602	0.401	0.00602	U	U	0.00693	0.462	0.00693	U	U
Methylphenol, 4-	mg/kg	0.0122	0.391	0.0122	U	U	0.0145	0.464	0.0145	U	U	0.0123	0.393	0.0123	U	U	0.0125	0.401	0.0125	U	U	0.0144	0.462	0.0144	U	U
Naphthalene	mg/kg	0.00928	0.391	0.00928	U	U	0.011	0.464	0.011	U	U	0.00933	0.393	0.00933	U	U	0.00952	0.401	0.00952	U	U	0.011	0.462	0.011	U	U
Nitroaniline, 2-	mg/kg	0.0169	0.391	0.0169	U	U	0.0201	0.464	0.0201	U	U	0.017	0.393	0.017	U	U	0.0173	0.401	0.0173	U	U	0.02	0.462	0.02	U	U
Nitroaniline, 3-	mg/kg	0.0133	0.391	0.0133	U	U	0.0157	0.464	0.0157	U	U	0.0133	0.393	0.0133	Q1,U	UJ	0.0136	0.401	0.0136	U	U	0.0157	0.462	0.0157	Q1,U	UJ
Nitroaniline, 4-	mg/kg	0.139	0.391	0.139	U	U	0.164	0.464	0.164	U	U	0.139	0.393	0.139	U	U	0.142	0.401	0.142	U	U	0.164	0.462	0.164	U	U
Nitrobenzene	mg/kg	0.0128	0.391	0.0128	U	U	0.0152	0.464	0.0152	U	U	0.0129	0.393	0.0129	U	U	0.0131	0.401	0.0131	U	U	0.0151	0.462	0.0151	U	U
Nitrophenol, 2-	mg/kg	0.0139	0.391	0.0139	U	U	0.0164	0.464	0.0164	U	U	0.0139	0.393	0.0139	U	U	0.0142	0.401	0.0142	U	U	0.0164	0.462	0.0164	U	U
Nitrophenol, 4-	mg/kg	0.0317	0.391	0.0317	U	U	0.0376	0.464	0.0376	U	U	0.0319	0.393	0.0319	U	U	0.0325	0.401	0.0325	U	U	0.0374	0.462	0.0374	U	U
n-Nitrosodimethylamine	mg/kg	0.0117	0.391	0.0117	U	U	0.0139	0.464	0.0139	U	U	0.0118	0.393	0.0118	U	U	0.012	0.401	0.012	U	U	0.0139	0.462	0.0139	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.014	0.391	0.014	U	U	0.0166	0.464	0.0166	U	U	0.0141	0.393	0.0141	U	U	0.0143	0.401	0.0143	U	U	0.0165	0.462	0.0165	U	U
n-Nitrosodiphenylamine	mg/kg	0.00552	0.391	0.00552	U	U	0.00655	0.464	0.00655	U	U	0.00555	0.393	0.00555	U	U	0.00566	0.401	0.00566	U	U	0.00652	0.462	0.00652	U	U
Pentachlorophenol	mg/kg	0.0351	0.782	0.0351	U	U	0.0417	0.928	0.0417	U	U	0.0353	0.393	0.0353	U	U	0.036	0.401	0.036	U	U	0.0415	0.462	0.0415	U	U
Phenanthrene	mg/kg	0.00951	0.391	0.00951	U	U	0.102	0.464	0.0113	J	J	0.0504	0.393	0.00957	J	J	0.00976	0.401	0.00976	U	U	0.392	0.462	0.0112	J	J
Phenol	mg/kg	0.0047	0.391	0.0047	U	U	0.00558	0.464	0.00558	U	U	0.00473	0.393	0.00473	U	U	0.00482	0.401	0.00482	U	U	0.00555	0.462	0.00555	U	U
Pyrene	mg/kg	0.0156	0.391	0.0156	U	U	0.12	0.464	0.0185	J	J	0.0157	0.393	0.0157	U	U	0.016	0.401	0.016	U	U	2.22	0.462	0.0184		
Trichlorobenzene, 1,2,4-	mg/kg	0.00963	0.391	0.00963	U	U	0.0114	0.464	0.0114	U	U	0.00969	0.393	0.00969	U	U	0.00988	0.401	0.00988	U	U	0.0114	0.462	0.0114	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.0336	0.391	0.0336	U	U	0.0399	0.464	0.0399	U	U	0.0338	0.393	0.0338	U	U	0.0345	0.401	0.0345	U	U	0.0397	0.462	0.0397	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.0264	0.391	0.0264	U	U	0.0314	0.464	0.0314	U	U	0.0266	0.393	0.0266	U	U	0.0271	0.401	0.0271	U	U	0.0312	0.462	0.0312	U	U

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-SB02					TNTA-SL-SB05					TNTA-SL-SB05					TNTA-SL-SB12					TNTA-SL-SB14					TNTA-SL-SB15				
SAMPLE_NO		SL0232					SL0071					SL0233					SL0237					SL0239					SL0240				
SAMPLE_DATE		22-Aug-11					13-Jan-09					23-Aug-11					23-Aug-11					23-Aug-11					22-Aug-11				
FK_DEPTH		5 - 7 Ft					0 - 1 Ft					0 - 1 Ft					0 - 1 Ft					0 - 1 Ft					5 - 7 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																															
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.07	0.18	0.07	U	U	18.5	2.97	1.49			15.9	5	2			31.3	20	8			2.04	0.2	0.08			0.073	0.18	0.073	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.07	0.18	0.07	U	U	16.4	2.97	1.49			15.6	5	2			50.1	20	8			1.63	0.2	0.08			0.073	0.18	0.073	U	U
Dinitrobenzene, 1,3-	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.08	0.2	0.08	U	U	0.073	0.18	0.073	U	U
Dinitrotoluene, 2,4-	mg/kg	0.085	0.18	0.085	U	U	1.46	0.297	0.149			2.4	5	2.4	U	U	9.7	20	9.7	U	U	0.097	0.2	0.097	U	U	0.088	0.18	0.088	U	U
Dinitrotoluene, 2,6-	mg/kg	0.077	0.18	0.077	U	U	0.75	0.297	0.149			2.2	5	2.2	U	U	8.7	20	8.7	U	U	0.087	0.2	0.087	U	U	0.079	0.18	0.079	U	U
HMX	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.08	0.2	0.08	U	U	0.073	0.18	0.073	U	U
Nitrobenzene	mg/kg	0.082	0.18	0.082	U	U	0.149	0.297	0.149	U	U	2.3	5	2.3	U	U	9.3	20	9.3	U	U	0.093	0.2	0.093	U	U	0.085	0.18	0.085	U	U
Nitrotoluene, 2-	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.08	0.2	0.08	U	U	0.073	0.18	0.073	U	U
Nitrotoluene, 3-	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.08	0.2	0.08	U	U	0.073	0.18	0.073	U	U
Nitrotoluene, 4-	mg/kg	0.089	0.18	0.089	U	U	0.149	0.297	0.149	U	U	2.5	5	2.5	U	U	10	20	10	U	U	0.1	0.2	0.1	U	U	0.092	0.18	0.092	U	U
RDX	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.08	0.2	0.08	U	U	0.073	0.18	0.073	U	U
Tetryl	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.08	0.2	0.08	U	U	0.073	0.18	0.073	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.07	0.18	0.07	U	U	0.149	0.297	0.149	U	U	2	5	2	U	U	8	20	8	U	U	0.196	0.2	0.08	J	J	0.073	0.18	0.073	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.0793	0.18	0.07	J	J	138	14.9	7.43			287	5	2			1200	20	8			18	0.2	0.08			0.073	0.18	0.073	U	U
METALS (UNFILTERED)																															
Aluminum	mg/kg						8810	4.11	2.05																						
Antimony	mg/kg						0.257	0.514	0.257	U	UJ																				
Arsenic	mg/kg						6.15	1.03	0.514		J																				
Barium	mg/kg						52.3	0.205	0.103																						
Beryllium	mg/kg						6.43	0.205	0.103		J																				
Cadmium	mg/kg						0.257	0.514	0.257	U	U																				
Calcium	mg/kg						4030	10.3	5.14																						
Chromium	mg/kg						1.7	0.514	0.257																						
Cobalt	mg/kg						7.1	0.205	0.103																						
Copper	mg/kg						21.9	0.514	0.257																						
Iron	mg/kg						19000	2.05	1.03																						
Lead	mg/kg						11.4	0.514	0.257																						
Magnesium	mg/kg						2270	2.05	1.03		J																				
Manganese	mg/kg						211	0.205	0.103																						
Mercury	mg/kg						0.0441	0.0244	0.0122																						
Nickel	mg/kg						8.35	0.308	0.154		J																				
Potassium	mg/kg						616	25.7	12.8																						
Selenium	mg/kg						0.514	1.03	0.514	U	UJ																				
Silver	mg/kg						0.257	0.514	0.257	U	U																				
Sodium	mg/kg						51.9	20.5	10.3																						
Thallium	mg/kg						0.257	0.514	0.257	U	U																				
Vanadium	mg/kg						23	0.205	0.103																						
Zinc	mg/kg						48.7	2.57	1.28		J																				
PESTICIDES/PCBS																															
Aroclor 1016	mg/kg						1.16	0.0434	0.0087	P	J																				
Aroclor 1221	mg/kg						0.0087	0.0434	0.0087	U	U																				
Aroclor 1232	mg/kg						0.0087	0.0434	0.0087	U	U																				
Aroclor 1242	mg/kg						0.0087	0.0434	0.0087	U	U																				
Aroclor 1248	mg/kg						0.0087	0.0434	0.0087	U	U																				
Aroclor 1254	mg/kg						0.0087	0.0434	0.0087	U	U																				
Aroclor 1260	mg/kg						0.0087	0.0434	0.0087	U	U																				
SEMIVOLATILES																															
Acenaphthene	mg/kg						0.0388	2.15	0.0388	U	U																				
Acenaphthylene	mg/kg						0.0258	2.15	0.0258	U	U																				
Anthracene	mg/kg						0.0465	2.15	0.0465	U	U																				
Benzo(a)anthracene	mg/kg						0.141	2.15	0.141	U	U																				
Benzo(a)pyrene	mg/kg						0.141	2.15	0.141	U	U																				
Benzo(b)fluoranthene	mg/kg						0.358	2.15	0.358	U	U																				
Benzo(ghi)perylene	mg/kg						0.524	2.15	0.524	U	U																				
Benzo(k)fluoranthene	mg/kg						0.652	2.15	0.652	U	U																				
Benzoic acid	mg/kg						0.524	2.15	0.524	U	U																				
Benzyl alcohol	mg/kg						0.524	2.15	0.524	U	U																				
Bis(2-chloroethoxy)methane	mg/kg						0.0452	2.15	0.0452	U	U																				
Bis(2-chloroethyl)ether	mg/kg						0.0549	2.15	0.0549	U	U																				
Bis(2-chloroisopropyl)ether	mg/kg						0.0936	2.15	0.0936	U	U																				
Bis(2-ethylhexyl)phthalate	mg/kg						0.199	2.15	0.199	U	U																				
Bromophenyl phenyl ether, 4-	mg/kg						0.0769	2.15	0.0769	U	U																				
Butyl benzyl phthalate	mg/kg						0.0872	2.15	0.0872	U	U																				
Carbazole	mg/kg						0.215	2.15	0.215	U	U																				
Chloro-3-methylphenol, 4-	mg/kg						0.053	2.15	0.053	U	U																				
Chloroaniline, 4-	mg/kg						0.187	2.15	0.187	Q1,U	UJ																				
Chloronaphthalene, 2-	mg/kg						0.0342	2.15	0.0342	U	U																				
Chlorophenol, 2-	mg/kg						0.0265	2.15	0.0265	U	U																				
Chlorophenyl phenyl ether, 4-	mg/kg						0.165	2.15	0.165	U	U																				
Chrysene	mg/kg						0.0853	2.15	0.0853	U	U																				

