FINAL

AMENDED REMEDIAL INVESTIGATION / FEASIBILITY STUDY REPORT FOR FTMM-57 – BUILDING 108 UST GASOLINE RELEASE

FORT MONMOUTH, OCEANPORT, MONMOUTH COUNTY, NEW JERSEY

BRAC 05 Facility
Contract W912DY-09-D-0062
Task Order: 0012, Project No. 369857

Submitted To:

U.S. Corps of Engineers, New York District

and

U.S. Army Engineering and Support Center

Huntsville, Alabama

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New Jersey Department of Environmental Protection
Site Remediation Program

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Document:

- "Amended Remedial Investigation/Feasibility Study Report for FTMM-57 - Building 108 UST Gasoline Release, Fort Monmouth, Oceanport, Monmouth County, New Jersey" (September 2020)

PERSON RESPONSIBLE FOR CONDUCTING THE REMEDIATION INFORMATION AND CERTIFICATION

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This certification shall be signed by the person responsible for conducting the remediation who is submitting this notification in accordance with Administrative Requirements for the Remediation of Contaminated Sites rule at N.J.A.C. 7:26C-1.5(a).

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein, including all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, to the best of my knowledge, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.

Signature: William R Colvin Date: 14 September 2020

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List of Acronyms

ACRONYM	DEFINITION
µg/L	micrograms per liter
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BRAC	Base Realignment and Closure
CAFRA	Costal Area Facility Review Act
CECOM	Communications and Electronics Command
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
COPC	constituent of potential concern
CSM	conceptual site model
DER	Declaration of Environmental Restriction
DERP	Defense Environmental Restoration Program
EC	engineering control
ECP	Environmental Condition of Property
ft	feet or foot
FHACA	Flood Hazard Area Control Act
FTMM	Fort Monmouth
GRA	general response action
GWQC	Ground Water Quality Criteria
HASP	health and safety plan
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IC	institutional control
IGW	Impact to Ground Water
IRP	Installation Restoration Program
LUC	land use controls
LUCIP	Land Use Control Implementation Plan
mg/kg	milligrams per kilogram
MP	Main Post
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
N.J.S.A.	New Jersey Statutes Annotated
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standard
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PPE	personal protective equipment
RACR	Remedial Action Completion Report
RAO	remedial action objective

ACRONYM	DEFINITION
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RDCSRS	Residential Direct Contact Soil Remediation Standard
RI	remedial investigation
RI/FS	Remedial Investigation/Feasibility Study
RSL	Regional Screening Levels
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SL	screening level
SRA	specific response action
SVOC	semivolatile organic compound
TBC	to be considered
THQ	Target Hazard Quotient
TO	task order
TPH	total petroleum hydrocarbon
TPV	total present value
TR	Target Risk
UCL	upper confidence limit
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
VOCs	volatile organic compounds
WERS	Worldwide Environmental Restoration Services

EXECUTIVE SUMMARY

The U.S. Army (Army) Base Realignment and Closure Division (BRAC) is responsible for compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at the former Fort Monmouth Army Installation (FTMM). The United States Army Corps of Engineers (USACE) is executing the FTMM Installation Restoration Program (IRP) to meet the Army's obligations under CERCLA. USACE's prime contractor, Parsons Government Services, Inc. (Parsons), was tasked to prepare this Amended Remedial Investigation (RI)/Feasibility Study (FS) Report for IRP Site FTMM-57 (Building 108 Underground Storage Tank (UST) Gasoline Release). The gasoline release was discovered in 1993. However, since that time other FTMM-57 environmental issues have emerged that are not attributable to the UST release. An RI for FTMM-57 was completed by Versar in 2004. To update and complete the Remedial Investigation, this report summarizes relevant information from previous field investigations beginning in 1993 and presents the results from the most recent field investigations. This report also includes a Feasibility Study to perform a detailed analysis of potential remedial alternatives to provide decision-makers the information needed to select the most appropriate remedial alternative for FTMM-57.

E.1 Site Description

FTMM is located in Oceanport, Monmouth County, New Jersey. FTMM-57 is located north of Building 488, east of Building 484, and near former Building 108 within the 400 Area of former FTMM. It is surrounded by Parcel 83 except along the eastern side where it aligns with the FTMM property boundary. Concrete and asphalt pavement covers most of the parcel while less than 30 percent consists of unpaved grass or shrub areas. The site is currently unoccupied. Future land use is planned to be open space, park land, or recreational use.

E.2 Soil Sampling Results

Soil samples were collected in 1993, 2001, 2010, 2016, and 2017 and compared to U.S. Environmental Protection Agency (USEPA) and New Jersey Department of Environmental Protection (NJDEP) criteria. Both residential and non-residential criteria were used to provide context in consideration of potential future land use.

Constituents of potential concern (COPCs) in soil included volatile organic compounds (VOCs: benzene, ethylbenzene, *meta/para*-xylene, and ortho xylene), polycyclic aromatic hydrocarbons (PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, and naphthalene), and one metal (arsenic).

E.3 Groundwater Sampling Results

The results of the groundwater monitoring data collected from 2007 to 2015 were evaluated for this Amended RI. Groundwater concentrations were compared to NJDEP Ground Water Quality Criteria (GWQC) and USEPA Tap Water Regional Screening Levels (RSLs).

The analytes that were selected as COPCs in groundwater include antimony, arsenic, cobalt, manganese, and vanadium. The maximum detected concentrations of antimony, arsenic, cobalt, and vanadium in groundwater did not exceed the maximum background concentration reported by Weston (1995). Manganese slightly exceeded the background concentration in one sample and could be attributed to background conditions at the site.

E.4 Human Health Risk Assessment

An evaluation of the potential risk resulting from human exposure to contaminants in soil and groundwater was conducted as part of this Amended RI (**Appendix F**). This human health risk assessment (HHRA) evaluated the exposure of current and/or future unlimited use and unrestricted

exposure (UU/UE) receptors (the scenario protective of residential users), outdoor workers, utility workers, and recreational users to COPCs in soil through dermal contact, incidental ingestion, and inhalation of particulates. The HHRA evaluated the exposure of current and/or future UU/UE receptors and utility workers to COPCs in groundwater through ingestion as potable water (UU/UE receptors only), dermal contact, and incidental ingestion.

The HHRA concluded that unacceptable risks to human health from arsenic in soil from a variety of potential sources (Section 4.1.3.3) are present for the UU/UE receptors. The HHRA estimated an unacceptable risk/hazard to human health from arsenic in groundwater. However, the risk assessment concluded that the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic.

E.5 Remedial Investigation Conclusions

The HHRA concluded that there is no unacceptable risk to human health from VOCs or PAHs in soil. Therefore, the Army has determined that no further action (NFA) with regard to VOCs or PAHs in soil is warranted under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The HHRA concluded that there is an unacceptable risk to human health attributable to anthropogenic sources of arsenic in soil. Potential sources of arsenic in soil may include historic fill, properly applied pesticides, or naturally occurring glauconitic soils. There were no exceedances of the NJDEP comparison criteria for VOCs in the recent soil samples at FTMM-57, however, multiple PAHs in soil exceeded these criteria.

NJDEP supported the NFA decision for groundwater in 2016 (**Appendix B, Correspondence 2**). To be CERCLA compliant, the HHRA also evaluated groundwater and concluded that there is an unacceptable risk to human health from arsenic in groundwater. However, the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic and therefore no further action is needed for groundwater. Note that onsite groundwater is not currently used as a potable drinking water source.

E.6 Feasibility Study

Four alternatives were evaluated in the FS:

Alternative 1: No Action
Alternative 2: Land Use Controls
Alternative 3: Containment via Asphalt Capping with Alternative 2
Alternative 4: Source Removal via Direct Excavation and Backfill

Based on the analyses of remedial alternatives conducted in this FS, a proposed plan should be developed to recommend a preferred alternative for implementation. This preferred alternative should be the alternative that best meets the nine CERCLA criteria.

1.0 INTRODUCTION

The U. S. Army Base Realignment and Closure Division is responsible for compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at the former Fort Monmouth Army Installation. Parsons Government Services, Inc. (Parsons) is the prime contractor to the United States Army Corps of Engineers, New York District and the United States Army Engineering and Support Center, Huntsville (CEHNC) for preparation of Remedial Investigation (RI) or RI/Feasibility Study (RI/FS) reports as part of the U.S. Army's obligations under CERCLA and the Defense Environmental Restoration Program (DERP) for cleanup at former Fort Monmouth (FTMM) in Oceanport, Monmouth County, New Jersey. This project is being performed under task order (TO) 0012 issued under the Worldwide Environmental Restoration Services (WERS) contract number W912DY-09-D-0062 to support the US Army Corps of Engineers New York District and its customer G9.

The Army conducted this Amended RI/FS in accordance with its delegated authority under Executive Order 12580, as amended, to carry out the federal government's environmental obligations under CERCLA of 1980 (42 U.S.C. 9601 et. seq.). FTMM is not on the National Priorities List and the Army's environmental response is in accordance with the DERP (10 U.S.C. 2701), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 Code of Federal Regulations [CFR] Part 300). All environmental investigations and responses have been coordinated with the state of New Jersey, Department of Environmental Protection (NJDEP), as required by §121(f) of CERCLA and 40 CFR 300.500.

1.1 Purpose and Scope of the Amended Remedial Investigation/Feasibility Study

The purpose of this report is to characterize the nature and extent of contamination at the site, discuss contaminant fate and transport, assess the risk to human health and the environment, and develop and evaluate effective remedial alternatives (40 CFR 300.430(d)). This report summarizes relevant information from previous investigations and presents the results from the most recent field investigations for FTMM-57. The findings from the field investigations were incorporated into a revised baseline risk assessment (40 CFR 300.430(d)(4)). In addition, a conceptual site model (CSM) is presented which incorporates all relevant information from the current and previous investigations including physical site characteristics, nature and extent of contamination, contaminant fate and transport, and potential receptors.

1.2 Site Background

The Main Post (MP) of FTMM was established in 1917 as Camp Little Silver. The name of the Camp was changed shortly thereafter to Camp Alfred Vail. The initial mission of the Camp was to train Signal Corps operators for service in World War I. After the war, Camp Alfred Vail was designated as the site of the Signal Corps School. In 1925, the facility became a permanent post, and its name was changed to Fort Monmouth. The primary mission of FTMM was to provide command, administrative, and logistical support for Headquarters, U.S. Fort Monmouth Communications and Electronics Command (CECOM) (Shaw, 2012).

Installation Restoration Program Site FTMM-57 (FTMM-57) is located on the eastern edge of the Main Post near existing Buildings 484 and 488 (**Figure 1**) and is the site of an Underground Storage Tank (UST) Gasoline Release. FTMM-57 has also been designated as Site 108 based on proximity to the former Building T-108 Motor Pool Office (**Figure 1**), which was demolished between 1994 and 2004. FTMM-57 is surrounded by Parcel 83 except along the eastern side where it aligns with the property boundary of the former FTMM (**Figures 1** and **2**). Real property records indicate that four gasoline tanks and one kerosene tank with associated pump islands were installed at this location in 1952 and refer to this same area as the Building 109 motor pool gasoline and kerosene service station. Based on historical drawings, gasoline tanks and pump islands were present at this location as early as 1941.

1.3 Previous Investigations

FTMM-57 was initially identified as an Installation Restoration Program (IRP) site based on a UST gasoline release discovered in 1993. However, since that time other FTMM-57 environmental issues have emerged that are not attributable to the UST release, as described below. Therefore, a summary of previous investigations at FTMM-57 is provided in this section, while additional details concerning the USTs are presented in **Appendix A**, which culminates in a request for NJDEP concurrence that no further action (NFA) determinations are appropriate for these USTs.

Five USTs were removed from the FTMM-57 site in April 1993 along with approximately 221 cubic yards of potentially contaminated soil. Post-excavation soil samples were collected from the area of the former USTs, fuel dispenser area, and below ground piping. These samples were collected from the sidewalls of the excavation above the groundwater for volatile organic compound (VOC), semivolatile organic compound (SVOC), lead, and total petroleum hydrocarbon (TPH) analyses; analytical results were presented in the Underground Storage Tank Closure and Site Investigation Report, Building 108 (Weston, 1994; included in **Appendix C**). Multiple analytes exceeded the September 2017 NJDEP Residential Direct Contact Soil Remediation Standards (RDCSRS) in one or more of the 1993 closure soil samples:

- Benzene exceeded the RDCSRS of 2.0 milligrams per kilogram (mg/kg) in two soil samples: S-7 at 4.0 mg/kg, and S-17 at 2.5 mg/kg.
- Polynuclear aromatic hydrocarbons (PAHs) exceeded their respective RDCSRSs: benzo(a)pyrene at S-3 (1.8 mg/kg), S-5 (0.63 mg/kg), S-6 (1.1 mg/kg), S-14 (1.3 mg/kg), and S-19 (3.3 mg/kg); benzo(b)fluoranthene at S-19 (5.3 mg/kg); and dibenz(a,h)anthracene at S-19 (0.97 mg/kg).

In accordance with Table 2-1 of NJAC 7:26E, PAHs are not associated with gasoline, and only naphthalene and 2-methylnaphthalene are associated with kerosene releases. Therefore, most of the PAHs detected in the UST closure soil samples are not attributed to a release from the former fuel USTs. Sources of PAHs could be asphalt pavement, fill material, or the nearby railroad tracks to the northeast. Another possible ubiquitous anthropogenic source includes deposition of airborne PAHs resulting from fossil fuel combustion. Although not attributed to these USTs, PAHs are addressed further in the evaluation of FTMM-57 in Section 4 of this report.

Four monitoring wells were subsequently installed between September 1993 and August 1995 as part of the UST closures. Quarterly groundwater monitoring for a full suite of analytes including VOCs, SVOCs, pesticides, and metals was performed from 1997 through 2004. Exceedances of the Groundwater Quality Criteria (GWQC) for arsenic were noted; however, arsenic is not attributed to a release from the former fuel USTs. In 2004, NJDEP agreed with the decision to reduce the groundwater monitoring to metals only. Quarterly monitoring ceased in 2011 following FTMM closure. Annual monitoring resumed from 2013 through 2015 (Parsons, 2015a) and, on 14 November 2016, NJDEP agreed no further action was required for groundwater at FTMM-57 (**Appendix B, Correspondence 2**).

A Remedial Investigation (RI) for FTMM-57 was completed by Versar (2004; excerpts included in **Appendix C**) which evaluated the arsenic occurrences in soil and groundwater. NJDEP provided review comments on the RI report on 24 June 2008 (**Appendix B, Correspondence 5**) which included a recommendation for additional evaluation of benzene in groundwater. In response to these NJDEP comments, the Army conducted additional soil and groundwater sampling in 2010 using 12 Geoprobe borings (BL-1 through BL-12; see **Figure 2** and **Appendix C**). Temporary wells were installed at sample locations BL-5, BL-7, and BL-12 (**Figure 2**) and groundwater was sampled for VOCs analyses; no VOCs were detected (**Appendix C**). However multiple PAHs were detected in soil at concentrations in excess of the then-current RDCSRS in the 2010 borings (**Appendix C**). As described above and in Section 4.1.2.3, the PAHs are not attributed to a release from the former fuel USTs.

1.4 Report Organization

This report is organized in a manner consistent with USEPA guidance for conducting remedial investigations and feasibility studies under CERCLA (USEPA, 1988).

- Chapter 2 describes the sources of data for this Amended RI.
- Chapter 3 describes the physical characteristics of the site.
- Chapter 4 describes the nature and extent of contaminants identified during the field investigations.
- Chapter 5 discusses the fate and transport of contaminants at the site.
- Chapter 6 summarizes the baseline human health and environmental risk assessments.
- Chapter 7 provides a summary and conclusions of the Amended RI.
- Chapter 8 presents the remedial action objectives (RAOs), the Applicable or Relevant and Appropriate Requirements (ARARs), and the site-specific remediation level.
- Chapter 9 identifies and screens response actions.
- Chapter 10 describes the remedial alternatives.
- Chapter 11 compares the remedial alternatives.
- Chapter 12 provides the conclusions of the FS.

2.0 AMENDED REMEDIAL INVESTIGATION

As described in Section 1.1, the overall objectives of this Amended RI Report are to provide an overview of previous investigations (including UST closures and site assessments; see **Appendix A**), to characterize the nature and extent of site-related contamination in soil and groundwater, and to evaluate the potential risk to human health and the environment.

This Amended RI Report is based on data collected in May 1993 through the most recent sampling event completed in 2017. The 2017 soil sampling was performed to characterize the extent of benzene, arsenic, and PAHs in soil. Proposed activities were documented in a letter work plan (Department of the Army, 2017) to which NJDEP concurred. (**Appendix B, Correspondence 1**). The data from the most recent sampling event is combined with soil and groundwater data from previous investigations (Weston, 1994; Versar, 2004; excerpts included in **Appendix C**) and presented in Sections 3 and 4 to meet the objectives of this Amended RI.

3.0 PHYSICAL CHARACTERISTICS OF THE SITE

3.1 Site Land Use

FTMM-57 is located north of Building 488, east of Building 484, and near former Building 108. It is surrounded by Parcel 83 except along the eastern side where it coincides with the property boundary of the former FTMM (**Figures 1** and **2**). Concrete and asphalt pavement covers most of the parcel and a relatively small portion of the parcel (less than 30 percent) consists of unpaved grass or shrub areas. The site is currently unoccupied. Future land use may be designated as open space, park land, or recreational use according to the Fort Monmouth Economic Revitalization Authority Land Use Rules (N.J.A.C. 19:31C-3 - Effective Date July 15, 2013).

3.2 Site Geology and Hydrogeology

The soil at FTMM-57 consists primarily of sand with some silt to approximately six ft below ground surface (bgs). In some borings, deeper soils below six ft bgs consist of olive green sandy clays, indicating glauconitic materials. Soil boring logs from the 2017 investigation are provided in **Appendix D**. The depth to groundwater at FTMM-57 ranged from approximately 3.6 to 8.8 ft bgs during the most recent groundwater monitoring event in October 2015. Groundwater flows southeast towards a ditch that discharges into Oceanport Creek (**Figure 3**).

Versar (2004; excerpts included in **Appendix C**) reported that the lithology at FTMM-57 consisted of fill and native material, and the fill encountered was comprised of brown sand, silt, cobbles and a trace of cinders. The native material observed at FTMM-57 consisted of greenish gray to black clay with sand and was consistent with the Shrewsbury member of the Red Bank Formation.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 Soil

The following data comprise the RI soil results for FTMM-57 as shown in **Table 1**:

- 1993 soil data collected as part of UST closure sampling;
- 2001 soil data collected for the earlier RI (Versar, 2004);
- 2010 soil data collected in response to NJDEP comments on the earlier RI; and
- 2016 and 2017 results of the field investigations performed by Parsons for adjacent Parcel 83 and UST 482, and for FTMM-57.

Sample locations are shown on **Figure 2**.

Soil boring logs for the 2017 FTMM-57 sampling are included in **Appendix D**. Laboratory analytical reports for the 2017 FTMM-57 samples are included on cd only in **Appendix E**. Laboratory analytical results for soil were compared to U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) (USEPA, 2017). Soil analytical results were also compared to NJDEP RDCSRS, Non-Residential Direct Contact Soil Remediation Standards (NRDCSRS), and Impact to Ground Water (IGW) screening levels (SLs) (N.J.A.C. 7:26D, 2017). Analytical results for petroleum constituents were compared to applicable NJDEP criteria in accordance with guidance for gasoline and kerosene petroleum hydrocarbon mixtures (Table 2-1 of N.J.A.C. 7:26E, 2012); no comparable federal criteria were available.

Tables 2 and **3** show the soil sampling results for detected analytes as well as the selected USEPA (**Table 2**) and NJDEP (**Table 3**) comparison criteria. Both residential and non-residential criteria were used to provide context in consideration of potential future land use.

4.1.1 Soil Results for VOCs

During UST closure in 1993, 18 soil samples were analyzed for VOCs. Benzene exceeded the RDCSRS of 2.0 mg/kg in two soil samples: S-7 at 4.0 mg/kg, and S-17 at 2.5 mg/kg. The locations of the 1993 post-excavation soil samples S-7 and S-17 were re-sampled to evaluate site soils that previously (1993) exceeded the September 2017 RDCSRS for benzene. Two soil borings (FTMM-57-SB-01 and FTMM-57-SB-02) were advanced on 13 November 2017 and three soil samples per boring were collected from the former UST area and analyzed for VOCs. Additionally, two samples associated with adjacent Parcel 83 but within the FTMM-57 boundary were analyzed for VOCs in 2016. Soil sampling results were compared to USEPA RSLs in **Table 2** and to NJDEP criteria in **Table 3**, and results of the comparison to the USEPA RSLs are shown on **Figure 4** and to NJDEP criteria on **Figure 5**.

4.1.1.1 VOC Exceedances of Comparison Criteria

As described in Section 4.1.1, concentrations of benzene in soil sampled in 1993 exceeded the current USEPA Residential RSLs (and NJDEP RDCSRS) in two locations. VOC exceedances of the current USEPA Residential RSL or the NJDEP RDCSRS ranged in depth from 6 to 7 ft bgs. However, there were no exceedances of the RSLs, RDCSRS, or IGW criteria in the 2017 soil samples at FTMM-57, and benzene was not detected in these soil samples (**Tables 2 and 3**) indicating that benzene is no longer present in FTMM-57 soils.

Concentrations of the following VOCs exceeded their current NJDEP IGW SL in at least one of the soil samples collected in 1993, 2016, and 2017 (**Tables 2, 3, and 4**): benzene, chloroform, ethylbenzene, isopropylbenzene, *meta/para*-xylene, methylene chloride, n-butylbenzene, ortho xylene, propylbenzene, sec-butylbenzene, and toluene. However, none of these VOCs were detected in FTMM-57 groundwater samples.

4.1.1.2 VOC Constituents of Potential Concern (COPCs)

VOC COPCs in soil were identified by comparing the maximum detected concentration of each analyte to the USEPA Residential RSL (TR = 1 x 10^{-6} and THQ = 0.1) as detailed in the Risk Assessment Work Plan (Parsons, 2015b). Results that are B flagged were considered not-detected as detailed in the Risk Assessment Work Plan (Parsons, 2015b). Although there were no exceedances of the RSLs in the 2017 soil samples at FTMM-57, there were exceedances from previous sampling in locations that were not re-sampled in 2017; therefore, there are VOC COPCs. The VOC COPCs in soil at FTMM-57 include (**Table 4**): benzene, ethylbenzene, *meta/para*-xylene, and ortho xylene. COPCs were evaluated in the Human Health Risk Assessment (HHRA) in **Appendix F** and results are summarized in Section 6.

4.1.1.3 Potential Sources of VOCs in Soil

Gasoline tanks and pump islands were present at this location as early as 1941 based on historical drawings. The FTMM-57 gasoline, diesel, and kerosene USTs were removed in 1993, and a release at the kerosene UST was noted during closure (Section 3). The VOC COPCs identified in soil are hydrocarbons that are commonly associated with kerosene, gasoline, and diesel fuels. Therefore, the fuel USTs and dispensers were likely the source of the VOC COPCs in soil.

4.1.2 Soil Results for PAHs

During UST closure in 1993, 18 soil samples were analyzed for PAHs. In 2010, 10 more soil samples were analyzed for PAHs. During the 2017 field investigation, samples from the two FTMM-57 borings were analyzed for PAHs (including naphthalene and 2-methylnaphthalene in accordance with the N.J.A.C. [2012; **Table 2-1**] requirements for kerosene). Additionally, six samples associated with adjacent Parcel 83 and UST 482 but within the FTMM-57 boundary were analyzed for PAHs in 2016 and 2017.

Soil sampling results for PAHs were compared to current USEPA RSLs in **Table 2** and to September 2017 NJDEP criteria in **Table 3**. The results of the comparison to USEPA RSLs are shown on **Figure 6** and to the 2017 NJDEP criteria on **Figure 7**.

It should be noted that the USEPA RSLs for PAHs were updated in June 2017, and the updated toxicity criteria resulted in higher (less stringent) screening levels. Therefore, some exceedances identified in reports prior to 2017 are no longer exceedances of the updated USEPA RSLs and those past exceedances were not evaluated as part of the HHRA. Similarly, in September 2017 the NJDEP revised the RDCSRS and NRDCSRS for the carcinogenic PAHs, and the updated toxicity criteria resulted in higher (less stringent) cleanup levels. Therefore, some exceedances identified in reports prior to 2017 are no longer exceedances of the updated NJDEP RDCSRS criteria.

4.1.2.1 PAH Exceedances of Comparison Criteria

Concentrations of the following PAHs exceeded their current USEPA Residential RSL and/or NJDEP RDCSRS in at least one of the soil samples (**Tables 2, 3, and 4**): benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene. PAH exceedances of the current USEPA Residential RSL or the NJDEP RDCSRS ranged in depth from 0.5 to 6 ft bgs.

Concentrations of the following PAHs and other SVOCs exceeded their current USEPA Groundwater Protection RSL and/or NJDEP IGW SL in at least one of the soil samples (**Tables 2, 3, and 4**): acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, and pyrene.

NJDEP RDCSRS PAH exceedances in soil were bounded by the FTMM-57 and installation border to the northeast, and by borings from adjacent Parcel 83 beyond the FTMM-57 border in other directions (**Figure 7**). PAHs in soil have not been delineated vertically at all locations within FTMM-57; however, the deepest exceedance was present at 6 ft bgs in sample S-5, which was bounded vertically by the 8.5 ft bgs samples in nearby borings FTMM-57-SB-01 and FTMM-57-SB-02 (**Table 3**).

4.1.2.2 PAH COPCs

PAH COPCs in soil were identified by comparing the maximum detected concentration of each analyte to the USEPA Residential RSL (TR = 1 x 10^{-6} and THQ = 0.1) as detailed in the Risk Assessment Work Plan (Parsons, 2015b). Results that are B flagged were considered not-detected as detailed in the Risk Assessment Work Plan (Parsons, 2015b). The PAHs that exceeded the USEPA Residential RSL in soil at FTMM-57 include (**Table 4**): benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene.

1-methylnaphthalene is detected in only two borings (PAR-83-SB-12 and PAR-83-SB-14) which are both near the boundary of FTMM-57 and are associated with adjacent Parcel 83 and UST 482. 1-Methylnaphthalene was only detected once (31 mg/kg) at a concentration greater than the USEPA Residential RSL (18 mg/kg) at PAR-83-SB-12. Since this analyte is a likely fuel oil constituent, it is associated with adjacent UST 482, which was addressed under separate cover (Department of the Army, 2018). Therefore, 1-methylnaphthalene was not selected as a COPC in soil at FTMM-57.

The PAH COPCs in soil at FTMM-57 include: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, and naphthalene. COPCs were evaluated in the HHRA in **Appendix F** and results are summarized in Section 6.

4.1.2.3 Potential Sources of PAHs in Soil

Soil at FTMM-57 exceeded the RDCSRS for multiple PAHs; however, most of these PAH analytes are not commonly associated with gasoline, diesel, and kerosene fuels, and therefore were not attributed to the former FTMM-57 fueling station. Instead, detected PAHs were generally ubiquitous across FTMM-57. Sources of PAHs could be asphalt pavement, fill material, or the nearby railroad tracks to the northeast. Another possible ubiquitous anthropogenic source includes deposition of airborne PAHs resulting from fossil fuel combustion. Due to the occurrence of PAHs in soil at depths to 6.5 ft bgs, fill material is a plausible source of PAHs in FTMM-57 soil.

The COPCs 2-methylnaphthalene and naphthalene are commonly associated with hydrocarbon fuels, and so are likely related to gasoline, diesel, and kerosene tanks and dispensers that were present at this location as early as 1941 based on historical drawings. All FTMM-57 USTs and dispensers were removed in 1993 (Section 3).

4.1.3 Soil Results for Metals

During UST closure in 1993, 18 soil samples were analyzed for lead because lead is the only metal related to hydrocarbon releases from the former gasoline, diesel, and kerosene fuel USTs. In 2001, 9 more soil borings were analyzed for lead and arsenic based on elevated lead and arsenic in groundwater monitoring results. Therefore, lead and arsenic are the only metals analyzed for in soil. During the 2017 field investigation, the two FTMM-57 borings were analyzed for arsenic to further delineate arsenic in soil. Lead was not analyzed for in 2017 because previous lead detections did not exceed screening criteria. Additional samples associated with adjacent Parcel 83 and UST 482 but within the FTMM-57 boundary were also analyzed for lead and arsenic in 2016 (2 samples), and for arsenic in 2017 (4 samples).

Analytical results for lead and arsenic in soil samples obtained in 1993, 2001, 2016, and 2017 were compared to current USEPA RSLs in **Table 2** and to NJDEP criteria in **Table 3**. The results of the comparison to the USEPA RSLs are shown on **Figure 8** and to NJDEP criteria on **Figure 9**.

There are no USEPA RSL or NJDEP RDCSRS exceedances of lead in soil. USEPA RSL and NJDEP RDCSRS arsenic exceedances in soil greater than the maximum background concentration for the MP reported by Weston (1995) were bounded by the installation border to the northeast, by samples PAR-83-482-SB-02 to the northwest, PAR-83-482-SB-01 and SS-9 to the west, PAR-83-SB-34 to the east, and by PAR-83-SB-33 (boring from adjacent Parcel 83) to the south (**Figure 9**). Arsenic in soil has not been delineated vertically at all locations within FTMM-57; however, the deepest exceedances greater than the reported background were present at 2.5 ft bgs, which were bounded vertically by samples collected from 2.5 to 13 ft bgs across the site that do not have USEPA or NJDEP exceedances greater than the reported background value for arsenic (**Table 2**).

4.1.3.1 Metal Exceedances of Comparison Criteria

Detected concentrations of arsenic were greater than the USEPA Residential RSL or NJDEP RDCSRS. Arsenic exceedances of the USEPA Residential RSL ranged in depth from 0 to 8.5 ft bgs, and arsenic exceedances of the NJDEP RDCSRS ranged in depth from 0 to 2.5 ft bgs. However, the maximum detected concentrations of arsenic at FTMM-57 did not exceed the maximum background concentration for the Main Post reported by Weston (1995) in any samples below 2.5 ft bgs (**Table 2** and **Table 3**).

Concentrations of arsenic and lead exceeded their current USEPA Groundwater Protection RSL and/or NJDEP IGW SL in at least one of the soil samples (**Tables 2** and **3**); however, since 2011, lead has not been detected at concentrations in groundwater that exceed the USEPA Tapwater RSL or the NJDEP GWQC.

4.1.3.2 Metal COPCs

Metal COPCs in soil were identified by comparing the maximum detected concentration of each analyte to the USEPA Residential RSL (TR = 1 x 10^{-6} and THQ = 0.1). Results that were B flagged were considered not-detected as detailed in the Risk Assessment Work Plan (Parsons, 2015b). The only metal COPC identified in soil at FTMM-57 is arsenic (**Table 4**). COPCs were evaluated in the HHRA in **Appendix F** and results are summarized in Section 6.

4.1.3.3 Potential Sources of Metals in Soil

Soil at FTMM-57 exceeds the RDCSRS for arsenic; however, arsenic is not a constituent of hydrocarbon fuels and therefore is not attributable to the former FTMM-57 gasoline and kerosene service station. Historic fill is a likely reason for arsenic found in FTMM-57 soil samples, as NJDEP agreed on 24 June 2008 (**Appendix B, Correspondence 5**). Arsenic could also be associated with historical application of arsenical pesticides, applied either at the site, or at a source of fill and subsequently brought to the site. Another contributing factor could be the presence of elevated naturally-occurring metal concentrations (e.g., arsenic) in glauconitic soils such as those present at FTMM-57.

4.2 Groundwater

The results of the groundwater monitoring data collected from 2007 to 2015 were evaluated for this Amended RI. Groundwater concentrations were compared to NJDEP GWQC and USEPA Tap Water RSLs.

Table 1 includes a sample and analytical summary of the groundwater sampling performed from 2007 to 2015. Sample locations are shown on **Figure 2**. **Table 5** shows the results for groundwater sampling events recently performed by Parsons (2013 to 2015) as well as the selected NJDEP and USEPA comparison criteria. Historical (2007 to 2011) groundwater sampling results are shown in **Appendix C**.

The historical groundwater sampling results are discussed below. There were two additional wells (PAR-83-482-MW-01 and PAR-83-482-MW-02) located within the FTMM-57 boundary that were installed in 2017 to assess adjacent UST 482. Groundwater samples from these two wells were analyzed for VOCs, SVOCs, and PAHs; PAHs were not detected. The VOCs and SVOCs detected in these wells were associated with adjacent UST 482 which was addressed under separate cover (Department of the Army, 2018).

4.2.1 Historical Exceedances of NJDEP Comparison Criteria in Groundwater Monitoring Results

Four monitoring wells were installed between September 1993 and August 1995 as part of the FTMM-57 UST closures. Quarterly groundwater monitoring for a full suite of analytes including VOCs, SVOCs, pesticides, and metals was performed from 1997 through 2004. Exceedances of the GWQC for arsenic were noted. On 12 November 2004 (**Appendix B, Correspondence 6**) NJDEP agreed to reducing the groundwater monitoring analytes to metals only. Therefore by 2004 it was evident that there were no significant impacts to groundwater from the gasoline, diesel or kerosene USTs.

An RI for FTMM-57 was completed by Versar (2004). As reported in the RI (see excerpts in **Appendix C**), a Geoprobe investigation of arsenic and lead in soil was conducted in 2001 (see **Figure 2**) to identify potential sources of the elevated concentrations encountered in FTMM-57 groundwater.

NJDEP provided review comments on the RI report on 24 June 2008 (**Appendix B**) which included a recommendation for additional evaluation of benzene in groundwater. In response to NJDEP comments, the Army conducted additional groundwater sampling in 2010. Temporary wells were installed at sample locations BL-5, BL-7, and BL-12 (**Figure 2**) and groundwater was sampled for VOCs analyses; no VOCs were detected (**Appendix C**). In summary, groundwater monitoring results indicated that benzene was not a constituent of concern in groundwater, and therefore the benzene exceedances detected in the 1993 soil results at two locations may have naturally attenuated over time. This was confirmed by re-sampling for benzene in 2017 near the locations of the 1993 samples S-7 and S-17.

Quarterly monitoring ceased in 2011 following FTMM closure. Groundwater monitoring at FTMM-57 resumed in August 2013 to re-establish baseline groundwater conditions. Groundwater samples were collected from the four FTMM-57 monitoring wells during the August 2013 baseline sampling event and analyzed for VOCs, pesticides, and metals. Acetone was the only VOC detected and its concentrations were below NJDEP and USEPA screening criteria. No pesticides were detected. Aluminum, arsenic, iron, manganese, and sodium were detected above NJDEP and USEPA screening criteria.

Based on the recommendations in the Final August 2013 Baseline Groundwater Sampling Report (Parsons, 2014), which were agreed to by NJDEP (**Appendix B, Correspondence 4**), three of the four monitoring wells (108MW01, 108MW02, and 108MW03) were removed from further long-term monitoring. NJDEP agreed to annual groundwater sampling from 108MW04 for two more rounds to confirm the 2013 results for lead in groundwater (**Appendix B, Correspondence 4**). Lead was not detected in annual groundwater samples from monitor well 108MW04 in 2014 and 2015, and on 14 November 2016 (**Appendix B, Correspondence 2**), NJDEP agreed that no further action was necessary for groundwater at FTMM-57.

4.2.2 Exceedances of USEPA Comparison Criteria and Selection of Constituents of Potential Concern (COPCs)

COPCs in groundwater were selected and evaluated in this Amended RI to fulfill CERCLA requirements. COPCs in groundwater were identified by comparing the maximum detected concentrations of samples collected from permanent monitoring wells to the USEPA Tapwater RSLs (TR = $1x10^{-6}$ and THQ = 0.1) (USEPA, 2017). Detected analytes that exceed the Tapwater RSLs were then assessed more holistically

to determine whether exceedances are representative of site-related contamination or are due to other factors such as turbidity or upgradient sources, as detailed in the Risk Assessment Work Plan (Parsons, 2015b). Only the most recent results from the last 8 rounds of groundwater monitoring were used for identifying COPCs.

Analytes that exceed the USEPA Tapwater RSLs in FTMM-57 wells (108MW01, 108MW02, 108MW03, and 108MW04) in the last 8 rounds of sampling (August 2010 to November 2015, in accordance with Parsons, 2015b) include: antimony, arsenic, cadmium, cobalt, iron, lead, manganese, selenium, and vanadium (**Figure 10** and **Tables 5** and **6**).

It should be noted that detections of antimony, arsenic, cadmium, cobalt, iron, and vanadium in groundwater did not exceed the maximum background concentrations for the MP reported by Weston (1995) (**Table 6**).

Iron is classified as an essential human nutrient and therefore was not selected as a COPC in groundwater.

Cadmium exceeded the USEPA Tapwater RSL (0.92 µg/L) in only one sample (from well 108MW02) at an estimated concentration of 1.33 µg/L in 2010 and was detected only twice (in one well) out of 24 samples. This exceedance of cadmium was not repeated in later 2010, 2011, or 2013 samples and thus is not representative of current site conditions. Therefore, cadmium was not selected as a COPC in groundwater.

Lead exceeded only the USEPA Tapwater RSL (15 µg/L) in one well (108MW04) in samples collected from August 2010 to August 2011. As demonstrated by samples collected in this well from August 2013 to November 2015, lead is no longer detected at FTMM-57. Therefore, the exceedance of lead was not observed since 2011 and thus is not representative of current site conditions. Therefore, lead was not selected as a COPC in groundwater

Selenium exceeded the USEPA Tapwater RSL in one sample event in August 2010. The exceedance of selenium was not observed since 2010 and thus is not representative of current site conditions. Therefore, selenium was not selected as a COPC in groundwater.