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-SB02					TNTA-SL-SB05					TNTA-SL-SB05					TNTA-SL-SB12					TNTA-SL-SB14					TNTA-SL-SB15				
SAMPLE_NO		SL0232					SL0071					SL0233					SL0237					SL0239					SL0240				
SAMPLE_DATE		22-Aug-11					13-Jan-09					23-Aug-11					23-Aug-11					23-Aug-11					22-Aug-11				
FK_DEPTH		5 - 7 Ft					0 - 1 Ft					0 - 1 Ft					0 - 1 Ft					0 - 1 Ft					5 - 7 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg						0.486	2.15	0.486	U	U																				
Dibenzofuran	mg/kg						0.0362	2.15	0.0362	U	U																				
Dichlorobenzene, 1,2-	mg/kg						0.0497	2.15	0.0497	U	U																				
Dichlorobenzene, 1,3-	mg/kg						0.0781	2.15	0.0781	U	U																				
Dichlorobenzene, 1,4-	mg/kg						0.042	2.15	0.042	U	U																				
Dichlorobenzidine, 3,3'-	mg/kg						0.213	2.15	0.213	Q1,U	UJ																				
Dichlorophenol, 2,4-	mg/kg						0.0769	2.15	0.0769	U	U																				
Diethyl phthalate	mg/kg						0.0872	2.15	0.0872	U	U																				
Dimethyl phthalate	mg/kg						0.0659	2.15	0.0659	U	U																				
Dimethylphenol, 2,4-	mg/kg						0.0568	2.15	0.0568	U	U																				
Di-n-butyl phthalate	mg/kg						0.0465	2.15	0.0465	U	U																				
Dinitro-2-methylphenol, 4,6-	mg/kg						0.216	2.15	0.216	U	U																				
Dinitrophenol, 2,4-	mg/kg						0.343	2.15	0.343	U	U																				
Dinitrotoluene, 2,4-	mg/kg						4.42	2.15	0.0756																						
Dinitrotoluene, 2,6-	mg/kg						2.18	2.15	0.0517																						
Di-n-octyl phthalate	mg/kg						0.405	2.15	0.405	U	U																				
DIPHENYLAMINE	mg/kg						0.213	2.15	0.213	U	U																				
Fluoranthene	mg/kg						0.0465	2.15	0.0465	U	U																				
Fluorene	mg/kg						0.0911	2.15	0.0911	U	U																				
Hexachlorobenzene	mg/kg						0.134	2.15	0.134	U	U																				
Hexachlorobutadiene	mg/kg						0.204	2.15	0.204	U	U																				
Hexachlorocyclopentadiene	mg/kg						0.0685	2.15	0.0685	Q2,U	UJ																				
Hexachloroethane	mg/kg						0.0659	2.15	0.0659	U	U																				
Indeno(1,2,3-cd)pyrene	mg/kg						0.698	2.15	0.698	U	U																				
Isophorone	mg/kg						0.0258	2.15	0.0258	U	U																				
Methylnaphthalene, 2-	mg/kg						0.564	2.15	0.564	U	U																				
Methylphenol, 2-	mg/kg						0.0323	2.15	0.0323	U	U																				
Methylphenol, 4-	mg/kg						0.0672	2.15	0.0672	U	U																				
Naphthalene	mg/kg						0.051	2.15	0.051	U	U																				
Nitroaniline, 2-	mg/kg						0.093	2.15	0.093	U	U																				
Nitroaniline, 3-	mg/kg						0.299	2.15	0.073	J	J																				
Nitroaniline, 4-	mg/kg						0.762	2.15	0.762	U	U																				
Nitrobenzene	mg/kg						0.0704	2.15	0.0704	U	U																				
Nitrophenol, 2-	mg/kg						0.0762	2.15	0.0762	U	U																				
Nitrophenol, 4-	mg/kg						0.174	2.15	0.174	U	U																				
n-Nitrosodimethylamine	mg/kg						0.0646	2.15	0.0646	U	U																				
n-Nitroso-di-n-propylamine	mg/kg						0.0769	2.15	0.0769	U	U																				
n-Nitrosodiphenylamine	mg/kg						0.0304	2.15	0.0304	U	U																				
Pentachlorophenol	mg/kg						0.193	2.15	0.193	U	U																				
Phenanthrene	mg/kg						0.0523	2.15	0.0523	U	U																				
Phenol	mg/kg						0.0258	2.15	0.0258	U	U																				
Pyrene	mg/kg						0.0859	2.15	0.0859	U	U																				
Trichlorobenzene, 1,2,4-	mg/kg						0.053	2.15	0.053	U	U																				
Trichlorophenol, 2,4,5-	mg/kg						0.185	2.15	0.185	U	U																				
Trichlorophenol, 2,4,6-	mg/kg						0.145	2.15	0.145	U	U																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-SB22					TNTA-SL-SB23					TNTA-SL-SB27					TNTA-SL-TP03					TNTA-SL-TP04				
SAMPLE_NO		SL0247					SL0248					SL0252					SL0003					SL0004				
SAMPLE_DATE		22-Aug-11					22-Sep-11					22-Sep-11					4-Dec-08					4-Dec-08				
FK_DEPTH		5 - 7 Ft					0 - 1 Ft					0 - 1 Ft					5 - 5_5 Ft					4 - 4_5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.267	0.294	0.147	J	J	0.153	0.306	0.153	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.401	0.294	0.147			0.153	0.306	0.153	U	U
Dinitrobenzene, 1,3-	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Dinitrotoluene, 2,4-	mg/kg	0.094	0.19	0.094	U	U	0.092	0.19	0.092	U	U	0.09	0.19	0.09	U	U	0.624	0.294	0.147			0.153	0.306	0.153	U	U
Dinitrotoluene, 2,6-	mg/kg	0.084	0.19	0.084	U	U	0.082	0.19	0.082	U	U	0.081	0.19	0.081	U	U	0.217	0.294	0.147	J	J	0.153	0.306	0.153	U	U
HMX	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Nitrobenzene	mg/kg	0.09	0.19	0.09	U	U	0.088	0.19	0.088	U	U	0.086	0.19	0.086	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Nitrotoluene, 2-	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Nitrotoluene, 3-	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Nitrotoluene, 4-	mg/kg	0.098	0.19	0.098	U	U	0.096	0.19	0.096	U	U	0.094	0.19	0.094	U	U	0.147	0.294	0.147	U		0.153	0.306	0.153	U	U
RDX	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Tetryl	mg/kg	0.078	0.19	0.078	U	U	0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.147	0.294	0.147	U	U	0.153	0.306	0.153	U	U
Trinitrobenzene, 1,3,5-	mg/kg	1.17	0.19	0.078			0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.567	0.294	0.147			0.153	0.306	0.153	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.549	0.19	0.078			0.076	0.19	0.076	U	U	0.074	0.19	0.074	U	U	0.68	0.294	0.147			0.153	0.306	0.153	U	U
METALS (UNFILTERED)																										
Aluminum	mg/kg																									
Antimony	mg/kg																									
Arsenic	mg/kg																									
Barium	mg/kg																									
Beryllium	mg/kg																									
Cadmium	mg/kg																									
Calcium	mg/kg																									
Chromium	mg/kg																									
Cobalt	mg/kg																									
Copper	mg/kg																									
Iron	mg/kg																									
Lead	mg/kg																									
Magnesium	mg/kg																									
Manganese	mg/kg																									
Mercury	mg/kg																									
Nickel	mg/kg																									
Potassium	mg/kg																									
Selenium	mg/kg																									
Silver	mg/kg																									
Sodium	mg/kg																									
Thallium	mg/kg																									
Vanadium	mg/kg																									
Zinc	mg/kg																									
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg																									
Aroclor 1221	mg/kg																									
Aroclor 1232	mg/kg																									
Aroclor 1242	mg/kg																									
Aroclor 1248	mg/kg																									
Aroclor 1254	mg/kg																									
Aroclor 1260	mg/kg																									
SEMIVOLATILES																										
Acenaphthene	mg/kg																									
Acenaphthylene	mg/kg																									
Anthracene	mg/kg																									
Benzo(a)anthracene	mg/kg																									
Benzo(a)pyrene	mg/kg																									
Benzo(b)fluoranthene	mg/kg																									
Benzo(ghi)perylene	mg/kg																									
Benzo(k)fluoranthene	mg/kg																									
Benzoic acid	mg/kg																									
Benzyl alcohol	mg/kg																									
Bis(2-chloroethoxy)methane	mg/kg																									
Bis(2-chloroethyl)ether	mg/kg																									
Bis(2-chloroisopropyl)ether	mg/kg																									
Bis(2-ethylhexyl)phthalate	mg/kg																									
Bromophenyl phenyl ether, 4-	mg/kg																									
Butyl benzyl phthalate	mg/kg																									
Carbazole	mg/kg																									
Chloro-3-methylphenol, 4-	mg/kg																									
Chloroaniline, 4-	mg/kg																									
Chloronaphthalene, 2-	mg/kg																									
Chlorophenol, 2-	mg/kg																									
Chlorophenyl phenyl ether, 4-	mg/kg																									
Chrysene	mg/kg																									