The analytes that were selected as COPCs in groundwater include antimony, arsenic, cobalt, manganese, and vanadium. Although the background concentrations were not used to screen COPCs, it should be noted that the maximum detected concentrations of antimony, arsenic, cobalt, and vanadium in groundwater do not exceed the maximum background concentration for the MP reported by Weston (1995). Manganese slightly exceeded the background concentration (331 µg/L) in one sample (108MW02, 363 µg/L) (**Table 6**) and could be attributed to background conditions at the site. However, all 5 metals selected as COPCs were evaluated in the risk assessment (Section 6.0, below).

4.2.2.1 Potential Sources of Metals in Groundwater

Review of the site history has not identified any specific potential sources of metals contamination at FTMM-57. With the exception of manganese, these metals were detected within background concentrations, and none of the metal analytes (except lead) are related to hydrocarbon releases from the former gasoline, diesel, and kerosene fuel USTs. As an example, arsenic is not associated with fuel USTs, and the maximum detection of arsenic (34 µg/L) in the last eight rounds of groundwater sampling is approximately one-third of the background value (89 µg/L) reported by Weston (1995).

Background arsenic concentrations in excess of the GWQC have previously been noted in groundwater at the Main Post portion of FTMM (as described in FTMM, 2011). For example, arsenic was detected in excess of the GWQC of 3 µg/L at concentrations ranging up to 8.77 µg/L in shallow groundwater at the MP and is associated with glauconitic soils (FTMM, 2011). Therefore, arsenic in groundwater is likely due to naturally occurring background conditions rather than the former fuel USTs.

Previous studies have documented the presence of elevated naturally-occurring metal concentrations (e.g., arsenic) in glauconitic soils such as those present within the New Jersey Coastal Plain physiographic province (Dooley, 2001; U.S. Geological Survey [USGS], 1984). As indicated on the geologic logs in **Appendix D**, green soil was encountered during drilling of FTMM-57-SB-01, which suggests the presence of glauconite. Therefore, dissolved arsenic exceedances at these wells are likely attributed to glauconite in soil. Additional contributing factors could include historic fill and/or historical application of arsenical pesticides, applied either at the site, or at a source of fill and subsequently brought to the site. Regardless, arsenic was retained as a COPC.

5.0 CONTAMINANT FATE AND TRANSPORT

5.1 Fate and Transport of VOCs, PAHs, and Metals in Soil

Potential migration routes for contaminants detected in soil at FTMM-57 include the following:

- Dissolution of soluble residual contamination in soil into infiltrating precipitation that percolates through the vadose zone to the water table (i.e., recharge water); and
- Volatilization into soil gas and/or the atmosphere.

In general, VOCs in soil are subject to volatilization, biodegradation, and vertical migration toward the water table due to infiltration and percolating rainwater. Therefore, VOCs are expected to have a relatively low degree of persistence in vadose zone soil at FTMM-57, and the potential for substantial vertical migration to groundwater exists. However, none of the VOCs that exceeded their current USEPA Groundwater Protection RSL and/or NJDEP IGW SL were detected in FTMM-57 groundwater samples.

The PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) have 18 to 22 carbon atoms (i.e., C18-C22). As hydrocarbons approach a size of approximately 15 to 20 carbon atoms, their vapor pressures and water solubilities become negligible, and partitioning to air or dissolution in water is unimportant (American Petroleum Institute [API], 2011). 2-methylnaphthalene and naphthalene are PAHs having 11 and 10 carbon atoms. API generally classifies petroleum substances in the C9 to C25 range as “not readily biodegradable” because their biodegradation rates are typically slower than lighter, more volatile fuels, such as gasoline or jet fuel. Therefore, PAHs identified as COPCs in soil are expected to be relatively persistent in vadose zone soil at FTMM-57 and (with the possible exceptions of 2-methylnaphthalene and naphthalene) are expected to be relatively immobile and not readily leach to groundwater. Metals are subject to various transformation processes in soil. For example, metals can exist in the environment in several valence forms, and they can also exist as organometallic compounds that have a metal-carbon bond. Metal transformation processes, such as metal methylation, occur through interactions with other chemicals and biota in the environment. In general, however, metals are elements that have limited mobility in the environment, and therefore are expected to be relatively persistent in vadose zone soil at FTMM-57.

5.2 Fate and Transport of Metals in Groundwater

The primary migration route for contaminants detected in groundwater at FTMM-57 is lateral migration of contaminants dissolved in groundwater. In general, metals in groundwater are sorbed to aquifer matrix particles or retained in solution without significant biotic or abiotic transformation, and they are expected to be relatively persistent in shallow groundwater at FTMM-57.

Metals in groundwater will likely be moderately to highly sorbed to aquifer matrix materials and thus have more limited mobility than VOCs, but their mobility in groundwater is dependent on too many metal- and site-specific factors to predict with confidence. NJDEP (2003) found that New Jersey soils typically have high iron concentrations. Glauconitic soils have iron-rich clay minerals (Dooley, 2001); these soils are common at FTMM and potentially may enhance sorption of metals to the soil matrix in the saturated zone.

6.0 HUMAN HEALTH RISK ASSESSMENT SUMMARY AND CONCLUSIONS

An evaluation of the potential risk resulting from human exposure to contaminants in soil and groundwater was conducted as part of this Amended RI (**Appendix F**). This HHRA (40 CFR 300.430(d)(4)) evaluated the exposure of current and/or future unlimited use and unrestricted exposure (UU/UE) receptors (the scenario protective of residential users), outdoor workers, utility workers, and recreational users to COPCs in soil through dermal contact, incidental ingestion, and inhalation of particulates. The HHRA evaluated the exposure of current and/or future UU/UE receptors and utility workers to COPCs in groundwater through ingestion as potable water (UU/UE receptors only), dermal contact, and incidental ingestion. The HHRA used an initial exposure point concentration for soil that was the maximum detected concentration of each analyte. If an unacceptable cumulative risk or hazard index was calculated, 95% upper confidence limits (UCLs) were calculated for those COPCs contributing significantly to the risk/hazard (i.e., greater than 25% of the cumulative risk/hazard) and the risk was estimated using the 95% UCL on the mean as the exposure point concentration for those analytes. The HHRA used the maximum detected concentration from any well as the exposure point concentration for groundwater.

One exposure area of approximately 0.36 acres (i.e. representing the approximate size of a residential lot) was evaluated for the UU/UE receptor exposed to soil, based on the area at the site with the highest concentrations of COPCs that would be most likely to pose an unacceptable risk. The remaining receptors were assumed to access the entire site. For groundwater, each well location was considered a separate exposure point, because it was assumed each well could be an individual potential source of drinking water.

The cumulative carcinogenic risks and noncarcinogenic hazards estimated for the receptors at the site are as follows (**Tables F.2.64 and F.2.65**):

- UU/UE receptors exposed to surface soil, combined surface and subsurface soil, outdoor air, and potable groundwater: The cumulative carcinogenic risk in surface soil is 2×10^{-4} which is greater than the cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in soil. The cumulative carcinogenic risk in combined surface and subsurface soil is 2×10^{-4} which is greater than the cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in soil.

  The cumulative noncarcinogenic HI for surface soil is estimated to be 4 for the child receptor (HI_{child}) and 0.4 for the adult receptor (HI_{adult}) which is greater than 1 for the child receptor and less than one for the adult receptor. Arsenic is the only significant contributor to the cumulative hazard estimate. The cumulative noncarcinogenic HI for combined surface and subsurface soil is estimated to be 3 for the child receptor (HI_{child}) and 0.4 for the adult receptor (HI_{adult}) which is greater than 1 for the child receptor and less than one for the adult receptor. Arsenic is the only significant contributor to the cumulative hazard estimate. Since the total HI for the child was greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with separate target organs would still result in an unacceptable hazard due to exposure to arsenic in soil.

  The cumulative carcinogenic risk for UU/UE receptors exposed to groundwater was estimated to be 7×10^{-4} which is greater than the cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in groundwater. The cumulative noncarcinogenic HI for UU/UE receptors exposed to groundwater is estimated to be 8 for the child receptor

(HI_{child}) and 5 for the adult receptor (HI_{adult}). The main contributor to these hazard estimates is ingestion of arsenic (HI_{child} = 6 and HI_{adult} = 3).

Evaluation of the hazard associated with exposure to groundwater in each individual well (presented in **Tables F.2.52** through **F.2.63**) demonstrates that all the hazard estimates for all wells exceed the noncarcinogenic hazard goal of 1 for child receptors, while three wells exceed the hazard goal for adult receptors. HIs are 108MW01 (HI_{child} = 3, and HI_{adult} =2), 108MW02 (HI_{child} = 5, and HI_{adult} =3), 108MW03 (HI_{child} = 2, and HI_{adult} =1), and 108MW04 (HI_{child} = 7, and HI_{adult} =4).

Since the total HIs are greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with separate target organs would still result in an unacceptable hazard due to exposure to arsenic in groundwater.

However, it should be noted that the maximum detected concentration of arsenic in groundwater (34 µg/L) observed in any well in the last 8 rounds of groundwater sampling is approximately one-third of the background value (89 µg/L) reported by Weston (1995). Therefore, the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic.

- Utility workers exposed to surface soil, combined surface and subsurface soil, and groundwater: The cumulative carcinogenic risk for utility worker exposure to surface soil (2×10^{-6}), combined surface and subsurface soil (2×10^{-6}), and groundwater (2×10^{-8}) are less than the cumulative risk goal of 1×10^{-4}. The HI for utility workers is less than 1 for exposure to surface soil (HI=0.2), combined surface and subsurface soil (HI=0.4), and groundwater (HI = 0.01).
- Outdoor workers exposed to surface soil: The cumulative carcinogenic risk for outdoor worker exposure to surface soil (9×10^{-5}) is less than the cumulative risk goal of 1×10^{-4}. The HI for outdoor workers is less than 1 for exposure to surface soil (HI=0.6).
- Recreational users exposed to surface soil: The cumulative carcinogenic risk for recreational users exposure to surface soil (2×10^{-5}) is less than the cumulative risk goal of 1×10^{-4}. The recreational user HI_{adl} for exposure to surface soil is 0.2 and the HI_{adult} is 0.07, which are less than 1.

Uncertainties may result in overestimated risks/hazards. Most notably, onsite groundwater is not currently used as a potable drinking water source so the risk/hazard estimates herein may be overestimated. The estimated risks/hazards associated with potable groundwater would apply only if a well was installed for potable water. The maximum concentrations used from one sample are not representative of true site conditions, especially over time, and the hazard is overestimated. The maximum detected concentration of arsenic in groundwater (34 µg/L) observed in any well in the last 8 rounds of groundwater sampling is approximately one-third of the background value (89 µg/L) reported by Weston (1995). Therefore, the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic.

7.0 REMEDIAL INVESTIGATION SUMMARY AND CONCLUSIONS

7.1 Underground Storage Tanks

There were no exceedances of the NJDEP comparison criteria in the recent soil samples at FTMM-57, and benzene is no longer present. Therefore, the Army has determined that NFA with regard to the former FTMM-57 USTs is warranted under N.J.A.C 7:26E, Technical Requirements for Site Remediation (**Appendix A**).

7.2 VOCs in Soil

There were no exceedances of the NJDEP comparison criteria in the recent soil samples at FTMM-57, and benzene is no longer present. The HHRA concluded that there is no unacceptable risk to human health from VOCs in soil. Therefore, the Army has determined that NFA with regard to VOCs in soil is warranted under CERCLA.

7.3 PAHs in Soil

Concentrations in soil at FTMM-57 exceed the RDCSRS for PAHs. The HHRA concluded that there is no unacceptable risk to human health from PAHs in soil. Therefore, the Army has determined that NFA with regard to PAHs in soil is warranted under CERCLA.

7.4 Metals in Soil

Soil at FTMM-57 exceeds the RDCSRS for arsenic. As discussed in Section 4.1.3.3, potential sources of arsenic in soil may include historic fill, properly applied pesticides, or naturally occurring glauconitic soils. The HHRA concluded that there is an unacceptable risk to human health attributable to anthropogenic sources of arsenic in soil.

7.5 Groundwater

NJDEP has agreed to NFA for groundwater. However, to be CERCLA compliant, the HHRA evaluated groundwater. The HHRA concluded that there is an unacceptable risk to human health from arsenic in groundwater. However, the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic and therefore NFA is required for groundwater. It should also be noted that onsite groundwater is not currently used as a potable drinking water source.

7.6 Conclusions

Following are recommendations for USTs, soil, and groundwater at FTMM-57:

- An unrestricted use, NFA determination is recommended for the five former UST108 locations based on the conclusions of this Amended RI Report (**Appendix A**).
- The HHRA concluded that unacceptable risks to human health from arsenic in soil from a variety of potential sources (Section 4.1.3.3) are present for the UU/UE receptors. Therefore, an FS was performed to address arsenic in soil (**Sections 8 through 12)**.
- The HHRA estimated an unacceptable risk/hazard to human health from arsenic in groundwater. The risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic. In 2016 NJDEP determined that NFA for groundwater was needed (**Appendix B, Correspondence 2**). This Amended RI Report and others document naturally occurring metals in groundwater at former Fort Monmouth. An FS is not required to address arsenic in groundwater as the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic and not to an Army release at the site.
- The FS should also consider areas where the concentrations of PAHs exceed the NJDEP RDCSRS as incidental remediation areas.

8.0 FEASIBILITY STUDY REMEDIAL ACTION OBJECTIVES AND ARARS

The Feasibility Study (FS) uses a focused approach to reduce redundancy, facilitate rapid reviews, and accelerate cleanup decisions pursuant to the NCP (40 CFR 300.430(a)(1)(ii)(C)). The scope of this FS has been streamlined as practicable for the conditions present at FTMM-57 and applies to the constituent of concern (COC) that poses an unacceptable risk in soil and warrants further investigation at FTMM-57. The purpose of an FS is to identify, develop, and perform a detailed analysis of potential remedial alternatives that are protective of human health and the environment, can be implemented in a cost-effective manner, and can meet the RAOs for FTMM-57 so that decision-makers will have adequate information to select the most appropriate remedial alternative (40 CFR 300.430(e)(1)). In this section, one RAO for FTMM-57 is defined so that appropriate general response actions (GRAs) and specific response actions (SRAs) can be selected. Finally, ARARs (40 CFR 300.400(g)) and "to be considered" (TBC) criteria are identified.

8.1 Remedial Action Objectives

RAOs are specific goals for protecting human health and the environment from the environmental hazards identified in the HHRA. RAOs can be accomplished by ensuring exposure pathways are not completed or by reducing concentrations of COCs at exposure points to protective concentrations.

COCs are "the hazardous substances, pollutants, and contaminants that, at the end of the risk assessment, are found to be the risk drivers or those that may actually pose unacceptable human or ecological risks." The COC was derived from the list of COPCs that are contributing to risk in soil shown on HHRA tables (Section 6). Only the analyte that contributes to either the cumulative risk (carcinogenic analytes) or the HQ (i.e., for noncarcinogenic analytes) was retained as a COC. The COC in soil identified for FTMM-57 is arsenic (**Table 7**).

The RAO developed in this section addresses the risks and hazards identified in the HHRA (Section 6 and **Appendix G**). For hypothetical receptors representing an UU/UE scenario at FTMM-57, the contributor to cumulative carcinogenic risk is arsenic in surface soil, and combined surface and subsurface soil. In addition, there were unacceptable noncarcinogenic risk and noncarcinogenic hazard identified in the HHRA for arsenic in soil. The RI concluded the risks/hazards to UU/UE receptors exposed to groundwater are attributable to naturally occurring concentrations of arsenic and therefore, NFA is warranted for groundwater. Therefore, the following RAO was developed for FTMM-57 to protect human health and the environment:

- Protect public health by preventing exposure (inhalation, dermal contact, and ingestion) to soil containing arsenic at concentrations in excess of the cleanup level.

8.2 ARARs and TBC Criteria

The NCP established a general requirement that response actions comply with ARARs, based on site-specific conditions. "Applicable requirements" are promulgated environmental cleanup standards, standards of control, and other substantive requirements, criteria, or limitations that specifically address a hazardous substance, remedial action, location, or other circumstances found at a release site. "Relevant and appropriate requirements" are promulgated environmental cleanup standards, standards of control, and other substantive requirement, criteria, or limitations that, while not legally "applicable" to site conditions, address problems or situations sufficiently similar to those encountered at the site that their use is well suited for the site. Pursuant to the USEPA guidance (USEPA, 1988), ARARs are generally divided into three categories: chemical-, location- and action-specific requirements. ARARs must be complied with unless waived. Other TBC criteria, such as non-promulgated policy and guidance

documents, may also be useful in directing a response action at a site. The ARARs and TBC criteria for this site are presented in **Table 8**.

8.2.1 Chemical-Specific ARARs

Chemical-specific ARARs are promulgated health-based numerical values that establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment. FTMM-57 chemical-specific ARARs are the NJDEP RDCSRS published in the New Jersey Administrative Code (N.J.A.C.) 7:26D Remediation Standards. Risk-based screening levels (e.g., USEPA RSLs) used in determining COPCs are not considered chemical-specific ARARs because they are not promulgated.

8.2.2 Location-Specific ARARs

Location-specific ARARs prevent damage to unique or sensitive areas, such as floodplains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they take place. Resource Conservation and Recovery Act (RCRA), for example, prohibits the placement of hazardous waste in geologically unstable areas. Based on the proximity of tidally-influenced Parkers Creek, Oceanport Creek, and the back-bay areas of the Shrewsbury River, Parcel 83 lies within a potential flood hazard area. Therefore, any remediation activity conducted within the Parcel 83 vicinity needs to be in compliance with N.J.A.C. 7:13 Flood Hazard Area Control Act (FHACA) Rules, and the substantive permit and authorization requirements of the FHACA need to be established. As stated in N.J.A.C. 7:13-1.1(c), flooding presents a significant risk to the public health, safety, and welfare due to loss of life, injury, and property damage, and therefore needs to be controlled. There are multiple development scenarios that are subject to the FHACA Rules and that could apply to the remediation of Parcel 83, including stormwater management (N.J.A.C. 7:13-12.2); excavation, filling and grading (N.J.A.C. 7:13-12.3); and the cleanup of hazardous substances (N.J.A.C. 7:13-12.17).

New Jersey Statutes Annotated (N.J.S.A.) 13:19-1 Coastal Area Facility Review Act (CAFRA), as promulgated under N.J.A.C. 7:7 Coastal Zone Management Rules, requires that any coastal area use be protective of public health. Oceanport, New Jersey is designated as a municipality within the CAFRA zone. Therefore, any remediation activity conducted within the Parcel 83 vicinity needs to be in substantive compliance with the CAFRA requirements.

8.2.3 Action-Specific ARARs

Action-specific ARARs are usually technology or activity-based requirements or limitations placed on actions taken with respect to remedial/removal actions, or requirements to conduct certain actions to address circumstances at a site. These actions include capping, removal, decontamination, and/or control of impacted media. Provisions of RCRA regulations which may become ARARs include 40 CFR Sections 261, 262, 264, 258, 268, and 260-268, and RCRA (42 U.S. Code Chapter 82, Subchapter III) regulations that establish rules for hazardous waste management that may apply to capping, excavation, storage, management, and disposal of impacted media has been identified as potential action-specific ARARs.

8.2.4 TBC Criteria

When ARARs do not exist for a chemical or remedial activity, other criteria, advisories, and guidance referred to as TBC are useful in designing and selecting a remedial alternative. TBC criteria are risk-based screening levels (e.g., USEPA RSLs) used in determining COPCs are chemical-specific TBC because they are not promulgated.

8.3 Cleanup Levels

The RAO refers to an analyte-specific cleanup level for soil. The numerical cleanup goal for arsenic in soil at FTMM-57 evaluated in this FS is the site-specific remediation level presented on **Table 7**. This table also lists the NJDEP RDCSRS for arsenic which is a chemical-specific ARAR (Section 8.2.1). The remediation level is based on the background value for arsenic as determined in the Final Site Investigation completed by Weston in 1995. The site-specific remediation level would accommodate hypothetical receptors representing a UU/UE scenario at FTMM-57 from cumulative carcinogenic risk and noncarcinogenic hazard due to arsenic in soil.

At FTMM-57, PAH concentrations in soil exceed the NJDEP RDCSRS. Although not required to address unacceptable risk, meeting the NJDEP RDCSRS for PAHs is incidental to the remediation of arsenic at FTMM-57.

9.0 IDENTIFICATION AND SCREENING OF RESPONSE ACTIONS

The NCP establishes expectations for the types of remedies that will be used for addressing principal threat and low-level threat wastes. FTMM-57 is considered a low level threat waste rather than a principal threat waste. The concept of principal threat waste and low level threat waste developed in the NCP is applied on a site-specific basis when characterizing source material. Source material is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, to air, or acts as a source for direct exposure. Low-level threat wastes are wastes that exhibit a low toxicity, low mobility in the environment or are near health-based levels. In contrast, principal threat wastes are highly toxic or highly mobile wastes that would present a significant risk to human health or the environment should exposure occur.

The NCP establishes the expectation to:

- Use treatment to address the principal threats posed by a site, wherever practicable;
- Use engineering controls (ECs), such as containment, for wastes that pose a relatively low long-term threat or where treatment is impractical;
- Use institutional controls (ICs) such as water use and deed restrictions to supplement EC as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances; and
- Use a combination of methods, as appropriate to achieve protection of human health and the environment. (40 CFR 300/430(e)).

The primary objective of this section is to identify remedial technologies and approaches that are suitable to address one or more elements of the site conditions that warrant a response action. This section identifies GRAs that could possibly be used to achieve the RAO. Under each GRA, numerous SRAs that could potentially be implemented are identified and screened.

9.1 General Response Actions

GRAs represent broad classes of technologies that have common characteristics that could possibly be used to address the risk posed by site impacts and achieve the RAO. Following the USEPA guidelines (USEPA, 1988), these GRAs are considered for soil at FTMM-57:

- **No Action**: Contaminated media are left in place and remain un-mitigated. The No Action response action is used as a baseline for comparison to other preliminary response actions. Under this action, FTMM-57 will be maintained under the current conditions, and the RAO would not be met. This action will be retained for evaluation in accordance with the NCP to provide a baseline comparison with other alternatives (42 CFR 300.430(e)(6)).
- **Risk and Hazard Management (Land Use Controls)**: Contaminated media are left in place and land use controls (LUCs) such as ICs (deed restrictions) or ECs (signs and fences) are established to prevent potential exposure, but no active remediation of contaminated media is considered. The actions meet the RAO of minimizing direct contact via the soil exposure pathway with the contaminated soil. LUCs may be used in conjunction with other technologies.
- **Containment**: Contaminated media are isolated from the environment and potential receptors by blocking the exposure/transport mechanism. These technologies are generally appropriate for wastes that pose a relatively low-level threat or where treatment is impracticable. Containment technologies range from simple to complex depending on the risks and hazards identified at a site.

- **Treatment**: Contaminated soil could be remediated through either in situ or ex situ treatment including physical, chemical, and biological treatments. Treatment measures would reduce toxicity, mobility, or volume of a contaminant or waste by altering the physical or chemical properties of the contaminants and/or media. The action meets the RAO because the contaminated soil would be treated to regulated acceptable levels to protect human health and the environment.
- **Source Removal and Disposal**: Contaminated media and solid wastes are physically removed from the subsurface and are either treated or properly disposed offsite. The action meets the RAO because the contaminated soil would be completely removed from FTMM-57.

9.2 Identification and Screening of Technology Types and Process Options

The objective of this section is to identify remedial technologies and process options for soil remediation at FTMM-57. A focused approach was used at FTMM-57 to address the COC that poses an unacceptable risk in the soil. This objective is accomplished using a variety of information including previous investigations and remedial actions conducted at FTMM-57, remedial actions at other sites, references developed by USEPA for application at remedial sites, USEPA computerized technology databases (ATTIC, Version 1.0 and CLU-IN), and standard engineering references.

For each GRA discussed above, several remedial technologies exist that are applicable to the type of soil contamination at FTMM-57. The goal of the screening process is to evaluate many of these technologies to identify those that are technically feasible to implement under the site-specific conditions. In this step, entire technology types and process options can be eliminated based on technical effectiveness and/or implementability considerations. Information on site characteristics and chemical types and concentrations were used to eliminate technology types and process options that are neither applicable nor effectively implementable at FTMM-57.

Table 9 lists the GRAs for identified FTMM-57 impacts requiring remedy and identifies the remedial technologies and process types for each response action. In order to streamline the development of remedial action alternatives, only “presumptive” remedial technologies from each GRA are identified, which include technologies that are presumed to be successful based on reasonable grounds or probable evidence. This table also shows graphically which technologies were retained and screened out, with a brief description of each. General technology description is presented below along with if it was retained or screened out.

9.2.1 No Action

No action refers to a site remedy where no active remediation or risk and hazard management are implemented. Under DERP, evaluation of a no-action remedial alternative is required, pursuant to the NCP, 40 CFR 300.430(e), to provide a baseline for comparison with other remedial alternatives. Under the no action alternative, no formal programs would be put into place to control potential receptor exposure to the COC.

9.2.2 Risk and Hazard Management

Risk and hazard management uses enforceable LUCs, including both ICs or ECs to prevent or limit exposure of receptors to potentially harmful concentrations of COC. ICs are actions taken to reduce or eliminate risks to public health and the environment by controlling exposure pathways rather than removing the contaminants or reducing their mobility, toxicity, or volume. ICs may consist of physical restrictions, administrative restrictions to include deed notices, zoning ordinances, special use permits, or restrictions on construction activities. Examples of ECs include physical barriers and access restrictions such as fencing, locked gates, or warning signs.

LUCs are cost-effective, reliable, and immediately effective; they can be implemented either alone or with other remedial components. Inspections are typically required to document long-term effectiveness of LUCs. The administrative feasibility of and cost to implement LUCs depend on site-specific circumstances (e.g., whether a site is under the direct operational control of the federal government or has been transferred to non-federal ownership). Typically, this GRA is easily implemented. Implementation of LUCs is addressed in the DoD Policy and Guidance Document on LUCs associated with Environmental Restoration Activities (Office of the Under Secretary of Defense-Acquisition and Technology, 2001). Risk and hazard management using LUCs is a viable option and was retained for further evaluation.

9.2.3 Containment

Containment technologies range from simple (such as an asphalt cap) to complex (such as a hazardous waste containment system) depending on the risks and hazards identified at a site. Examples of containment approaches applicable to FTMM-57 include impermeable barriers such as an asphalt cap. An asphalt cap would be protective of human health by eliminating contact with underlying soil but would not reduce or eliminate the contamination. An asphalt cap would require hydrologic modeling and extensive State permitting, design and installation considerations due to the FTMM-57 location in a lowland coastal area. A Deed Notice would be required as well as on-going pavement maintenance. Containment technologies have been retained for further evaluation.

9.2.4 Treatment

Treatment uses engineered and non-engineered approaches to reduce the toxicity, mobility, or volume of contaminants in the subsurface, thereby preventing or minimizing exposure of receptors to, or further degradation of natural resources by, site contamination. The primary potential advantage of in situ treatment is that it allows the contaminated media to be treated without being removed which could result in cost savings due to the elimination of costs associated with physical removal, ex situ treatment, and disposal. Biological, chemical, and physical processes may be used for in situ treatment. Examples of in situ treatment options include solidification/stabilization, solvent extraction/soil washing, electro kinetic, vitrification, and phytoremediation technologies. Implementability and effectiveness generally are governed by site hydrogeologic, geochemical, and microbiological conditions, the physicochemical properties of the COC, and the mass of contaminants present in the affected media.

Solidification/stabilization success depends on many factors and would require testing. Solvent extraction/soil washing success depends on many factors and variables and would result in additional materials that would require disposal. Electro kinetic would require a complicated system, power supply, installation of electrodes, and higher capital and operation and maintenance (O&M) costs. Vitrification would require large amounts of energy and may generate off-gasses. Phytoremediation would require long term plant growth and extensive maintenance to be effective. Due to these limitations and based on impracticality of implementation and unknown success for the COC, treatment technology options are not retained for further evaluation.

9.2.5 Source Removal and Disposal

Removal of source materials by direct excavation and offsite disposal would be effective at FTMM-57. The targeted source area that precludes UU/UE at FTMM-57 is approximately 946 square yards and averages 3 feet deep for a total volume of 946 cubic yards. This technology has been previously applied at multiple locations within FTMM for remediation. It represents a viable technology for site remediation. Source removal and offsite disposal was retained for further evaluation as an appropriate remedial option.

9.3 Evaluation of Technology Process Options

The next step in developing and screening alternatives involves an evaluation of the technologies and process options remaining from the initial technology screening. Technologies and process options judged to be potentially viable in the previous section for application to FTMM-57 soil are reviewed according to three criteria: effectiveness, implementability, and cost. These criteria are briefly discussed below.

- **Effectiveness.** The effectiveness evaluation focuses on the following elements:
  - Potential effectiveness of process options for handling the estimated areas or volumes of media and meeting the RAO;
  - Potential impacts to human health and the environment during the construction and implementation phase; and
  - Reliability and proven effectiveness of the process with respect to the contaminant and conditions at FTMM-57.
- **Implementability.** The initial technology screening eliminated technology types or process options that were clearly ineffective or unworkable at the site. The following evaluation addresses both the technical and institutional feasibility of implementing each process that was retained after the initial technology screening, including the following institutional aspects:
  - Ability to obtain necessary permits and rights-of-way for offsite actions;
  - Availability of necessary equipment and skilled workers to implement the technology; and
  - Availability (including capacity) of treatment, storage, and disposal services.
- **Cost.** Cost plays a limited role in the screening of technologies at this phase. Relative capital and O&M costs are considered rather than absolute costs. For this evaluation, the cost analysis is based on engineering judgment. Each technology is evaluated as to whether costs are low, moderate, or high relative to other process options in the same technology type. Therefore, a process option that has a relatively low cost associated with its implementation would receive a "High" rating in the evaluation table, while a process option that is relatively costly to implement would receive a "Low" rating. The greatest cost consequences in site remediation are usually associated with the degree to which different technology types are used. Using different process options within a technology type usually has a less significant effect on cost than the use of different technology types. A technology process option can be eliminated based on costs only if other process options within the same technology type are comparably effective and implementable but have a much lower cost.

Based on the above criteria, the process options were evaluated relative to other processes within the same technology type to select a representative process option to be included in a remedial alternative. At this stage of the FS, the major focus is on the effectiveness of each option; implementability and cost are of lesser importance. Each criterion is rated as low, moderate, or high relative to the technologies within the same process option. The results of the evaluation are discussed in the following sections and are summarized in **Table 10.**

9.3.1 No Action

The evaluation of the no action option for soil is summarized below:

Criterion	Evaluation	Rating
Effectiveness	Contaminants would remain in the soil. The COC is expected to be persistent in vadose zone soil and is	Low

Criterion	Evaluation	Rating
	expected to be relatively immobile and will not readily leach to groundwater. The effectiveness of the no action option is rated low because exposure to impacted soil would be unrestricted.	
Implementability	No equipment, skilled workers, or permits are required for the no action option.	High
Cost	There are no costs associated with no action.	High

The no action option is retained for incorporation into remedial action alternatives, as required by the NCP, and will be used as a baseline for comparison of other options.

9.3.2 Land Use Controls

This option involves LUCs and restricting access to soil at FTMM-57. The evaluation of this option is summarized below:

Criterion	Evaluation	Rating
Effectiveness	Contaminants would remain in the soil. A Deed Notice or Declaration of Environmental Restriction (DER) would be in effect which is an effective, reliable, and proven technology that is an integral component of any remedial action. This option will not directly contribute to cleaning up contaminated soil but would protect human health by limiting access/use of soil.	Moderate
Implementability	A Deed Notice would be required. A LUC Implementation Plan (LUCIP) would be prepared and would include five-year reviews.	High
Cost	Costs associated with this option include minimal administrative and five-year inspection and reporting preparation.	Moderate

Based on the moderate ratings for effectiveness and cost, and the high rating for implementability, LUCs is retained for incorporation into the remedial action alternatives.

9.3.3 Containment via Asphalt Capping

Containment via an asphalt cap would mitigate exposure to soil at FTMM-57. The evaluation of this option is summarized below:

Criterion	Evaluation	Rating
Effectiveness	This option will not clean up contaminated soil but would protect human health by limiting access/use of soil. An asphalt cap is a proven, effective technology that provides a physical barrier between receptors and contaminated soils. The cap would reduce the potential for direct contact and would minimize exposure. This option would require LUCs in the form of a Deed Notice to limit use of or access to the site, environmental monitoring to detect	Moderate to High

Criterion	Evaluation	Rating
	breaching of the cap, and maintenance. The major disadvantage of the capping alternative is that soil contamination is not addressed.	
Implementability	Though there is an onsite permit exemption under CERCLA, this option would require extensive requirements to comply with the substantive provisions of a state permit under the CAFRA and FHACA, for design and installation due to location in lowland coastal area. Requires long-term maintenance and limits future use. Capping is a well-established technology and would be implementable at the site. Some clearing and grubbing, rerouting of utilities and other site preparation activities would be required before the cap could be constructed. Site monitoring would be required for as long as the media under the cap represents a threat to human health and the environment.	Moderate
Cost	Capping would have capital and O&M costs. The capital costs of capping would be lower than soil excavation and offsite disposal. The capital costs include permitting and design, transportation of capping materials to the site, and installation of a cap. O&M costs would consist of the long-term monitoring requirements.	Moderate

Based on the moderate to high ratings for effectiveness, and the moderate rating for implementability and cost, asphalt capping is retained for incorporation into the remedial action alternatives.

9.3.4 Source Removal via Mechanical Excavation and Offsite Disposal

Source removal via direct excavation would target the impacted soil in exceedance of cleanup level. The evaluation of this process option is summarized below:

Criterion	Evaluation	Rating
Effectiveness	Remove all impacted contaminated soil and backfill excavation with clean soil. Demonstrated ability to meet RAO very rapidly and without long-term treatment.	High
Implementability	Technology is well established. Excavation area is small (approximately 950 square yards) and easily accessible. Requires agency approval, FTMM coordination, and health and safety planning. Requires compliance the substantive provisions of CAFRA and FHACA for excavation work.	Moderate
Cost	Expected moderate to high initial capital costs and minimal long term O&M costs.	Low

The source removal option is an important strategic option available to support remedial actions at FTMM-57 and is retained for further consideration in the development of remedial alternatives.

9.4 Summary of Process Option Selection

The selection of process options for remediation of soil at FTMM-57 is summarized below:

- The no action response is retained as required by the NCP.
- LUCs is selected as the risk and hazard management actions.
- Containment via asphalt capping is retained as a containment action.
- Source removal via direct excavation is retained as the removal action.

The selected process options were retained for further consideration in developing remedial alternatives for FTMM-57 soil. Different combinations of these process options were assembled to form site-wide remedial alternatives. The process options used to implement the design may not be selected until the remedial design phase. The alternatives developed for FTMM-57 soil are discussed in Section 10 and evaluated in Section 11.

10.0 DESCRIPTION OF REMEDIAL ALTERNATIVES

Guidance for the development of remedial alternatives for FTMM-57 was obtained from the following sources: 40 CFR Part 300 (NCP), Section 121 of CERCLA, and Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988). As required by the NCP and recommended by USEPA guidance (USEPA, 1988), acceptable engineering practices that relate to site-specific conditions were considered during development of the remedial action alternatives. The alternatives developed satisfy the requirements of 40 CFR 300.430(e), which specifies that alternatives be developed to include no action, ICs, little to no treatment alternatives, and alternatives that reduce the toxicity, mobility, or volume of contaminants, to the extent practical.

The following remedial alternatives were developed to address the remediation of contaminated soil at FTMM-57:

Alternative 1: No Action

Alternative 2: LUCs

Alternative 3: Containment via Asphalt Capping with Alternative 2

Alternative 4: Source Removal via Direct Excavation and Backfill

Each alternative is described in detail in the following sections. Cost estimates for each alternative (including summary and detailed cost information) are provided in **Appendix G**.

10.1 Alternative 1 – No Action

Under the no action alternative, no remedial actions of any kind would be undertaken. The NCP requires that a no action alternative be retained for detailed evaluation to provide a baseline comparison with other alternatives (42 CFR 300.430(e)(6)). No formalized LUCs would be established or monitored to control potential receptor exposures to the site-related COC, and no active remediation would be performed. Any existing monitoring wells on FTMM-57 would be secured and locked to prevent illegal disposal or tampering. Alternative 1 would not achieve the RAO.

10.2 Alternative 2 – Land Use Controls

Alternative 2 consists of implementing LUCs (ICs) to control exposure of arsenic in soil (**Figure 11**), in the form of a Deed Notice. Reporting would be conducted to document the continuing effectiveness of the remedy. Alternative 2 would achieve the RAO.

The common elements and distinguishing features of Alternative 2 are as follows:

- A Deed Notice would be prepared, submitted for approval, and implemented to restrict access to soil in exceedance of the cleanup level. Due to the small (0.7 acre) size of FTMM-57, the entire site (as shown on **Figure 11**) would be included in the LUCs and Deed Notice to incorporate all areas that exceed the remediation level for arsenic and meet the requirements for a NJDEP-approved Deed Notice.
- A site wide LUCIP would be prepared and submitted for approval.
- Biennial (every two years) inspections of LUCs and reporting would be conducted.
- Five-year reviews and reporting would be conducted to update and verify the Deed Notice and to assess the effectiveness of meeting the RAO.

The U.S. Army would prepare a LUCIP to document the ICs; specify the physical, administrative, and legal mechanisms; and identify procedural responsibilities including inspections, monitoring and

reporting and long-term management responsibilities to be used to ensure the restricted use of, or access to, the specific property parcel. As part of the environmental restoration process and as required by the CERCLA, five-year reviews and long-term monitoring of other environmental restoration sites at FTMM would also provide convenient opportunity to concurrently review LUCs. At that time, the integrity of the LUCs can also be checked (e.g., are land uses still consistent with the use restrictions, are required markers still in place) to assess the effectiveness of meeting the RAO and verify/confirm the Deed Notice. When the property is transferred to private ownership, the LUCs would be incorporated into the title and the new owner would be responsible for complying with the LUCs.