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-SB22					TNTA-SL-SB23					TNTA-SL-SB27					TNTA-SL-TP03					TNTA-SL-TP04				
SAMPLE_NO		SL0247					SL0248					SL0252					SL0003					SL0004				
SAMPLE_DATE		22-Aug-11					22-Sep-11					22-Sep-11					4-Dec-08					4-Dec-08				
FK_DEPTH		5 - 7 Ft					0 - 1 Ft					0 - 1 Ft					5 - 5_5 Ft					4 - 4_5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg																									
Dibenzofuran	mg/kg																									
Dichlorobenzene, 1,2-	mg/kg																									
Dichlorobenzene, 1,3-	mg/kg																									
Dichlorobenzene, 1,4-	mg/kg																									
Dichlorobenzidine, 3,3'-	mg/kg																									
Dichlorophenol, 2,4-	mg/kg																									
Diethyl phthalate	mg/kg																									
Dimethyl phthalate	mg/kg																									
Dimethylphenol, 2,4-	mg/kg																									
Di-n-butyl phthalate	mg/kg																									
Dinitro-2-methylphenol, 4,6-	mg/kg																									
Dinitrophenol, 2,4-	mg/kg																									
Dinitrotoluene, 2,4-	mg/kg																									
Dinitrotoluene, 2,6-	mg/kg																									
Di-n-octyl phthalate	mg/kg																									
DIPHENYLAMINE	mg/kg																									
Fluoranthene	mg/kg																									
Fluorene	mg/kg																									
Hexachlorobenzene	mg/kg																									
Hexachlorobutadiene	mg/kg																									
Hexachlorocyclopentadiene	mg/kg																									
Hexachloroethane	mg/kg																									
Indeno(1,2,3-cd)pyrene	mg/kg																									
Isophorone	mg/kg																									
Methylnaphthalene, 2-	mg/kg																									
Methylphenol, 2-	mg/kg																									
Methylphenol, 4-	mg/kg																									
Naphthalene	mg/kg																									
Nitroaniline, 2-	mg/kg																									
Nitroaniline, 3-	mg/kg																									
Nitroaniline, 4-	mg/kg																									
Nitrobenzene	mg/kg																									
Nitrophenol, 2-	mg/kg																									
Nitrophenol, 4-	mg/kg																									
n-Nitrosodimethylamine	mg/kg																									
n-Nitroso-di-n-propylamine	mg/kg																									
n-Nitrosodiphenylamine	mg/kg																									
Pentachlorophenol	mg/kg																									
Phenanthrene	mg/kg																									
Phenol	mg/kg																									
Pyrene	mg/kg																									
Trichlorobenzene, 1,2,4-	mg/kg																									
Trichlorophenol, 2,4,5-	mg/kg																									
Trichlorophenol, 2,4,6-	mg/kg																									

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP21					TNTA-SL-TP22					TNTA-SL-TP22					TNTA-SL-TP23					TNTA-SL-TP24				
SAMPLE_NO		SL0025					SL0026					SL0027					SL0029					SL0030				
SAMPLE_DATE		5-Dec-08					5-Dec-08					5-Dec-08					5-Dec-08					5-Dec-08				
FK_DEPTH		4 - 4_5 Ft					4 - 4_5 Ft					4 - 4_5 Ft					4 - 4_5 Ft					4 - 4_25 Ft				
SAMPLE_PURPOSE		REG					REG					FD					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Dinitrobenzene, 1,3-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Dinitrotoluene, 2,4-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Dinitrotoluene, 2,6-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
HMX	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Nitrobenzene	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Nitrotoluene, 2-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Nitrotoluene, 3-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Nitrotoluene, 4-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
RDX	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Tetryl	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.147	0.294	0.147	U	U	0.143	0.286	0.143	U	U	0.152	0.303	0.152	U	U	0.139	0.278	0.139	U	U	0.15	0.3	0.15	U	U
METALS (UNFILTERED)																										
Aluminum	mg/kg																									
Antimony	mg/kg																									
Arsenic	mg/kg																									
Barium	mg/kg																									
Beryllium	mg/kg																									
Cadmium	mg/kg																									
Calcium	mg/kg																									
Chromium	mg/kg																									
Cobalt	mg/kg																									
Copper	mg/kg																									
Iron	mg/kg																									
Lead	mg/kg																									
Magnesium	mg/kg																									
Manganese	mg/kg																									
Mercury	mg/kg																									
Nickel	mg/kg																									
Potassium	mg/kg																									
Selenium	mg/kg																									
Silver	mg/kg																									
Sodium	mg/kg																									
Thallium	mg/kg																									
Vanadium	mg/kg																									
Zinc	mg/kg																									
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg																									
Aroclor 1221	mg/kg																									
Aroclor 1232	mg/kg																									
Aroclor 1242	mg/kg																									
Aroclor 1248	mg/kg																									
Aroclor 1254	mg/kg																									
Aroclor 1260	mg/kg																									
SEMIVOLATILES																										
Acenaphthene	mg/kg																									
Acenaphthylene	mg/kg																									
Anthracene	mg/kg																									
Benzo(a)anthracene	mg/kg																									
Benzo(a)pyrene	mg/kg																									
Benzo(b)fluoranthene	mg/kg																									
Benzo(ghi)perylene	mg/kg																									
Benzo(k)fluoranthene	mg/kg																									
Benzoic acid	mg/kg																									
Benzyl alcohol	mg/kg																									
Bis(2-chloroethoxy)methane	mg/kg																									
Bis(2-chloroethyl)ether	mg/kg																									
Bis(2-chloroisopropyl)ether	mg/kg																									
Bis(2-ethylhexyl)phthalate	mg/kg																									
Bromophenyl phenyl ether, 4-	mg/kg																									
Butyl benzyl phthalate	mg/kg																									
Carbazole	mg/kg																									
Chloro-3-methylphenol, 4-	mg/kg																									
Chloroaniline, 4-	mg/kg																									
Chloronaphthalene, 2-	mg/kg																									
Chlorophenol, 2-	mg/kg																									
Chlorophenyl phenyl ether, 4-	mg/kg																									
Chrysene	mg/kg																									