LUCs would be required for the site indefinitely because the COC arsenic is unlikely to naturally attenuate in soils. For cost estimating purposes, a 30-year time period was used for estimating O&M costs **(Appendix G).**

10.3 Alternative 3 – Containment via Asphalt Capping with Alternative 2

Alternative 3 implements the LUCs previously discussed for Alternative 2. In addition, this alternative addresses impacted soil above remediation levels through installation of an asphalt cap to mitigate risk and ensure achievement of the RAO. The logistics associated with the implementation of Alternative 3 would be addressed in a Remedial Action Work Plan (RAWP). The following elements are associated with Alternative 3:

- Preparation and submittal for approval of RAWP;
- Remedy design including hydrologic modeling to meet the substantive requirements of CAFRA and FHACA, and associated permitting;
- Site demolition including removal of existing pavement, which is aged and in need of replacement;
- Earthwork, stockpiling, and clean imported borrow material loading;
- Waste characterization, material handling, shipping, and transportation of the excavated top layer of pavement and any incidental soil to an offsite landfill disposal facility;
- Construction including base course placement, asphalt paving, and site restoration; and
- Preparation of a Remedial Action Completion Report (RACR).

This alternative involves installing an asphalt cap over approximately 2,700 square yards (0.6 acres) at the FTMM-57 area shown on **Figure 12**, which includes the entire site (excluding Buildings 484 and 488) to incorporate all areas that exceed the remediation level for arsenic in soil, and incidentally would cover the exceedances of the NJDEP RDCSRSs for PAHs. Capping would involve covering the impacted surface area with asphalt pavement to eliminate direct contact with underlying contaminated soils.

Location-specific ARARs include the CAFRA and the FHACA rules. Under CAFRA there are limitations to the total percentage of impermeable surfaces versus permeable surfaces at a site in a CAFRA area. A porous asphalt pavement will be selected to function as a semi-permeable surface, so that no site-specific hydrologic modeling will be required within the designated CAFRA-impacted area. The actual percentage of these limitations varies based on the acreage of the site and the corresponding CAFRA zone (which would be determined during remedial design) in accordance with Subchapter 13 of the CAFRA Rules and discussions with the NJDEP Land Use. Under FHACA, site remediation is exempt from flood storage displacement and net-fill standards if the new asphalt cap does not raise the existing elevation. Alternatively, if the cap design will result in raising the existing elevation, then the corresponding flood storage displacement can be addressed with additional water storage somewhere else on the surrounding area. To minimize permitting requirements, it is assumed that the new asphalt cap will be constructed at

or below the existing grade and will be completed under a CAFRA General Permit 11 for hazardous site investigations and cleanup. In addition, a FHACA Permit-by-Rule 9 will be applied for general construction activities.

Site demolition would include removing existing pavement. Earthwork includes excavating the top layer of pavement or soil to 3 inches below grade, stockpiling into like materials, and disposing offsite as non-hazardous contaminated soil or pavement. Asphalt pavement (3-inch thick) would then be installed. Stormwater collection and conveyance will be incorporated into the asphalt cap to prevent local flooding.

Capping would not reduce the toxicity of the soil contaminants, but would reduce mobility or migration, as well as exposure. Residual contamination will be left in place. A Deed Notice and institutional controls will be implemented to maintain the integrity of the asphalt cover for the protection of site users from exposure to the COC in soil. Biennial inspection, maintenance, and monitoring of the asphalt cap would be conducted. In addition, in accordance with CERCLA requirements, five-year reviews of remedy effectiveness will be required with this alternative, because impacted soil will be left in place. Containment of the impacted soil via capping under this alternative combined with LUCs (Alternative 2) would achieve the RAO. The overall time-frame for this alternative would be 30 years to be protective of human health and the environment.

10.4 Alternative 4 - Source Removal via Direct Excavation and Backfill

Alternative 4 addresses impacted soil above the cleanup goal by removal through direct excavation, backfill with clean soil, and offsite disposal of contaminated subsurface soils. This alternative would result in removal of contaminant mass to meet the RAO. The logistics associated with the implementation of Alternative 4 would be addressed in a RAWP. The following elements are associated with Alternative 4:

- Preparation of RAWP and submittal for approval;
- Remedy design including hydrologic modeling to meet the substantive requirements of CAFRA and FHACA, and associated permitting;
- Site preparation including waste characterization of soil for offsite disposal;
- Excavation of the soil exceeding the arsenic remediation level, and incidental remediation to the NJDEP RDCSRSs for PAHs (approximately 950 cubic yards), and placement into stockpiles of contaminated soil;
- Transportation of the excavated contaminated soil to an offsite landfill disposal facility;
- Post-excavation confirmation soil sampling;
- Backfilling the excavation with suitable clean import material;
- Site restoration; and
- Preparation of a RACR.

Excavation would selectively remove approximately 950 cubic yards of soil where the remediation levels for arsenic and NJDEP RDCSRS for PAHs were exceeded (**Figure 13**). Under Alternative 4, the entire contaminated soil mass would be removed by excavation for offsite disposal, eliminating the need for LUCs or a Deed Notice. The substantive requirements of CAFRA and FHACA permitting and authorization for excavation would be established prior to commencement of work. It is assumed the excavation backfill will be compacted and completed at the existing grade and will be completed under a CAFRA General Permit 11 for hazardous site investigations and cleanup. In addition, a FHACA Permit-by-Rule 9 will be applied for general construction activities.

An average soil excavation depth of 3 feet was assumed under this alternative for removal of the contaminated soil mass and for cost estimating purposes. Actual excavation depth will vary at the site and will target the deepest remediation level exceedance for arsenic and NJDEP RDCSRS exceedance of PAHs at each area slated for removal. Prior to excavation, asphalt would be removed and stockpiled separately for offsite recycling or disposal. It is assumed that groundwater would not be encountered based on the shallow depth of excavation. If precipitation or other water accumulates in the excavation, a temporary sump area would be used as the excavation advances to accumulate water for removal by pumping. The removed water would be staged at the ground surface, characterized for proper waste classification for disposal, and disposed accordingly.

Confirmation soil samples will be collected from the excavation floor and side walls to determine if further step-out excavation is needed. NJDEP guidance specifies confirmation sampling be conducted at the following intervals: 1 sidewall sample per 30 feet and 1 bottom sample per 900 square feet. If cleanup goals are exceeded in confirmation samples, a 2 feet setback for additional excavation will be conducted in that area. For this alternative, the volume of soil to be excavated was estimated as the original estimated volume plus 20% for 1,140 cubic yards. It is assumed all material will require offsite disposal and import backfill will be required. Conventional earthmoving equipment would be used to excavate the soil to the depth and area required. After excavation has been completed, placement of backfill and compaction would be initiated. Compaction tests would be performed during the backfill operation to document the percent relative compaction of the soil. The excavation would be backfilled to the original surface contours and restored to near pre-excavation conditions (crushed stone in paved areas and reseeded in vegetated areas).

The excavated material will be stockpiled, sampled, and characterized for proper disposal. For the purpose of the cost estimate in this FS, the excavated soil is assumed to be classified as non-hazardous waste. Offsite soil would be hauled to a permitted offsite landfill for disposal, using a manifest tracking system. Contaminated soil from FTMM has previously been transported to the Cumberland County landfill near Newburg, Pennsylvania for offsite disposal; therefore, use of this facility was assumed for soil disposal under this alternative.

Detailed field procedures for the management and maintenance of an open excavation area, temporary soil stockpiles, and soil sampling would be provided in the RAWP. This alternative would achieve source removal. Direct excavation under this alternative would achieve the RAO. The overall time-frame for this alternative would be 6 months to be protective of human health and the environment.

11.0 DETAILED COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

This section summarizes information necessary to evaluate the remedial alternatives in accordance with CERCLA and NCP requirements and, to the extent possible, the substantive requirements of N.J.A.C. 7:26E, and presents a detailed comparative analysis of the remedial alternatives.

11.1 Evaluation Criteria

Nine evaluation criteria were developed under the NCP to select a site remedy from remedial action alternatives to address the CERCLA requirements, as well as additional technical and policy considerations. The nine criteria are divided into two threshold criteria, five balancing criteria, and two modifying criteria, as summarized below. The NCP requires that a detailed evaluation of each alternative address each of the nine criteria. The nine criteria are listed below and briefly described in **Table 11**. The first two criteria are Threshold Criteria and must be satisfied for a remedial alternative to be acceptable. Criteria 3 through 7 are Primary Balancing Criteria and are used to weigh major trade-offs among the remedial alternatives that meet the Threshold Criteria. Criteria 8 and 9 are Modifying Criteria and will be considered once State and community comments are received on the preferred remedial alternative and are evaluated during the public review process. The remedial alternatives were evaluated with respect to seven of the nine evaluation criteria outlined by the NCP (40 CFR 300.430) and USEPA (1988) guidance for conducting feasibility studies under CERCLA.

Nine NCP Evaluation Criteria for Detailed Analysis of Alternatives

Threshold Criteria	1. Overall protection of human health and the environment 2. Compliance with ARARs
Primary Balancing Criteria	3. Long-term effectiveness and permanence 4. Reduction of toxicity, mobility, or volume through treatment 5. Short-term effectiveness 6. Implementability 7. Cost
Modifying Criteria	8. State acceptance 9. Community acceptance

11.2 Comparative Analysis

This section presents a detailed comparative analysis of the four remedial alternatives that were developed for FTMM-57 based on evaluating each selected alternative against seven of the nine NCP evaluation criteria (state and community acceptance will be evaluated in the future). The objective of the detailed analysis is to present and interpret the relevant information necessary to select the most appropriate and cost-effective remedy for a site to meet the RAO. The detailed comparative analysis is designed to provide decision-makers with enough information to compare the alternatives, select an appropriate remedy for the site, and demonstrate conformance with the CERCLA remedy selection requirements.

11.2.1 Overall Protection of Human Health and the Environment

An analysis of how well each alternative meets overall protection of human health and the environment is provided below.

11.2.1.1 Alternative 1: No Action

The no action alternative includes no treatment and no control of exposure pathways. Alternative 1 does not achieve the RAO. Under this alternative, short and long-term risks could be unacceptable if people were exposed to the impacted soil. Therefore, this alternative does not provide adequate protection of human health.

11.2.1.2 Alternative 2: Land Use Controls

The LUCs alternative adequately protects human health and the environment by restricting access to the impacted soil, effectively eliminating the exposure pathway, and therefore would achieve the RAO. A Deed Notice is required to document the specifics of the LUCs, and an implementation plan would be in-place. Implementation of this alternative would not have any adverse environmental or health impacts.

11.2.1.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

An asphalt cap eliminates direct contact with soil exceeding the remediation level by placing an asphalt cap over approximately 2,700 square yards that exceed the remediation level for arsenic and incidentally would also cap over the soil that exceeds NJDEP RDCSRS for PAHs. Alternative 3 includes remedial actions that will reduce future exposure to the soil and is considered protective of human-health and the environment. The exposure to contaminated soil will be reduced but not eliminated, since the contamination will remain onsite.

11.2.1.4 Alternative 4: Source Removal via Direct Excavation and Backfill

Alternative 4 would protect human health and the environment by reducing contaminant mass through physical removal of contaminated soil exceeding the remediation level for arsenic and incidentally would also achieve remediation to the NJDEP RDCSRS for PAHs, disposal of impacted source material offsite, and backfill of the excavation with clean imported soil. Alternative 4 would protect human health and the environment because contaminated soil would be removed and so the site would no longer pose a risk to potential receptors. Compared to Alternatives 2 and 3, Alternative 4 adds permanent removal of soil contaminants exceeding cleanup goals. LUCs would not be needed since all contaminated soil would be removed.

11.2.2 Compliance with ARARs

An analysis of how well each alternative complies with ARARs is provided below.

11.2.2.1 Alternative 1: No Action

The requirements to meet ARARs are not triggered by the no action alternative and therefore a discussion of compliance with ARARs is not appropriate for this alternative since it is not applicable.

11.2.2.2 Alternative 2: Land Use Controls

Alternative 2 would comply with ARARs. LUCs would be used to restrict construction and future land use within the arsenic remediation level exceedance area and incidentally NJDEP RDCSRS PAH exceedance areas. Soil access would be restricted through establishment of a Deed Notice and remain in effect over the expected time duration (greater than 30 years). This alternative includes an LUCIP with biennial inspections and five-year reviews, maintenance, and evaluations to verify effectiveness of the technology.

11.2.2.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

Alternative 3 complies with action–specific and chemical-specific ARARs. Location-specific ARARs pertaining to floodplains and coastal areas would be addressed in the remedial design. This alternative will eliminate exposure to contamination in soil by placement of asphalt pavement; therefore, all ARARs will be attained.

11.2.2.4 Alternative 4: Source Removal via Direct Excavation and Backfill

Alternative 4 complies with action–specific and chemical-specific ARARs. Location-specific ARARs pertaining to floodplains and coastal areas would be addressed in the remedial design. This alternative involves direct removal of soil exceeding arsenic remediation levels and NJDEP RDCSRS for PAHs with offsite disposal to remove source material and reduce contaminant mass. The removed soil and any generated wastewater would be staged on site and characterized prior to offsite disposal. Compliance would be achieved more quickly than with Alternatives 2 and 3.

11.2.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refer to expected residual risk and the ability of the remedial alternative to maintain reliable protection of human health and the environment over time. This criterion includes the consideration of residual risk that would remain onsite following remediation (if any), and the adequacy and reliability of controls. An analysis of the long-term effectiveness and permanence for each alternative is provided below.

11.2.3.1 Alternative 1: No Action

This alternative would not provide any actions or controls to reduce the existing contaminant levels or risks to human health and the environment. No measures are provided to monitor its effectiveness or to control exposure during the duration of this alternative. In addition, implementation of this remedial alternative may have adverse consequences should the soil be exposed. Therefore, the long-term effectiveness and permanence criterion is rated low for this alternative.

11.2.3.2 Alternative 2: Land Use Controls

Alternative 2 provides actions to reduce risks to human health and the environment through LUCs and a Deed Notice designed to prohibit access of impacted soil. The current contamination levels exceed the cleanup goal. However, over an extended period (greater than 30 years) this alternative is expected to mitigate exposure to soil contaminants through administrative controls. Therefore, this alternative would provide moderate long-term effectiveness and permanence.

11.2.3.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

This alternative would provide a moderate to high degree of long-term effectiveness and permanence. Controls for exposure and long-term management measures will be implemented through a remedial action to cover the impacted soil with an asphalt cap and impose LUCs to minimize disturbances of the asphalt cap. Biennial inspections and repairs will be required to retain integrity of the asphalt layer. Long-term effectiveness is contingent on maintenance of the asphalt cap. Inspections and maintenance of the asphalt cap will need to be conducted as long as the cover is in place, which is assumed for 30 years for the purpose of this FS.

11.2.3.4 Alternative 4: Source Removal via Direct Excavation and Backfill

This alternative would provide a high degree of long-term effectiveness and permanence because all contaminated soils would be directly removed from the site through excavation and replaced with clean imported soil. The excavation of impacted materials provides a permanent solution for protecting human receptors and results in an adequate and reliable reduction of exposure pathways. This alternative satisfies

the RAO. Removing this contamination effectively reduces the area of potential exposure to contamination and accelerates the time frame for attaining RAO by permanent removal of the chemical mass in the soil.

11.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction in toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of the remedial alternative to permanently or significantly reduce the toxicity, mobility, or volume of contaminants. An analysis of the reduction of toxicity, mobility, or volume through treatment for each alternative is presented below.

11.2.4.1 Alternative 1: No Action

This alternative would not include active treatment and does not provide for any reduction of toxicity, mobility, or volume through treatment of the contaminated soil. Therefore, this criterion is rated low for this alternative.

11.2.4.2 Alternative 2: Land Use Controls

This criterion is rated low for Alternative 2 because it does not include active treatment of the contaminated soil but contains LUCs and a monitoring program to achieve the RAO.

11.2.4.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

This criterion is rated low for Alternative 3 since no treatment is being applied and it will not reduce toxicity, mobility, or volume; however, the risk is mitigated through capping and LUCs. The asphalt cap will require long-term O&M to verify that the integrity of the semi-permeable layer is still intact.

11.2.4.4 Alternative 4: Source Removal via Direct Excavation and Backfill

Although treatment is not a component of this alternative, there would be significant mass reduction since all impacted soil would be removed and disposed offsite. Therefore, since the soil contaminants would be removed, this criterion is rated high.

11.2.5 Short-Term Effectiveness

Short-term effectiveness addresses the time needed to implement the remedy and any adverse impacts to workers, the community, and the environment during construction and operation of the remedy. An analysis of the short-term effectiveness for each alternative is provided below.

11.2.5.1 Alternative 1: No Action

No remedial actions would be implemented under the no action alternative; therefore, this evaluation criterion is rated high.

11.2.5.2 Alternative 2: Land Use Controls

Short-term effectiveness is rated moderate for this alternative. Field activity associated with this alternative is limited to installing any ICs such as markings. This alternative would require implementation for a period of 30 years, which results in increased potential adverse impacts over the entire duration of the project.

11.2.5.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

Measures will be put in place to limit the risk of off-site migration during all remedial activities. Air monitoring will be conducted to verify proper protection of onsite personnel during excavation and pavement removal activities, specifically during grading of each area prior to cover installation. During

existing pavement excavation and loading, the work areas will be wetted to minimize dust generation. An increased level of truck traffic will occur during implementation. A site-specific workplan, sampling and analysis plan (SAP), and health and safety plan (HASP) would be prepared and implemented. Field personnel would wear personal protective equipment (PPE) as specified in the HASP. HASP will include a traffic control plan to minimize risks from moving equipment during construction. The implementation of the excavation, paving, and disposal portion of this alternative would take approximately 6 months; in addition, LUCs would be implemented for a period of 30 years, which results in increased potential adverse impacts over the entire duration of the project. Therefore, the short-term effectiveness for Alternative 3 is rated moderate to low

11.2.5.4 Alternative 4: Source Removal via Direct Excavation and Backfill

Field activities associated with this alternative include excavation of 1,140 cubic yards of soil, field sampling, loading, and transport of site media to an approved disposal facility. A site-specific workplan, SAP, and HASP would be prepared and implemented. Field personnel participating in the sampling activity would wear PPE as specified in the HASP. Heavy equipment operated at the site would conform to Occupational Safety and Health Administration (OSHA) specifications and would be operated only by authorized, trained personnel. Risks associated with exposure of site personnel and nearby receptors to dust emissions and/or direct contact with contaminated soil during excavation, stockpiling, and sampling would be minimized by using dust suppressants and/or appropriate PPE, where applicable. There are associated potential construction hazards over the duration of the excavation remedy, such as potential struck-by hazards from heavy equipment. There would also be added traffic on public roadways associated with the transport of contaminated soil to the disposal facility. The implementation of the excavation and disposal portion of this alternative would take approximately 6 months. Therefore, the short-term effectiveness for Alternative 4 is rated low.

11.2.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedial alternative from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered. An analysis of the implementability of each alternative is provided below.

11.2.6.1 Alternative 1: No Action

This alternative is not rated because no action would be taken.

11.2.6.2 Alternative 2: Land Use Controls

Implementability is ranked high for Alternative 2. LUCs limiting soil access is an administrative process that is readily implementable. A Deed Notice would be developed for areas with remediation level exceedances of arsenic and would incidentally include the areas with NJDEP RDCSRS exceedances of PAHs, which has been previously applied to numerous sites in New Jersey. The Army will prepare a LUCIP to document the LUCs and identify procedural responsibilities.

11.2.6.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

The installation of an asphalt cap is an established technology but is expected to require design and logistical planning and permitting requirements due to the location of the site within a 100-year flood plain. No new technologies need to be used or implemented. Materials for the asphalt cap can be easily obtained and installed; however, the permitting associated with the impermeable surface, tying the asphalt cap into existing grade and managing storm water may cause some technical and administrative challenges. The State and community, as well as the Army, would need to accept impacted material remaining onsite. LUCs would also be implemented for the duration of the remedial alternative. Although

installation of an asphalt cap is a widely implemented technology, implementability is ranked moderate to low for Alternative 3 due to these logistics.

11.2.6.4 Alternative 4: Source Removal via Direct Excavation and Backfill

Excavation and disposal of existing pavement, contaminated soil, and any wastewater at an offsite disposal facility is implementable but is expected to require design and logistical planning, and extensive permitting requirements due to the location of the site within a 100-year flood plain. Several firms can provide the necessary equipment, materials, and labor to excavate and dispose of the contaminated materials. Any buried utilities will have to be accurately and safely identified prior to excavation which may present logistical challenges during field work. Licensed disposal facilities capable of accepting the contaminated materials currently exist. Approximately 75 truckloads of contaminated material would be transported across public roadways for offsite disposal. Although excavation is a widely implemented technology, implementability is ranked moderate to low for Alternative 4 due to site logistics.

11.2.7 Cost

A summary of the costs is provided below. Total present value (TPV) cost including a 25% contingency have been provided. A detailed breakdown of these costs for each alternative is presented in **Appendix G**.

11.2.7.1 Alternative 1: No Action

There are no costs for Alternative 1.

11.2.7.2 Alternative 2: Land Use Controls

The TPV cost for Alternative 2 is approximately $319,000. The capital costs include the preparation of a LUCIP and a Deed Notice; biennial inspection, monitoring, reporting, and long-term management; and periodic cost which includes the five-year review and reporting. Time-frame for Alternative 2 is 30 years.

11.2.7.3 Alternative 3: Containment via Asphalt Capping with Alternative 2

The TPV cost for Alternative 3 is estimated at $771,000. The capital costs include preparation of a RAWP and all required permitting; the required equipment, materials, and labor to perform site preparation and removal of existing pavement; asphalt paving at or below existing grade; waste characterization, transportation and disposal of excavated material at an appropriate disposal facility; and site restoration and the preparation of a completion report. In addition, costs for Alternative 2 are included. Time-frame for costing Alternative 3 is 30 years.

11.2.7.4 Alternative 4: Source Removal via Direct Excavation and Backfill

The TPV cost for Alternative 4 is estimated at $416,000. The capital costs include preparation of a RAWP and the required equipment, materials, and labor to perform site preparation; excavation, backfilling with clean soil, and stockpiling; confirmation sampling and waste characterization; transportation and disposal of excavated material at an appropriate disposal facility; and site restoration and the preparation of a completion report. Time-frame for Alternative 4 is 6 months.

11.3 Summary of Comparative Analysis

The results of the comparative analyses are summarized below and on **Table 12**.

Alternative 1 is not protective of human health; does not trigger ARARs since there is no action; provides little long-term effectiveness and permanence; achieves no reduction in toxicity, mobility, or volume through active treatment; does provide short-term effectiveness; and has no cost.

Alternatives 2, 3, and 4 would provide adequate protection of human health and the environment and comply with ARARs and therefore, satisfy the threshold criteria for a CERCLA remedy.

Alternatives 2 provides long-term effectiveness and permanence and short-term effectiveness, and is the most easily implemented alternative, but it does not provide removal of soil contamination, and therefore achieves no reduction of toxicity, mobility, or volume by treatment. This alternative would provide necessary restrictions to limit exposure to the site contaminants. It is the least expensive alternative.

Alternative 3 mitigates exposure and containment of the impacted soil via capping and would provide moderate to high long-term effectiveness and moderate to low short-term effectiveness and implementability. Alternative 3 does not provide removal of soil contamination, and therefore achieves no reduction of toxicity, mobility, or volume by treatment. Alternative 3 is the most expensive alternative.

Alternative 4 remediates all impacted soil exceeding the remediation level and would provide the highest long-term effectiveness and reduction of toxicity, mobility, or volume by removing all impacted material and disposing offsite. Short-term effectiveness is rated low and implementability is rated moderate to low. Alternative 4 provides the shortest remedial time-frame.

12.0 FEASIBILITY STUDY CONCLUSIONS

The remedial alternatives identified to address the risk to human health due to exposure to arsenic in soil at FTMM-57 were evaluated against the NCP evaluation criteria. The comparative analysis of alternatives was conducted using the current RI and HHRA results, which include the present state of knowledge concerning potential contamination and both current and reasonably anticipated future land use. If new information arises concerning contamination at the site or if land uses change beyond what has been assumed, the evaluation of these remedial alternatives may need to be revisited. For the Alternatives 1 through 3 that do not achieve UU/UE, the five-year reviews that are required for each potential alternative provide a formal mechanism to assess these possible changes, evaluate whether implemented remedies remain sufficiently protective of human health and the environment, and to recommend further steps to be taken if they are not.

Based on the analyses of remedial alternatives conducted in this FS, a Proposed Plan should be developed to recommend a preferred alternative for implementation. This preferred alternative should be the alternative that best meets the nine CERCLA criteria.

13.0 REFERENCES

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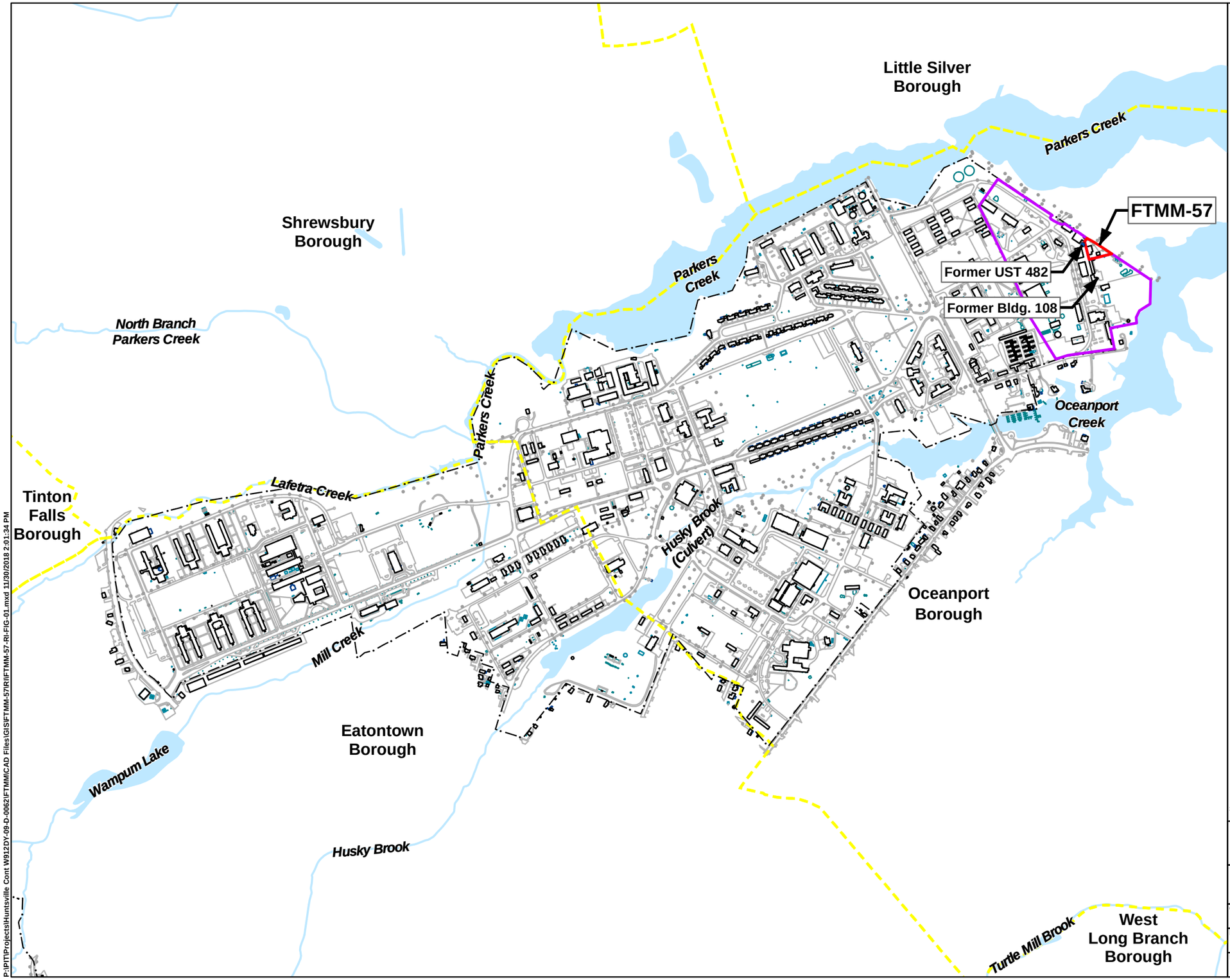
FIGURES



LEGEND:

- UST 482
- FTMM-57 Boundary
- Parcel 83 Boundary
- Installation Boundary
- Municipal Boundary
- Surface Water Feature

N

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Source: FTMM Supplied CAD, 2013; ESRI Data and Maps, 2011; USGS NHD, 2012.

PARSONS 401 Diamond Drive NW, Huntsville AL	**Fort Monmouth** **New Jersey**

FTMM-57 SITE LOCATION

CREATED BY: RR	REVIEWED BY: AM
DATE: NOV. 2018	FIGURE NUMBER: FIGURE 1
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-01.mxd

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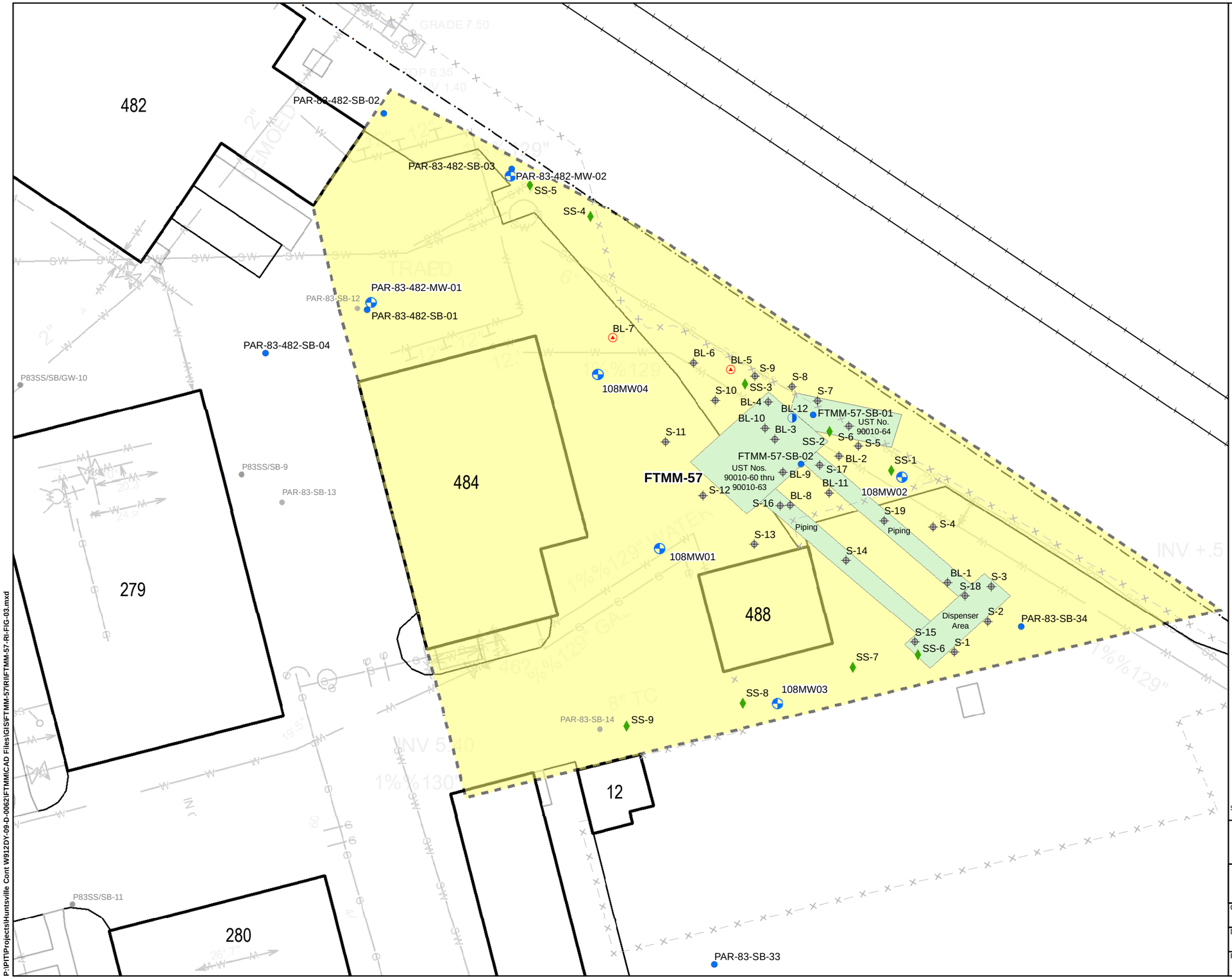

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LEGEND:

- Parsons Sampling Locations (2017)
- Soil Sample (1993 and 2010)
- Soil and Groundwater Sample (2010)
- Groundwater Sample (2010)
- Geoprobe Location (2001)
- Site Investgation Sample (2007, 2016)
- Shallow Monitoring Well
- Fenceline
- Railroad Tracks
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

NOTE:

See Parcel 83 Work Plan (Reference 4) for PAR-83-SB-49 and PAR-83-SB-50 sample locations.