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP21					TNTA-SL-TP22					TNTA-SL-TP22					TNTA-SL-TP23					TNTA-SL-TP24				
SAMPLE_NO		SL0025					SL0026					SL0027					SL0029					SL0030				
SAMPLE_DATE		5-Dec-08					5-Dec-08					5-Dec-08					5-Dec-08					5-Dec-08				
FK_DEPTH		4 - 4_5 Ft					4 - 4_5 Ft					4 - 4_5 Ft					4 - 4_5 Ft					4 - 4_25 Ft				
SAMPLE_PURPOSE		REG					REG					FD					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg																									
Dibenzofuran	mg/kg																									
Dichlorobenzene, 1,2-	mg/kg																									
Dichlorobenzene, 1,3-	mg/kg																									
Dichlorobenzene, 1,4-	mg/kg																									
Dichlorobenzidine, 3,3'-	mg/kg																									
Dichlorophenol, 2,4-	mg/kg																									
Diethyl phthalate	mg/kg																									
Dimethyl phthalate	mg/kg																									
Dimethylphenol, 2,4-	mg/kg																									
Di-n-butyl phthalate	mg/kg																									
Dinitro-2-methylphenol, 4,6-	mg/kg																									
Dinitrophenol, 2,4-	mg/kg																									
Dinitrotoluene, 2,4-	mg/kg																									
Dinitrotoluene, 2,6-	mg/kg																									
Di-n-octyl phthalate	mg/kg																									
DIPHENYLAMINE	mg/kg																									
Fluoranthene	mg/kg																									
Fluorene	mg/kg																									
Hexachlorobenzene	mg/kg																									
Hexachlorobutadiene	mg/kg																									
Hexachlorocyclopentadiene	mg/kg																									
Hexachloroethane	mg/kg																									
Indeno(1,2,3-cd)pyrene	mg/kg																									
Isophorone	mg/kg																									
Methylnaphthalene, 2-	mg/kg																									
Methylphenol, 2-	mg/kg																									
Methylphenol, 4-	mg/kg																									
Naphthalene	mg/kg																									
Nitroaniline, 2-	mg/kg																									
Nitroaniline, 3-	mg/kg																									
Nitroaniline, 4-	mg/kg																									
Nitrobenzene	mg/kg																									
Nitrophenol, 2-	mg/kg																									
Nitrophenol, 4-	mg/kg																									
n-Nitrosodimethylamine	mg/kg																									
n-Nitroso-di-n-propylamine	mg/kg																									
n-Nitrosodiphenylamine	mg/kg																									
Pentachlorophenol	mg/kg																									
Phenanthrene	mg/kg																									
Phenol	mg/kg																									
Pyrene	mg/kg																									
Trichlorobenzene, 1,2,4-	mg/kg																									
Trichlorophenol, 2,4,5-	mg/kg																									
Trichlorophenol, 2,4,6-	mg/kg																									

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP25					TNTA-SL-TP26					TNTA-SL-TP27					TNTA-SL-TP28					TNTA-SL-TP28				
SAMPLE_NO		SL0031					SL0032					SL0033					SL0034					SL0035				
SAMPLE_DATE		5-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08				
FK_DEPTH		4 - 4_25 Ft					4 - 4_3 Ft					3 - 3_5 Ft					3 - 3_25 Ft					3 - 3_25 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.268	0.274	0.137	J	J	0.14	0.28	0.14	U	U	3.78	0.287	0.144			0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.476	0.274	0.137			0.14	0.28	0.14	U	U	9.98	1.44	0.718			0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Dinitrobenzene, 1,3-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Dinitrotoluene, 2,4-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	3.25	0.287	0.144			0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Dinitrotoluene, 2,6-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.526	0.287	0.144			0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
HMX	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Nitrobenzene	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Nitrotoluene, 2-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Nitrotoluene, 3-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Nitrotoluene, 4-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
RDX	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Tetryl	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	0.144	0.287	0.144	U	U	0.151	0.302	0.151	U	U	0.149	0.299	0.149	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.137	0.274	0.137	U	U	0.14	0.28	0.14	U	U	3.35	1.44	0.718			0.151	0.302	0.151	U	U	0.251	0.299	0.149	J	J
METALS (UNFILTERED)																										
Aluminum	mg/kg																									
Antimony	mg/kg																									
Arsenic	mg/kg																									
Barium	mg/kg																									
Beryllium	mg/kg																									
Cadmium	mg/kg																									
Calcium	mg/kg																									
Chromium	mg/kg																									
Cobalt	mg/kg																									
Copper	mg/kg																									
Iron	mg/kg																									
Lead	mg/kg																									
Magnesium	mg/kg																									
Manganese	mg/kg																									
Mercury	mg/kg																									
Nickel	mg/kg																									
Potassium	mg/kg																									
Selenium	mg/kg																									
Silver	mg/kg																									
Sodium	mg/kg																									
Thallium	mg/kg																									
Vanadium	mg/kg																									
Zinc	mg/kg																									
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg																									
Aroclor 1221	mg/kg																									
Aroclor 1232	mg/kg																									
Aroclor 1242	mg/kg																									
Aroclor 1248	mg/kg																									
Aroclor 1254	mg/kg																									
Aroclor 1260	mg/kg																									
SEMIVOLATILES																										
Acenaphthene	mg/kg																									
Acenaphthylene	mg/kg																									
Anthracene	mg/kg																									
Benzo(a)anthracene	mg/kg																									
Benzo(a)pyrene	mg/kg																									
Benzo(b)fluoranthene	mg/kg																									
Benzo(ghi)perylene	mg/kg																									
Benzo(k)fluoranthene	mg/kg																									
Benzoic acid	mg/kg																									
Benzyl alcohol	mg/kg																									
Bis(2-chloroethoxy)methane	mg/kg																									
Bis(2-chloroethyl)ether	mg/kg																									
Bis(2-chloroisopropyl)ether	mg/kg																									
Bis(2-ethylhexyl)phthalate	mg/kg																									
Bromophenyl phenyl ether, 4-	mg/kg																									
Butyl benzyl phthalate	mg/kg																									
Carbazole	mg/kg																									
Chloro-3-methylphenol, 4-	mg/kg																									
Chloroaniline, 4-	mg/kg																									
Chloronaphthalene, 2-	mg/kg																									
Chlorophenol, 2-	mg/kg																									
Chlorophenyl phenyl ether, 4-	mg/kg																									
Chrysene	mg/kg																									

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP25					TNTA-SL-TP26					TNTA-SL-TP27					TNTA-SL-TP28					TNTA-SL-TP28				
SAMPLE_NO		SL0031					SL0032					SL0033					SL0034					SL0035				
SAMPLE_DATE		5-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08				
FK_DEPTH		4 - 4_25 Ft					4 - 4_3 Ft					3 - 3_5 Ft					3 - 3_25 Ft					3 - 3_25 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg																									
Dibenzofuran	mg/kg																									
Dichlorobenzene, 1,2-	mg/kg																									
Dichlorobenzene, 1,3-	mg/kg																									
Dichlorobenzene, 1,4-	mg/kg																									
Dichlorobenzidine, 3,3'-	mg/kg																									
Dichlorophenol, 2,4-	mg/kg																									
Diethyl phthalate	mg/kg																									
Dimethyl phthalate	mg/kg																									
Dimethylphenol, 2,4-	mg/kg																									
Di-n-butyl phthalate	mg/kg																									
Dinitro-2-methylphenol, 4,6-	mg/kg																									
Dinitrophenol, 2,4-	mg/kg																									
Dinitrotoluene, 2,4-	mg/kg																									
Dinitrotoluene, 2,6-	mg/kg																									
Di-n-octyl phthalate	mg/kg																									
DIPHENYLAMINE	mg/kg																									
Fluoranthene	mg/kg																									
Fluorene	mg/kg																									
Hexachlorobenzene	mg/kg																									
Hexachlorobutadiene	mg/kg																									
Hexachlorocyclopentadiene	mg/kg																									
Hexachloroethane	mg/kg																									
Indeno(1,2,3-cd)pyrene	mg/kg																									
Isophorone	mg/kg																									
Methylnaphthalene, 2-	mg/kg																									
Methylphenol, 2-	mg/kg																									
Methylphenol, 4-	mg/kg																									
Naphthalene	mg/kg																									
Nitroaniline, 2-	mg/kg																									
Nitroaniline, 3-	mg/kg																									
Nitroaniline, 4-	mg/kg																									
Nitrobenzene	mg/kg																									
Nitrophenol, 2-	mg/kg																									
Nitrophenol, 4-	mg/kg																									
n-Nitrosodimethylamine	mg/kg																									
n-Nitroso-di-n-propylamine	mg/kg																									
n-Nitrosodiphenylamine	mg/kg																									
Pentachlorophenol	mg/kg																									
Phenanthrene	mg/kg																									
Phenol	mg/kg																									
Pyrene	mg/kg																									
Trichlorobenzene, 1,2,4-	mg/kg																									
Trichlorophenol, 2,4,5-	mg/kg																									
Trichlorophenol, 2,4,6-	mg/kg																									

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP29					TNTA-SL-TP30					TNTA-SL-TP32					TNTA-SL-TP33					TNTA-SL-TP34				
SAMPLE_NO		SL0037					SL0038					SL0040					SL0041					SL0042				
SAMPLE_DATE		4-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08				
FK_DEPTH		5 - 5_5 Ft					5 - 5_25 Ft					5 - 5_5 Ft					5 - 5_5 Ft					5 - 5_5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																										
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.142	0.283	0.142	U	U	1.67	0.305	0.152			0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.142	0.283	0.142	U	U	3.16	0.305	0.152			0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Dinitrobenzene, 1,3-	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Dinitrotoluene, 2,4-	mg/kg	0.142	0.283	0.142	U	U	0.896	0.305	0.152			0.147	0.294	0.147	U	U	1.76	0.311	0.155			0.141	0.282	0.141	U	U
Dinitrotoluene, 2,6-	mg/kg	0.142	0.283	0.142	U	U	0.529	0.305	0.152			0.147	0.294	0.147	U	U	0.584	0.311	0.155			0.141	0.282	0.141	U	U
HMX	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Nitrobenzene	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Nitrotoluene, 2-	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Nitrotoluene, 3-	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Nitrotoluene, 4-	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
RDX	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Tetryl	mg/kg	0.142	0.283	0.142	U	U	0.152	0.305	0.152	U	U	0.147	0.294	0.147	U	U	0.155	0.311	0.155	U	U	0.141	0.282	0.141	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.142	0.283	0.142	U	U	0.978	0.305	0.152			0.147	0.294	0.147	U	U	1.51	0.311	0.155			0.141	0.282	0.141	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.142	0.283	0.142	U	U	77.8	15.2	7.61			0.147	0.294	0.147	U	U	1380	155	77.7			0.149	0.282	0.141	J	J
METALS (UNFILTERED)																										
Aluminum	mg/kg																									
Antimony	mg/kg																									
Arsenic	mg/kg																									
Barium	mg/kg																									
Beryllium	mg/kg																									
Cadmium	mg/kg																									
Calcium	mg/kg																									
Chromium	mg/kg																									
Cobalt	mg/kg																									
Copper	mg/kg																									
Iron	mg/kg																									
Lead	mg/kg																									
Magnesium	mg/kg																									
Manganese	mg/kg																									
Mercury	mg/kg																									
Nickel	mg/kg																									
Potassium	mg/kg																									
Selenium	mg/kg																									
Silver	mg/kg																									
Sodium	mg/kg																									
Thallium	mg/kg																									
Vanadium	mg/kg																									
Zinc	mg/kg																									
PESTICIDES/PCBS																										
Aroclor 1016	mg/kg																									
Aroclor 1221	mg/kg																									
Aroclor 1232	mg/kg																									
Aroclor 1242	mg/kg																									
Aroclor 1248	mg/kg																									
Aroclor 1254	mg/kg																									
Aroclor 1260	mg/kg																									
SEMIVOLATILES																										
Acenaphthene	mg/kg																									
Acenaphthylene	mg/kg																									
Anthracene	mg/kg																									
Benzo(a)anthracene	mg/kg																									
Benzo(a)pyrene	mg/kg																									
Benzo(b)fluoranthene	mg/kg																									
Benzo(ghi)perylene	mg/kg																									
Benzo(k)fluoranthene	mg/kg																									
Benzoic acid	mg/kg																									
Benzyl alcohol	mg/kg																									
Bis(2-chloroethoxy)methane	mg/kg																									
Bis(2-chloroethyl)ether	mg/kg																									
Bis(2-chloroisopropyl)ether	mg/kg																									
Bis(2-ethylhexyl)phthalate	mg/kg																									
Bromophenyl phenyl ether, 4-	mg/kg																									
Butyl benzyl phthalate	mg/kg																									
Carbazole	mg/kg																									
Chloro-3-methylphenol, 4-	mg/kg																									
Chloroaniline, 4-	mg/kg																									
Chloronaphthalene, 2-	mg/kg																									
Chlorophenol, 2-	mg/kg																									
Chlorophenyl phenyl ether, 4-	mg/kg																									
Chrysene	mg/kg																									

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP29					TNTA-SL-TP30					TNTA-SL-TP32					TNTA-SL-TP33					TNTA-SL-TP34				
SAMPLE_NO		SL0037					SL0038					SL0040					SL0041					SL0042				
SAMPLE_DATE		4-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08					4-Dec-08				
FK_DEPTH		5 - 5_5 Ft					5 - 5_25 Ft					5 - 5_5 Ft					5 - 5_5 Ft					5 - 5_5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg																									
Dibenzofuran	mg/kg																									
Dichlorobenzene, 1,2-	mg/kg																									
Dichlorobenzene, 1,3-	mg/kg																									
Dichlorobenzene, 1,4-	mg/kg																									
Dichlorobenzidine, 3,3'-	mg/kg																									
Dichlorophenol, 2,4-	mg/kg																									
Diethyl phthalate	mg/kg																									
Dimethyl phthalate	mg/kg																									
Dimethylphenol, 2,4-	mg/kg																									
Di-n-butyl phthalate	mg/kg																									
Dinitro-2-methylphenol, 4,6-	mg/kg																									
Dinitrophenol, 2,4-	mg/kg																									
Dinitrotoluene, 2,4-	mg/kg																									
Dinitrotoluene, 2,6-	mg/kg																									
Di-n-octyl phthalate	mg/kg																									
DIPHENYLAMINE	mg/kg																									
Fluoranthene	mg/kg																									
Fluorene	mg/kg																									
Hexachlorobenzene	mg/kg																									
Hexachlorobutadiene	mg/kg																									
Hexachlorocyclopentadiene	mg/kg																									
Hexachloroethane	mg/kg																									
Indeno(1,2,3-cd)pyrene	mg/kg																									
Isophorone	mg/kg																									
Methylnaphthalene, 2-	mg/kg																									
Methylphenol, 2-	mg/kg																									
Methylphenol, 4-	mg/kg																									
Naphthalene	mg/kg																									
Nitroaniline, 2-	mg/kg																									
Nitroaniline, 3-	mg/kg																									
Nitroaniline, 4-	mg/kg																									
Nitrobenzene	mg/kg																									
Nitrophenol, 2-	mg/kg																									
Nitrophenol, 4-	mg/kg																									
n-Nitrosodimethylamine	mg/kg																									
n-Nitroso-di-n-propylamine	mg/kg																									
n-Nitrosodiphenylamine	mg/kg																									
Pentachlorophenol	mg/kg																									
Phenanthrene	mg/kg																									
Phenol	mg/kg																									
Pyrene	mg/kg																									
Trichlorobenzene, 1,2,4-	mg/kg																									
Trichlorophenol, 2,4,5-	mg/kg																									
Trichlorophenol, 2,4,6-	mg/kg																									

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP35					TNTA-SL-TP36					TNTA-SL-TP37				
SAMPLE_NO		SL0043					SL0044					SL0045				
SAMPLE_DATE		4-Dec-08					4-Dec-08					4-Dec-08				
FK_DEPTH		5 - 5_25 Ft					5 - 5_5 Ft					4 - 4_25 Ft				
SAMPLE_PURPOSE		REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Dinitrobenzene, 1,3-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Dinitrotoluene, 2,4-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Dinitrotoluene, 2,6-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
HMX	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Nitrobenzene	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Nitrotoluene, 2-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Nitrotoluene, 3-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Nitrotoluene, 4-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
RDX	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Tetryl	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	0.145	0.29	0.145	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.155	0.309	0.155	U	U	0.146	0.293	0.146	U	U	1.09	0.29	0.145		
METALS (UNFILTERED)																
Aluminum	mg/kg															
Antimony	mg/kg															
Arsenic	mg/kg															
Barium	mg/kg															
Beryllium	mg/kg															
Cadmium	mg/kg															
Calcium	mg/kg															
Chromium	mg/kg															
Cobalt	mg/kg															
Copper	mg/kg															
Iron	mg/kg															
Lead	mg/kg															
Magnesium	mg/kg															
Manganese	mg/kg															
Mercury	mg/kg															
Nickel	mg/kg															
Potassium	mg/kg															
Selenium	mg/kg															
Silver	mg/kg															
Sodium	mg/kg															
Thallium	mg/kg															
Vanadium	mg/kg															
Zinc	mg/kg															
PESTICIDES/PCBS																
Aroclor 1016	mg/kg															
Aroclor 1221	mg/kg															
Aroclor 1232	mg/kg															
Aroclor 1242	mg/kg															
Aroclor 1248	mg/kg															
Aroclor 1254	mg/kg															
Aroclor 1260	mg/kg															
SEMIVOLATILES																
Acenaphthene	mg/kg															
Acenaphthylene	mg/kg															
Anthracene	mg/kg															
Benzo(a)anthracene	mg/kg															
Benzo(a)pyrene	mg/kg															
Benzo(b)fluoranthene	mg/kg															
Benzo(ghi)perylene	mg/kg															
Benzo(k)fluoranthene	mg/kg															
Benzoic acid	mg/kg															
Benzyl alcohol	mg/kg															
Bis(2-chloroethoxy)methane	mg/kg															
Bis(2-chloroethyl)ether	mg/kg															
Bis(2-chloroisopropyl)ether	mg/kg															
Bis(2-ethylhexyl)phthalate	mg/kg															
Bromophenyl phenyl ether, 4-	mg/kg															
Butyl benzyl phthalate	mg/kg															
Carbazole	mg/kg															
Chloro-3-methylphenol, 4-	mg/kg															
Chloroaniline, 4-	mg/kg															
Chloronaphthalene, 2-	mg/kg															
Chlorophenol, 2-	mg/kg															
Chlorophenyl phenyl ether, 4-	mg/kg															
Chrysene	mg/kg															

Table E-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		TNTA-SL-TP35					TNTA-SL-TP36					TNTA-SL-TP37				
SAMPLE_NO		SL0043					SL0044					SL0045				
SAMPLE_DATE		4-Dec-08					4-Dec-08					4-Dec-08				
FK_DEPTH		5 - 5_25 Ft					5 - 5_5 Ft					4 - 4_25 Ft				
SAMPLE_PURPOSE		REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dibenz(a,h)anthracene	mg/kg															
Dibenzofuran	mg/kg															
Dichlorobenzene, 1,2-	mg/kg															
Dichlorobenzene, 1,3-	mg/kg															
Dichlorobenzene, 1,4-	mg/kg															
Dichlorobenzidine, 3,3'-	mg/kg															
Dichlorophenol, 2,4-	mg/kg															
Diethyl phthalate	mg/kg															
Dimethyl phthalate	mg/kg															
Dimethylphenol, 2,4-	mg/kg															
Di-n-butyl phthalate	mg/kg															
Dinitro-2-methylphenol, 4,6-	mg/kg															
Dinitrophenol, 2,4-	mg/kg															
Dinitrotoluene, 2,4-	mg/kg															
Dinitrotoluene, 2,6-	mg/kg															
Di-n-octyl phthalate	mg/kg															
DIPHENYLAMINE	mg/kg															
Fluoranthene	mg/kg															
Fluorene	mg/kg															
Hexachlorobenzene	mg/kg															
Hexachlorobutadiene	mg/kg															
Hexachlorocyclopentadiene	mg/kg															
Hexachloroethane	mg/kg															
Indeno(1,2,3-cd)pyrene	mg/kg															
Isophorone	mg/kg															
Methylnaphthalene, 2-	mg/kg															
Methylphenol, 2-	mg/kg															
Methylphenol, 4-	mg/kg															
Naphthalene	mg/kg															
Nitroaniline, 2-	mg/kg															
Nitroaniline, 3-	mg/kg															
Nitroaniline, 4-	mg/kg															
Nitrobenzene	mg/kg															
Nitrophenol, 2-	mg/kg															
Nitrophenol, 4-	mg/kg															
n-Nitrosodimethylamine	mg/kg															
n-Nitroso-di-n-propylamine	mg/kg															
n-Nitrosodiphenylamine	mg/kg															
Pentachlorophenol	mg/kg															
Phenanthrene	mg/kg															
Phenol	mg/kg															
Pyrene	mg/kg															
Trichlorobenzene, 1,2,4-	mg/kg															
Trichlorophenol, 2,4,5-	mg/kg															
Trichlorophenol, 2,4,6-	mg/kg															

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

Grey cells had no data.