N

1 inch = 30 feet

0 15 30 60 Feet

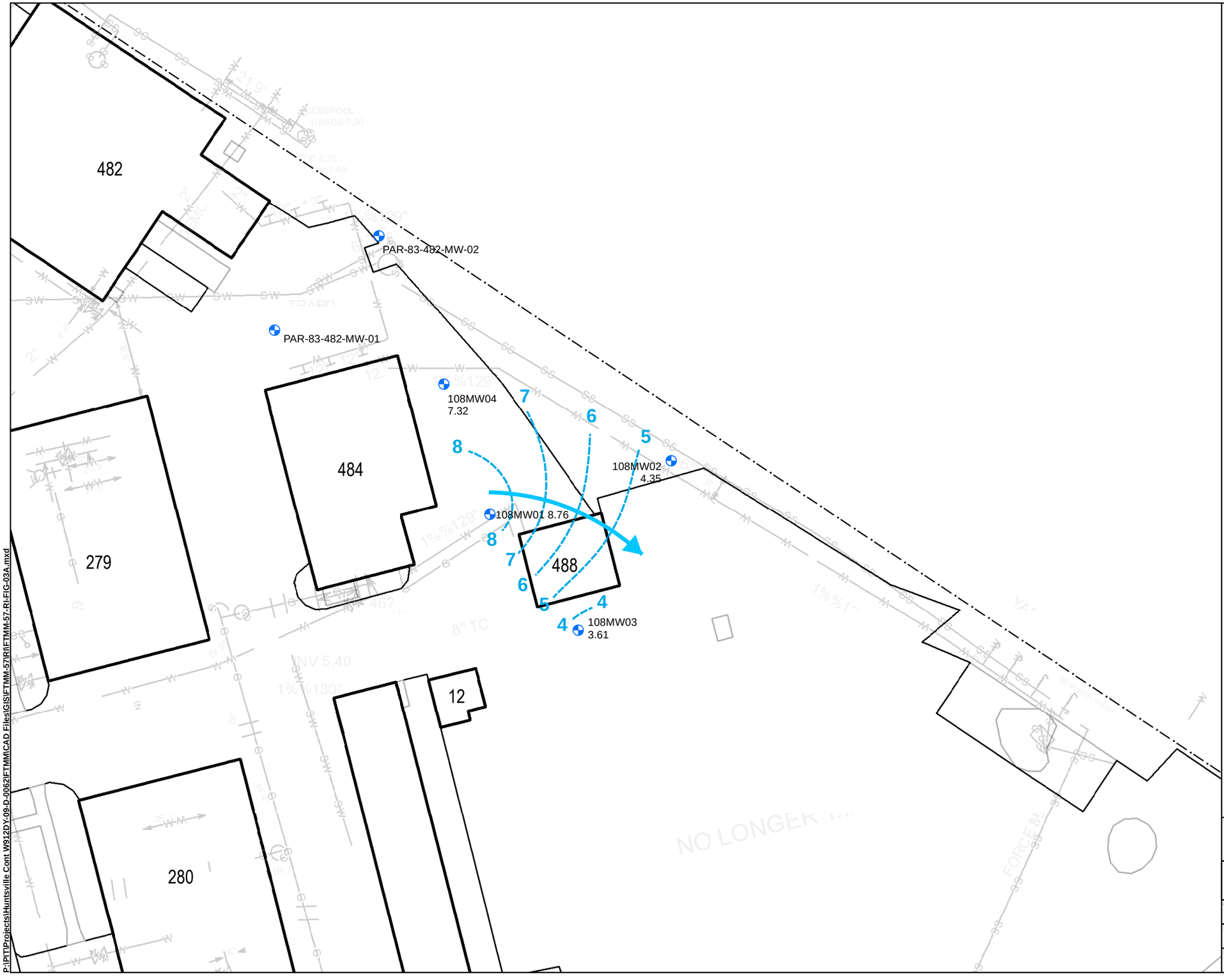
Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS
401 Diamond Drive NW, Huntsville AL

Fort Monmouth New Jersey

FTMM-57 SITE LAYOUT AND SAMPLING LOCATIONS

CREATED BY:	REVIEWED BY:
RR	KF
DATE:	FIGURE NUMBER:
OCT. 2018	FIGURE 2
PROJECT NUMBER:	FILE:
748810-06018	FTMM-57-RI-FIG-03.mxd



LEGEND:

- Shallow Monitoring Well
- Installation Boundary
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Groundwater Elevation Contour
- Inferred Groundwater Flow Direction

DRAFT

N

1 inch = 40 feet

0 20 40 80 Feet

Source: FTMM Supplied CAD

PARSONS 401 Diamond Drive NW, Huntsville AL	**Fort Monmouth** **New Jersey**

FTMM-57 SHALLOW GROUNDWATER CONTOURS - OCTOBER 2, 2015

CREATED BY: RR	REVIEWED BY: ME
DATE: OCT. 2018	FIGURE NUMBER: FIGURE 3
PROJECT NUMBER: 748810-01000	FILE: FTMM-57-RI-FIG-03A.mxd

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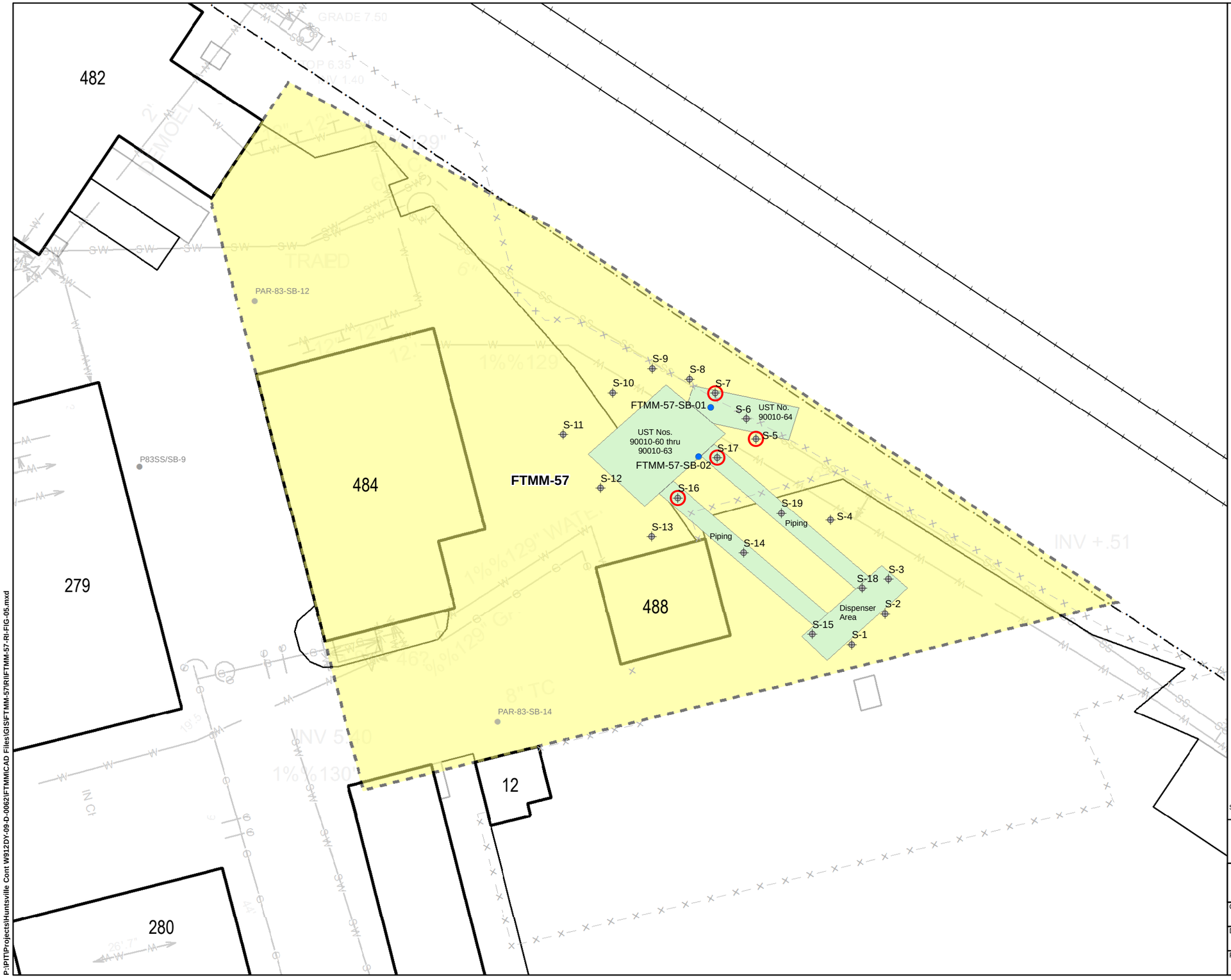

LEGEND:

- Sampling Locations (2017)
- Exceeds USEPA RSL for Benzene, Ethylbenzene, or Xylenes
- Soil Sample (1993)
- Site Investgation Sample (2007, 2016)
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

N

1 inch = 30 feet

0 15 30 60 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 COMPARISON OF SOIL RESULTS FOR VOCs TO USEPA RSLs

CREATED BY: RR	REVIEWED BY: KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 4
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-05.mxd

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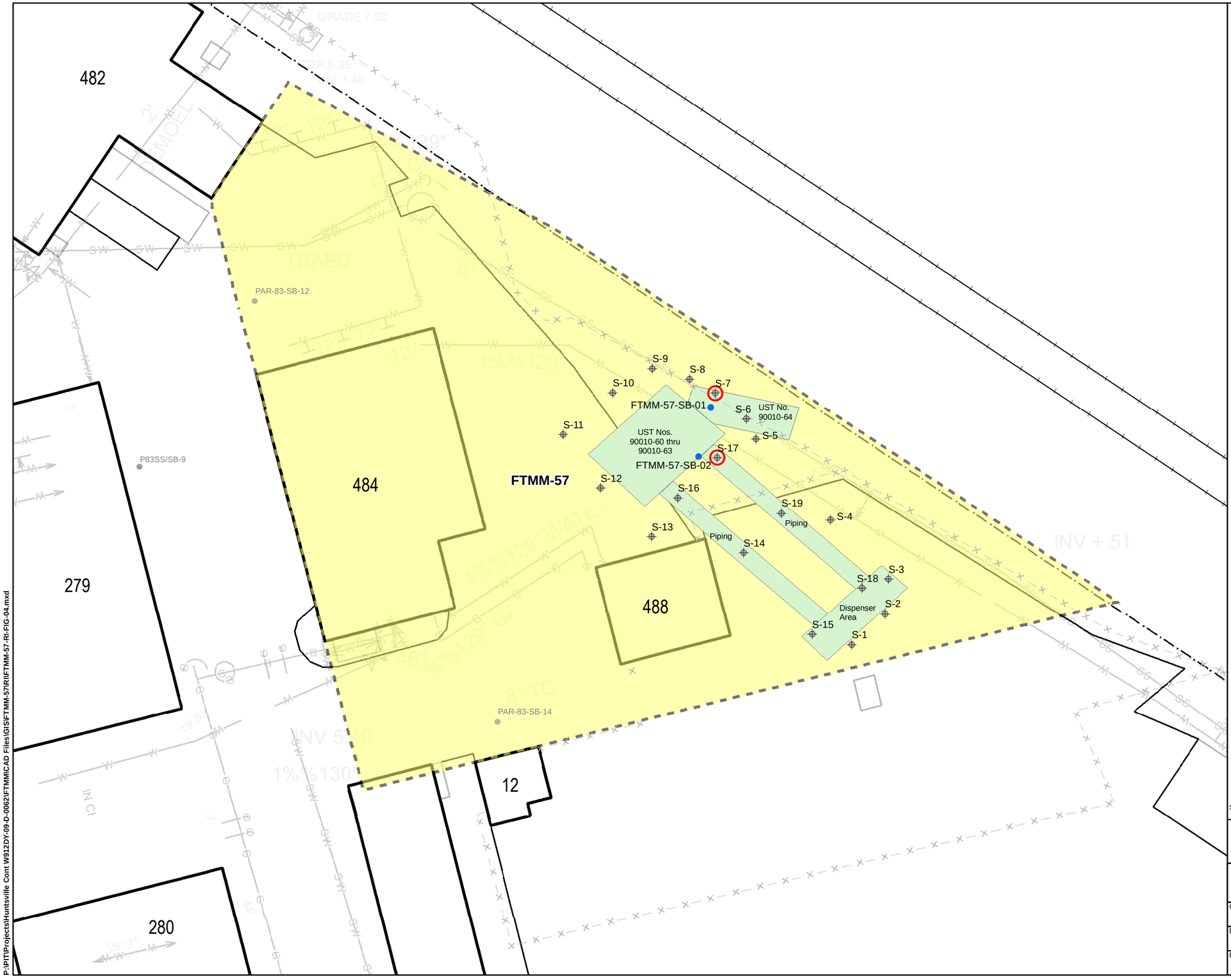

LEGEND:

- Sampling Locations (2017)
- Exceeds RDCSRS for Benzene
- Soil Sample (1993)
- Site Investgation Sample (2007, 2016)
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

N

1 inch = 30 feet

0 15 30 60 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 COMPARISON OF SOIL RESULTS FOR VOCs TO NJDEP DIRECT CONTACT STANDARDS

CREATED BY: RR	REVIEWED BY: KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 5
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-04.mxd

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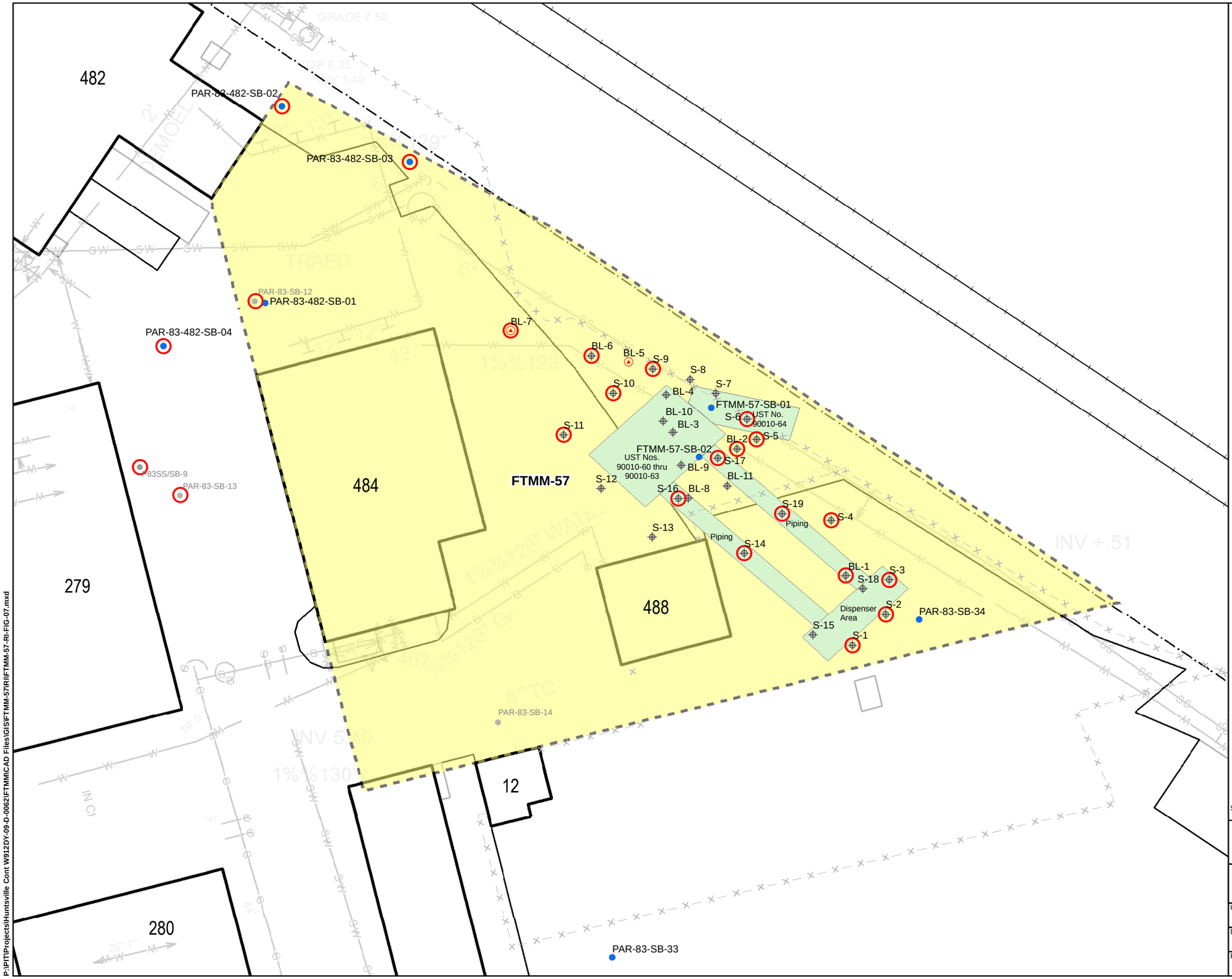

LEGEND:

- Sampling Locations (2017)
- Exceeds USEPA RSLs for PAHs
- Soil Sample (1993 and 2010)
- Soil and Groundwater Sample (2010)
- Site Investgation Sample (2007, 2016)
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

N

1 inch = 30 feet

0 15 30 60 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS
401 Diamond Drive NW, Huntsville AL

Fort Monmouth
New Jersey

FTMM-57 COMPARISON OF SOIL RESULTS FOR PAHs TO USEPA RSLs

CREATED BY:	REVIEWED BY:
RR	KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 6
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-07.mxd

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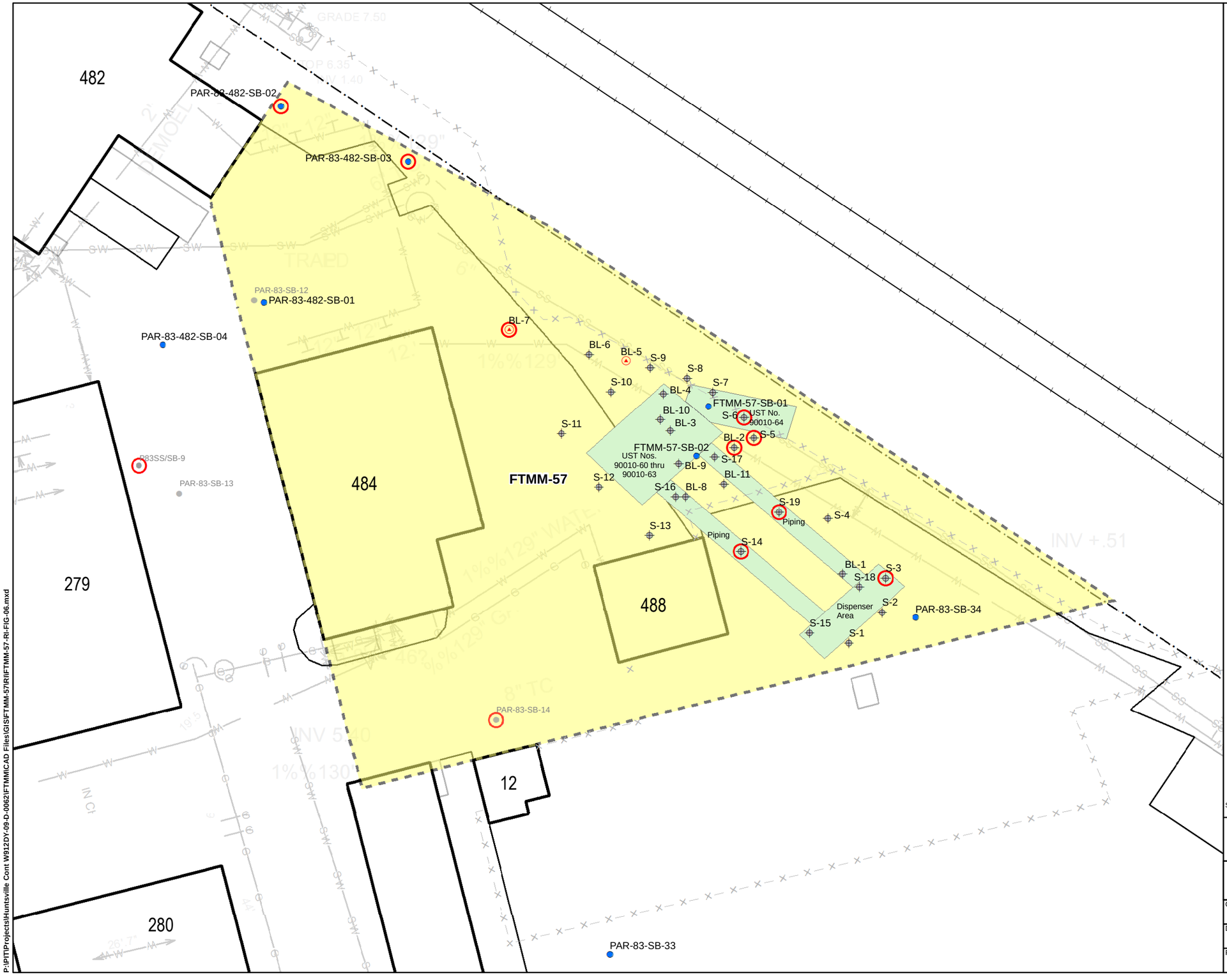

LEGEND:

- Sampling Locations (2017)
- Exceeds RDCSRS for PAHs
- Soil Sample (1993 and 2010)
- Soil and Groundwater Sample (2010)
- Site Investgation Sample (2007, 2016)
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

N

1 inch = 30 feet

0 15 30 60 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 COMPARISON OF SOIL RESULTS FOR PAHs TO NJDEP DIRECT CONTACT STANDARDS

CREATED BY: RR	REVIEWED BY: KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 7
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-06.mxd

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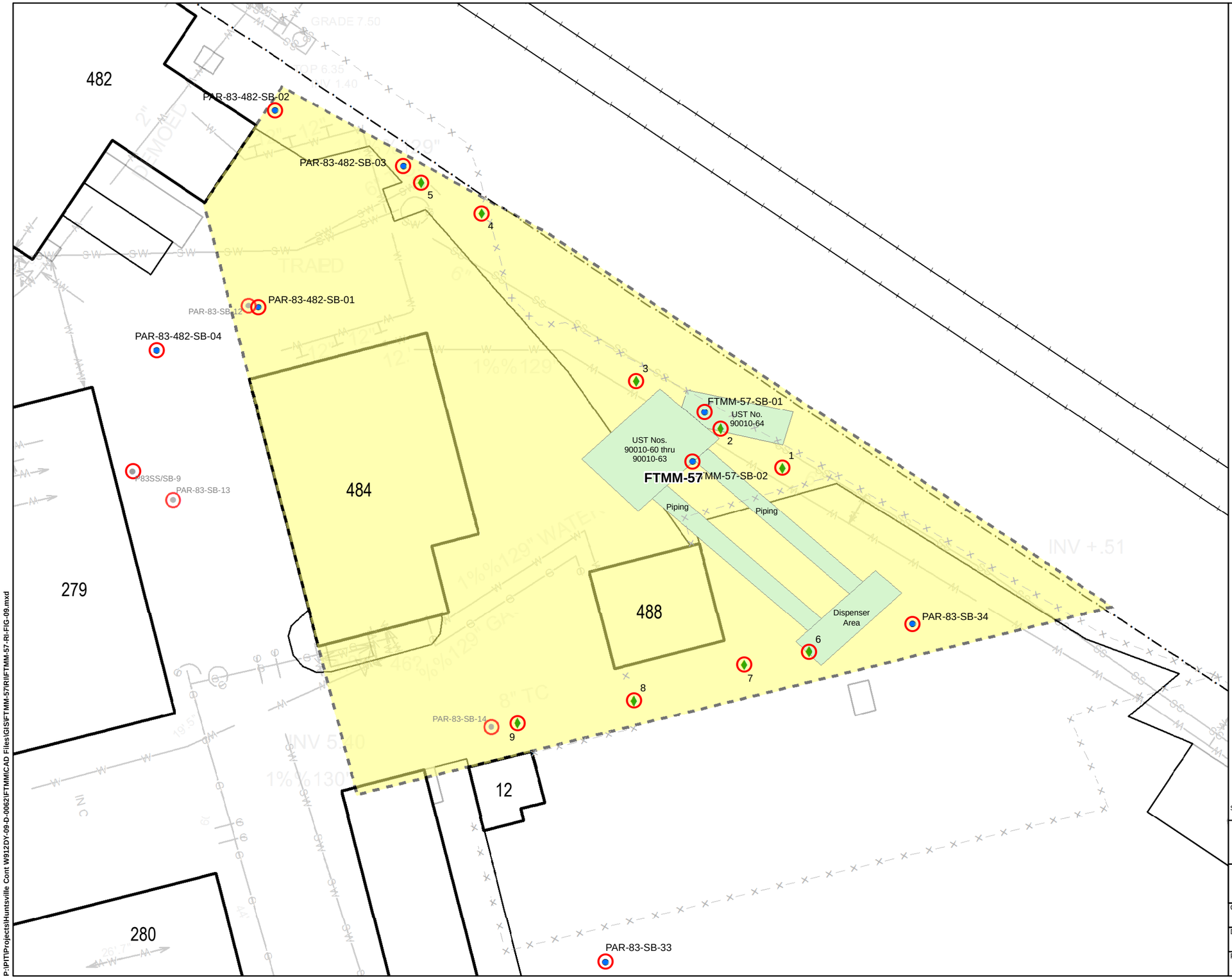


LEGEND:

- Sampling Locations (2017)
- Exceeds USEPS RSL for
- Geoprobe Location (2001)
- Site Investgation Sample (2007, 2016)
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

N

1 inch = 30 feet

0 15 30 60 Feet

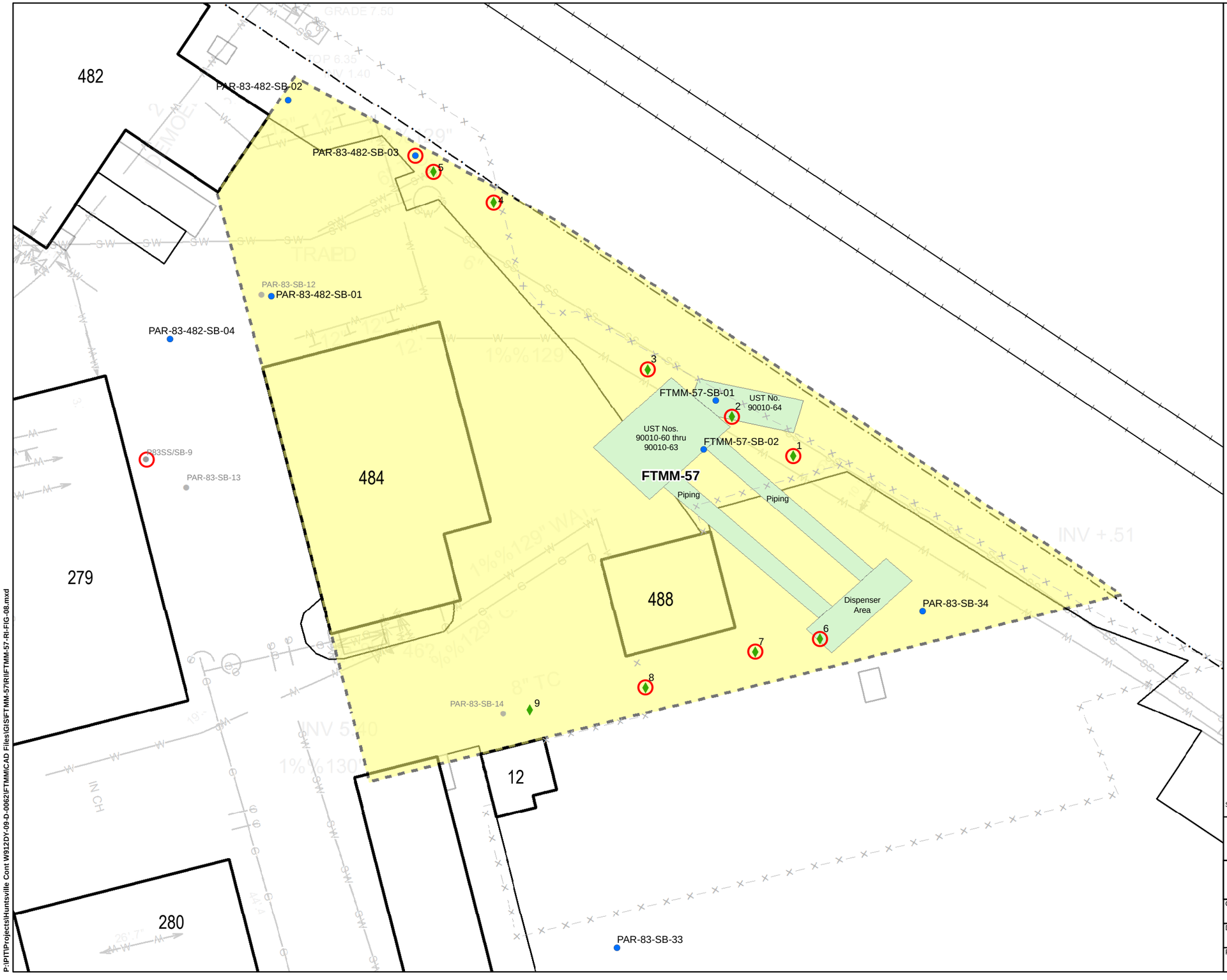
Source: FTMM Supplied CAD; Shaw Environmental 2008.

P:\PIT\Projects\Huntsville Cont W912DY-09-D-0062\FTMM\CAD Files\GIS\FTMM-57\RI\FTMM-57-RI-FIG-09.mxd

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 COMPARISON OF SOIL RESULTS FOR ARSENIC TO USEPA RSLs

CREATED BY: RR	REVIEWED BY: KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 8
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-09.mxd



LEGEND:

- Sampling Locations (2017)
- Exceeds RDCSRS and Weston 1995 maximum background for Arsenic
- Geoprobe Location (2001)
- Site Investgation Sample (2007, 2016)
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser

N

1 inch = 30 feet

0 15 30 60 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 COMPARISON OF SOIL RESULTS FOR METALS TO NJDEP DIRECT CONTACT STANDARDS

CREATED BY: RR	REVIEWED BY: KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 9
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-08.mxd

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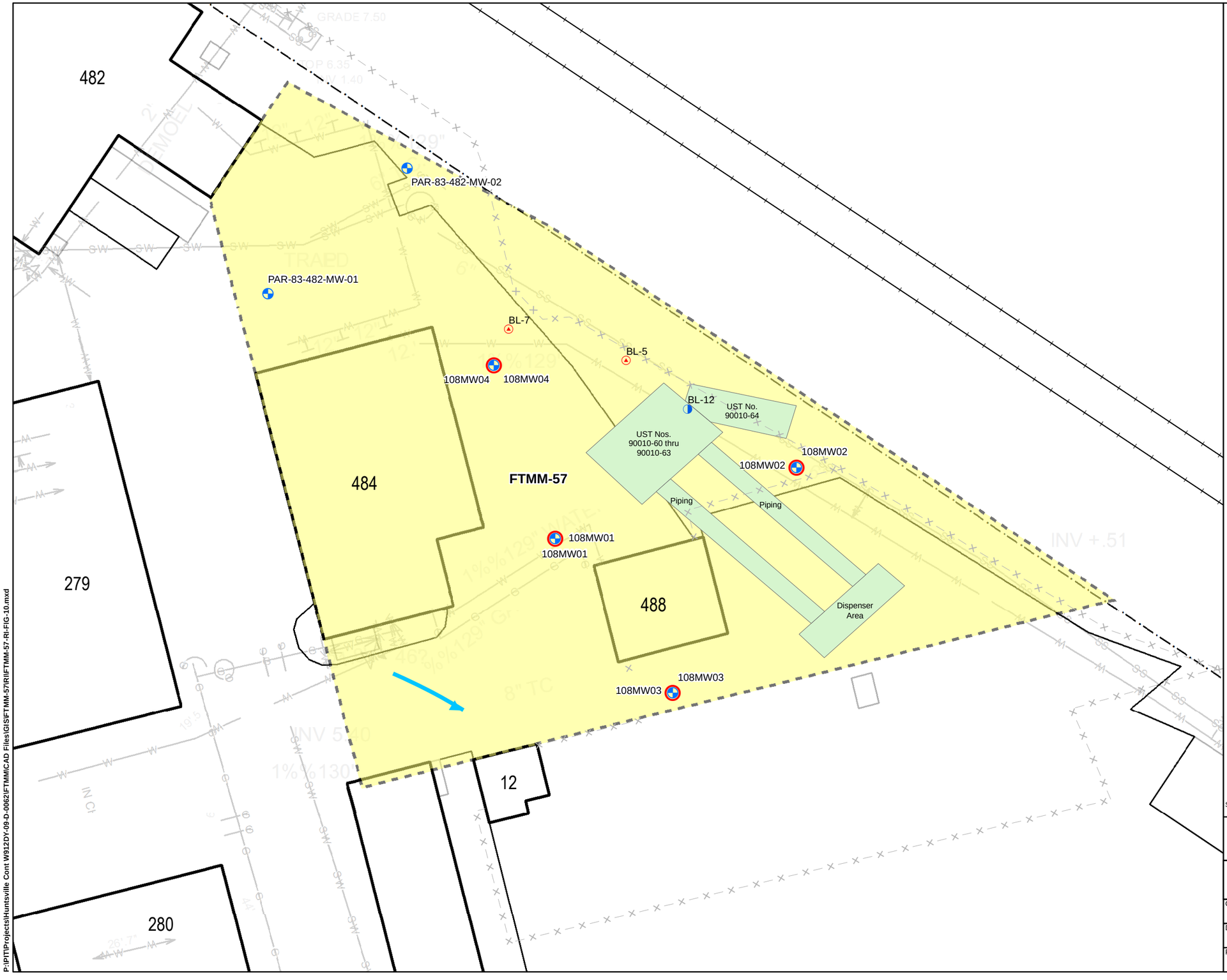

LEGEND:

- Soil and Groundwater Sample (2010)
- Groundwater Sample (2010)
- Shallow Monitoring Well
- Exceeds USEPA Tapwater RSLs
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser
- Generalized Groundwater Flow Direction

NOTE:

PAR-83-482-MW01 and PAR-83-482-MW02 were not sampled for metals. Any COPCs detected in these wells are considered to be associated with adjacent UST482 which is addressed under separate cover.

N

1 inch = 30 feet

0 15 30 60 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 GROUNDWATER EXCEEDANCES OF USEPA TAPWATER RSLs

CREATED BY: RR	REVIEWED BY: KF
DATE: AUG. 2018	FIGURE NUMBER: FIGURE 10
PROJECT NUMBER: 748810-06018	FILE: FTMM-57-RI-FIG-10.mxd

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LEGEND:

- Exceeds RDCSRS & Background for
- Exceeds RDCSRS for PAHs
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser
- Land Use Controls

NOTE:

Sample location P83SS/SB-9 would be addressed in the Parcel 83 remedy.

N

1 inch = 40 feet

0 20 40 80 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

ALTERNATIVE 2
CONCEPTUAL LAYOUT

CREATED BY: RR	REVIEWED BY: KF
DATE: JUN. 2020	FIGURE NUMBER: FIGURE 11
PROJECT NUMBER: 748810-06030	FILE: FTMM-57-RI-FIG-11.mxd

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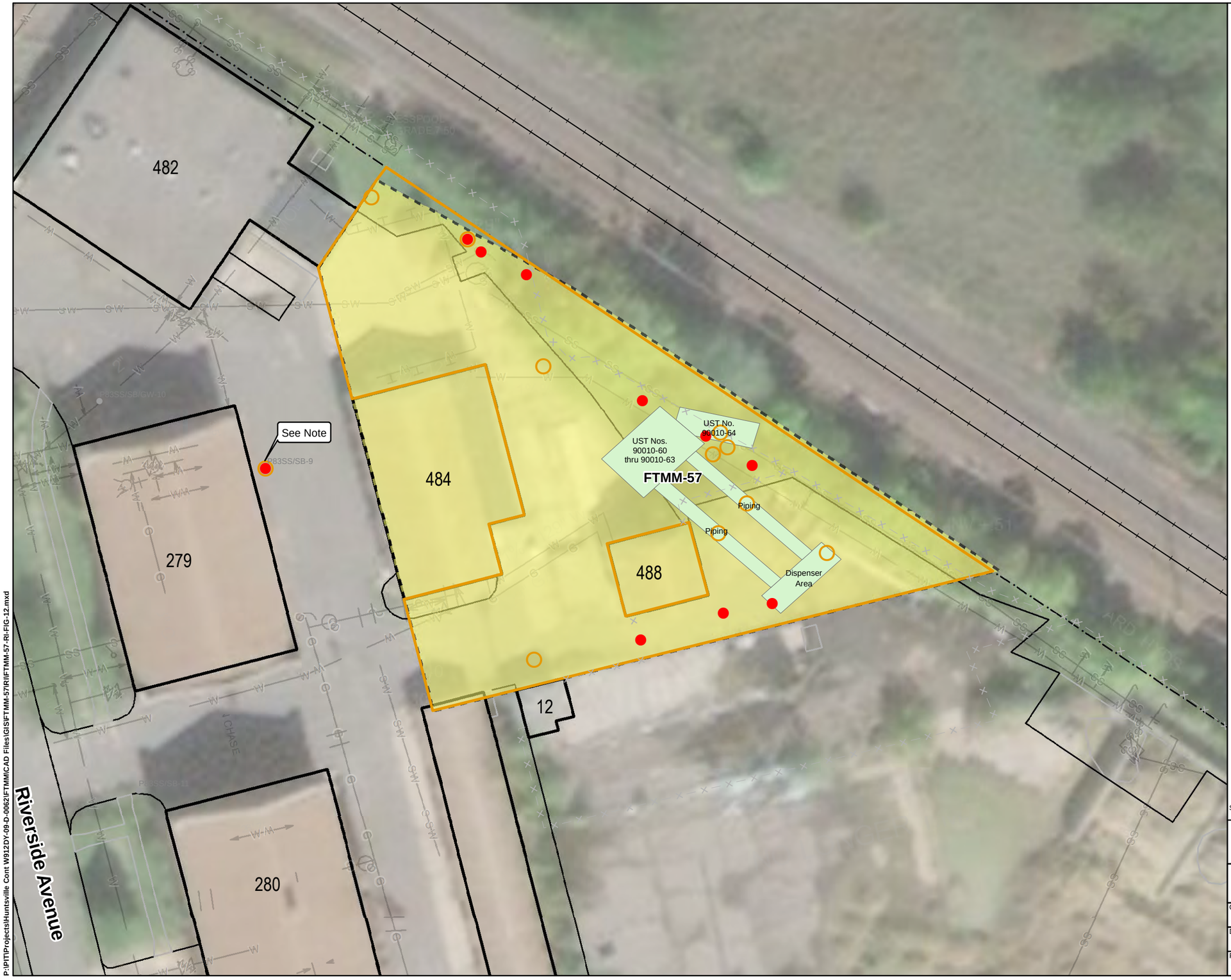

LEGEND:

- Exceeds RDCSRS & Background for
- Exceeds RDCSRS for PAHs
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser
- Asphalt Pavement

NOTE:

Sample location P83SS/SB-9 would be addressed in the Parcel 83 remedy.

N

1 inch = 40 feet

0 20 40 80 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

ALTERNATIVE 3
CONCEPTUAL LAYOUT

CREATED BY: RR	REVIEWED BY: KF
DATE: JUN. 2020	FIGURE NUMBER: FIGURE 12
PROJECT NUMBER: 748810-06030	FILE: FTMM-57-RI-FIG-12.mxd

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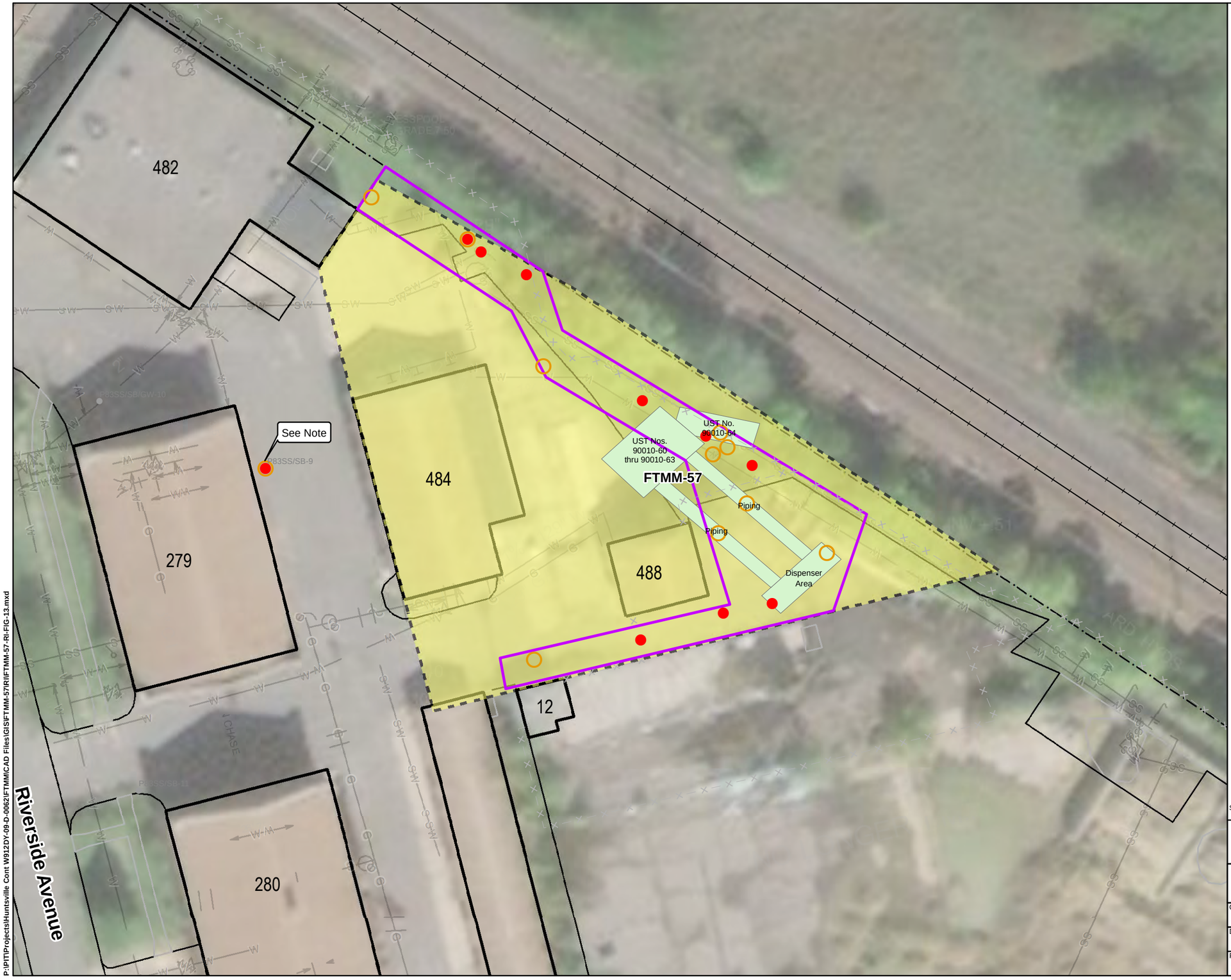

LEGEND:

- Exceeds RDCSRS & Background for Arsenic
- Exceeds RDCSRS for PAHs
- Fenceline
- Railroad Tracks
- Surface Water Feature
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Installation Boundary
- FTMM-57 Boundary
- Former UST Piping and Dispenser
- Excavation Areas

NOTE:

Sample location P83SS/SB-9 would be addressed in the Parcel 83 remedy.

N

1 inch = 40 feet

0 20 40 80 Feet

Source: FTMM Supplied CAD; Shaw Environmental 2008.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

ALTERNATIVE 4
CONCEPTUAL LAYOUT

CREATED BY: RR	REVIEWED BY: KF
DATE: JUN. 2020	FIGURE NUMBER: FIGURE 13
PROJECT NUMBER: 748810-06030	FILE: FTMM-57-RI-FIG-13.mxd

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TABLES

TABLE 1
SAMPLE AND ANALYTICAL SUMMARY
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Media	Type	Sample Location	Sample Identification	Sample Type	Sample Date	Sample Depth Top	Sample Depth Bottom	VO+ TICs	SVO+ TICs	Metals	PAHs	Pesticides	EPH
1993 Closure Samples (Weston)													
Soil	Stainless Steel Scoop	S-1	Bldg108 S-1-4-4	Primary Sample	03-May-93	4	4	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-2	Bldg108 S-2-4-4	Primary Sample	03-May-93	4	4	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-3	Bldg108 S-3-4-4	Primary Sample	03-May-93	4	4	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-4	Bldg108 S-4-1-1	Primary Sample	03-May-93	1	1	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-5	Bldg108 S-5-6-6	Primary Sample	03-May-93	6	6	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-6	Bldg108 S-6-5-5	Primary Sample	03-May-93	5	5	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-7	Bldg108 S-7-7-7	Primary Sample	03-May-93	7	7	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-8	Bldg108 S-8-6-6	Primary Sample	03-May-93	6	6	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-9	Bldg108 S-9-5-5	Primary Sample	03-May-93	5	5	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-10	Bldg108 S-10-5-5	Primary Sample	03-May-93	5	5	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-11	Bldg108 S-11-5-5	Primary Sample	03-May-93	5	5	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-13	Bldg108 S-13-1.5-1.5	Primary Sample	03-May-93	1.5	1.5	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-14	Bldg108 S-14-3-3	Primary Sample	03-May-93	3	3	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-15	Bldg108 S-15-4-4	Primary Sample	03-May-93	4	4	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-16	Bldg108 S-16-6-6	Primary Sample	03-May-93	6	6	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-17	Bldg108 S-17-6-6	Primary Sample	03-May-93	6	6	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-18	Bldg108 S-18-4-4	Primary Sample	03-May-93	4	4	X	--	X[(1)]	X	--	--
Soil	Stainless Steel Scoop	S-19	Bldg108 S-19-3-3	Primary Sample	03-May-93	3	3	X	--	X[(1)]	X	--	--

TABLE 1
SAMPLE AND ANALYTICAL SUMMARY
SUMMARY REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Media	Type	Sample Location	Sample Identification	Sample Type	Sample Date	Sample Depth Top	Sample Depth Bottom	VO+ TICs	SVO+ TICs	Metals	PAHs	Pesticides	EPH
2001 Remedial Investigation (Versar)													
Soil	Geoprobe	SS-1	Bldg108 SS-1-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-1-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-1-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-2	Bldg108 SS-2-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-2-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-2-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-3	Bldg108 SS-3-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-3-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-3-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-4	Bldg108 SS-4-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-4-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-4-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-5	Bldg108 SS-5-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-5-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-5-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-6	Bldg108 SS-6-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-6-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-6-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-7	Bldg108 SS-7-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-7-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-7-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-8	Bldg108 SS-8-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-8-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-8-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
Soil	Geoprobe	SS-9	Bldg108 SS-9-0-0.5	Primary Sample	08-Mar-01	0	0.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-9-1-1.5	Primary Sample	08-Mar-01	1	1.5	--	--	X[(2)]	--	--	--
	Geoprobe		Bldg108 SS-9-2-2.5	Primary Sample	08-Mar-01	2	2.5	--	--	X[(2)]	--	--	--
2007 to 2011 Groundwater Monitoring (Parsons)													
Groundwater	Monitoring Well (LFPS 2010-2011 only)	108MW01	Multiple	Primary and Duplicate Samples	Quarterly	Varying	Varying	--	--	X	--	--	--
Groundwater	Monitoring Well (LFPS 2010-2011 only)	108MW02	Multiple	Primary and Duplicate Samples	Quarterly	Varying	Varying	--	--	X	--	--	--
Groundwater	Monitoring Well (LFPS 2010-2011 only)	108MW03	Multiple	Primary and Duplicate Samples	Quarterly	Varying	Varying	--	--	X	--	--	--
Groundwater	Monitoring Well (LFPS 2010-2011 only)	108MW04	Multiple	Primary and Duplicate Samples	Quarterly	Varying	Varying	--	--	X	--	--	--

TABLE 1
SAMPLE AND ANALYTICAL SUMMARY
SUMMARY REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Media	Type	Sample Location	Sample Identification	Sample Type	Sample Date	Sample Depth Top	Sample Depth Bottom	VO+ TICs	SVO+ TICs	Metals	PAHs	Pesticides	EPH
2010 Sampling in Response to NJDEP Comments on RI (Army)													
Soil	Geoprobe	BL-1	Bldg488 BL-1-3.5-4	Primary Sample	16-Dec-10	3.5	4	--	X	--	X	--	--
Soil	Geoprobe	BL-2	Bldg488 BL-2-2.5-3	Primary Sample	15-Dec-10	2.5	3	--	X	--	X	--	--
Soil	Geoprobe	BL-3	Bldg488 BL-3-2-2.5	Primary Sample	15-Dec-10	2	2.5	--	X	--	X	--	--
Soil	Geoprobe	BL-4	Bldg488 BL-4-3.5-4	Primary Sample	15-Dec-10	3.5	4	--	X	--	X	--	--
Soil	Geoprobe	BL-6	Bldg488 BL-6-5.5-6	Primary Sample	15-Dec-10	5.5	6	--	X	--	X	--	--
Soil	Geoprobe	BL-7	Bldg488 BL-7-3-3.5	Primary Sample	15-Dec-10	3	3.5	--	X	--	X	--	--
Soil	Geoprobe	BL-8	Bldg488 BL-8-3-3.5	Primary Sample	15-Dec-10	3	3.5	--	X	--	X	--	--
Soil	Geoprobe	BL-9	Bldg488 BL-9-2.5-3	Primary Sample	15-Dec-10	2.5	3	--	X	--	X	--	--
Soil	Geoprobe	BL-10	Bldg488 BL-10-2-2.5	Primary Sample	16-Dec-10	2	2.5	--	X	--	X	--	--
Soil	Geoprobe	BL-11	Bldg488 BL-11-2-2.5	Primary Sample	15-Dec-10	2	2.5	--	X	--	X	--	--
Groundwater	Temporary Well	BL-5	Bldg488 BL-5	Primary Sample	16-Dec-10	0	0.1	X	X	--	--	--	--
Groundwater	Temporary Well	BL-7	Bldg488 BL-7	Primary Sample	16-Dec-10	0	0.1	X	X	--	--	--	--
Groundwater	Temporary Well	BL-12	Bldg488 BL-12	Primary Sample	16-Dec-10	0	0.1	X	X	--	--	--	--
2013 August Basline Sampling (Parsons)													
Groundwater	Monitoring Well / LFPS	108MW01	FTMM-57-GW-108MW01	Primary Sample	19-Aug-13	3	13	X	--	X	--	X	--
Groundwater	Monitoring Well / LFPS	108MW02	FTMM-57-GW-108MW02	Primary Sample	19-Aug-13	3	13	X	--	X	--	X	--
Groundwater	Monitoring Well / LFPS	108MW03	FTMM-57-GW-108MW03	Primary Sample	19-Aug-13	3	13	X	--	X	--	X	--
Groundwater	Monitoring Well / LFPS	108MW04	FTMM-57-GW-108MW04	Primary Sample	19-Aug-13	2	12	X	--	X	--	X	--
2014 Fourth Quarter Groundwater Sampling (Parsons)													
Groundwater	Monitoring Well / LFPS	108MW04	FTMM-57-GW-108MW04-8.25_2014-Q4	Primary Sample	02-Oct-14	8.25	8.25	--	--	X[(1)]	--	--	--
2015 Fourth Quarter Groundwater Sampling (Parsons)													
Groundwater	Monitoring Well / LFPS	108MW04	FTMM-57-GW-108MW04-7.5_4Q2015	Primary Sample	20-Nov-15	7.5	7.5	--	--	X[(3)]	--	--	--
2016 Environmental Condition of Property for Parcel 83 (Parsons)													
Soil	Geoprobe	PAR-83-SB-12	PAR-83-SB-12-1-1.5	Primary Sample	05-Apr-16	1	1.5	X	--	X[(2)]	X	--	--
Soil	Geoprobe		PAR-83-SB-12-2.5-3	Primary Sample	05-Apr-16	2.5	3	X	--	X[(2)]	X	--	--
Soil	Geoprobe	PAR-83-SB-14	PAR-83-SB-14-0.5-1	Primary Sample	05-Apr-16	0.5	1	X	--	X[(2)]	X	--	--
Soil	Geoprobe		PAR-83-SB-14-2.5-3	Primary Sample	05-Apr-16	2.5	3	X	--	X[(2)]	X	--	--

TABLE 1
SAMPLE AND ANALYTICAL SUMMARY
SUMMARY REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Media	Type	Sample Location	Sample Identification	Sample Type	Sample Date	Sample Depth Top	Sample Depth Bottom	VO+ TICs	SVO+ TICs	Metals	PAHs	Pesticides	EPH
2017 November Field Investigation for FTMM-57, Parcel 83, and UST 482 (Parsons)													
Soil	Geoprobe	FTMM57-SB-01	FTMM-57-SB-01-2.5-3	Primary Sample	13-Nov-17	2.5	3	X	X[4]	X[5]	X	--	--
Soil	Geoprobe		FTMM-57-SB-01-6-6.5	Primary Sample	13-Nov-17	6	6.5	X	X[4]	X[5]	X	--	--
Soil	Geoprobe		FTMM-57-SB-01-8-8.5	Primary Sample	13-Nov-17	8	8.5	X	X[4]	X[5]	X	--	--
Soil	Geoprobe	FTMM57-SB-02	FTMM-57-SB-02-2.5-3	Primary Sample	13-Nov-17	2.5	3	X	X[4]	X[5]	X	--	--
Soil	Geoprobe		FTMM-57-SB-02-7-7.5	Primary Sample	13-Nov-17	7	7.5	X	X[4]	X[5]	X	--	--
Soil	Geoprobe		FTMM-57-SB-102-7-7.5	Duplicate of FTMM-57-SB-02-7-7.5	13-Nov-17	7	7.5	X	X[4]	X[5]	X	--	--
Soil	Geoprobe		FTMM-57-SB-02-8-8.5	Primary Sample	13-Nov-17	8	8.5	X	X[4]	X[5]	X	--	--
Soil	Geoprobe	PAR-83-SB-34	PAR-83-SB-34-2-2.5	Primary Sample	15-Nov-17	2	2.5	--	--	X[5]	X	--	--
Soil	Geoprobe	PAR-83-482-SB-01	PAR-83-482-SB-01-0.5-1	Primary Sample	13-Nov-17	0.5	1	--	--	X[5]	X	--	X
Soil	Geoprobe		PAR-83-482-SB-01-1.5-2	Primary Sample	13-Nov-17	1.5	2	--	--	X[5]	X	--	X
Soil	Geoprobe		PAR-83-482-SB-01-7.5-8	Primary Sample	13-Nov-17	7.5	8	--	--	X[5]	X	--	X
Soil	Geoprobe	PAR-83-482-SB-02	PAR-83-482-SB-02-5.5-6	Primary Sample	13-Nov-17	5.5	6	--	--	X[5]	X	--	X
Soil	Geoprobe		PAR-83-482-SB-02-7.5-8	Primary Sample	13-Nov-17	7.5	8	--	--	X[5]	X	--	X
Soil	Geoprobe		PAR-83-482-SB-02-12.5-13	Primary Sample	13-Nov-17	12.5	13	--	--	X[5]	X	--	X
Soil	Geoprobe	PAR-83-482-SB-03	PAR-83-482-SB-03-1.5-2	Primary Sample	13-Nov-17	1.5	2	--	--	X[5]	X	--	X
Soil	Geoprobe		PAR-83-482-SB-03-5-5.5	Primary Sample	13-Nov-17	5	5.5	--	--	X[5]	X	--	X
Soil	Geoprobe		PAR-83-482-SB-03-6-6.5	Primary Sample	13-Nov-17	6	6.5	--	--	X[5]	X	--	X

Notes:
1) X[1] Analyzed for Lead only
2) X[2] Analyzed for Arsenic and Lead only
3) X[3] Analyzed for Arsenic, Cadmium, and Lead only
4) X[4] Analyzed for naphthalene and 2-methylnaphthalene only
5) X[5] Analyzed for Arsenic only
6) VO+TICs = volatile organics + tentatively identified compounds, SVO = semivolatile organics, PAHs = polycyclic aromatic hydrocarbons, EPH = extractable petroleum hydrocarbons
7) Soil sample depths are in feet below ground surface
8) Groundwater sample depths, where known, are in feet below top of casing
9) LFPS = low flow purge and sample method