Table E-2

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

LOCATION_CODE			1SLA-SW01					1SLA-SW02					1SLA-SW03					1SLA-SW04				
SAMPLE_NO			SL2000					SL2001					SL2002					SL2003				
SAMPLE_DATE			30-Oct-09					30-Oct-09					30-Oct-09					30-Oct-09				
FK_DEPTH			0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			REG					REG					REG					REG				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																						
Amino-2,6-dinitrotoluene, 4-	N	µg/L	0.048	0.19	0.048	U	U	0.048	0.19	0.048	U	U	0.05	0.2	0.05	U	U	0.048	0.19	0.048	U	U
Amino-4,6-dinitrotoluene, 2-	N	µg/L	0.073	0.19	0.073	U	U	0.073	0.19	0.073	U	U	0.077	0.2	0.077	U	U	0.073	0.19	0.073	U	U
Dinitrobenzene, 1,3-	N	µg/L	0.049	0.19	0.049	U	U	0.049	0.19	0.049	U	U	0.051	0.2	0.051	U	U	0.049	0.19	0.049	U	U
Dinitrotoluene, 2,4-	N	µg/L	0.062	0.19	0.062	U	U	0.062	0.19	0.062	U	U	0.065	0.2	0.065	U	U	0.062	0.19	0.062	U	U
Dinitrotoluene, 2,6-	N	µg/L	0.089	0.19	0.089	U	U	0.089	0.19	0.089	U	U	0.093	0.2	0.093	U	U	0.089	0.19	0.089	U	U
HMX	N	µg/L	0.1	0.19	0.1	U	U	0.1	0.19	0.1	U	U	0.11	0.2	0.11	U	U	0.1	0.19	0.1	U	U
Nitrobenzene	N	µg/L	0.048	0.19	0.048	U	U	0.048	0.19	0.048	U	U	0.05	0.2	0.05	U	U	0.048	0.19	0.048	U	U
Nitrotoluene, 2-	N	µg/L	0.061	0.19	0.061	U	U	0.061	0.19	0.061	U	U	0.064	0.2	0.064	U	U	0.061	0.19	0.061	U	U
Nitrotoluene, 3-	N	µg/L	0.092	0.19	0.092	U	U	0.092	0.19	0.092	U	U	0.097	0.2	0.097	U	U	0.092	0.19	0.092	U	U
Nitrotoluene, 4-	N	µg/L	0.072	0.19	0.072	U	U	0.072	0.19	0.072	U	U	0.076	0.2	0.076	U	U	0.072	0.19	0.072	U	U
RDX	N	µg/L	0.071	0.19	0.071	U	U	0.071	0.19	0.071	U	U	0.075	0.2	0.075	U	U	0.071	0.19	0.071	U	U
Tetryl	N	µg/L	0.074	0.19	0.074	U	U	0.074	0.19	0.074	U	U	0.078	0.2	0.078	U	U	0.074	0.19	0.074	U	U
Trinitrobenzene, 1,3,5-	N	µg/L	0.048	0.19	0.048	U	U	0.048	0.19	0.048	U	U	0.05	0.2	0.05	U	U	0.048	0.19	0.048	U	U
Trinitrotoluene, 2,4,6-	N	µg/L	0.066	0.19	0.066	U	U	0.066	0.19	0.066	U	U	0.069	0.2	0.069	U	U	0.066	0.19	0.066	U	U

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
µg/L - Micrograms per liter.
REG - Regular Sample.
RL - Reporting limit.
VQ - Validation qualifier.

Table E-2

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE			1SLA-SW05					1SLA-SW06					1SLA-SW06				
SAMPLE_NO			SL2004					SL2005					SL2006				
SAMPLE_DATE			30-Oct-09					30-Oct-09					30-Oct-09				
FK_DEPTH			0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			REG					REG					FD				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	N	µg/L	0.048	0.19	0.048	U	U	0.048	0.19	0.048	U	U	0.049	0.2	0.049	U	U
Amino-4,6-dinitrotoluene, 2-	N	µg/L	0.074	0.19	0.074	U	U	0.074	0.19	0.074	U	U	0.075	0.2	0.075	U	U
Dinitrobenzene, 1,3-	N	µg/L	0.049	0.19	0.049	U	U	0.049	0.19	0.049	U	U	0.05	0.2	0.05	U	U
Dinitrotoluene, 2,4-	N	µg/L	0.062	0.19	0.062	U	U	0.062	0.19	0.062	U	U	0.064	0.2	0.064	U	U
Dinitrotoluene, 2,6-	N	µg/L	0.089	0.19	0.089	U	U	0.089	0.19	0.089	U	U	0.091	0.2	0.091	U	U
HMX	N	µg/L	0.1	0.19	0.1	U	U	0.1	0.19	0.1	U	U	0.11	0.2	0.11	U	U
Nitrobenzene	N	µg/L	0.048	0.19	0.048	U	U	0.048	0.19	0.048	U	U	0.049	0.2	0.049	U	U
Nitrotoluene, 2-	N	µg/L	0.062	0.19	0.062	U	U	0.062	0.19	0.062	U	U	0.063	0.2	0.063	U	U
Nitrotoluene, 3-	N	µg/L	0.093	0.19	0.093	U	U	0.093	0.19	0.093	U	U	0.095	0.2	0.095	U	U
Nitrotoluene, 4-	N	µg/L	0.073	0.19	0.073	U	U	0.073	0.19	0.073	U	U	0.075	0.2	0.075	U	U
RDX	N	µg/L	0.072	0.19	0.072	U	U	0.072	0.19	0.072	U	U	0.074	0.2	0.074	U	U
Tetryl	N	µg/L	0.075	0.19	0.075	U	U	0.075	0.19	0.075	U	U	0.076	0.2	0.076	U	U
Trinitrobenzene, 1,3,5-	N	µg/L	0.048	0.19	0.048	U	U	0.048	0.19	0.048	U	U	0.049	0.2	0.049	U	U
Trinitrotoluene, 2,4,6-	N	µg/L	0.066	0.19	0.066	U	U	0.066	0.19	0.066	U	U	0.068	0.2	0.068	U	U

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
µg/L - Micrograms per liter.
REG - Regular Sample.
RL - Reporting limit.
VQ - Validation qualifier.

Table E-3

Sediment Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		1SLA-SD01					1SLA-SD02					1SLA-SD03					1SLA-SD04				
SAMPLE_NO		SL1000					SL1001					SL1002					SL1003				
SAMPLE_DATE		30-Oct-09					30-Oct-09					30-Oct-09					30-Oct-09				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.039	0.16	0.039	U	U	0.044	0.18	0.044	U	U	0.041	0.17	0.041	U	U	0.039	0.15	0.039	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.085	0.16	0.085	U	U	0.096	0.18	0.096	U	U	0.09	0.17	0.09	U	U	0.084	0.15	0.084	U	U
Dinitrobenzene, 1,3-	mg/kg	0.041	0.16	0.041	U	U	0.047	0.18	0.047	U	U	0.044	0.17	0.044	U	U	0.041	0.15	0.041	U	U
Dinitrotoluene, 2,4-	mg/kg	0.047	0.16	0.047	U	U	0.053	0.18	0.053	U	U	0.05	0.17	0.05	U	U	0.046	0.15	0.046	U	U
Dinitrotoluene, 2,6-	mg/kg	0.041	0.16	0.041	U	U	0.047	0.18	0.047	U	U	0.044	0.17	0.044	U	U	0.041	0.15	0.041	U	U
HMX	mg/kg	0.067	0.16	0.067	U	U	0.076	0.18	0.076	U	U	0.071	0.17	0.071	U	U	0.066	0.15	0.066	U	U
Nitrobenzene	mg/kg	0.051	0.16	0.051	U	U	0.058	0.18	0.058	U	U	0.055	0.17	0.055	U	U	0.051	0.15	0.051	U	U
Nitrotoluene, 2-	mg/kg	0.039	0.16	0.039	U	U	0.044	0.18	0.044	U	U	0.041	0.17	0.041	U	U	0.039	0.15	0.039	U	U
Nitrotoluene, 3-	mg/kg	0.065	0.16	0.065	U	U	0.074	0.18	0.074	U	U	0.07	0.17	0.07	U	U	0.065	0.15	0.065	U	U
Nitrotoluene, 4-	mg/kg	0.048	0.16	0.048	U	U	0.055	0.18	0.055	U	U	0.051	0.17	0.051	U	U	0.048	0.15	0.048	U	U
RDX	mg/kg	0.066	0.16	0.066	U	U	0.075	0.18	0.075	U	U	0.071	0.17	0.071	U	U	0.066	0.15	0.066	U	U
Tetryl	mg/kg	0.04	0.16	0.04	U	U	0.045	0.18	0.045	U	U	0.042	0.17	0.042	U	U	0.039	0.15	0.039	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.039	0.16	0.039	U	U	0.044	0.18	0.044	U	U	0.041	0.17	0.041	U	U	0.039	0.15	0.039	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.039	0.16	0.039	U	U	0.044	0.18	0.044	U	U	0.041	0.17	0.041	U	U	0.039	0.15	0.039	U	U
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg	0.011	0.022	0.011	U	U	0.012	0.024	0.012	U	U	0.01	0.021	0.01	U	U	0.013	0.026	0.013	U	U
Aroclor 1221	mg/kg	0.018	0.022	0.018	U	U	0.02	0.024	0.02	U	U	0.017	0.021	0.017	U	U	0.021	0.026	0.021	U	U
Aroclor 1232	mg/kg	0.018	0.022	0.018	U	U	0.02	0.024	0.02	U	U	0.017	0.021	0.017	U	U	0.021	0.026	0.021	U	U
Aroclor 1242	mg/kg	0.011	0.022	0.011	U	U	0.012	0.024	0.012	U	U	0.01	0.021	0.01	U	U	0.013	0.026	0.013	U	U
Aroclor 1248	mg/kg	0.011	0.022	0.011	U	U	0.012	0.024	0.012	U	U	0.01	0.021	0.01	U	U	0.013	0.026	0.013	U	U
Aroclor 1254	mg/kg	0.011	0.022	0.011	U	U	0.0513	0.024	0.012			0.184	0.021	0.01			0.093	0.026	0.013		
Aroclor 1260	mg/kg	0.011	0.022	0.011	U	U	0.012	0.024	0.012	U	U	0.01	0.021	0.01	U	U	0.013	0.026	0.013	U	U
WATER QUALITY																					
% Solids	Percent	75.2	0				68.3	0				80.6	0				63.6	0			