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	FTMM57-SB-01		
Sample ID					FTMM-57-SB-01-2.5-3	FTMM-57-SB-01-6-6.5	FTMM-57-SB-01-8-8.5
Sample Date					11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	< 0.0009	< 0.001	< 0.0011
1,1,1-Trichloroethane	810	3,600	0.28	-	< 0.0009	< 0.001	< 0.0011
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	< 0.0009	< 0.001	< 0.0011
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	< 0.0009	< 0.001	< 0.0011
1,1-Dichloroethane	3.6	16	0.00078	-	< 0.0009	< 0.001	< 0.0011
1,1-Dichloroethene	23	100	0.01	-	< 0.0009	< 0.001	< 0.0011
1,1-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	< 0.0009	< 0.001	< 0.0011
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	< 0.0009	< 0.001	< 0.0011
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	< 0.0009	< 0.001	< 0.0011
1,2,4-Trimethylbenzene	30	180	0.0081	-	< 0.0009	< 0.001	< 0.0011
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	< 0.0022	< 0.0025	< 0.0029
1,2-Dibromoethane	0.036	0.16	0.0000021	-	< 0.0009	< 0.001	< 0.0011
1,2-Dichlorobenzene	180	930	0.03	-	< 0.0009	< 0.001	< 0.0011
1,2-Dichloroethane	0.46	2	0.000048	-	< 0.0009	< 0.001	< 0.0011
1,2-Dichloropropane	0.28	1.2	0.000047	-	< 0.0009	< 0.001	< 0.0011
1,3,5-Trimethylbenzene	27	150	0.0087	-	< 0.0009	< 0.001	< 0.0011
1,3-Dichlorobenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,3-Dichloropropane	160	2,300	0.013	-	< 0.0009	< 0.001	< 0.0011
1,4-Dichlorobenzene	2.6	11	0.00046	-	< 0.0009	< 0.001	< 0.0011
2,2-Dichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
2-Chlorotoluene	160	2,300	0.023	-	< 0.0009	< 0.001	< 0.0011
Acetone	6,100	67,000	0.29	-	**0.11**	**0.11**	**0.12**
Benzene	1.2	5.1	0.00023	-	< 0.0009	< 0.001	< 0.0011
Bromobenzene	29	180	0.0042	-	< 0.0009	< 0.001	< 0.0011
Bromochloromethane	15	63	0.0021	-	< 0.0009	< 0.001	< 0.0011
Bromodichloromethane	0.29	1.3	0.000036	-	< 0.0009	< 0.001	< 0.0011
Bromoform	19	86	0.00087	-	< 0.0009	< 0.001	< 0.0011
Carbon disulfide	77	350	0.024	-	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	< 0.0009	< 0.001	< 0.0011
Chlorobenzene	28	130	0.0053	-	< 0.0009	< 0.001	< 0.0011
Chlorodibromomethane	8.3	39	0.00023	-	< 0.0009	< 0.001	< 0.0011
Chloroethane	1,400	5,700	0.59	-	< 0.0022	< 0.0025	< 0.0029
Chloroform	0.32	1.4	0.000061	-	**0.0005 J**	< 0.001	**0.001 J**
Cis-1,2-Dichloroethene	16	230	0.0011	-	< 0.0009	< 0.001	< 0.0011
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Cymene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Dichlorodifluoromethane	8.7	37	0.03	-	< 0.0009	< 0.001	< 0.0011
Ethyl benzene	5.8	25	0.0017	-	< 0.0009	< 0.001	< 0.0011
Hexachlorobutadiene	1.2	5.3	0.00027	-	< 0.0009	< 0.001	< 0.0011
Isopropylbenzene	190	990	0.074	-	< 0.0009	< 0.001	< 0.0011
Meta/Para Xylene	55	240	0.019	-	< 0.0018	< 0.002	< 0.0023
Methyl bromide	0.68	3	0.00019	-	< 0.0009	< 0.001	< 0.0011
Methyl butyl ketone	20	130	0.00088	-	< 0.0045 UJ	< 0.005 UJ	< 0.0057 UJ
Methyl chloride	11	46	0.0049	-	< 0.0009	< 0.001	< 0.0011
Methyl ethyl ketone	2,700	19,000	0.12	-	**0.0093**	**0.0079 J**	**0.0071 J**
Methyl isobutyl ketone	3,300	14,000	0.14	-	< 0.0045	< 0.005	< 0.0057
Methyl Tertbutyl Ether	47	210	0.0032	-	**0.0006 J**	< 0.001	< 0.0011
Methylene chloride	35	320	0.0027	-	< 0.0009	< 0.001	< 0.0011
Naphthalene	3.8	17	0.00054	-	< 0.0009	< 0.001	< 0.0011
n-Butylbenzene	390	5,800	0.32	-	< 0.0009	< 0.001	< 0.0011
Ortho Xylene	65	280	0.019	-	< 0.0009	< 0.001	< 0.0011
p-Chlorotoluene	160	2,300	0.024	-	< 0.0009	< 0.001	< 0.0011
Propylbenzene	380	2,400	0.12	-	< 0.0009	< 0.001	< 0.0011
sec-Butylbenzene	780	12,000	0.59	-	< 0.0009	< 0.001	< 0.0011
Styrene	600	3,500	0.13	-	< 0.0009	< 0.001	< 0.0011
Tert Butyl Alcohol	NLE	NLE	NLE	-	**0.0034 J**	**0.012**	**0.011 J**
tert-Butylbenzene	780	12,000	0.16	-	< 0.0009	< 0.001	< 0.0011
Tetrachloroethene	8.1	39	0.0018	-	< 0.0009	< 0.001	< 0.0011
Toluene	490	4,700	0.076	-	< 0.0009	< 0.001	< 0.0011
Total Xylenes	58	250	0.019	-	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	< 0.0009	< 0.001	< 0.0011
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Trichloroethene	0.41	1.9	0.0001	-	< 0.0009	< 0.001	< 0.0011
Trichlorofluoromethane	2,300	35,000	0.33	-	< 0.0009	< 0.001	< 0.0011
Vinyl chloride	0.059	1.7	0.0000065	-	< 0.0009	< 0.001	< 0.0011
TIC VOCs (µg/kg)							
Total TICs	NLE	NLE	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	< 0.077	< 0.078	< 0.083
2-Nitroaniline	63	800	0.008	-	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	< 0.077	< 0.078	< 0.083
Acenaphthylene	NLE	NLE	NLE	-	< 0.077	< 0.078	< 0.083
Aniline	44	400	0.0046	-	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	< 0.077	< 0.078	< 0.083
Azobenzene	5.6	26	0.00093	-	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.029 J**	< 0.078	< 0.083
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.033 J**	< 0.078	< 0.083
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.039 J**	< 0.078	< 0.083
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.031 J**	< 0.078	< 0.083
Benzo(k)fluoranthene	11	210	2.9	-	**0.018 J**	< 0.078	< 0.083
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA
Chrysene	110	2,100	9	-	**0.027 J**	< 0.078	< 0.083
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	**0.013 J**	< 0.078	< 0.083
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**0.057 J**	< 0.078	< 0.083
Fluorene	240	3,000	0.54	-	< 0.077	< 0.078	< 0.083
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	< 0.077	< 0.078	< 0.083
Isophorone	570	2,400	0.026	-	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	< 0.077	< 0.078	< 0.083
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**0.027 J**	**0.014 J**	< 0.083
Pyrene	180	2,300	1.3	-	**0.053 J**	**0.015 J**	< 0.083
Pyridine	7.8	120	0.00068	-	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)							
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)							
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA
Inorganics (mg/kg)							
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**5.9**	**4.6**	**5.4**
Barium	1,500	22,000	16	32.3	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA
Lead	400	800	14	19.5	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	FTMM57-SB-02			
Sample ID					FTMM-57-SB-02-2.5-3	FTMM-57-SB-02-7-7.5	FTMM-57-SB-102-7-7.5	FTMM-57-SB-02-8-8.5
Sample Date					11/13/2017	11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)								
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,1-Trichloroethane	810	3,600	0.28	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloroethane	3.6	16	0.00078	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloroethene	23	100	0.01	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,4-Trimethylbenzene	30	180	0.0081	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	< 0.0023	< 0.0023	< 0.0022	< 0.0022
1,2-Dibromoethane	0.036	0.16	0.0000021	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichlorobenzene	180	930	0.03	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichloroethane	0.46	2	0.000048	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichloropropane	0.28	1.2	0.000047	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,3,5-Trimethylbenzene	27	150	0.0087	-	< 0.0009	< 0.0009	< 0.0009	**0.0005 J**
1,3-Dichlorobenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,3-Dichloropropane	160	2,300	0.013	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,4-Dichlorobenzene	2.6	11	0.00046	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
2,2-Dichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
2-Chlorotoluene	160	2,300	0.023	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Acetone	6,100	67,000	0.29	-	**0.012**	**0.064 J**	**0.072**	**0.075**
Benzene	1.2	5.1	0.00023	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromobenzene	29	180	0.0042	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromochloromethane	15	63	0.0021	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromodichloromethane	0.29	1.3	0.000036	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromoform	19	86	0.00087	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Chlorobenzene	28	130	0.0053	-	< 0.0009	< 0.0009 UJ	< 0.0009	< 0.0009
Chlorodibromomethane	8.3	39	0.00023	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Chloroethane	1,400	5,700	0.59	-	< 0.0023	< 0.0023	< 0.0022	< 0.0022
Chloroform	0.32	1.4	0.000061	-	**0.0007 J**	< 0.0009	< 0.0009	< 0.0009
Cis-1,2-Dichloroethene	16	230	0.0011	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cymene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Dichlorodifluoromethane	8.7	37	0.03	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Ethyl benzene	5.8	25	0.0017	-	< 0.0009	< 0.0009 UJ	< 0.0009	< 0.0009
Hexachlorobutadiene	1.2	5.3	0.00027	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Isopropylbenzene	190	990	0.074	-	< 0.0009	< 0.0009	< 0.0009	**0.0045**
Meta/Para Xylene	55	240	0.019	-	< 0.0018	< 0.0018 UJ	< 0.0018	**0.0008 J**
Methyl bromide	0.68	3	0.00019	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Methyl butyl ketone	20	130	0.00088	-	< 0.0046 UJ	< 0.0045 UJ	< 0.0045 UJ	< 0.0043 UJ
Methyl chloride	11	46	0.0049	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Methyl ethyl ketone	2,700	19,000	0.12	-	< 0.0046	**0.0088 J**	**0.013**	< 0.0043
Methyl isobutyl ketone	3,300	14,000	0.14	-	< 0.0046	< 0.0045	< 0.0045	< 0.0043
Methyl Tertbutyl Ether	47	210	0.0032	-	< 0.0009	**0.0006 J**	**0.0007 J**	**0.0028**
Methylene chloride	35	320	0.0027	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Naphthalene	3.8	17	0.00054	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
n-Butylbenzene	390	5,800	0.32	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Ortho Xylene	65	280	0.019	-	< 0.0009	< 0.0009	< 0.0009	**0.0016 J**
p-Chlorotoluene	160	2,300	0.024	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Propylbenzene	380	2,400	0.12	-	< 0.0009	< 0.0009	< 0.0009	**0.0005 J**
sec-Butylbenzene	780	12,000	0.59	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Styrene	600	3,500	0.13	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Tert Butyl Alcohol	NLE	NLE	NLE	-	**0.0032 J**	< 0.0045	< 0.0045	**0.0085 J**
tert-Butylbenzene	780	12,000	0.16	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Tetrachloroethene	8.1	39	0.0018	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Toluene	490	4,700	0.076	-	< 0.0009	< 0.0009 UJ	< 0.0009	**0.0006 J**
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trichloroethene	0.41	1.9	0.0001	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trichlorofluoromethane	2,300	35,000	0.33	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Vinyl chloride	0.059	1.7	0.0000065	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
TIC VOCs (µg/kg)								
Total TICs	NLE	NLE	NLE	-	NA	141.4	323.7	484.4
Semivolatile Organic Compounds (mg/kg)								
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	< 0.073	**0.083 J**	**0.051 J**	**0.035 J**
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	< 0.073	< 0.078	< 0.074	< 0.076
Acenaphthylene	NLE	NLE	NLE	-	< 0.073	< 0.078	< 0.074	< 0.076
Aniline	44	400	0.0046	-	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	< 0.073	**0.02 J**	< 0.074	< 0.076
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	< 0.073	**0.065 J**	**0.057 J**	**0.02 J**
Benzo(a)pyrene	0.11	2.1	0.029	-	< 0.073	**0.046 J**	**0.02 J**	**0.029 J**
Benzo(b)fluoranthene	1.1	21	0.3	-	< 0.073	**0.084 J**	**0.059 J**	**0.042 J**
Benzo(ghi)perylene	NLE	NLE	NLE	-	< 0.073	**0.032 J**	**0.034 J**	**0.02 J**
Benzo(k)fluoranthene	11	210	2.9	-	< 0.073	**0.022 J**	**0.031 J**	**0.017 J**
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA
Chrysene	110	2,100	9	-	< 0.073	**0.036 J**	**0.056 J**	**0.017 J**
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	< 0.073	**0.016 J**	< 0.074	< 0.076
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	< 0.073	**0.19**	**0.1 J**	**0.064 J**
Fluorene	240	3,000	0.54	-	< 0.073	**0.013 J**	< 0.074	< 0.076
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	< 0.073	**0.023 J**	**0.036 J**	< 0.076
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	< 0.073	**0.046 J**	**0.042 J**	**0.033 J**
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	< 0.073	**0.12**	**0.052 J**	**0.033 J**
Pyrene	180	2,300	1.3	-	< 0.073	**0.17**	**0.11 J**	**0.068 J**
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)								
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)								
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**3.9**	**3.7**	**5.6**	**4.4**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA
Lead	400	800	14	19.5	NA	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 S-1	Bldg 108 S-10	Bldg 108 S-11	Bldg 108 S-13	Bldg 108 S-14	Bldg 108 S-15	Bldg 108 S-16
Sample ID					Bldg108 S-1-4-4	Bldg108 S-10-5-5	Bldg108 S-11-5-5	Bldg108 S-13-1.5-1.5	Bldg108 S-14-3-3	Bldg108 S-15-4-4	Bldg108 S-16-6-6
Sample Date					5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	0.004 JB	< 0.012	0.0046 JB	< 0.011	< 6	< 0.039	< 1.6
Benzene	1.2	5.1	0.00023	-	< 0.06	< 0.006	< 0.006	< 0.005	< 3	< 0.006	**0.76 J**
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	< 0.06	< 0.006	< 0.006	< 0.005	< 3	< 0.006	< 0.78
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	< 0.06	< 0.006	< 0.006	< 0.005	**1.1 J**	**0.0077 J**	**21**
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	< 0.06	< 0.006	< 0.006	< 0.005	**6.2**	**0.01**	**170 D**
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	< 0.071	0.0042 JB	0.0042 JB	0.005 JB	2.3 JB	0.0056 JB	**0.87**
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	< 0.06	< 0.006	< 0.006	< 0.005	**1.4 J**	0 J	**69 D**
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	< 0.06	< 0.006	< 0.006	< 0.005	< 3	< 0.006	**9.5**
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)											
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)											
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	**0.13 J**	**0.47**	**0.043 J**	< 0.36	**0.33 J**	< 0.39	**2.5**
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	**0.062 J**	< 0.38	< 0.4	< 0.36	**0.37 J**	< 0.39	< 0.41
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	**0.083 J**	**0.01 J**	**0.096 J**	< 0.36	**0.7**	< 0.39	**0.21 J**
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.14 J**	**0.13 J**	**0.13 J**	**0.11 J**	**1.4**	< 0.39	**0.22 J**
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.13 J**	**0.14 J**	**0.43**	**0.11 J**	**1.3**	< 0.39	**0.16 J**
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.2 J**	**0.11 J**	**0.43**	**0.12 J**	**1**	< 0.39	**0.13 J**
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.082 J**	**0.11 J**	**0.3 J**	**0.08 J**	**0.9**	< 0.39	**0.097 J**
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	**1.1 J**	**0.57**	**0.67**	**0.05 J**	**0.097 J**	< 0.39	**2**
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	**0.16 J**	**0.15 J**	**0.53**	**0.13 J**	**1.5**	< 0.39	**0.21 J**
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	< 0.41	< 0.38	**0.4 J**	< 0.36	**0.37 J**	< 0.39	< 0.41
Dibenzofuran	7.3	100	0.015	-	**0.043 J**	< 0.38	< 0.4	< 0.36	**0.31 J**	< 0.39	**0.09 J**
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**0.36 J**	**0.18 J**	**0.67**	**0.18 J**	**2.4**	< 0.39	**0.53**
Fluorene	240	3,000	0.54	-	**0.069 J**	< 0.38	< 0.4	< 0.36	**0.47**	< 0.39	**0.22 J**
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.09 J**	**0.11 J**	**0.29 J**	**0.07 J**	**0.8**	< 0.39	**0.09 J**
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.24 J**	< 0.38	< 0.4	< 0.36	**0.21 J**	< 0.39	**1.5**
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**0.3 J**	**0.16 J**	**0.37 J**	**0.1 J**	**2.2**	< 0.39	**0.8**
Pyrene	180	2,300	1.3	-	**0.2 J**	**0.21 J**	**0.67**	**0.2 J**	**1.9**	< 0.39	**0.47**
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)											
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	**3.82**	**35.9**	**50.8**	**158**	**380**	**5.22**	**1,100**
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)											
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)											
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	NA	NA	NA	NA	NA	NA	NA
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**30.7**	**55.8**	**155**	**14.8**	**28.8**	**11**	**12.3**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 S-17	Bldg 108 S-18	Bldg 108 S-19	Bldg 108 S-2	Bldg 108 S-3	Bldg 108 S-4	Bldg 108 S-5
Sample ID					Bldg108 S-17-6-6	Bldg108 S-18-4-4	Bldg108 S-19-3-3	Bldg108 S-2-4-4	Bldg108 S-3-4-4	Bldg108 S-4-1-1	Bldg108 S-5-6-6
Sample Date					5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	< 1.5	< 1.5	< 0.063	0.005 JB	0.005 JB	< 0.011	0.6 JB
Benzene	1.2	5.1	0.00023	-	**2.5**	< 0.74	< 0.031	< 0.06	< 0.006	< 0.005	**1**
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	< 0.76	< 0.74	< 0.031	< 0.06	< 0.006	< 0.005	< 0.75
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	**0.34 J**	**0.85**	< 0.031	< 0.06	< 0.006	< 0.005	**7.6**
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	**1.9**	**3.4**	**0.025 J**	< 0.06	< 0.006	< 0.005	**30**
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	**1**	**0.87**	**0.049**	0.0061 JB	< 0.0069	0.0035 JB	< 1.1
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	< 0.76	**1.2**	< 0.031	< 0.06	< 0.006	< 0.005	**0.87**
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	< 0.76	**0.92**	< 0.031	< 0.06	< 0.006	< 0.005	**0.76**
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)											
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)											
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	**1.3**	< 0.39	**0.18 J**	< 0.41	**0.21 J**	**0.054 J**	**4.3**
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	**0.19 J**	< 0.39	< 0.41	< 0.41	< 0.41	**0.095 J**	**0.67**
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	**0.23 J**	< 0.39	**1.6**	< 0.41	**1.7**	**0.22 J**	**1.6**
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.32 J**	**0.05 J**	**3.7**	< 0.41	**2.3**	**0.35**	**0.87**
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.25 J**	< 0.39	**3.3**	**0.25 J**	**1.8**	**0.34 J**	**0.63**
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.2 J**	**0.06 J**	**5.3**	< 0.41	**1.8**	**0.22 J**	< 0.4
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.15 J**	< 0.39	**2.5 J**	< 0.41	**1**	**0.21 J**	**0.3 J**
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	**2.2**	< 0.39	**0.13 J**	**0.37 J**	**0.28 J**	**0.16 J**	**4.7**
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	**0.37 J**	**0.04 J**	**4**	< 0.41	**2.2**	**0.36**	**0.87**
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	**0.07 J**	< 0.39	**0.97**	< 0.41	**0.35 J**	**0.074 J**	**0.19 J**
Dibenzofuran	7.3	100	0.015	-	**0.078 J**	< 0.39	**0.53**	< 0.41	**0.81**	**0.044 J**	**0.54**
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**0.6**	**0.08 J**	**7.3**	< 0.41	**4.9**	**0.66**	**2.1**
Fluorene	240	3,000	0.54	-	**0.18 J**	< 0.39	**0.93**	< 0.41	< 1.1	**0.09 J**	**0.8**
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.14 J**	< 0.39	**2.3**	< 0.41	**1.1**	**0.19 J**	**0.33 J**
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.87**	< 0.39	**0.21 J**	< 0.41	**0.41 J**	**0.04 J**	**5.3**
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**0.87 J**	< 0.39	**2.7**	< 0.41	**4.4**	**0.66**	**3.2**
Pyrene	180	2,300	1.3	-	**0.57 J**	**0.08 J**	**5.3**	< 0.41	**2.4**	**0.45**	**1.6**
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)											
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	**340**	< 3.3	**46.1**	**1.93**	**10.8**	**27.5**	**2,970**
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)											
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)											
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	NA	NA	NA	NA	NA	NA	NA
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**21.8**	**10.4**	**174**	< 5	**9.05**	< 5	**16.3**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 S-6	Bldg 108 S-7	Bldg 108 S-8	Bldg 108 S-9	Bldg 108 SS-1		
Sample ID					Bldg108 S-6-5-5	Bldg108 S-7-7-7	Bldg108 S-8-6-6	Bldg108 S-9-5-5	Bldg108 SS-1-0-0.5	Bldg108 SS-1-1-1.5	Bldg108 SS-1-2-2.5
Sample Date					5/3/1993	5/3/1993	5/3/1993	5/3/1993	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	0.004 JB	0.3 JB	**0.029**	< 0.012	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	< 0.06	**4**	< 0.031	< 0.006	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	< 0.06	< 0.75	< 0.031	**0.013**	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	< 0.06	**0.89**	< 0.031	< 0.006	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	< 0.06	**2**	< 0.031	< 0.006	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	**0.0044 J**	< 0.98	**0.02**	0.0042 JB	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	< 0.06	**0.45 J**	< 0.031	< 0.006	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	< 0.06	< 0.75	< 0.031	< 0.006	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)											
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)											
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	**0.074 J**	**0.044 J**	< 0.41	**0.04 J**	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	**0.089 J**	< 0.4	< 0.41	< 0.4	NA	NA	NA
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	**0.34 J**	< 0.4	< 0.41	**0.074 J**	NA	NA	NA
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**1.2**	< 0.4	**0.05 J**	**0.19 J**	NA	NA	NA
Benzo(a)pyrene	0.11	2.1	0.029	-	**1.1**	< 0.4	< 0.41	**0.17 J**	NA	NA	NA
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.95**	< 0.4	< 0.41	**0.17 J**	NA	NA	NA
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.67**	< 0.4	< 0.41	**0.13 J**	NA	NA	NA
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	**0.11 J**	**0.15 J**	**4.7**	**0.23 J**	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	**1.2**	< 0.4	**0.055 J**	**0.23 J**	NA	NA	NA
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	**0.3**	< 0.4	< 0.41	**0.07 J**	NA	NA	NA
Dibenzofuran	7.3	100	0.015	-	**0.082 J**	< 0.4	< 0.41	< 0.4	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**2.7**	< 0.4	**0.11 J**	**0.33 J**	NA	NA	NA
Fluorene	240	3,000	0.54	-	**0.12 J**	< 0.4	< 0.41	**0.047 J**	NA	NA	NA
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.68**	< 0.4	< 0.41	**0.13 J**	NA	NA	NA
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.082 J**	< 0.4	< 0.41	**0.04 J**	NA	NA	NA
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**0.87**	< 0.4	**0.085 J**	< 0.4	NA	NA	NA
Pyrene	180	2,300	1.3	-	**1.1**	< 0.4	**0.11 J**	**0.32 J**	NA	NA	NA
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)											
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	**333**	**230**	**26**	**128**	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)											
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)											
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	NA	NA	NA	NA	**108.46**	**30.96**	**9.3**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**52.1**	**12.4**	< 5	**58.2**	**10.6**	**6.49**	**7.74**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 SS-2			Bldg 108 SS-3		
Sample ID					Bldg108 SS-2-0-0.5	Bldg108 SS-2-1-1.5	Bldg108 SS-2-2-2.5	Bldg108 SS-3-0-0.5	Bldg108 SS-3-1-1.5	Bldg108 SS-3-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	NA	NA	NA	NA	NA	NA
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.11	2.1	0.029	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1.1	21	0.3	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	NA	NA	NA	NA	NA	NA
Fluorene	240	3,000	0.54	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	NA	NA	NA	NA	NA	NA
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	180	2,300	1.3	-	NA	NA	NA	NA	NA	NA
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	< 10.4	**7.81**	**44.06**	**98.11**	< 10.9	< 11
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**2.55**	**1.98**	**11.9**	**13.9**	**1.33**	**15.2**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 SS-4			Bldg 108 SS-5		
Sample ID					Bldg108 SS-4-0-0.5	Bldg108 SS-4-1-1.5	Bldg108 SS-4-2-2.5	Bldg108 SS-5-0-0.5	Bldg108 SS-5-1-1.5	Bldg108 SS-5-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	NA	NA	NA	NA	NA	NA
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.11	2.1	0.029	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1.1	21	0.3	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	NA	NA	NA	NA	NA	NA
Fluorene	240	3,000	0.54	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	NA	NA	NA	NA	NA	NA
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	180	2,300	1.3	-	NA	NA	NA	NA	NA	NA
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**4.95**	**195.74**	< 12.1	**27.55**	**28.31**	**57.92**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**8.97**	**8.32**	**16.3**	**11.9**	**10**	**6.52**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 SS-6			Bldg 108 SS-7		
Sample ID					Bldg108 SS-6-0-0.5	Bldg108 SS-6-1-1.5	Bldg108 SS-6-2-2.5	Bldg108 SS-7-0-0.5	Bldg108 SS-7-1-1.5	Bldg108 SS-7-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	NA	NA	NA	NA	NA	NA
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.11	2.1	0.029	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1.1	21	0.3	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	NA	NA	NA	NA	NA	NA
Fluorene	240	3,000	0.54	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	NA	NA	NA	NA	NA	NA
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	180	2,300	1.3	-	NA	NA	NA	NA	NA	NA
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**17.86**	**18.37**	**22.99**	**30.62**	**32.9**	**7.5**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**9.28**	**10.4**	**9.07**	**8.91**	**23**	**10.6**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 108 SS-8			Bldg 108 SS-9		
Sample ID					Bldg108 SS-8-0-0.5	Bldg108 SS-8-1-1.5	Bldg108 SS-8-2-2.5	Bldg108 SS-9-0-0.5	Bldg108 SS-9-1-1.5	Bldg108 SS-9-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	NA	NA	NA	NA	NA	NA
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.11	2.1	0.029	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1.1	21	0.3	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	11	210	2.9	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	NA	NA	NA	NA	NA	NA
Fluorene	240	3,000	0.54	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	NA	NA	NA	NA	NA	NA
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	180	2,300	1.3	-	NA	NA	NA	NA	NA	NA
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**24.37**	**68.51**	**297.03**	**16.98**	< 10.7	**15.56**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**6.29**	**14.3**	**166**	**11.8**	**1.99**	**11.4**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 488 BL-1	Bldg 488 BL-10	Bldg 488 BL-11	Bldg 488 BL-2	Bldg 488 BL-3	Bldg 488 BL-4
Sample ID					Bldg488 BL-1-3.5-4	Bldg488 BL-10-2-2.5	Bldg488 BL-11-2-2.5	Bldg488 BL-2-2.5-3	Bldg488 BL-3-2-2.5	Bldg488 BL-4-3.5-4
Sample Date					12/16/2010	12/16/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	< 0.254	< 0.244	< 0.237	< 0.242	< 0.489	< 0.241
1,2-Dichlorobenzene	180	930	0.03	-	< 0.225	< 0.216	< 0.21	< 0.215	< 0.433	< 0.214
1,3-Dichlorobenzene	NLE	NLE	NLE	-	< 0.194	< 0.186	< 0.181	< 0.185	< 0.373	< 0.184
1,4-Dichlorobenzene	2.6	11	0.00046	-	< 0.202	< 0.194	< 0.188	< 0.192	< 0.388	< 0.192
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	< 0.303	< 0.291	< 0.283	< 0.289	< 0.582	< 0.287
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	< 0.303	< 0.291	< 0.283	< 0.289	< 0.582	< 0.287
2-Chloronaphthalene	480	6,000	0.39	-	< 0.291	< 0.28	< 0.272	< 0.278	< 0.56	< 0.276
2-Methylnaphthalene	24	300	0.019	-	< 0.301	< 0.29	< 0.281	< 0.288	< 0.58	< 0.286
2-Nitroaniline	63	800	0.008	-	< 0.356	< 0.342	< 0.332	< 0.34	< 0.685	< 0.34
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	< 0.315	< 0.303	< 0.294	< 0.301	< 0.607	< 0.299
3-Nitroaniline	NLE	NLE	NLE	-	< 0.256	< 0.246	< 0.239	< 0.244	< 0.493	< 0.243
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	< 0.334	< 0.321	< 0.312	< 0.319	< 0.642	< 0.317
4-Chloroaniline	2.7	11	0.00016	-	< 0.429	< 0.412	< 0.401	< 0.409	< 0.825	< 0.407
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	< 0.322	< 0.31	< 0.301	< 0.307	< 0.62	< 0.306
4-Nitroaniline	25	110	0.0016	-	< 0.316	< 0.304	< 0.296	< 0.302	< 0.609	< 0.301
Acenaphthene	360	4,500	0.55	-	**0.41 J**	< 0.302	< 0.293	< 0.3	< 0.605	< 0.298
Acenaphthylene	NLE	NLE	NLE	-	< 0.315	< 0.303	< 0.294	< 0.301	< 0.607	< 0.299
Aniline	44	400	0.0046	-	< 0.309	< 0.297	< 0.289	< 0.295	< 0.596	< 0.294
Anthracene	1,800	23,000	5.8	-	< 0.347	< 0.333	< 0.324	**0.36 J**	< 0.667	< 0.329
Azobenzene	5.6	26	0.00093	-	< 0.333	< 0.32	< 0.311	< 0.317	< 0.64	< 0.316
Benzidine	0.00053	0.01	0.00000028	-	< 0.312	< 0.3	< 0.291	< 0.298	< 0.6	< 0.296
Benzo(a)anthracene	1.1	21	0.011	-	**0.5 J**	< 0.332	< 0.323	**1.36**	< 0.665	< 0.328
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.44 J**	< 0.256	< 0.249	**1.1**	< 0.513	< 0.253
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.64**	< 0.238	< 0.232	**1.46**	< 0.477	< 0.236
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.28 J**	< 0.206	< 0.2	**0.71**	< 0.413	< 0.204
Benzo(k)fluoranthene	11	210	2.9	-	< 0.298	< 0.286	< 0.28	**0.59**	< 0.573	< 0.283
Benzyl alcohol	630	8,200	0.048	-	< 0.299	< 0.287	< 0.279	< 0.285	< 0.576	< 0.284
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	< 0.23	< 0.221	< 0.214	< 0.219	< 0.442	< 0.218
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	< 0.224	< 0.215	< 0.209	< 0.213	< 0.431	< 0.212
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	< 0.26	< 0.249	< 0.243	< 0.248	< 0.5	< 0.247
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	< 0.366	< 0.352	< 0.342	< 0.349	< 0.705	< 0.348
Butyl benzyl phthalate	290	1,200	0.24	-	< 0.305	< 0.293	< 0.285	< 0.291	< 0.587	< 0.29
Chrysene	110	2,100	9	-	**0.49 J**	< 0.313	< 0.304	**1.34**	< 0.627	< 0.309
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	< 0.211	< 0.203	< 0.197	< 0.201	< 0.406	< 0.2
Dibenzofuran	7.3	100	0.015	-	< 0.37	< 0.355	< 0.345	< 0.353	< 0.712	< 0.351
Diethyl phthalate	5,100	66,000	0.61	-	< 0.29	< 0.278	< 0.271	< 0.276	< 0.558	< 0.275
Dimethyl phthalate	NLE	NLE	NLE	-	< 0.306	< 0.294	< 0.286	< 0.292	< 0.589	< 0.291
Di-n-butylphthalate	630	8,200	0.23	-	< 0.332	< 0.319	< 0.31	< 0.316	< 0.638	< 0.315
Di-n-octylphthalate	63	820	5.7	-	< 0.307	< 0.295	< 0.287	< 0.293	< 0.591	< 0.292
Fluoranthene	240	3,000	8.9	-	**0.92**	< 0.331	< 0.322	**2.99**	< 0.663	< 0.327
Fluorene	240	3,000	0.54	-	< 0.328	< 0.315	< 0.306	< 0.313	< 0.631	< 0.312
Hexachlorobenzene	0.21	0.96	0.00012	-	< 0.348	< 0.334	< 0.325	< 0.332	< 0.669	< 0.33
Hexachlorobutadiene	1.2	5.3	0.00027	-	< 0.25	< 0.241	< 0.234	< 0.239	< 0.482	< 0.238
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	< 0.169	< 0.163	< 0.158	< 0.161	< 0.326	< 0.161
Hexachloroethane	1.8	8	0.0002	-	< 0.219	< 0.21	< 0.205	< 0.209	< 0.422	< 0.208
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.24 J**	< 0.217	< 0.211	**0.64**	< 0.435	< 0.215
Isophorone	570	2,400	0.026	-	< 0.278	< 0.267	< 0.26	< 0.265	< 0.535	< 0.264
Naphthalene	3.8	17	0.00054	-	< 0.281	< 0.27	< 0.262	< 0.268	< 0.54	< 0.266
Nitrobenzene	5.1	22	0.000092	-	< 0.262	< 0.252	< 0.245	< 0.25	< 0.504	< 0.249
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	< 0.195	< 0.187	< 0.182	< 0.186	< 0.375	< 0.185
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	< 0.293	< 0.282	< 0.274	< 0.28	< 0.564	< 0.279
N-Nitrosodiphenylamine	110	470	0.067	-	< 0.314	< 0.302	< 0.293	< 0.3	< 0.605	< 0.298
Phenanthrene	NLE	NLE	NLE	-	**0.46 J**	< 0.331	< 0.322	**1.53**	< 0.663	< 0.327
Pyrene	180	2,300	1.3	-	**0.79**	< 0.353	< 0.343	**2.5**	< 0.707	< 0.349
Pyridine	7.8	120	0.00068	-	< 0.115	< 0.11	< 0.107	< 0.109	< 0.221	< 0.109
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	NA	NA	NA	NA	NA	NA
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	NA	NA	NA	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 488 BL-6	Bldg 488 BL-7	Bldg 488 BL-8	Bldg 488 BL-9	PAR-83-SB-12	
Sample ID					Bldg488 BL-6-5.5-6	Bldg488 BL-7-3-3.5	Bldg488 BL-8-3-3.5	Bldg488 BL-9-2.5-3	PAR-83-SB-12-1-1.5	PAR-83-SB-12-2.5-3
Sample Date					12/15/2010	12/15/2010	12/15/2010	12/15/2010	4/5/2016	4/5/2016
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	< 0.0036	< 0.48
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA	NA	< 0.0036	< 0.48
Acetone	6,100	67,000	0.29	-	NA	NA	NA	NA	**0.012**	< 0.48
Benzene	1.2	5.1	0.00023	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromobenzene	29	180	0.0042	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromochloromethane	15	63	0.0021	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromoform	19	86	0.00087	-	NA	NA	NA	NA	< 0.0036	< 0.48
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chlorobenzene	28	130	0.0053	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA	NA	< 0.0036	< 0.48
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA	NA	< 0.0036	< 0.48
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA	NA	< 0.0036	< 0.48
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA	NA	< 0.0036	< 0.48
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	< 0.0036	< 0.48
Isopropylbenzene	190	990	0.074	-	NA	NA	NA	NA	< 0.0036	**0.86**
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA	NA	< 0.0072	< 0.96
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl chloride	11	46	0.0049	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA	NA	**0.0033 J**	< 0.48
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methylene chloride	35	320	0.0027	-	NA	NA	NA	NA	< 0.0036	< 0.48
Naphthalene	3.8	17	0.00054	-	NA	NA	NA	NA	< 0.0036	< 0.48
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA	NA	< 0.0036	**1.6**
Ortho Xylene	65	280	0.019	-	NA	NA	NA	NA	< 0.0036	< 0.48
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA	NA	< 0.0036	< 0.48
Propylbenzene	380	2,400	0.12	-	NA	NA	NA	NA	< 0.0036	**1.7**
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA	NA	< 0.0036	**1.4**
Styrene	600	3,500	0.13	-	NA	NA	NA	NA	< 0.0036	< 0.48
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.072	< 9.6
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA	NA	< 0.0036	**0.095 J**
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA	NA	< 0.0036	< 0.48
Toluene	490	4,700	0.076	-	NA	NA	NA	NA	< 0.0036	< 0.48
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA	NA	< 0.0036	< 0.48
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA	NA	< 0.0036	< 0.48
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA	NA	< 0.0036	< 0.48
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA	NA	< 0.0036	< 0.48
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	NA	NA	NA	NA	0.0078	155
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	< 0.261	< 0.245	< 0.245	< 0.252	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	< 0.23	< 0.217	< 0.217	< 0.223	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	< 0.199	< 0.187	< 0.187	< 0.192	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	< 0.207	< 0.195	< 0.195	< 0.2	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA	NA	**0.0066 J**	**31**
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	< 0.311	< 0.292	< 0.292	< 0.3	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	< 0.311	< 0.292	< 0.292	< 0.3	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	< 0.299	< 0.281	< 0.281	< 0.289	NA	NA
2-Methylnaphthalene	24	300	0.019	-	< 0.31	< 0.291	< 0.291	< 0.299	**0.0041 J**	**53**
2-Nitroaniline	63	800	0.008	-	< 0.366	< 0.344	< 0.343	< 0.353	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	< 0.324	< 0.305	< 0.304	< 0.313	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	< 0.263	< 0.248	< 0.247	< 0.254	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	< 0.343	< 0.323	< 0.322	< 0.331	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	< 0.441	< 0.415	< 0.414	< 0.426	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	< 0.331	< 0.311	< 0.311	< 0.32	NA	NA
4-Nitroaniline	25	110	0.0016	-	< 0.325	< 0.306	< 0.305	< 0.314	NA	NA
Acenaphthene	360	4,500	0.55	-	< 0.323	< 0.304	< 0.303	< 0.312	**0.01**	**3.3**
Acenaphthylene	NLE	NLE	NLE	-	< 0.324	< 0.305	< 0.304	< 0.313	< 0.0071	< 0.39
Aniline	44	400	0.0046	-	< 0.318	< 0.299	< 0.299	< 0.307	NA	NA
Anthracene	1,800	23,000	5.8	-	< 0.356	< 0.335	< 0.334	< 0.344	**0.0023 J**	< 0.39
Azobenzene	5.6	26	0.00093	-	< 0.342	< 0.322	< 0.321	< 0.33	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	< 0.32	< 0.301	< 0.301	< 0.31	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.52 J**	**0.66**	< 0.333	< 0.343	**0.0061 J**	**0.17 J**
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.43 J**	**0.58**	< 0.257	< 0.265	< 0.0079	< 0.39
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.67**	**0.81**	< 0.239	< 0.246	**0.0097**	< 0.39
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.31 J**	**0.38 J**	< 0.207	< 0.213	**0.0078**	< 0.39
Benzo(k)fluoranthene	11	210	2.9	-	< 0.306	< 0.288	< 0.287	< 0.296	**0.0043 J**	< 0.39
Benzyl alcohol	630	8,200	0.048	-	< 0.307	< 0.289	< 0.289	< 0.297	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	< 0.236	< 0.222	< 0.221	< 0.228	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	< 0.23	< 0.216	< 0.216	< 0.222	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	< 0.267	< 0.251	< 0.25	< 0.258	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	< 0.376	< 0.354	< 0.353	< 0.364	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	< 0.313	< 0.295	< 0.294	< 0.303	NA	NA
Chrysene	110	2,100	9	-	**0.5 J**	**0.67**	< 0.314	< 0.323	**0.0069 J**	< 0.39
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	< 0.217	< 0.204	< 0.204	< 0.209	< 0.0071	< 0.39
Dibenzofuran	7.3	100	0.015	-	< 0.38	< 0.357	< 0.357	< 0.367	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	< 0.298	< 0.28	< 0.28	< 0.288	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	< 0.314	< 0.296	< 0.295	< 0.304	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	< 0.341	< 0.32	< 0.32	< 0.329	NA	NA
Di-n-octylphthalate	63	820	5.7	-	< 0.316	< 0.297	< 0.296	< 0.305	NA	NA
Fluoranthene	240	3,000	8.9	-	**0.69**	**1.42**	< 0.332	< 0.342	**0.014**	**0.39 J**
Fluorene	240	3,000	0.54	-	< 0.337	< 0.317	< 0.316	< 0.326	**0.01**	**3.8**
Hexachlorobenzene	0.21	0.96	0.00012	-	< 0.357	< 0.336	< 0.335	< 0.345	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	< 0.257	< 0.242	< 0.242	< 0.249	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	< 0.174	< 0.164	< 0.163	< 0.168	NA	NA
Hexachloroethane	1.8	8	0.0002	-	< 0.225	< 0.212	< 0.211	< 0.217	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	< 0.232	**0.35 J**	< 0.218	< 0.224	**0.0063 J**	< 0.39
Isophorone	570	2,400	0.026	-	< 0.286	< 0.269	< 0.268	< 0.276	NA	NA
Naphthalene	3.8	17	0.00054	-	< 0.288	< 0.271	< 0.271	< 0.278	**0.011**	< 0.39
Nitrobenzene	5.1	22	0.000092	-	< 0.269	< 0.253	< 0.253	< 0.26	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	< 0.2	< 0.188	< 0.188	< 0.193	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	< 0.301	< 0.283	< 0.283	< 0.291	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	< 0.323	< 0.304	< 0.303	< 0.312	NA	NA
Phenanthrene	NLE	NLE	NLE	-	< 0.354	**0.56**	< 0.332	< 0.344	**0.0074**	**8.9**
Pyrene	180	2,300	1.3	-	**0.62**	**1.05**	< 0.355	< 0.365	**0.015**	**1**
Pyridine	7.8	120	0.00068	-	< 0.118	< 0.111	< 0.111	< 0.114	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	NA	NA	NA	NA	**5.2**	**5.4**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	NA	NA	NA	NA	**11.1**	**5.3 J**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	PAR-83-SB-14		PAR-83-SB-34	PAR-83-482-SB-01		
Sample ID					PAR-83-SB-14-0.5-1	PAR-83-SB-14-2.5-3	PAR-83-SB-34-2-2.5	PAR-83-482-SB-01-0.5-1	PAR-83-482-SB-01-1.5-2	PAR-83-482-SB-01-7.5-8
Sample Date					4/5/2016	4/5/2016	11/15/2017	11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	< 0.0035	< 0.0039	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Acetone	6,100	67,000	0.29	-	**0.028**	**0.062**	NA	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromobenzene	29	180	0.0042	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromoform	19	86	0.00087	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	**0.00018 J**	< 0.0039	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	< 0.0071	< 0.0077	NA	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl chloride	11	46	0.0049	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	**0.0067**	**0.0065**	NA	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methylene chloride	35	320	0.0027	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.00054 J**	< 0.0039	NA	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Ortho Xylene	65	280	0.019	-	< 0.0035	< 0.0039	NA	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	< 0.0035	< 0.0039	NA	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Styrene	600	3,500	0.13	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	< 0.071	< 0.077	NA	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Toluene	490	4,700	0.076	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	< 0.0035	< 0.0039	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	NLE	NLE	NLE	-	0.0294	0.0041	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	**0.17**	< 0.0081	NA	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	**0.054**	< 0.0081	NA	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	**0.65**	**0.0041 J**	**0.11 J**	< 0.073	**0.84**	< 0.082
Acenaphthylene	NLE	NLE	NLE	-	**0.014 J**	< 0.0081	< 0.083	< 0.073	< 0.078	< 0.082
Aniline	44	400	0.0046	-	NA	NA	NA	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	**0.52**	**0.0071 J**	< 0.083	< 0.073	< 0.078	< 0.082
Azobenzene	5.6	26	0.00093	-	NA	NA	NA	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.62**	**0.017**	**0.011 J**	< 0.073	< 0.078	< 0.082
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.73**	< 0.014	< 0.083	< 0.073	< 0.078	< 0.082
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.92**	**0.02**	**0.014 J**	**0.0082 J**	< 0.078	< 0.082
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.42**	**0.011**	< 0.083	< 0.073	< 0.078	< 0.082
Benzo(k)fluoranthene	11	210	2.9	-	**0.33**	**0.0064 J**	< 0.083	< 0.073	< 0.078	< 0.082
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA	NA	NA	NA
Chrysene	110	2,100	9	-	**0.63**	**0.012**	< 0.083	< 0.073	< 0.078	< 0.082
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	**0.086**	< 0.0081	< 0.083	< 0.073	< 0.078	< 0.082
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**2.1**	**0.037**	**0.018 J**	< 0.073	< 0.078	< 0.082
Fluorene	240	3,000	0.54	-	**0.41**	**0.0043 J**	**0.029 J**	< 0.073	**1.2**	< 0.082
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.4**	< 0.0081	< 0.083	< 0.073	< 0.078	< 0.082
Isophorone	570	2,400	0.026	-	NA	NA	NA	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.14**	< 0.0081	< 0.083	< 0.073	**0.092 J**	< 0.082
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**1.2**	**0.022**	**0.02 J**	< 0.073	**2.3**	< 0.082
Pyrene	180	2,300	1.3	-	**1.7**	**0.026**	**0.017 J**	< 0.073	**0.19**	< 0.082
Pyridine	7.8	120	0.00068	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	NLE	NLE	NLE	-	NA	NA	NA	**19.8**	**2,410**	**0.55 J**
Inorganics (mg/kg)										
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**7**	**16.2**	**4**	**4.8**	**6.1**	**9.3**
Barium	1,500	22,000	16	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	14	19.5	**49.4**	**8.8**	NA	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	PAR-83-482-SB-02		
Sample ID					PAR-83-482-SB-02-5.5-6	PAR-83-482-SB-02-7.5-8	PAR-83-482-SB-02-12.5-13
Sample Date					11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA
TIC VOCs (µg/kg)							
Total TICs	NLE	NLE	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	**0.021 J**	**0.97**	< 0.094
Acenaphthylene	NLE	NLE	NLE	-	**0.15**	< 0.087	< 0.094
Aniline	44	400	0.0046	-	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	**0.14**	< 0.087	< 0.094
Azobenzene	5.6	26	0.00093	-	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.69**	< 0.087	< 0.094
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.68**	< 0.087	< 0.094
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.98**	< 0.087	< 0.094
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.46**	< 0.087	< 0.094
Benzo(k)fluoranthene	11	210	2.9	-	**0.39**	< 0.087	< 0.094
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA
Chrysene	110	2,100	9	-	**0.72**	< 0.087	< 0.094
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	**0.13**	< 0.087	< 0.094
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**1.1**	< 0.087	< 0.094
Fluorene	240	3,000	0.54	-	**0.037 J**	**1.4**	< 0.094
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.47**	< 0.087	< 0.094
Isophorone	570	2,400	0.026	-	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.087 J**	< 0.087	< 0.094
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**0.4**	**2.7**	< 0.094
Pyrene	180	2,300	1.3	-	**1.1**	**0.14**	< 0.094
Pyridine	7.8	120	0.00068	-	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)							
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)							
EPH (C9-C40)	NLE	NLE	NLE	-	**66.9**	**1,560**	**0.54 J**
Inorganics (mg/kg)							
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**15.7**	**13.5**	**8**
Barium	1,500	22,000	16	32.3	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA
Lead	400	800	14	19.5	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA

TABLE 2
SOIL SAMPLING RESULTS - COMPARISON TO USEPA RISK-BASED SCREENING LEVELS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	2017-06 RSL Residential Soil (HQ=0.1)	2017-06 RSL Industrial Soil (HQ=0.1)	2017-06 RSL Protect GW Risk-Based (HQ=0.1)	Weston 1995 Background (Main Post)	PAR-83-482-SB-03		
Sample ID					PAR-83-482-SB-03-1.5-2	PAR-83-482-SB-03-5-5.5	PAR-83-482-SB-03-6-6.5
Sample Date					11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane	2	8.8	0.00022	-	NA	NA	NA
1,1,1-Trichloroethane	810	3,600	0.28	-	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.6	2.7	0.00003	-	NA	NA	NA
1,1,2-Trichloroethane	0.15	0.63	0.000013	-	NA	NA	NA
1,1-Dichloroethane	3.6	16	0.00078	-	NA	NA	NA
1,1-Dichloroethene	23	100	0.01	-	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
1,2,3-Trichlorobenzene	6.3	93	0.0021	-	NA	NA	NA
1,2,3-Trichloropropane	0.0051	0.11	0.00000032	-	NA	NA	NA
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA
1,2,4-Trimethylbenzene	30	180	0.0081	-	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.0053	0.064	0.00000014	-	NA	NA	NA
1,2-Dibromoethane	0.036	0.16	0.0000021	-	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA
1,2-Dichloroethane	0.46	2	0.000048	-	NA	NA	NA
1,2-Dichloropropane	0.28	1.2	0.000047	-	NA	NA	NA
1,3,5-Trimethylbenzene	27	150	0.0087	-	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,3-Dichloropropane	160	2,300	0.013	-	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA
2-Chlorotoluene	160	2,300	0.023	-	NA	NA	NA
Acetone	6,100	67,000	0.29	-	NA	NA	NA
Benzene	1.2	5.1	0.00023	-	NA	NA	NA
Bromobenzene	29	180	0.0042	-	NA	NA	NA
Bromochloromethane	15	63	0.0021	-	NA	NA	NA
Bromodichloromethane	0.29	1.3	0.000036	-	NA	NA	NA
Bromoform	19	86	0.00087	-	NA	NA	NA
Carbon disulfide	77	350	0.024	-	NA	NA	NA
Carbon tetrachloride	0.65	2.9	0.00018	-	NA	NA	NA
Chlorobenzene	28	130	0.0053	-	NA	NA	NA
Chlorodibromomethane	8.3	39	0.00023	-	NA	NA	NA
Chloroethane	1,400	5,700	0.59	-	NA	NA	NA
Chloroform	0.32	1.4	0.000061	-	NA	NA	NA
Cis-1,2-Dichloroethene	16	230	0.0011	-	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA
Dichlorodifluoromethane	8.7	37	0.03	-	NA	NA	NA
Ethyl benzene	5.8	25	0.0017	-	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA
Isopropylbenzene	190	990	0.074	-	NA	NA	NA
Meta/Para Xylene	55	240	0.019	-	NA	NA	NA
Methyl bromide	0.68	3	0.00019	-	NA	NA	NA
Methyl butyl ketone	20	130	0.00088	-	NA	NA	NA
Methyl chloride	11	46	0.0049	-	NA	NA	NA
Methyl ethyl ketone	2,700	19,000	0.12	-	NA	NA	NA
Methyl isobutyl ketone	3,300	14,000	0.14	-	NA	NA	NA
Methyl Tertbutyl Ether	47	210	0.0032	-	NA	NA	NA
Methylene chloride	35	320	0.0027	-	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	NA	NA	NA
n-Butylbenzene	390	5,800	0.32	-	NA	NA	NA
Ortho Xylene	65	280	0.019	-	NA	NA	NA
p-Chlorotoluene	160	2,300	0.024	-	NA	NA	NA
Propylbenzene	380	2,400	0.12	-	NA	NA	NA
sec-Butylbenzene	780	12,000	0.59	-	NA	NA	NA
Styrene	600	3,500	0.13	-	NA	NA	NA
Tert Butyl Alcohol	NLE	NLE	NLE	-	NA	NA	NA
tert-Butylbenzene	780	12,000	0.16	-	NA	NA	NA
Tetrachloroethene	8.1	39	0.0018	-	NA	NA	NA
Toluene	490	4,700	0.076	-	NA	NA	NA
Total Xylenes	58	250	0.019	-	NA	NA	NA
Trans-1,2-Dichloroethene	160	2,300	0.011	-	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Trichloroethene	0.41	1.9	0.0001	-	NA	NA	NA
Trichlorofluoromethane	2,300	35,000	0.33	-	NA	NA	NA
Vinyl chloride	0.059	1.7	0.0000065	-	NA	NA	NA
TIC VOCs (µg/kg)							
Total TICs	NLE	NLE	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	5.8	26	0.0012	-	NA	NA	NA
1,2-Dichlorobenzene	180	930	0.03	-	NA	NA	NA
1,3-Dichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,4-Dichlorobenzene	2.6	11	0.00046	-	NA	NA	NA
1-Methylnaphthalene	18	73	0.006	-	NA	NA	NA
2,4-Dinitrotoluene	1.7	7.4	0.00032	-	NA	NA	NA
2,6-Dinitrotoluene	0.36	1.5	0.000067	-	NA	NA	NA
2-Chloronaphthalene	480	6,000	0.39	-	NA	NA	NA
2-Methylnaphthalene	24	300	0.019	-	NA	NA	NA
2-Nitroaniline	63	800	0.008	-	NA	NA	NA
3,3'-Dichlorobenzidine	1.2	5.1	0.00082	-	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Chloroaniline	2.7	11	0.00016	-	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Nitroaniline	25	110	0.0016	-	NA	NA	NA
Acenaphthene	360	4,500	0.55	-	< 0.075	**0.61**	**0.017 J**
Acenaphthylene	NLE	NLE	NLE	-	**0.046 J**	**0.051 J**	**0.051 J**
Aniline	44	400	0.0046	-	NA	NA	NA
Anthracene	1,800	23,000	5.8	-	**0.1 J**	**3.3**	**0.056 J**
Azobenzene	5.6	26	0.00093	-	NA	NA	NA
Benzidine	0.00053	0.01	0.00000028	-	NA	NA	NA
Benzo(a)anthracene	1.1	21	0.011	-	**0.32**	**4.2**	**0.21**
Benzo(a)pyrene	0.11	2.1	0.029	-	**0.33**	**3.3**	**0.25**
Benzo(b)fluoranthene	1.1	21	0.3	-	**0.47**	**4.1**	**0.32**
Benzo(ghi)perylene	NLE	NLE	NLE	-	**0.21**	**1.6**	**0.18**
Benzo(k)fluoranthene	11	210	2.9	-	**0.18**	**1.6**	**0.13**
Benzyl alcohol	630	8,200	0.048	-	NA	NA	NA
Bis(2-Chloroethoxy)methane	19	250	0.0013	-	NA	NA	NA
Bis(2-Chloroethyl)ether	0.23	1	0.0000036	-	NA	NA	NA
Bis(2-Chloroisopropyl)ether	310	4,700	0.026	-	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	39	160	1.3	-	NA	NA	NA
Butyl benzyl phthalate	290	1,200	0.24	-	NA	NA	NA
Chrysene	110	2,100	9	-	**0.35**	**3.7**	**0.13**
Dibenz(a,h)anthracene	0.11	2.1	0.096	-	**0.024 J**	**0.47**	**0.042 J**
Dibenzofuran	7.3	100	0.015	-	NA	NA	NA
Diethyl phthalate	5,100	66,000	0.61	-	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA
Di-n-butylphthalate	630	8,200	0.23	-	NA	NA	NA
Di-n-octylphthalate	63	820	5.7	-	NA	NA	NA
Fluoranthene	240	3,000	8.9	-	**0.59**	**9.5**	**0.39**
Fluorene	240	3,000	0.54	-	**0.0079 J**	**1.1**	**0.019 J**
Hexachlorobenzene	0.21	0.96	0.00012	-	NA	NA	NA
Hexachlorobutadiene	1.2	5.3	0.00027	-	NA	NA	NA
Hexachlorocyclopentadiene	0.18	0.75	0.00013	-	NA	NA	NA
Hexachloroethane	1.8	8	0.0002	-	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1	21	0.98	-	**0.23**	**1.7**	**0.15**
Isophorone	570	2,400	0.026	-	NA	NA	NA
Naphthalene	3.8	17	0.00054	-	**0.13**	**0.069 J**	**0.024 J**
Nitrobenzene	5.1	22	0.000092	-	NA	NA	NA
N-Nitrosodimethylamine	0.002	0.034	0.000000027	-	NA	NA	NA
N-Nitroso-di-n-propylamine	0.078	0.33	0.0000081	-	NA	NA	NA
N-Nitrosodiphenylamine	110	470	0.067	-	NA	NA	NA
Phenanthrene	NLE	NLE	NLE	-	**0.28**	**9.8**	**0.23**
Pyrene	180	2,300	1.3	-	**0.54**	**8.4**	**0.4**
Pyridine	7.8	120	0.00068	-	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)							
Total Petroleum Hydrocarbons	NLE	NLE	NLE	-	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)							
EPH (C9-C40)	NLE	NLE	NLE	-	**120**	**190**	**216**
Inorganics (mg/kg)							
Aluminum	7,700	110,000	3,000	15,200	NA	NA	NA
Antimony	3.1	47	0.035	ND	NA	NA	NA
Arsenic	0.68	3	0.0015	22.9	**28.3**	**9.7**	**10.1**
Barium	1,500	22,000	16	32.3	NA	NA	NA
Beryllium	16	230	1.9	2	NA	NA	NA
Cadmium	7.1	98	0.069	ND	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA
Chromium	12,000	180,000	4,000,000	269	NA	NA	NA
Cobalt	2.3	35	0.027	2.5	NA	NA	NA
Copper	310	4,700	2.8	8	NA	NA	NA
Iron	5,500	82,000	35	55,800	NA	NA	NA
Lead	400	800	14	19.5	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA
Manganese	180	2,600	2.8	90.7	NA	NA	NA
Mercury	1.1	4.6	0.0033	ND	NA	NA	NA
Nickel	150	2,200	2.6	8.4	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA
Selenium	39	580	0.052	1.9	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA
Vanadium	39	580	8.6	94.1	NA	NA	NA
Zinc	2,300	35,000	37	81.4	NA	NA	NA

Footnote:

1) All historical data collected prior to 2013 are reported as provided by others.

2) NLE = no limit established.

3) ND = not detected in any background sample, no background concentration available.

4) Bold chemical dectection

5) Chemical result qualifiers are assigned by the laboratory and are evaluated and modified (if necessary) during the data validation.

[blank] = detect, i.e. detected chemical result value.

B =non-detect, i.e. not detected at or above this value.

D = Results from dilution of sample.

U = non-detect, i.e. not detected at or above this value.

UJ=The compound was not detected: however, the results is estimated because of discrepancies in meeting certain analyte-specific QC criteria.

J = estimated detected value due to a concetration below the reporting limit or due to discrepancies in meeting certain analyte-specific quality control.

6) Chemical results greater than or equal to the action level (depending on criteria) are highlighted based on the Criteria that are present.

- Cell Shade values represent a result that is above the USEPA 2017-06 RSL Residential Soil (HQ=0.1). ####

- Cell Shade values represent a result that is above the USEPA 2017-06 RSL Industrial Soil (HQ=0.1). ###

- Cell Shade values represent a result that is above the USEPA 2017-06 RSL Protect GW Risk-Based (HQ=0.1). ###

- Cell Style values represent a result that is above the Weston 1995 Background (Main Post). ###

- Cell Shade values represent a result that is above both the USEPA RSL Residential and Industrial Soil (HQ=0.1), 2017-06. ###

- Cell Shade values represent a result that is above the USEPA RSL Residential, Industrial, Protect GW Risk-Based Soil (HQ=0.1), 2017-06. ###

7) Criteria action level source document and web address.

- The 2017-06 USEPA RSL Residential Soil (HQ=0.1) refers to the EPA's Regional Screening Levels (HQ=0.1)

https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017

- The 2017-06 USEPA RSL Industrial Soil (HQ=0.1) refers to the EPA's Regional Screening Levels (HQ=0.1)

https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017

- The 2017-06 USEPA RSL Protect GW Risk-Based (HQ=0.1) refers to the EPA's Regional Screening Levels (HQ=0.1)

https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017

- The Weston 1995 Background (Main Post) refers to the FTMM reports.

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	FTMM57-SB-01		
Sample ID					FTMM-57-SB-01-2.5-3	FTMM-57-SB-01-6-6.5	FTMM-57-SB-01-8-8.5
Sample Date					11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,1,1-Trichloroethane	160,000	NLE	0.3	-	< 0.0009	< 0.001	< 0.0011
1,1,2,2-Tetrachloroethane	1	3	0.007	-	< 0.0009	< 0.001	< 0.0011
1,1,2-Trichloroethane	2	6	0.02	-	< 0.0009	< 0.001	< 0.0011
1,1-Dichloroethane	8	24	0.2	-	< 0.0009	< 0.001	< 0.0011
1,1-Dichloroethene	11	150	0.008	-	< 0.0009	< 0.001	< 0.0011
1,1-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,2,3-Trichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,2,4-Trichlorobenzene	73	820	0.7	-	< 0.0009	< 0.001	< 0.0011
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	< 0.0022	< 0.0025	< 0.0029
1,2-Dibromoethane	0.008	0.04	0.005	-	< 0.0009	< 0.001	< 0.0011
1,2-Dichlorobenzene	5,300	59,000	17	-	< 0.0009	< 0.001	< 0.0011
1,2-Dichloroethane	0.9	3	0.005	-	< 0.0009	< 0.001	< 0.0011
1,2-Dichloropropane	2	5	0.005	-	< 0.0009	< 0.001	< 0.0011
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,3-Dichlorobenzene	5,300	59,000	19	-	< 0.0009	< 0.001	< 0.0011
1,3-Dichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
1,4-Dichlorobenzene	5	13	2	-	< 0.0009	< 0.001	< 0.0011
2,2-Dichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
2-Chlorotoluene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Acetone	70,000	NLE	19	-	**0.11**	**0.11**	**0.12**
Benzene	2	5	0.005	-	< 0.0009	< 0.001	< 0.0011
Bromobenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Bromochloromethane	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Bromodichloromethane	1	3	0.005	-	< 0.0009	< 0.001	< 0.0011
Bromoform	81	280	0.03	-	< 0.0009	< 0.001	< 0.0011
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	< 0.0009	< 0.001	< 0.0011
Chlorobenzene	510	7,400	0.6	-	< 0.0009	< 0.001	< 0.0011
Chlorodibromomethane	3	8	0.005	-	< 0.0009	< 0.001	< 0.0011
Chloroethane	220	1,100	NLE	-	< 0.0022	< 0.0025	< 0.0029
Chloroform	0.6	2	0.4	-	**0.0005 J**	< 0.001	**0.001 J**
Cis-1,2-Dichloroethene	230	560	0.3	-	< 0.0009	< 0.001	< 0.0011
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Cymene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Dichlorodifluoromethane	490	230,000	39	-	< 0.0009	< 0.001	< 0.0011
Ethyl benzene	7,800	110,000	13	-	< 0.0009	< 0.001	< 0.0011
Hexachlorobutadiene	6	25	0.9	-	< 0.0009	< 0.001	< 0.0011
Isopropylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Meta/Para Xylene	NLE	NLE	NLE	-	< 0.0018	< 0.002	< 0.0023
Methyl bromide	25	59	0.04	-	< 0.0009	< 0.001	< 0.0011
Methyl butyl ketone	NLE	NLE	NLE	-	< 0.0045 UJ	< 0.005 UJ	< 0.0057 UJ
Methyl chloride	4	12	NLE	-	< 0.0009	< 0.001	< 0.0011
Methyl ethyl ketone	3,100	44,000	0.9	-	**0.0093**	**0.0079 J**	**0.0071 J**
Methyl isobutyl ketone	NLE	NLE	NLE	-	< 0.0045	< 0.005	< 0.0057
Methyl Tertbutyl Ether	110	320	0.2	-	**0.0006 J**	< 0.001	< 0.0011
Methylene chloride	46	230	0.01	-	< 0.0009	< 0.001	< 0.0011
Naphthalene	6	17	25	-	< 0.0009	< 0.001	< 0.0011
n-Butylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Ortho Xylene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
p-Chlorotoluene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Propylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
sec-Butylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Styrene	90	260	3	-	< 0.0009	< 0.001	< 0.0011
Tert Butyl Alcohol	1,400	11,000	0.3	-	**0.0034 J**	**0.012**	**0.011 J**
tert-Butylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Tetrachloroethene	43	1,500	0.005	-	< 0.0009	< 0.001	< 0.0011
Toluene	6,300	91,000	7	-	< 0.0009	< 0.001	< 0.0011
Total Xylenes	12,000	170,000	19	-	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	< 0.0009	< 0.001	< 0.0011
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.001	< 0.0011
Trichloroethene	3	10	0.01	-	< 0.0009	< 0.001	< 0.0011
Trichlorofluoromethane	23,000	340,000	34	-	< 0.0009	< 0.001	< 0.0011
Vinyl chloride	0.7	2	0.005	-	< 0.0009	< 0.001	< 0.0011
TIC VOCs (µg/kg)							
Total TICs	500	NLE	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	< 0.077	< 0.078	< 0.083
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	< 0.077	< 0.078	< 0.083
Acenaphthylene	NLE	300,000	NLE	-	< 0.077	< 0.078	< 0.083
Aniline	NLE	NLE	NLE	-	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	< 0.077	< 0.078	< 0.083
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.029 J**	< 0.078	< 0.083
Benzo(a)pyrene	0.5	2	0.2	-	**0.033 J**	< 0.078	< 0.083
Benzo(b)fluoranthene	5	17	2	-	**0.039 J**	< 0.078	< 0.083
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.031 J**	< 0.078	< 0.083
Benzo(k)fluoranthene	45	170	25	-	**0.018 J**	< 0.078	< 0.083
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA
Chrysene	450	1,700	80	-	**0.027 J**	< 0.078	< 0.083
Dibenz(a,h)anthracene	0.5	2	0.8	-	**0.013 J**	< 0.078	< 0.083
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**0.057 J**	< 0.078	< 0.083
Fluorene	2,300	24,000	170	-	< 0.077	< 0.078	< 0.083
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	< 0.077	< 0.078	< 0.083
Isophorone	510	2,000	0.2	-	NA	NA	NA
Naphthalene	6	17	25	-	< 0.077	< 0.078	< 0.083
Nitrobenzene	5	14	0.2	-	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**0.027 J**	**0.014 J**	< 0.083
Pyrene	1,700	18,000	840	-	**0.053 J**	**0.015 J**	< 0.083
Pyridine	NLE	NLE	NLE	-	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)							
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)							
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA
Inorganics (mg/kg)							
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA
Arsenic	19	19	19	22.9	**5.9**	**4.6**	**5.4**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA
Lead	400	800	90	19.5	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	FTMM57-SB-02			
Sample ID					FTMM-57-SB-02-2.5-3	FTMM-57-SB-02-7-7.5	FTMM-57-SB-102-7-7.5	FTMM-57-SB-02-8-8.5
Sample Date					11/13/2017	11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)								
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,1-Trichloroethane	160,000	NLE	0.3	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,2,2-Tetrachloroethane	1	3	0.007	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,2-Trichloroethane	2	6	0.02	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloroethane	8	24	0.2	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloroethene	11	150	0.008	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,3-Trichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,4-Trichlorobenzene	73	820	0.7	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	< 0.0023	< 0.0023	< 0.0022	< 0.0022
1,2-Dibromoethane	0.008	0.04	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichlorobenzene	5,300	59,000	17	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichloroethane	0.9	3	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichloropropane	2	5	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	**0.0005 J**
1,3-Dichlorobenzene	5,300	59,000	19	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,3-Dichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,4-Dichlorobenzene	5	13	2	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
2,2-Dichloropropane	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
2-Chlorotoluene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Acetone	70,000	NLE	19	-	**0.012**	**0.064 J**	**0.072**	**0.075**
Benzene	2	5	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromobenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromochloromethane	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromodichloromethane	1	3	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromoform	81	280	0.03	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Chlorobenzene	510	7,400	0.6	-	< 0.0009	< 0.0009 UJ	< 0.0009	< 0.0009
Chlorodibromomethane	3	8	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Chloroethane	220	1,100	NLE	-	< 0.0023	< 0.0023	< 0.0022	< 0.0022
Chloroform	0.6	2	0.4	-	**0.0007 J**	< 0.0009	< 0.0009	< 0.0009
Cis-1,2-Dichloroethene	230	560	0.3	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cymene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Dichlorodifluoromethane	490	230,000	39	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Ethyl benzene	7,800	110,000	13	-	< 0.0009	< 0.0009 UJ	< 0.0009	< 0.0009
Hexachlorobutadiene	6	25	0.9	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Isopropylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	**0.0045**
Meta/Para Xylene	NLE	NLE	NLE	-	< 0.0018	< 0.0018 UJ	< 0.0018	**0.0008 J**
Methyl bromide	25	59	0.04	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Methyl butyl ketone	NLE	NLE	NLE	-	< 0.0046 UJ	< 0.0045 UJ	< 0.0045 UJ	< 0.0043 UJ
Methyl chloride	4	12	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Methyl ethyl ketone	3,100	44,000	0.9	-	< 0.0046	**0.0088 J**	**0.013**	< 0.0043
Methyl isobutyl ketone	NLE	NLE	NLE	-	< 0.0046	< 0.0045	< 0.0045	< 0.0043
Methyl Tertbutyl Ether	110	320	0.2	-	< 0.0009	**0.0006 J**	**0.0007 J**	**0.0028**
Methylene chloride	46	230	0.01	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Naphthalene	6	17	25	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
n-Butylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Ortho Xylene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	**0.0016 J**
p-Chlorotoluene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Propylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	**0.0005 J**
sec-Butylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Styrene	90	260	3	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Tert Butyl Alcohol	1,400	11,000	0.3	-	**0.0032 J**	< 0.0045	< 0.0045	**0.0085 J**
tert-Butylbenzene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Tetrachloroethene	43	1,500	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Toluene	6,300	91,000	7	-	< 0.0009	< 0.0009 UJ	< 0.0009	**0.0006 J**
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trichloroethene	3	10	0.01	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trichlorofluoromethane	23,000	340,000	34	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Vinyl chloride	0.7	2	0.005	-	< 0.0009	< 0.0009	< 0.0009	< 0.0009
TIC VOCs (µg/kg)								
Total TICs	500	NLE	NLE	-	NA	141.4	323.7	484.4
Semivolatile Organic Compounds (mg/kg)								
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	< 0.073	**0.083 J**	**0.051 J**	**0.035 J**
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	< 0.073	< 0.078	< 0.074	< 0.076
Acenaphthylene	NLE	300,000	NLE	-	< 0.073	< 0.078	< 0.074	< 0.076
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	< 0.073	**0.02 J**	< 0.074	< 0.076
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	< 0.073	**0.065 J**	**0.057 J**	**0.02 J**
Benzo(a)pyrene	0.5	2	0.2	-	< 0.073	**0.046 J**	**0.02 J**	**0.029 J**
Benzo(b)fluoranthene	5	17	2	-	< 0.073	**0.084 J**	**0.059 J**	**0.042 J**
Benzo(ghi)perylene	380,000	30,000	NLE	-	< 0.073	**0.032 J**	**0.034 J**	**0.02 J**
Benzo(k)fluoranthene	45	170	25	-	< 0.073	**0.022 J**	**0.031 J**	**0.017 J**
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA
Chrysene	450	1,700	80	-	< 0.073	**0.036 J**	**0.056 J**	**0.017 J**
Dibenz(a,h)anthracene	0.5	2	0.8	-	< 0.073	**0.016 J**	< 0.074	< 0.076
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	< 0.073	**0.19**	**0.1 J**	**0.064 J**
Fluorene	2,300	24,000	170	-	< 0.073	**0.013 J**	< 0.074	< 0.076
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	< 0.073	**0.023 J**	**0.036 J**	< 0.076
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA
Naphthalene	6	17	25	-	< 0.073	**0.046 J**	**0.042 J**	**0.033 J**
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	< 0.073	**0.12**	**0.052 J**	**0.033 J**
Pyrene	1,700	18,000	840	-	< 0.073	**0.17**	**0.11 J**	**0.068 J**
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)								
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)								
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA
Arsenic	19	19	19	22.9	**3.9**	**3.7**	**5.6**	**4.4**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA
Lead	400	800	90	19.5	NA	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 S-1	Bldg 108 S-10	Bldg 108 S-11	Bldg 108 S-13	Bldg 108 S-14	Bldg 108 S-15	Bldg 108 S-16
Sample ID					Bldg108 S-1-4-4	Bldg108 S-10-5-5	Bldg108 S-11-5-5	Bldg108 S-13-1.5-1.5	Bldg108 S-14-3-3	Bldg108 S-15-4-4	Bldg108 S-16-6-6
Sample Date					5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	0.004 JB	< 0.012	0.0046 JB	< 0.011	< 6	< 0.039	< 1.6
Benzene	2	5	0.005	-	< 0.06	< 0.006	< 0.006	< 0.005	< 3	< 0.006	**0.76 J**
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	< 0.06	< 0.006	< 0.006	< 0.005	< 3	< 0.006	< 0.78
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	< 0.06	< 0.006	< 0.006	< 0.005	**1.1 J**	**0.0077 J**	**21**
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	< 0.06	< 0.006	< 0.006	< 0.005	**6.2**	**0.01**	**170 D**
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	< 0.071	0.0042 JB	0.0042 JB	0.005 JB	2.3 JB	0.0056 JB	**0.87**
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	< 0.06	< 0.006	< 0.006	< 0.005	**1.4 J**	0 J	**69 D**
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	< 0.06	< 0.006	< 0.006	< 0.005	< 3	< 0.006	**9.5**
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)											
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)											
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	**0.13 J**	**0.47**	**0.043 J**	< 0.36	**0.33 J**	< 0.39	**2.5**
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	**0.062 J**	< 0.38	< 0.4	< 0.36	**0.37 J**	< 0.39	< 0.41
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	**0.083 J**	**0.01 J**	**0.096 J**	< 0.36	**0.7**	< 0.39	**0.21 J**
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.14 J**	**0.13 J**	**0.13 J**	**0.11 J**	**1.4**	< 0.39	**0.22 J**
Benzo(a)pyrene	0.5	2	0.2	-	**0.13 J**	**0.14 J**	**0.43**	**0.11 J**	**1.3**	< 0.39	**0.16 J**
Benzo(b)fluoranthene	5	17	2	-	**0.2 J**	**0.11 J**	**0.43**	**0.12 J**	**1**	< 0.39	**0.13 J**
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.082 J**	**0.11 J**	**0.3 J**	**0.08 J**	**0.9**	< 0.39	**0.097 J**
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	**1.1 J**	**0.57**	**0.67**	**0.05 J**	**0.097 J**	< 0.39	**2**
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	**0.16 J**	**0.15 J**	**0.53**	**0.13 J**	**1.5**	< 0.39	**0.21 J**
Dibenz(a,h)anthracene	0.5	2	0.8	-	< 0.41	< 0.38	**0.4 J**	< 0.36	**0.37 J**	< 0.39	< 0.41
Dibenzofuran	NLE	NLE	NLE	-	**0.043 J**	< 0.38	< 0.4	< 0.36	**0.31 J**	< 0.39	**0.09 J**
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**0.36 J**	**0.18 J**	**0.67**	**0.18 J**	**2.4**	< 0.39	**0.53**
Fluorene	2,300	24,000	170	-	**0.069 J**	< 0.38	< 0.4	< 0.36	**0.47**	< 0.39	**0.22 J**
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.09 J**	**0.11 J**	**0.29 J**	**0.07 J**	**0.8**	< 0.39	**0.09 J**
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	**0.24 J**	< 0.38	< 0.4	< 0.36	**0.21 J**	< 0.39	**1.5**
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**0.3 J**	**0.16 J**	**0.37 J**	**0.1 J**	**2.2**	< 0.39	**0.8**
Pyrene	1,700	18,000	840	-	**0.2 J**	**0.21 J**	**0.67**	**0.2 J**	**1.9**	< 0.39	**0.47**
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)											
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	**3.82**	**35.9**	**50.8**	**158**	**380**	**5.22**	**1,100**
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)											
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)											
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	NA	NA	NA	NA	NA	NA	NA
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**30.7**	**55.8**	**155**	**14.8**	**28.8**	**11**	**12.3**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 S-17	Bldg 108 S-18	Bldg 108 S-19	Bldg 108 S-2	Bldg 108 S-3	Bldg 108 S-4	Bldg 108 S-5
Sample ID					Bldg108 S-17-6-6	Bldg108 S-18-4-4	Bldg108 S-19-3-3	Bldg108 S-2-4-4	Bldg108 S-3-4-4	Bldg108 S-4-1-1	Bldg108 S-5-6-6
Sample Date					5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993	5/3/1993
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	< 1.5	< 1.5	< 0.063	0.005 JB	0.005 JB	< 0.011	0.6 JB
Benzene	2	5	0.005	-	**2.5**	< 0.74	< 0.031	< 0.06	< 0.006	< 0.005	**1**
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	< 0.76	< 0.74	< 0.031	< 0.06	< 0.006	< 0.005	< 0.75
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	**0.34 J**	**0.85**	< 0.031	< 0.06	< 0.006	< 0.005	**7.6**
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	**1.9**	**3.4**	**0.025 J**	< 0.06	< 0.006	< 0.005	**30**
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	**1**	**0.87**	**0.049**	0.0061 JB	< 0.0069	0.0035 JB	< 1.1
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	< 0.76	**1.2**	< 0.031	< 0.06	< 0.006	< 0.005	**0.87**
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	< 0.76	**0.92**	< 0.031	< 0.06	< 0.006	< 0.005	**0.76**
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)											
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)											
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	**1.3**	< 0.39	**0.18 J**	< 0.41	**0.21 J**	**0.054 J**	**4.3**
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	**0.19 J**	< 0.39	< 0.41	< 0.41	< 0.41	**0.095 J**	**0.67**
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	**0.23 J**	< 0.39	**1.6**	< 0.41	**1.7**	**0.22 J**	**1.6**
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.32 J**	**0.05 J**	**3.7**	< 0.41	**2.3**	**0.35**	**0.87**
Benzo(a)pyrene	0.5	2	0.2	-	**0.25 J**	< 0.39	**3.3**	**0.25 J**	**1.8**	**0.34 J**	**0.63**
Benzo(b)fluoranthene	5	17	2	-	**0.2 J**	**0.06 J**	**5.3**	< 0.41	**1.8**	**0.22 J**	< 0.4
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.15 J**	< 0.39	**2.5 J**	< 0.41	**1**	**0.21 J**	**0.3 J**
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	**2.2**	< 0.39	**0.13 J**	**0.37 J**	**0.28 J**	**0.16 J**	**4.7**
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	**0.37 J**	**0.04 J**	**4**	< 0.41	**2.2**	**0.36**	**0.87**
Dibenz(a,h)anthracene	0.5	2	0.8	-	**0.07 J**	< 0.39	**0.97**	< 0.41	**0.35 J**	**0.074 J**	**0.19 J**
Dibenzofuran	NLE	NLE	NLE	-	**0.078 J**	< 0.39	**0.53**	< 0.41	**0.81**	**0.044 J**	**0.54**
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**0.6**	**0.08 J**	**7.3**	< 0.41	**4.9**	**0.66**	**2.1**
Fluorene	2,300	24,000	170	-	**0.18 J**	< 0.39	**0.93**	< 0.41	< 1.1	**0.09 J**	**0.8**
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.14 J**	< 0.39	**2.3**	< 0.41	**1.1**	**0.19 J**	**0.33 J**
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	**0.87**	< 0.39	**0.21 J**	< 0.41	**0.41 J**	**0.04 J**	**5.3**
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**0.87 J**	< 0.39	**2.7**	< 0.41	**4.4**	**0.66**	**3.2**
Pyrene	1,700	18,000	840	-	**0.57 J**	**0.08 J**	**5.3**	< 0.41	**2.4**	**0.45**	**1.6**
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)											
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	**340**	< 3.3	**46.1**	**1.93**	**10.8**	**27.5**	**2,970**
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)											
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)											
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	NA	NA	NA	NA	NA	NA	NA
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**21.8**	**10.4**	**174**	< 5	**9.05**	< 5	**16.3**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 S-6	Bldg 108 S-7	Bldg 108 S-8	Bldg 108 S-9	Bldg 108 SS-1		
Sample ID					Bldg108 S-6-5-5	Bldg108 S-7-7-7	Bldg108 S-8-6-6	Bldg108 S-9-5-5	Bldg108 SS-1-0-0.5	Bldg108 SS-1-1-1.5	Bldg108 SS-1-2-2.5
Sample Date					5/3/1993	5/3/1993	5/3/1993	5/3/1993	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	0.004 JB	0.3 JB	**0.029**	< 0.012	NA	NA	NA
Benzene	2	5	0.005	-	< 0.06	**4**	< 0.031	< 0.006	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	< 0.06	< 0.75	< 0.031	**0.013**	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	< 0.06	**0.89**	< 0.031	< 0.006	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	< 0.06	**2**	< 0.031	< 0.006	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	**0.0044 J**	< 0.98	**0.02**	0.0042 JB	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	< 0.06	**0.45 J**	< 0.031	< 0.006	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	< 0.06	< 0.75	< 0.031	< 0.006	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)											
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)											
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	**0.074 J**	**0.044 J**	< 0.41	**0.04 J**	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	**0.089 J**	< 0.4	< 0.41	< 0.4	NA	NA	NA
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	**0.34 J**	< 0.4	< 0.41	**0.074 J**	NA	NA	NA
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**1.2**	< 0.4	**0.05 J**	**0.19 J**	NA	NA	NA
Benzo(a)pyrene	0.5	2	0.2	-	**1.1**	< 0.4	< 0.41	**0.17 J**	NA	NA	NA
Benzo(b)fluoranthene	5	17	2	-	**0.95**	< 0.4	< 0.41	**0.17 J**	NA	NA	NA
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.67**	< 0.4	< 0.41	**0.13 J**	NA	NA	NA
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	**0.11 J**	**0.15 J**	**4.7**	**0.23 J**	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	**1.2**	< 0.4	**0.055 J**	**0.23 J**	NA	NA	NA
Dibenz(a,h)anthracene	0.5	2	0.8	-	**0.3**	< 0.4	< 0.41	**0.07 J**	NA	NA	NA
Dibenzofuran	NLE	NLE	NLE	-	**0.082 J**	< 0.4	< 0.41	< 0.4	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**2.7**	< 0.4	**0.11 J**	**0.33 J**	NA	NA	NA
Fluorene	2,300	24,000	170	-	**0.12 J**	< 0.4	< 0.41	**0.047 J**	NA	NA	NA
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.68**	< 0.4	< 0.41	**0.13 J**	NA	NA	NA
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	**0.082 J**	< 0.4	< 0.41	**0.04 J**	NA	NA	NA
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**0.87**	< 0.4	**0.085 J**	< 0.4	NA	NA	NA
Pyrene	1,700	18,000	840	-	**1.1**	< 0.4	**0.11 J**	**0.32 J**	NA	NA	NA
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)											
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	**333**	**230**	**26**	**128**	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)											
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)											
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	NA	NA	NA	NA	**108.46**	**30.96**	**9.3**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**52.1**	**12.4**	< 5	**58.2**	**10.6**	**6.49**	**7.74**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 SS-2			Bldg 108 SS-3		
Sample ID					Bldg108 SS-2-0-0.5	Bldg108 SS-2-1-1.5	Bldg108 SS-2-2-2.5	Bldg108 SS-3-0-0.5	Bldg108 SS-3-1-1.5	Bldg108 SS-3-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	NA	NA	NA	NA	NA	NA
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.5	2	0.2	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	5	17	2	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	380,000	30,000	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.5	2	0.8	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	NA	NA	NA	NA	NA	NA
Fluorene	2,300	24,000	170	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	NA	NA	NA	NA	NA	NA
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	1,700	18,000	840	-	NA	NA	NA	NA	NA	NA
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	< 10.4	**7.81**	**44.06**	**98.11**	< 10.9	< 11
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**2.55**	**1.98**	**11.9**	**13.9**	**1.33**	**15.2**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 SS-4			Bldg 108 SS-5		
Sample ID					Bldg108 SS-4-0-0.5	Bldg108 SS-4-1-1.5	Bldg108 SS-4-2-2.5	Bldg108 SS-5-0-0.5	Bldg108 SS-5-1-1.5	Bldg108 SS-5-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	NA	NA	NA	NA	NA	NA
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.5	2	0.2	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	5	17	2	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	380,000	30,000	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.5	2	0.8	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	NA	NA	NA	NA	NA	NA
Fluorene	2,300	24,000	170	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	NA	NA	NA	NA	NA	NA
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	1,700	18,000	840	-	NA	NA	NA	NA	NA	NA
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	**4.95**	**195.74**	< 12.1	**27.55**	**28.31**	**57.92**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**8.97**	**8.32**	**16.3**	**11.9**	**10**	**6.52**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 SS-6			Bldg 108 SS-7		
Sample ID					Bldg108 SS-6-0-0.5	Bldg108 SS-6-1-1.5	Bldg108 SS-6-2-2.5	Bldg108 SS-7-0-0.5	Bldg108 SS-7-1-1.5	Bldg108 SS-7-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	NA	NA	NA	NA	NA	NA
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.5	2	0.2	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	5	17	2	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	380,000	30,000	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.5	2	0.8	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	NA	NA	NA	NA	NA	NA
Fluorene	2,300	24,000	170	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	NA	NA	NA	NA	NA	NA
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	1,700	18,000	840	-	NA	NA	NA	NA	NA	NA
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	**17.86**	**18.37**	**22.99**	**30.62**	**32.9**	**7.5**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**9.28**	**10.4**	**9.07**	**8.91**	**23**	**10.6**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 108 SS-8			Bldg 108 SS-9		
Sample ID					Bldg108 SS-8-0-0.5	Bldg108 SS-8-1-1.5	Bldg108 SS-8-2-2.5	Bldg108 SS-9-0-0.5	Bldg108 SS-9-1-1.5	Bldg108 SS-9-2-2.5
Sample Date					3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001	3/8/2001
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	NA	NA	NA	NA	NA	NA
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.5	2	0.2	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	5	17	2	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	380,000	30,000	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	45	170	25	-	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.5	2	0.8	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	NA	NA	NA	NA	NA	NA
Fluorene	2,300	24,000	170	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	NA	NA	NA	NA	NA	NA
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	1,700	18,000	840	-	NA	NA	NA	NA	NA	NA
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	**24.37**	**68.51**	**297.03**	**16.98**	< 10.7	**15.56**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**6.29**	**14.3**	**166**	**11.8**	**1.99**	**11.4**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 488 BL-1	Bldg 488 BL-10	Bldg 488 BL-11	Bldg 488 BL-2	Bldg 488 BL-3	Bldg 488 BL-4
Sample ID					Bldg488 BL-1-3.5-4	Bldg488 BL-10-2-2.5	Bldg488 BL-11-2-2.5	Bldg488 BL-2-2.5-3	Bldg488 BL-3-2-2.5	Bldg488 BL-4-3.5-4
Sample Date					12/16/2010	12/16/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	< 0.254	< 0.244	< 0.237	< 0.242	< 0.489	< 0.241
1,2-Dichlorobenzene	5,300	59,000	17	-	< 0.225	< 0.216	< 0.21	< 0.215	< 0.433	< 0.214
1,3-Dichlorobenzene	5,300	59,000	19	-	< 0.194	< 0.186	< 0.181	< 0.185	< 0.373	< 0.184
1,4-Dichlorobenzene	5	13	2	-	< 0.202	< 0.194	< 0.188	< 0.192	< 0.388	< 0.192
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	< 0.303	< 0.291	< 0.283	< 0.289	< 0.582	< 0.287
2,6-Dinitrotoluene	0.7	3	NLE	-	< 0.303	< 0.291	< 0.283	< 0.289	< 0.582	< 0.287
2-Chloronaphthalene	NLE	NLE	NLE	-	< 0.291	< 0.28	< 0.272	< 0.278	< 0.56	< 0.276
2-Methylnaphthalene	230	2,400	8	-	< 0.301	< 0.29	< 0.281	< 0.288	< 0.58	< 0.286
2-Nitroaniline	39	23,000	NLE	-	< 0.356	< 0.342	< 0.332	< 0.34	< 0.685	< 0.34
3,3'-Dichlorobenzidine	1	4	0.2	-	< 0.315	< 0.303	< 0.294	< 0.301	< 0.607	< 0.299
3-Nitroaniline	NLE	NLE	NLE	-	< 0.256	< 0.246	< 0.239	< 0.244	< 0.493	< 0.243
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	< 0.334	< 0.321	< 0.312	< 0.319	< 0.642	< 0.317
4-Chloroaniline	NLE	NLE	NLE	-	< 0.429	< 0.412	< 0.401	< 0.409	< 0.825	< 0.407
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	< 0.322	< 0.31	< 0.301	< 0.307	< 0.62	< 0.306
4-Nitroaniline	NLE	NLE	NLE	-	< 0.316	< 0.304	< 0.296	< 0.302	< 0.609	< 0.301
Acenaphthene	3,400	37,000	110	-	**0.41 J**	< 0.302	< 0.293	< 0.3	< 0.605	< 0.298
Acenaphthylene	NLE	300,000	NLE	-	< 0.315	< 0.303	< 0.294	< 0.301	< 0.607	< 0.299
Aniline	NLE	NLE	NLE	-	< 0.309	< 0.297	< 0.289	< 0.295	< 0.596	< 0.294
Anthracene	17,000	30,000	2,400	-	< 0.347	< 0.333	< 0.324	**0.36 J**	< 0.667	< 0.329
Azobenzene	NLE	NLE	NLE	-	< 0.333	< 0.32	< 0.311	< 0.317	< 0.64	< 0.316
Benzidine	0.7	0.7	0.7	-	< 0.312	< 0.3	< 0.291	< 0.298	< 0.6	< 0.296
Benzo(a)anthracene	5	17	0.8	-	**0.5 J**	< 0.332	< 0.323	**1.36**	< 0.665	< 0.328
Benzo(a)pyrene	0.5	2	0.2	-	**0.44 J**	< 0.256	< 0.249	**1.1**	< 0.513	< 0.253
Benzo(b)fluoranthene	5	17	2	-	**0.64**	< 0.238	< 0.232	**1.46**	< 0.477	< 0.236
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.28 J**	< 0.206	< 0.2	**0.71**	< 0.413	< 0.204
Benzo(k)fluoranthene	45	170	25	-	< 0.298	< 0.286	< 0.28	**0.59**	< 0.573	< 0.283
Benzyl alcohol	NLE	NLE	NLE	-	< 0.299	< 0.287	< 0.279	< 0.285	< 0.576	< 0.284
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	< 0.23	< 0.221	< 0.214	< 0.219	< 0.442	< 0.218
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	< 0.224	< 0.215	< 0.209	< 0.213	< 0.431	< 0.212
Bis(2-Chloroisopropyl)ether	23	67	5	-	< 0.26	< 0.249	< 0.243	< 0.248	< 0.5	< 0.247
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	< 0.366	< 0.352	< 0.342	< 0.349	< 0.705	< 0.348
Butyl benzyl phthalate	1,200	14,000	230	-	< 0.305	< 0.293	< 0.285	< 0.291	< 0.587	< 0.29
Chrysene	450	1,700	80	-	**0.49 J**	< 0.313	< 0.304	**1.34**	< 0.627	< 0.309
Dibenz(a,h)anthracene	0.5	2	0.8	-	< 0.211	< 0.203	< 0.197	< 0.201	< 0.406	< 0.2
Dibenzofuran	NLE	NLE	NLE	-	< 0.37	< 0.355	< 0.345	< 0.353	< 0.712	< 0.351
Diethyl phthalate	49,000	550,000	88	-	< 0.29	< 0.278	< 0.271	< 0.276	< 0.558	< 0.275
Dimethyl phthalate	NLE	NLE	NLE	-	< 0.306	< 0.294	< 0.286	< 0.292	< 0.589	< 0.291
Di-n-butylphthalate	6,100	68,000	760	-	< 0.332	< 0.319	< 0.31	< 0.316	< 0.638	< 0.315
Di-n-octylphthalate	2,400	27,000	3,300	-	< 0.307	< 0.295	< 0.287	< 0.293	< 0.591	< 0.292
Fluoranthene	2,300	24,000	1,300	-	**0.92**	< 0.331	< 0.322	**2.99**	< 0.663	< 0.327
Fluorene	2,300	24,000	170	-	< 0.328	< 0.315	< 0.306	< 0.313	< 0.631	< 0.312
Hexachlorobenzene	0.3	1	0.2	-	< 0.348	< 0.334	< 0.325	< 0.332	< 0.669	< 0.33
Hexachlorobutadiene	6	25	0.9	-	< 0.25	< 0.241	< 0.234	< 0.239	< 0.482	< 0.238
Hexachlorocyclopentadiene	45	110	320	-	< 0.169	< 0.163	< 0.158	< 0.161	< 0.326	< 0.161
Hexachloroethane	12	48	0.2	-	< 0.219	< 0.21	< 0.205	< 0.209	< 0.422	< 0.208
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.24 J**	< 0.217	< 0.211	**0.64**	< 0.435	< 0.215
Isophorone	510	2,000	0.2	-	< 0.278	< 0.267	< 0.26	< 0.265	< 0.535	< 0.264
Naphthalene	6	17	25	-	< 0.281	< 0.27	< 0.262	< 0.268	< 0.54	< 0.266
Nitrobenzene	5	14	0.2	-	< 0.262	< 0.252	< 0.245	< 0.25	< 0.504	< 0.249
N-Nitrosodimethylamine	0.7	0.7	0.7	-	< 0.195	< 0.187	< 0.182	< 0.186	< 0.375	< 0.185
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	< 0.293	< 0.282	< 0.274	< 0.28	< 0.564	< 0.279
N-Nitrosodiphenylamine	99	390	0.4	-	< 0.314	< 0.302	< 0.293	< 0.3	< 0.605	< 0.298
Phenanthrene	NLE	300,000	NLE	-	**0.46 J**	< 0.331	< 0.322	**1.53**	< 0.663	< 0.327
Pyrene	1,700	18,000	840	-	**0.79**	< 0.353	< 0.343	**2.5**	< 0.707	< 0.349
Pyridine	NLE	NLE	NLE	-	< 0.115	< 0.11	< 0.107	< 0.109	< 0.221	< 0.109
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	NA	NA	NA	NA	NA	NA
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	NA	NA	NA	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	Bldg 488 BL-6	Bldg 488 BL-7	Bldg 488 BL-8	Bldg 488 BL-9	PAR-83-SB-12	
Sample ID					Bldg488 BL-6-5.5-6	Bldg488 BL-7-3-3.5	Bldg488 BL-8-3-3.5	Bldg488 BL-9-2.5-3	PAR-83-SB-12-1-1.5	PAR-83-SB-12-2.5-3
Sample Date					12/15/2010	12/15/2010	12/15/2010	12/15/2010	4/5/2016	4/5/2016
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	< 0.0036	< 0.48
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Acetone	70,000	NLE	19	-	NA	NA	NA	NA	**0.012**	< 0.48
Benzene	2	5	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromodichloromethane	1	3	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
Bromoform	81	280	0.03	-	NA	NA	NA	NA	< 0.0036	< 0.48
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chloroethane	220	1,100	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Chloroform	0.6	2	0.4	-	NA	NA	NA	NA	< 0.0036	< 0.48
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA	NA	< 0.0036	< 0.48
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Cymene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA	NA	< 0.0036	< 0.48
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA	NA	< 0.0036	< 0.48
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	< 0.0036	< 0.48
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	**0.86**
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0072	< 0.96
Methyl bromide	25	59	0.04	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl chloride	4	12	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA	NA	**0.0033 J**	< 0.48
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA	NA	< 0.0036	< 0.48
Methylene chloride	46	230	0.01	-	NA	NA	NA	NA	< 0.0036	< 0.48
Naphthalene	6	17	25	-	NA	NA	NA	NA	< 0.0036	< 0.48
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	**1.6**
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	**1.7**
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	**1.4**
Styrene	90	260	3	-	NA	NA	NA	NA	< 0.0036	< 0.48
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA	NA	< 0.072	< 9.6
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	**0.095 J**
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
Toluene	6,300	91,000	7	-	NA	NA	NA	NA	< 0.0036	< 0.48
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA	NA	< 0.0036	< 0.48
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA	NA	< 0.0036	< 0.48
Trichloroethene	3	10	0.01	-	NA	NA	NA	NA	< 0.0036	< 0.48
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA	NA	< 0.0036	< 0.48
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA	NA	< 0.0036	< 0.48
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	NA	NA	NA	NA	**0.0078**	**155**
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	< 0.261	< 0.245	< 0.245	< 0.252	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	< 0.23	< 0.217	< 0.217	< 0.223	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	< 0.199	< 0.187	< 0.187	< 0.192	NA	NA
1,4-Dichlorobenzene	5	13	2	-	< 0.207	< 0.195	< 0.195	< 0.2	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	**0.0066 J**	**31**
2,4-Dinitrotoluene	0.7	3	NLE	-	< 0.311	< 0.292	< 0.292	< 0.3	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	< 0.311	< 0.292	< 0.292	< 0.3	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	< 0.299	< 0.281	< 0.281	< 0.289	NA	NA
2-Methylnaphthalene	230	2,400	8	-	< 0.31	< 0.291	< 0.291	< 0.299	**0.0041 J**	**53**
2-Nitroaniline	39	23,000	NLE	-	< 0.366	< 0.344	< 0.343	< 0.353	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	< 0.324	< 0.305	< 0.304	< 0.313	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	< 0.263	< 0.248	< 0.247	< 0.254	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	< 0.343	< 0.323	< 0.322	< 0.331	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	< 0.441	< 0.415	< 0.414	< 0.426	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	< 0.331	< 0.311	< 0.311	< 0.32	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	< 0.325	< 0.306	< 0.305	< 0.314	NA	NA
Acenaphthene	3,400	37,000	110	-	< 0.323	< 0.304	< 0.303	< 0.312	**0.01**	**3.3**
Acenaphthylene	NLE	300,000	NLE	-	< 0.324	< 0.305	< 0.304	< 0.313	< 0.0071	< 0.39
Aniline	NLE	NLE	NLE	-	< 0.318	< 0.299	< 0.299	< 0.307	NA	NA
Anthracene	17,000	30,000	2,400	-	< 0.356	< 0.335	< 0.334	< 0.344	**0.0023 J**	< 0.39
Azobenzene	NLE	NLE	NLE	-	< 0.342	< 0.322	< 0.321	< 0.33	NA	NA
Benzidine	0.7	0.7	0.7	-	< 0.32	< 0.301	< 0.301	< 0.31	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.52 J**	**0.66**	< 0.333	< 0.343	**0.0061 J**	**0.17 J**
Benzo(a)pyrene	0.5	2	0.2	-	**0.43 J**	**0.58**	< 0.257	< 0.265	< 0.0079	< 0.39
Benzo(b)fluoranthene	5	17	2	-	**0.67**	**0.81**	< 0.239	< 0.246	**0.0097**	< 0.39
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.31 J**	**0.38 J**	< 0.207	< 0.213	**0.0078**	< 0.39
Benzo(k)fluoranthene	45	170	25	-	< 0.306	< 0.288	< 0.287	< 0.296	**0.0043 J**	< 0.39
Benzyl alcohol	NLE	NLE	NLE	-	< 0.307	< 0.289	< 0.289	< 0.297	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	< 0.236	< 0.222	< 0.221	< 0.228	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	< 0.23	< 0.216	< 0.216	< 0.222	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	< 0.267	< 0.251	< 0.25	< 0.258	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	< 0.376	< 0.354	< 0.353	< 0.364	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	< 0.313	< 0.295	< 0.294	< 0.303	NA	NA
Chrysene	450	1,700	80	-	**0.5 J**	**0.67**	< 0.314	< 0.323	**0.0069 J**	< 0.39
Dibenz(a,h)anthracene	0.5	2	0.8	-	< 0.217	< 0.204	< 0.204	< 0.209	< 0.0071	< 0.39
Dibenzofuran	NLE	NLE	NLE	-	< 0.38	< 0.357	< 0.357	< 0.367	NA	NA
Diethyl phthalate	49,000	550,000	88	-	< 0.298	< 0.28	< 0.28	< 0.288	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	< 0.314	< 0.296	< 0.295	< 0.304	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	< 0.341	< 0.32	< 0.32	< 0.329	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	< 0.316	< 0.297	< 0.296	< 0.305	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**0.69**	**1.42**	< 0.332	< 0.342	**0.014**	**0.39 J**
Fluorene	2,300	24,000	170	-	< 0.337	< 0.317	< 0.316	< 0.326	**0.01**	**3.8**
Hexachlorobenzene	0.3	1	0.2	-	< 0.357	< 0.336	< 0.335	< 0.345	NA	NA
Hexachlorobutadiene	6	25	0.9	-	< 0.257	< 0.242	< 0.242	< 0.249	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	< 0.174	< 0.164	< 0.163	< 0.168	NA	NA
Hexachloroethane	12	48	0.2	-	< 0.225	< 0.212	< 0.211	< 0.217	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	< 0.232	**0.35 J**	< 0.218	< 0.224	**0.0063 J**	< 0.39
Isophorone	510	2,000	0.2	-	< 0.286	< 0.269	< 0.268	< 0.276	NA	NA
Naphthalene	6	17	25	-	< 0.288	< 0.271	< 0.271	< 0.278	**0.011**	< 0.39
Nitrobenzene	5	14	0.2	-	< 0.269	< 0.253	< 0.253	< 0.26	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	< 0.2	< 0.188	< 0.188	< 0.193	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	< 0.301	< 0.283	< 0.283	< 0.291	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	< 0.323	< 0.304	< 0.303	< 0.312	NA	NA
Phenanthrene	NLE	300,000	NLE	-	< 0.354	**0.56**	< 0.332	< 0.344	**0.0074**	**8.9**
Pyrene	1,700	18,000	840	-	**0.62**	**1.05**	< 0.355	< 0.365	**0.015**	**1**
Pyridine	NLE	NLE	NLE	-	< 0.118	< 0.111	< 0.111	< 0.114	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	NA	NA	NA	NA	**5.2**	**5.4**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	NA	NA	NA	NA	**11.1**	**5.3 J**
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	PAR-83-SB-14		PAR-83-SB-34	PAR-83-482-SB-01		
Sample ID					PAR-83-SB-14-0.5-1	PAR-83-SB-14-2.5-3	PAR-83-SB-34-2-2.5	PAR-83-482-SB-01-0.5-1	PAR-83-482-SB-01-1.5-2	PAR-83-482-SB-01-7.5-8
Sample Date					4/5/2016	4/5/2016	11/15/2017	11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)										
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	< 0.0035	< 0.0039	NA	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Acetone	70,000	NLE	19	-	**0.028**	**0.062**	NA	NA	NA	NA
Benzene	2	5	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Bromoform	81	280	0.03	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chloroethane	220	1,100	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Chloroform	0.6	2	0.4	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Cymene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	**0.00018 J**	< 0.0039	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	< 0.0071	< 0.0077	NA	NA	NA	NA
Methyl bromide	25	59	0.04	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl chloride	4	12	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	**0.0067**	**0.0065**	NA	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Methylene chloride	46	230	0.01	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Naphthalene	6	17	25	-	**0.00054 J**	< 0.0039	NA	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Styrene	90	260	3	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	< 0.071	< 0.077	NA	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Toluene	6,300	91,000	7	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Trichloroethene	3	10	0.01	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	< 0.0035	< 0.0039	NA	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	< 0.0035	< 0.0039	NA	NA	NA	NA
TIC VOCs (µg/kg)										
Total TICs	500	NLE	NLE	-	**0.0294**	**0.0041**	NA	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)										
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	**0.17**	< 0.0081	NA	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	**0.054**	< 0.0081	NA	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	**0.65**	**0.0041 J**	**0.11 J**	< 0.073	**0.84**	< 0.082
Acenaphthylene	NLE	300,000	NLE	-	**0.014 J**	< 0.0081	< 0.083	< 0.073	< 0.078	< 0.082
Aniline	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	**0.52**	**0.0071 J**	< 0.083	< 0.073	< 0.078	< 0.082
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.62**	**0.017**	**0.011 J**	< 0.073	< 0.078	< 0.082
Benzo(a)pyrene	0.5	2	0.2	-	**0.73**	< 0.014	< 0.083	< 0.073	< 0.078	< 0.082
Benzo(b)fluoranthene	5	17	2	-	**0.92**	**0.02**	**0.014 J**	**0.0082 J**	< 0.078	< 0.082
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.42**	**0.011**	< 0.083	< 0.073	< 0.078	< 0.082
Benzo(k)fluoranthene	45	170	25	-	**0.33**	**0.0064 J**	< 0.083	< 0.073	< 0.078	< 0.082
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA	NA	NA	NA
Chrysene	450	1,700	80	-	**0.63**	**0.012**	< 0.083	< 0.073	< 0.078	< 0.082
Dibenz(a,h)anthracene	0.5	2	0.8	-	**0.086**	< 0.0081	< 0.083	< 0.073	< 0.078	< 0.082
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**2.1**	**0.037**	**0.018 J**	< 0.073	< 0.078	< 0.082
Fluorene	2,300	24,000	170	-	**0.41**	**0.0043 J**	**0.029 J**	< 0.073	**1.2**	< 0.082
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.4**	< 0.0081	< 0.083	< 0.073	< 0.078	< 0.082
Isophorone	510	2,000	0.2	-	NA	NA	NA	NA	NA	NA
Naphthalene	6	17	25	-	**0.14**	< 0.0081	< 0.083	< 0.073	**0.092 J**	< 0.082
Nitrobenzene	5	14	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**1.2**	**0.022**	**0.02 J**	< 0.073	**2.3**	< 0.082
Pyrene	1,700	18,000	840	-	**1.7**	**0.026**	**0.017 J**	< 0.073	**0.19**	< 0.082
Pyridine	NLE	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)										
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)										
EPH (C9-C40)	5,100	NLE	NLE	-	NA	NA	NA	**19.8**	**2,410**	**0.55 J**
Inorganics (mg/kg)										
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA	NA	NA	NA
Arsenic	19	19	19	22.9	**7**	**16.2**	**4**	**4.8**	**6.1**	**9.3**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA	NA	NA	NA
Lead	400	800	90	19.5	**49.4**	**8.8**	NA	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	PAR-83-482-SB-02		
Sample ID					PAR-83-482-SB-02-5.5-6	PAR-83-482-SB-02-7.5-8	PAR-83-482-SB-02-12.5-13
Sample Date					11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA
TIC VOCs (µg/kg)							
Total TICs	500	NLE	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	**0.021 J**	**0.97**	< 0.094
Acenaphthylene	NLE	300,000	NLE	-	**0.15**	< 0.087	< 0.094
Aniline	NLE	NLE	NLE	-	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	**0.14**	< 0.087	< 0.094
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.69**	< 0.087	< 0.094
Benzo(a)pyrene	0.5	2	0.2	-	**0.68**	< 0.087	< 0.094
Benzo(b)fluoranthene	5	17	2	-	**0.98**	< 0.087	< 0.094
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.46**	< 0.087	< 0.094
Benzo(k)fluoranthene	45	170	25	-	**0.39**	< 0.087	< 0.094
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA
Chrysene	450	1,700	80	-	**0.72**	< 0.087	< 0.094
Dibenz(a,h)anthracene	0.5	2	0.8	-	**0.13**	< 0.087	< 0.094
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**1.1**	< 0.087	< 0.094
Fluorene	2,300	24,000	170	-	**0.037 J**	**1.4**	< 0.094
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.47**	< 0.087	< 0.094
Isophorone	510	2,000	0.2	-	NA	NA	NA
Naphthalene	6	17	25	-	**0.087 J**	< 0.087	< 0.094
Nitrobenzene	5	14	0.2	-	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**0.4**	**2.7**	< 0.094
Pyrene	1,700	18,000	840	-	**1.1**	**0.14**	< 0.094
Pyridine	NLE	NLE	NLE	-	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)							
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)							
EPH (C9-C40)	5,100	NLE	NLE	-	**66.9**	**1,560**	**0.54 J**
Inorganics (mg/kg)							
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA
Arsenic	19	19	19	22.9	**15.7**	**13.5**	**8**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA
Lead	400	800	90	19.5	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA