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
RL - Reporting limit.
VQ - Validation qualifier.

Table E-3

Sediment Data Used in the Screening-Level Ecological Risk Assessment
TNT Area A/Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		1SLA-SD05					1SLA-SD06					1SLA-SD06				
SAMPLE_NO		SL1004					SL1005					SL1006				
SAMPLE_DATE		30-Oct-09					30-Oct-09					30-Oct-09				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.039	0.16	0.039	U	U	0.043	0.17	0.043	U	U	0.044	0.18	0.044	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.086	0.16	0.086	U	U	0.093	0.17	0.093	U	U	0.097	0.18	0.097	U	U
Dinitrobenzene, 1,3-	mg/kg	0.042	0.16	0.042	U	U	0.045	0.17	0.045	U	U	0.047	0.18	0.047	U	U
Dinitrotoluene, 2,4-	mg/kg	0.047	0.16	0.047	U	U	0.051	0.17	0.051	U	U	0.053	0.18	0.053	U	U
Dinitrotoluene, 2,6-	mg/kg	0.042	0.16	0.042	U	U	0.045	0.17	0.045	U	U	0.047	0.18	0.047	U	U
HMX	mg/kg	0.068	0.16	0.068	U	U	0.074	0.17	0.074	U	U	0.076	0.18	0.076	U	U
Nitrobenzene	mg/kg	0.052	0.16	0.052	U	U	0.056	0.17	0.056	U	U	0.059	0.18	0.059	U	U
Nitrotoluene, 2-	mg/kg	0.039	0.16	0.039	U	U	0.043	0.17	0.043	U	U	0.044	0.18	0.044	U	U
Nitrotoluene, 3-	mg/kg	0.066	0.16	0.066	U	U	0.072	0.17	0.072	U	U	0.075	0.18	0.075	U	U
Nitrotoluene, 4-	mg/kg	0.049	0.16	0.049	U	U	0.053	0.17	0.053	U	U	0.055	0.18	0.055	U	U
RDX	mg/kg	0.067	0.16	0.067	U	U	0.073	0.17	0.073	U	U	0.076	0.18	0.076	U	U
Tetryl	mg/kg	0.04	0.16	0.04	U	U	0.044	0.17	0.044	U	U	0.045	0.18	0.045	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.039	0.16	0.039	U	U	0.043	0.17	0.043	U	U	0.044	0.18	0.044	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.039	0.16	0.039	U	U	0.043	0.17	0.043	U	U	0.044	0.18	0.044	U	U
PESTICIDES/PCBS																
Aroclor 1016	mg/kg	0.014	0.027	0.014	U	U	0.014	0.027	0.014	U	U	0.014	0.029	0.014	U	U
Aroclor 1221	mg/kg	0.022	0.027	0.022	U	U	0.022	0.027	0.022	U	U	0.023	0.029	0.023	U	U
Aroclor 1232	mg/kg	0.022	0.027	0.022	U	U	0.022	0.027	0.022	U	U	0.023	0.029	0.023	U	U
Aroclor 1242	mg/kg	0.014	0.027	0.014	U	U	0.014	0.027	0.014	U	U	0.014	0.029	0.014	U	U
Aroclor 1248	mg/kg	0.014	0.027	0.014	U	U	0.014	0.027	0.014	U	U	0.014	0.029	0.014	U	U
Aroclor 1254	mg/kg	0.215	0.027	0.014			0.0398	0.027	0.014			0.0419	0.029	0.014		
Aroclor 1260	mg/kg	0.014	0.027	0.014	U	U	0.014	0.027	0.014	U	U	0.014	0.029	0.014	U	U
WATER QUALITY																
% Solids	Percent	60.7	0				61.1	0				58.9	0			

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
RL - Reporting limit.
VQ - Validation qualifier.

RESPONSE TO COMMENTS

Response to Ohio Environmental Protection Agency Comments
Draft Baseline Human Health Risk Assessment (BHHRA) and
Draft Screening Level Ecological Risk Assessment (SLERA)
TNT Area A to Waste Water Treatment Plant 1 Sewer Lines
Plum Brook Ordnance Works, Sandusky, Ohio,
Dated February 16, 2012
FUDS Project No. G05OH001826

Comments from Janusz Byczkowski, Ph.D., Toxicologist, Ohio Environmental Protection Agency, Division of Emergency and Remedial Response, Columbus, Ohio, received April 30, 2012.

Comment 1: **BHHRA, Executive Summary, Page ES-1, Line 7; Page ES-2, Line 19, Section 2.4.3.1 Page 2-9, Line 26, etc., and SLERA Executive Summary, Page ES-1, Line 32, etc. These Documents state: In BHHRA: "…*agreements between the Ohio Environmental Protection Agency, the U.S. Army Corps of Engineers Nashville and Huntington Districts, and Shaw Environmental, Inc*…" and then: "…*Plum Brook Project Delivery Team agreement*…"Also in SLERA: "…*based on Plum Brook Project Delivery Team agreements, differs somewhat from the current Ohio Environmental Protection Agency guidance*…"**

The issue of "*agreements*" was already discussed in previous reviews. These Documents should be re-check for misstatements and errors. Please delete any statement claiming "agreement" between OEPA, and ACE or Shaw Environmental Inc. Please note that no legally binding agreement has been made with ACE or Shaw Environmental Inc., regarding risk assessment at the NASA Plum Brook Site. It is highly recommended that either the U.S. EPA RAGS part A or OEPA-DERR risk assessment methodology guidelines should be followed. Ohio EPA may (or may not) concur with the methodology that somewhat differs from OEPA-DERR guidance, based on scientifically sound reasoning and health protectiveness of the outcome, but not based on any informal "*agreement*". Statement regarding such an agreement should be deleted throughout the document, especially in the introductory paragraphs.

Response 1: It is the goal of the Project Delivery Team (PDT), including OEPA, NASA, USACE, and their contractors, to coordinate truly as a team. This includes reaching agreements during PDT meetings and teleconferences that are documented as part of meeting minutes, teleconference notes, and/or email correspondence. These agreements should not be regarded as "informal," as they have included review of the technical staff of all PDT members as appropriate. The PDT members have consistently abided by these PDT agreements and have not unilaterally revised them.

OEPA has requested in previous correspondence that where a specific PDT agreement differs from State guidance that the difference be noted and that the

PDT agreement be cited. This information was included in the TNTA/WWTP1 Sewer Lines BHHRA and SLERA for the agreements cited.

Please note that the RAGS Part A (U.S., Environmental Protection Agency [EPA], 1989), concentration/toxicity approach recommended by the reviewer is not recognized by the U.S. Army Corps of Engineers [USACE] (1999) nor by more recent EPA guidance (e.g., 2001a). This approach was provided as a suggestion in RAGS A prior to the development and of risk-based concentrations tables (EPA Region 3) and preliminary remediation goal tables (EPA Region 9) in the early 1990's, and their subsequent use for screening in baseline risk assessments. The RAGS A concentration/toxicity approach has numerous technical problems, including a lack of consideration for dermal uptake efficiencies, and the reliance on "relative toxicity" among chemicals rather than on predicted, conservative risk-based values at a given concentration (i.e., ILCR of 1E-6 or HQ of 0.1). USACE (1999) risk assessment guidance correctly states that "…it is imperative that these (health-based screening such as Region 9 PRGs and Region 3 RBCs) values be applied within the context that they were developed." (Please note that RSLs are currently used rather than RBCs or PRGs.) The RAGS A method suggests comparing media concentration values (e.g., mg/L) to dose rates (mg/kg-day) or dose-based risk rates $(mg/kg\text{-}day)^{-1}$, where the units and context are dissimilar. The use of dissimilar units is a generally discouraged practice, especially when the measurements goals (concentrations versus dose rates or dose-based risk rates) of these units are quite different. Using consistent units for maximum detected concentrations and human health risk-based screening concentrations is a current, widely accepted practice (e.g., EPA, 2008; 2001a; 1995) that has been used for two decades. In summary, the suggested RAGS A method is not current and is unreliable for screening, as it may identify "COPCs" that truly represent de minimis risk, and it may exclude COPCs that represent a potential human health risk or hazard using current human health risk assessment guidance.

Please note that the remainder of the reviewer's comments apply only to the BHHRA.

Comment 2: Section 2.4.1, _Page 2-6, line 27. This Document states: "…*OEPA (1999) stated that unadjusted tap water PRG values (i.e., HQ=1; ILCR = 1E-6) should be used for screening POBW surface water*…"

The issue of surface water screening was also discussed in prior reviews. The approach described in these documents is inconsistent with the previous reviewer's recommendation. Particularly, the obsolete reference: OEPA (1999) "*email correspondence between Lawrence Sirinek (OEPA Risk Assessor) and Paul Goetchius (Shaw Risk Assessor), March 5*", does not describe currently used methodology (e.g., the PRG values developed by U.S. EPA Region 9 have been since archived and replaced by the harmonized U.S. EPA Regions 3,6,9 RSL values). Please note, that surface water also have to meet the Lake Erie Basin surface water criteria and screening values, developed pursuant to Chapters 3745-1 and 3745-2 of the Ohio Administrative Code http://epa.ohio.gov/dsw/rules/effectiverules.aspx . As recommended before: in baseline risk assessment, please follow either the U.S. EPA RAGS part A or OEPA-DERR technical guidelines.

Response 2: First, because each of the chemicals analyzed (i.e., nitroaromatics) in TNTA/WWTP1 sewer lines surface water was a nondetect, this comment is a moot point for surface water in the BHHRA. It is agreed that Lake Erie Basin Human Health nondrinking values are used to screen surface water at PBOW. The last sentence of the first paragraph on Page 2-7 will be revised with text that is consistent with the following: "*The surface water RBSCs will be checked against the Lake Erie Basin Tier I and Tier II Nondrinking Values for Human Health. If Lake Erie Basin Human Health value is less than the RSL-based value, then the Lake Erie Basin value will be used as the RBSC.*" Please note that this practice has been followed in past PBOW risk assessments but that the RSL-based values are less than the Lake Erie Basin values for the chemicals detected in PBOW surface water.

The fact that RSLs have replaced Region 9 PRGs, Region 6 HHMSSLs, and Region 3 RBCs as the screening values of choice is documented by the various EPA regions and states which had previously used these former screening values. Use of the new screening values does not in any way change their implementation into risk-based screening, nor the technical basis for a specific hazard quotient level to screen a specific medium. Please note that the EPA Region 4 (2012) Web site states that RSLs replace PRGs for screening. This same Region 4 Web site also lists the Region's RAGS Supplemental HHRA guidance (EPA, 2001b), which includes the use of PRGs, as current guidance. This listing indicates that EPA Region 4 does not consider replacement of PRGs with RSLs as a basis to otherwise change their screening protocol and/or to re-issue their screening guidance. EPA Region 3 (2008) states the following concerning the replacement of RBCs with RSLs: "The Regional Screening table is generally used in the same manner as the Region III RBC Table. Except where noted above, the same national and regional guidance, the same uncertainties and limitations, and the same basic intended uses apply to this update as to previous versions of the Region III RBC Table. It is Region III's general expectation that the Fall 2008 Regional Screening table essentially serves as the Fall 2008 update to the Region III RBC table." It is clear that EPA does not equate a change in screening values with a change in screening protocol. Similarly, the referenced PDT agreement (OEPA, 1999) is not invalidated by a change in screening values.

Comment 3: **Section 4.1, Page 4-2, lines 6 to 31. This Document states: "…*Although […] most human studies have one or more of the following limitations*…" A critic of the carcinogenicity data and/or a list of limitations in the development of carcinogenic slope factors do not belong in the Section 4 "*Toxicity Evaluation*". This information may be re-used in Section 6, in order to discuss uncertainty. Please remove the last sentence of the first paragraph and the following bullets from Page 4-2 and reuse them in the Section 6 "*Uncertainty Analysis*".**

Response 3: The requested text will be removed from the BHHRA. This discussion is a summary of information contained in Sections 7.1 and 7.3 of the EPA (1989) RAGS A guidance that describes considerations of the use of human studies and animal studies in deriving toxicity values. It was included to provide a context so that the readers may gain some understanding as to when human studies and when animal studies are selected as the basis for the slope factor. This text was not intended as a criticism, neither was it included to cast uncertainty on verified slope factor values.

We appreciate the suggestion to include this text in the uncertainty analysis. However, the statements in Section 6.2.6 are regarded as sufficient to express general uncertainties concerning slope factor derivation, especially as no chemical-specific toxicological uncertainties are indentified in the TNTA/WWTP1 BHHRA sewer lines uncertainty analysis.

Comment 4: **Section 5.3.5, Page 5-11, Line 1. This Document states: "…*If the bedrock groundwater use is appropriately excluded, the ILCR for the resident is 2E-5*…" In the residential scenario, an unrestricted land use should be assumed. It includes digging/drilling, using ground water - in addition to the potable purpose – also to water plants/vegetable, to fill up basins/swimming pools, etc. Excluding the bedrock groundwater from BHHRA exposure scenario would necessitate a deed restriction preventing drilling – and thus, restricting the land use. Risk and health hazards associated with any (even hypothetical) groundwater use under unrestricted scenario may be important to risk managers and should not be excluded from BHHRA. Please do not exclude bedrock groundwater use under the unrestricted land use scenario.**

Response 4: This sentence will be revised consistent with the following: "If *use of* the bedrock groundwater is ~~appropriately~~ excluded *from this receptor in recognition that virtually all cancer risks associated with this medium result from naturally occurring constituents,* the ILCR for the resident is 2E-5 (Table 5-2)."

The BHHRA addresses residential risks associated with all pathways including bedrock groundwater use, all pathways including overburden groundwater use, and all pathways excluding groundwater use. The reasons for excluding groundwater use in the latter evaluation are: 1) Naturally poor groundwater quality that is associated with the presence of petroleum hydrocarbons and hydrogen sulfide gas, and 2) low groundwater yield. This poor quality makes future use of the groundwater questionable. Further, even if the groundwater were to be used, the unacceptable cancer risks incurred would not be due to DOD-related contamination.

Given these circumstances, it is best to include all scenarios with respect to groundwater so that risk managers have the most complete risk-related information to factor into their decisions, which may include issues other than risk. Discussions such as the possible need for deed restrictions may be considered by risks managers, but these risk management issues are not typically included in a BHHRA.

Comment 5: **Table 2-2. This Document states: *"…Vanadium…Range of Detected Concentrations 9 – 40.9 …Range of Reporting Limits 61.7 – 61.7… Background Screening Criterion 40.9…"* There are still unexplained (and unresolved) issues regarding the background concentrations, calculated by the method that *"…differs somewhat from the current Ohio Environmental Protection Agency guidance…"* (see: comment #1, above). Even though this issue was commented and discussed before, it is still difficult to understand, for example, how the analytical method with the reporting limit listed as 61.7 mg/kg can quantify vanadium concentrations between 9 and 40.9 mg/kg to yield a background screening criterion (=MDC) of 40.9 mg/kg. Please explain issues regarding the determination of background concentrations.**

Response 5: After reviewing Table 2-2, we found that the reporting limit ranges that are shown include only those of the nondetects. This omission will be corrected for all inorganics that are affected in the final BHHRA.

For vanadium, the lowest reporting limit was 6.0 mg/kg, which is less than all of the detections of vanadium. All of the other vanadium reporting limits, other than for the nondetect shown in Table 2-2 were between 6.0 and 9.0 mg/kg, which is the lowest detected level. The lone nondetect had an elevated reporting limit of 61.7 mg/kg reflects the 10X dilution that had to be performed because of a matrix interference. Please note that the maximum detected vanadium concentrations in TNT/WWTP1 sewer lines surface soil (26.3 mg/kg) and subsurface soil, (27.0 mg/kg) are less than both the RBSC (39.0 mg/kg) and BSC (40.9 mg/kg). Therefore, vanadium was correctly screened out as a non-COPC in soil.

References Used in these Responses

Ohio Environmental Protection Agency (OEPA), 1999, email correspondence between Lawrence Sirinek (OEPA Risk Assessor) and Paul Goetchius (Shaw Risk Assessor), March 5.

U.S. Army Corps of Engineers (USACE), 1999, ***Risk Assessment Handbook, Volume I: Human Health Evaluation***, Engineer Manual EM 200-1-4, January 31.

U.S. Environmental Protection Agency (EPA), 2012, *Technical Services – Risk Assessment and Hydrology*, Region 4, Atlanta, Georgia, online at http://epa.gov/region4/superfund/programs/riskassess/riskassess.html.

U.S. Environmental Protection Agency (EPA), 2008, "Risk-Based Concentration Table." Memorandum from J. Hubbard (Region 3 Toxicologist) to All RBC Table Users, Region 3, Philadelphia, Pennsylvania, September 11.

U.S. Environmental Protection Agency (EPA), 2001a, ***Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and***

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