TABLE 3
SOIL SAMPLING RESULTS - COMPARISON TO NJDEP DIRECT CONTACT CRITERIA
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Residential Direct Contact SRS	NJ Non-Residential Direct Contact SRS	NJ Impact to GW Soil Screening Level	Weston 1995 Background (Main Post)	PAR-83-482-SB-03		
Sample ID					PAR-83-482-SB-03-1.5-2	PAR-83-482-SB-03-5-5.5	PAR-83-482-SB-03-6-6.5
Sample Date					11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane	NLE	NLE	NLE	-	NA	NA	NA
1,1,1-Trichloroethane	160,000	NLE	0.3	-	NA	NA	NA
1,1,2,2-Tetrachloroethane	1	3	0.007	-	NA	NA	NA
1,1,2-Trichloroethane	2	6	0.02	-	NA	NA	NA
1,1-Dichloroethane	8	24	0.2	-	NA	NA	NA
1,1-Dichloroethene	11	150	0.008	-	NA	NA	NA
1,1-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
1,2,3-Trichlorobenzene	NLE	NLE	NLE	-	NA	NA	NA
1,2,3-Trichloropropane	NLE	NLE	NLE	-	NA	NA	NA
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA
1,2,4-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.08	0.2	0.005	-	NA	NA	NA
1,2-Dibromoethane	0.008	0.04	0.005	-	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA
1,2-Dichloroethane	0.9	3	0.005	-	NA	NA	NA
1,2-Dichloropropane	2	5	0.005	-	NA	NA	NA
1,3,5-Trimethylbenzene	NLE	NLE	NLE	-	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA
1,3-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA
2,2-Dichloropropane	NLE	NLE	NLE	-	NA	NA	NA
2-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA
Acetone	70,000	NLE	19	-	NA	NA	NA
Benzene	2	5	0.005	-	NA	NA	NA
Bromobenzene	NLE	NLE	NLE	-	NA	NA	NA
Bromochloromethane	NLE	NLE	NLE	-	NA	NA	NA
Bromodichloromethane	1	3	0.005	-	NA	NA	NA
Bromoform	81	280	0.03	-	NA	NA	NA
Carbon disulfide	7,800	110,000	6	-	NA	NA	NA
Carbon tetrachloride	2	4	0.005	-	NA	NA	NA
Chlorobenzene	510	7,400	0.6	-	NA	NA	NA
Chlorodibromomethane	3	8	0.005	-	NA	NA	NA
Chloroethane	220	1,100	NLE	-	NA	NA	NA
Chloroform	0.6	2	0.4	-	NA	NA	NA
Cis-1,2-Dichloroethene	230	560	0.3	-	NA	NA	NA
Cis-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Cymene	NLE	NLE	NLE	-	NA	NA	NA
Dichlorodifluoromethane	490	230,000	39	-	NA	NA	NA
Ethyl benzene	7,800	110,000	13	-	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA
Isopropylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Meta/Para Xylene	NLE	NLE	NLE	-	NA	NA	NA
Methyl bromide	25	59	0.04	-	NA	NA	NA
Methyl butyl ketone	NLE	NLE	NLE	-	NA	NA	NA
Methyl chloride	4	12	NLE	-	NA	NA	NA
Methyl ethyl ketone	3,100	44,000	0.9	-	NA	NA	NA
Methyl isobutyl ketone	NLE	NLE	NLE	-	NA	NA	NA
Methyl Tertbutyl Ether	110	320	0.2	-	NA	NA	NA
Methylene chloride	46	230	0.01	-	NA	NA	NA
Naphthalene	6	17	25	-	NA	NA	NA
n-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Ortho Xylene	NLE	NLE	NLE	-	NA	NA	NA
p-Chlorotoluene	NLE	NLE	NLE	-	NA	NA	NA
Propylbenzene	NLE	NLE	NLE	-	NA	NA	NA
sec-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Styrene	90	260	3	-	NA	NA	NA
Tert Butyl Alcohol	1,400	11,000	0.3	-	NA	NA	NA
tert-Butylbenzene	NLE	NLE	NLE	-	NA	NA	NA
Tetrachloroethene	43	1,500	0.005	-	NA	NA	NA
Toluene	6,300	91,000	7	-	NA	NA	NA
Total Xylenes	12,000	170,000	19	-	NA	NA	NA
Trans-1,2-Dichloroethene	300	720	0.6	-	NA	NA	NA
Trans-1,3-Dichloropropene	NLE	NLE	NLE	-	NA	NA	NA
Trichloroethene	3	10	0.01	-	NA	NA	NA
Trichlorofluoromethane	23,000	340,000	34	-	NA	NA	NA
Vinyl chloride	0.7	2	0.005	-	NA	NA	NA
TIC VOCs (µg/kg)							
Total TICs	500	NLE	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	73	820	0.7	-	NA	NA	NA
1,2-Dichlorobenzene	5,300	59,000	17	-	NA	NA	NA
1,3-Dichlorobenzene	5,300	59,000	19	-	NA	NA	NA
1,4-Dichlorobenzene	5	13	2	-	NA	NA	NA
1-Methylnaphthalene	NLE	NLE	NLE	-	NA	NA	NA
2,4-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA
2,6-Dinitrotoluene	0.7	3	NLE	-	NA	NA	NA
2-Chloronaphthalene	NLE	NLE	NLE	-	NA	NA	NA
2-Methylnaphthalene	230	2,400	8	-	NA	NA	NA
2-Nitroaniline	39	23,000	NLE	-	NA	NA	NA
3,3'-Dichlorobenzidine	1	4	0.2	-	NA	NA	NA
3-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Bromophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Chloroaniline	NLE	NLE	NLE	-	NA	NA	NA
4-Chlorophenyl phenyl ether	NLE	NLE	NLE	-	NA	NA	NA
4-Nitroaniline	NLE	NLE	NLE	-	NA	NA	NA
Acenaphthene	3,400	37,000	110	-	< 0.075	**0.61**	**0.017 J**
Acenaphthylene	NLE	300,000	NLE	-	**0.046 J**	**0.051 J**	**0.051 J**
Aniline	NLE	NLE	NLE	-	NA	NA	NA
Anthracene	17,000	30,000	2,400	-	**0.1 J**	**3.3**	**0.056 J**
Azobenzene	NLE	NLE	NLE	-	NA	NA	NA
Benzidine	0.7	0.7	0.7	-	NA	NA	NA
Benzo(a)anthracene	5	17	0.8	-	**0.32**	**4.2**	**0.21**
Benzo(a)pyrene	0.5	2	0.2	-	**0.33**	**3.3**	**0.25**
Benzo(b)fluoranthene	5	17	2	-	**0.47**	**4.1**	**0.32**
Benzo(ghi)perylene	380,000	30,000	NLE	-	**0.21**	**1.6**	**0.18**
Benzo(k)fluoranthene	45	170	25	-	**0.18**	**1.6**	**0.13**
Benzyl alcohol	NLE	NLE	NLE	-	NA	NA	NA
Bis(2-Chloroethoxy)methane	NLE	NLE	NLE	-	NA	NA	NA
Bis(2-Chloroethyl)ether	0.4	2	0.2	-	NA	NA	NA
Bis(2-Chloroisopropyl)ether	23	67	5	-	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	35	140	1,200	-	NA	NA	NA
Butyl benzyl phthalate	1,200	14,000	230	-	NA	NA	NA
Chrysene	450	1,700	80	-	**0.35**	**3.7**	**0.13**
Dibenz(a,h)anthracene	0.5	2	0.8	-	**0.024 J**	**0.47**	**0.042 J**
Dibenzofuran	NLE	NLE	NLE	-	NA	NA	NA
Diethyl phthalate	49,000	550,000	88	-	NA	NA	NA
Dimethyl phthalate	NLE	NLE	NLE	-	NA	NA	NA
Di-n-butylphthalate	6,100	68,000	760	-	NA	NA	NA
Di-n-octylphthalate	2,400	27,000	3,300	-	NA	NA	NA
Fluoranthene	2,300	24,000	1,300	-	**0.59**	**9.5**	**0.39**
Fluorene	2,300	24,000	170	-	**0.0079 J**	**1.1**	**0.019 J**
Hexachlorobenzene	0.3	1	0.2	-	NA	NA	NA
Hexachlorobutadiene	6	25	0.9	-	NA	NA	NA
Hexachlorocyclopentadiene	45	110	320	-	NA	NA	NA
Hexachloroethane	12	48	0.2	-	NA	NA	NA
Indeno(1,2,3-cd)pyrene	5	17	7	-	**0.23**	**1.7**	**0.15**
Isophorone	510	2,000	0.2	-	NA	NA	NA
Naphthalene	6	17	25	-	**0.13**	**0.069 J**	**0.024 J**
Nitrobenzene	5	14	0.2	-	NA	NA	NA
N-Nitrosodimethylamine	0.7	0.7	0.7	-	NA	NA	NA
N-Nitroso-di-n-propylamine	0.2	0.3	0.2	-	NA	NA	NA
N-Nitrosodiphenylamine	99	390	0.4	-	NA	NA	NA
Phenanthrene	NLE	300,000	NLE	-	**0.28**	**9.8**	**0.23**
Pyrene	1,700	18,000	840	-	**0.54**	**8.4**	**0.4**
Pyridine	NLE	NLE	NLE	-	NA	NA	NA
Total Petroleum Hydrocarbons (mg/kg)							
Total Petroleum Hydrocarbons	5,100	NLE	NLE	-	NA	NA	NA
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)							
EPH (C9-C40)	5,100	NLE	NLE	-	**120**	**190**	**216**
Inorganics (mg/kg)							
Aluminum	78,000	NLE	6,000	15,200	NA	NA	NA
Antimony	31	450	6	ND	NA	NA	NA
Arsenic	19	19	19	22.9	**28.3**	**9.7**	**10.1**
Barium	16,000	59,000	2,100	32.3	NA	NA	NA
Beryllium	16	140	0.7	2	NA	NA	NA
Cadmium	78	78	2	ND	NA	NA	NA
Calcium	NLE	NLE	NLE	921	NA	NA	NA
Chromium	NLE	NLE	NLE	269	NA	NA	NA
Cobalt	1,600	590	90	2.5	NA	NA	NA
Copper	3,100	45,000	11,000	8	NA	NA	NA
Iron	NLE	NLE	NLE	55,800	NA	NA	NA
Lead	400	800	90	19.5	NA	NA	NA
Magnesium	NLE	NLE	NLE	7,230	NA	NA	NA
Manganese	11,000	5,900	65	90.7	NA	NA	NA
Mercury	23	65	0.1	ND	NA	NA	NA
Nickel	1,600	23,000	48	8.4	NA	NA	NA
Potassium	NLE	NLE	NLE	15,400	NA	NA	NA
Selenium	390	5,700	11	1.9	NA	NA	NA
Sodium	NLE	NLE	NLE	51.6	NA	NA	NA
Vanadium	78	1,100	NLE	94.1	NA	NA	NA
Zinc	23,000	110,000	930	81.4	NA	NA	NA

Footnote:

1) All historical data collected prior to 2013 are reported as provided by others.

2) NLE = no limit established.

3) ND = not detected in any background sample, no background concentration available.

4) Bold chemical dectection

5) Chemical result qualifiers are assigned by the laboratory and are evaluated and modified (if necessary) during the data validation.

[blank] = detect, i.e. detected chemical result value.

B =non-detect, i.e. not detected at or above this value.

D = Results from dilution of sample.

U = non-detect, i.e. not detected at or above this value.

UJ=The compound was not detected: however, the results is estimated because of discrepancies in meeting certain analyte-specific QC criteria.

J = estimated detected value due to a concetration below the reporting limit or due to discrepancies in meeting certain analyte-specific quality control.

6) Chemical results greater than or equal to the action level (depending on criteria) are highlighted based on the Criteria that are present.

- Cell Shade values represent a result that is above the NJ Residential Direct Contact Soil Remediation Standard. ####

There are no NJDEP soil standards for individual PCB Aroclors, therefore the total PCB NJDEP standards were used for individual Aroclors.

- Cell Shade values represent a result that is above the NJ Non-Residential Direct Contact Soil Remediation Standard. ###

- Cell Shade values represent a result that is above the NJ Impact to GW Soil Screening Level ###

- Cell Style values represent a result that is above the Weston 1995 Background (Main Post). ###

- Cell Shade values represent a result that is above both the NJ Residential, Non-Residential, AND NJ Impact to GW Soil Screening Level Direct Contact Soil Remediation Standard. ###

- Cell Shade values represent a result that is above both the NJ Residential and Non-Residential Direct Contact Soil Remediation Standard. ###

7) Criteria action level source document and web address.

- The NJ Residential Direct Contact Soil Remediation Standard refers to the NJDEP's Sept 18, 2017 Remediation Standards

http://www.nj.gov/dep/rules/rules/njac7_26d.pdf

- The NJ Non-Residential Direct Contact Soil Remediation Standard refers to the NJDEP's Sept 18, 2017 Remediation Standards

http://www.nj.gov/dep/rules/rules/njac7_26d.pdf

- The NJ Impact to GW Soil Screening Level criteria refers to the Development of Site Specific Impact to Ground Water Soil Remediation Standards - Nov 2013 revised

http://www.nj.gov/dep/srp/guidance/rs/partition_equation.pdf

- The Weston 1995 Background (Main Post) refers to the FTMM reports.

TABLE 4
SOIL SAMPLING SUMMARY OF DETECTIONS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Analyte	Maximum Detected Concentration	Location of Maximum Concentration	Sample Date	Number of Samples	Number of Detections	NJ Residential Direct Contact SRS		NJ Non-Residential Direct Contact SRS		NJ Impact to GW Soil Screening Level		2017-06 RSL Residential Soil (HQ=0.1)		2017-06 RSL Industrial Soil (HQ=0.1)		2017-06 RSL Protect GW Risk-Based (HQ=0.1)		Weston 1995 Background (Main Post)		Identification of COPCs	
						Action Level	Num of Detects Above Standard	Action Level	Num of Detects Above Standard	Action Level	Num of Detects Above Standard	Action Level	Num of Detects Above Standard	Action Level	Num of Detects Above Standard	Action Level	Num of Detects Above Standard	Action Level	Num of Detects Above Standard	COPC in Risk Assessment?	Rationale
Volatile Organic Compounds (mg/kg)																					
1,3,5-Trimethylbenzene	0.0005 J	FTMM57-SB-02	11/13/2017	11	1	NLE	NLE	NLE	NLE	NLE	NLE	27	0	150	0	0.0087	0	-	n/a	No	Less than USEPA Residential RSL
Acetone	0.12	FTMM57-SB-01	11/13/2017	22	11	70,000	0	NLE	NLE	19	0	6,100	0	67,000	0	0.29	0	-	n/a	No	Less than USEPA Residential RSL
Benzene	4	Bldg 108 S-7	5/3/1993	29	4	2	2	5	0	0.005	4	1.2	2	5.1	0	0.00023	4	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Chloroform	0.013	Bldg 108 S-9	5/3/1993	29	4	0.6	0	2	0	0.4	0	0.32	0	1.4	0	0.000061	4	-	n/a	No	Less than USEPA Residential RSL
Ethyl benzene	21	Bldg 108 S-16	5/3/1993	29	8	7,800	0	110,000	0	13	1	5.8	2	25	0	0.0017	7	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Isopropylbenzene	0.86	PAR-83-SB-12	4/5/2016	11	2	NLE	NLE	NLE	NLE	NLE	NLE	190	0	990	0	0.074	1	-	n/a	No	Less than USEPA Residential RSL
Meta/Para Xylene	170 D	Bldg 108 S-16	5/3/1993	29	9	NLE	NLE	NLE	NLE	NLE	NLE	55	1	240	0	0.019	7	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Methyl ethyl ketone	0.013	FTMM57-SB-02	11/13/2017	11	8	3,100	0	44,000	0	0.9	0	2,700	0	19,000	0	0.12	0	-	n/a	No	Less than USEPA Residential RSL
Methyl Tertbutyl Ether	0.0028	FTMM57-SB-02	11/13/2017	11	4	110	0	320	0	0.2	0	47	0	210	0	0.0032	0	-	n/a	No	Less than USEPA Residential RSL
Methylene chloride	1	Bldg 108 S-17	5/3/1993	21	6	46	0	230	0	0.01	5	35	0	320	0	0.0027	6	-	n/a	No	Less than USEPA Residential RSL
Naphthalene	0.00054 J	PAR-83-SB-14	4/5/2016	11	1	6	0	17	0	25	0	3.8	0	17	0	0.00054	0	-	n/a	No	Less than USEPA Residential RSL
n-Butylbenzene	1.6	PAR-83-SB-12	4/5/2016	11	1	NLE	NLE	NLE	NLE	NLE	NLE	390	0	5,800	0	0.32	1	-	n/a	No	Less than USEPA Residential RSL
Ortho Xylene	69 D	Bldg 108 S-16	5/3/1993	28	6	NLE	NLE	NLE	NLE	NLE	NLE	65	1	280	0	0.019	5	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Propylbenzene	1.7	PAR-83-SB-12	4/5/2016	11	2	NLE	NLE	NLE	NLE	NLE	NLE	380	0	2,400	0	0.12	1	-	n/a	No	Less than USEPA Residential RSL
sec-Butylbenzene	1.4	PAR-83-SB-12	4/5/2016	11	1	NLE	NLE	NLE	NLE	NLE	NLE	780	0	12,000	0	0.59	1	-	n/a	No	Less than USEPA Residential RSL
Tert Butyl Alcohol	0.012	FTMM57-SB-01	11/13/2017	11	5	1,400	0	11,000	0	0.3	0	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
tert-Butylbenzene	0.095 J	PAR-83-SB-12	4/5/2016	11	1	NLE	NLE	NLE	NLE	NLE	NLE	780	0	12,000	0	0.16	0	-	n/a	No	Less than USEPA Residential RSL
Toluene	9.5	Bldg 108 S-16	5/3/1993	29	4	6,300	0	91,000	0	7	1	490	0	4,700	0	0.076	3	-	n/a	No	Less than USEPA Residential RSL
TIC VOCs (µg/kg)																					
Total TICs	484	FTMM57-SB-02	11/13/2017	7	7	500	0	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
Semivolatile Organic Compounds (mg/kg)																					
1-Methylnaphthalene	31	PAR-83-SB-12	4/5/2016	4	3	NLE	NLE	NLE	NLE	NLE	NLE	18	1	73	0	0.006	3	-	n/a	No	Associated with adjacent UST 482
2-Methylnaphthalene	53	PAR-83-SB-12	4/5/2016	39	19	230	0	2,400	0	8	1	24	1	300	0	0.019	18	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Acenaphthene	3.3	PAR-83-SB-12	4/5/2016	49	17	3,400	0	37,000	0	110	0	360	0	4,500	0	0.55	6	-	n/a	No	Less than USEPA Residential RSL
Acenaphthylene	0.15	PAR-83-482-SB-02	11/13/2017	31	5	NLE	NLE	300,000	0	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
Anthracene	3.3	PAR-83-482-SB-03	11/13/2017	49	21	17,000	0	30,000	0	2,400	0	1,800	0	23,000	0	5.8	0	-	n/a	No	Less than USEPA Residential RSL
Benzo(a)anthracene	4.2	PAR-83-482-SB-03	11/13/2017	49	32	5	0	17	0	0.8	7	1.1	6	21	0	0.011	30	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Benzo(a)pyrene	3.3	PAR-83-482-SB-03	11/13/2017	49	27	0.5	10	2	2	0.2	18	0.11	22	2.1	2	0.029	25	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Benzo(b)fluoranthene	5.3	Bldg 108 S-19	5/3/1993	49	30	5	1	17	0	2	2	1.1	4	21	0	0.3	14	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Benzo(ghi)perylene	2.5 J	Bldg 108 S-19	5/3/1993	49	28	380,000	0	30,000	0	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
Benzo(k)fluoranthene	1.6	PAR-83-482-SB-03	11/13/2017	31	12	45	0	170	0	25	0	11	0	210	0	2.9	0	-	n/a	No	Less than USEPA Residential RSL
Bis(2-Ethylhexyl)phthalate	4.7	Bldg 108 S-8	5/3/1993	28	16	35	0	140	0	1,200	0	39	0	160	0	1.3	4	-	n/a	No	Less than USEPA Residential RSL
Chrysene	4	Bldg 108 S-19	5/3/1993	49	30	450	0	1,700	0	80	0	110	0	2,100	0	9	0	-	n/a	No	Less than USEPA Residential RSL
Dibenz(a,h)anthracene	0.97	Bldg 108 S-19	5/3/1993	49	16	0.5	1	2	0	0.8	1	0.11	8	2.1	0	0.096	8	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Dibenzofuran	0.81	Bldg 108 S-3	5/3/1993	28	9	NLE	NLE	NLE	NLE	NLE	NLE	7.3	0	100	0	0.015	9	-	n/a	No	Less than USEPA Residential RSL
Fluoranthene	9.5	PAR-83-482-SB-03	11/13/2017	49	32	2,300	0	24,000	0	1,300	0	240	0	3,000	0	8.9	1	-	n/a	No	Less than USEPA Residential RSL
Fluorene	3.8	PAR-83-SB-12	4/5/2016	49	21	2,300	0	24,000	0	170	0	240	0	3,000	0	0.54	6	-	n/a	No	Less than USEPA Residential RSL
Indeno(1,2,3-cd)pyrene	2.3	Bldg 108 S-19	5/3/1993	49	24	5	0	17	0	7	0	1.1	2	21	0	0.98	3	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Naphthalene	5.3	Bldg 108 S-5	5/3/1993	49	20	6	0	17	0	25	0	3.8	1	17	0	0.00054	20	-	n/a	**Yes**	Exceeded USEPA Residential RSL
Phenanthrene	9.8	PAR-83-482-SB-03	11/13/2017	49	32	NLE	NLE	300,000	0	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
Pyrene	8.4	PAR-83-482-SB-03	11/13/2017	49	35	1,700	0	18,000	0	840	0	180	0	2,300	0	1.3	7	-	n/a	No	Less than USEPA Residential RSL
Total Petroleum Hydrocarbons (mg/kg)																					
Total Petroleum Hydrocarbon	2,970	Bldg 108 S-5	5/3/1993	18	17	5,100	0	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
Extractable/Volatile Petroleum Hydrocarbons (mg/kg)																					
EPH (C9-C40)	2,410	PAR-83-482-SB-01	11/13/2017	9	9	5,100	0	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	NLE	-	n/a	No	No USEPA Residential RSL Established
Pesticides & PCBs (mg/kg) (No Detects)																					
Inorganics (mg/kg)																					
Arsenic	297.03	Bldg 108 SS-8	3/8/2001	48	43	19	15	19	15	19	15	0.68	43	3	43	0.0015	43	22.9	15	**Yes**	Exceeded USEPA Residential RSL
Lead	174	Bldg 108 S-19	5/3/1993	49	46	400	0	800	0	90	3	400	0	800	0	14	16	19.5	11	No	Less than USEPA Residential RSL

TABLE 5
GROUNDWATER SAMPLING RESULTS - COMPARISON TO NJDEP GROUNDWATER QUALITY CRITERIA AND USEPA TAP WATER RSL AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57 FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Ground Water Quality Criteria	2017-06 RSL Tap Water (HQ=0.1)	Weston 1995 Background (Main Post)	108MW01	108MW02	108MW03	108MW04		
Sample ID				FTMM-57-GW-108MW01	FTMM-57-GW-108MW02	FTMM-57-GW-108MW03	FTMM-57-GW-108MW04	FTMM-57-GW-108MW04-8.25_2014-Q4	FTMM-57-GW-108MW04-7.5_4Q2015
Sample Date				8/19/2013	8/19/2013	8/19/2013	8/19/2013	10/2/2014	11/20/2015
Sample Round									
Filtered				Total	Total	Total	Total	Total	Total
Volatile Organic Compounds (µg/l)									
1,1,1,2-Tetrachloroethane	1	0.57	-	< 5	< 5	< 5	< 5	NA	NA
1,1,1-Trichloroethane	30	800	-	< 5	< 5	< 5	< 5	NA	NA
1,1,2,2-Tetrachloroethane	1	0.076	-	< 5	< 5	< 5	< 5	NA	NA
1,1,2-Trichloroethane	3	0.041	-	< 5	< 5	< 5	< 5	NA	NA
1,1-Dichloroethane	50	2.8	-	< 5	< 5	< 5	< 5	NA	NA
1,1-Dichloroethene	1	28	-	< 5	< 5	< 5	< 5	NA	NA
1,1-Dichloropropene	100	NLE	-	< 5	< 5	< 5	< 5	NA	NA
1,2,3-Trichlorobenzene	100	0.7	-	< 5	< 5	< 5	< 5	NA	NA
1,2,3-Trichloropropane	0.03	0.00075	-	< 5	< 5	< 5	< 5	NA	NA
1,2,4-Trichlorobenzene	9	0.4	-	< 5	< 5	< 5	< 5	NA	NA
1,2,4-Trimethylbenzene	100	5.6	-	< 5	< 5	< 5	< 5	NA	NA
1,2-Dibromo-3-chloropropane	0.02	0.00033	-	< 5	< 5	< 5	< 5	NA	NA
1,2-Dibromoethane	0.03	0.0075	-	< 5	< 5	< 5	< 5	NA	NA
1,2-Dichlorobenzene	600	30	-	< 5	< 5	< 5	< 5	NA	NA
1,2-Dichloroethane	2	0.17	-	< 5	< 5	< 5	< 5	NA	NA
1,2-Dichloropropane	1	0.14	-	< 5	< 5	< 5	< 5	NA	NA
1,3,5-Trimethylbenzene	100	6	-	< 5	< 5	< 5	< 5	NA	NA
1,3-Dichlorobenzene	600	NLE	-	< 5	< 5	< 5	< 5	NA	NA
1,3-Dichloropropane	100	37	-	< 5	< 5	< 5	< 5	NA	NA
1,4-Dichlorobenzene	75	0.48	-	< 5	< 5	< 5	< 5	NA	NA
2,2-Dichloropropane	100	NLE	-	< 5	< 5	< 5	< 5	NA	NA
2-Chloroethylvinylether	0	NLE	-	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	100	24	-	< 5	< 5	< 5	< 5	NA	NA
Acetone	6,000	1,400	-	< 5	**2.9 J**	< 5	**1.4 J**	NA	NA
Acrolein	5	0.0042	-	NA	NA	NA	NA	NA	NA
Acrylonitrile	2	0.052	-	NA	NA	NA	NA	NA	NA
Benzene	1	0.46	-	< 5	< 5	< 5	< 5	NA	NA
Bromobenzene	100	6.2	-	< 5	< 5	< 5	< 5	NA	NA
Bromochloromethane	100	8.3	-	< 5	< 5	< 5	< 5	NA	NA
Bromodichloromethane	1	0.13	-	< 5	< 5	< 5	< 5	NA	NA
Bromoform	4	3.3	-	< 5	< 5	< 5	< 5	NA	NA
Carbon disulfide	700	81	-	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	1	0.46	-	< 5	< 5	< 5	< 5	NA	NA
Chlorobenzene	50	7.8	-	< 5	< 5	< 5	< 5	NA	NA
Chlorodibromomethane	1	0.87	-	< 5	< 5	< 5	< 5	NA	NA
Chloroethane	5	2,100	-	< 5	< 5	< 5	< 5	NA	NA
Chloroform	70	0.22	-	< 5	< 5	< 5	< 5	NA	NA
Cis-1,2-Dichloroethene	70	3.6	-	< 5	< 5	< 5	< 5	NA	NA
Cis-1,3-Dichloropropene	1	NLE	-	< 5	< 5	< 5	< 5	NA	NA
Cymene	100	NLE	-	< 5	< 5	< 5	< 5	NA	NA
Dichlorodifluoromethane	1,000	20	-	< 5	< 5	< 5	< 5	NA	NA
Diisoproply Ether	20,000	150	-	NA	NA	NA	NA	NA	NA
Ethyl benzene	700	1.5	-	< 5	< 5	< 5	< 5	NA	NA
Hexachlorobutadiene	1	0.14	-	< 5	< 5	< 5	< 5	NA	NA
Isopropylbenzene	700	45	-	< 5	< 5	< 5	< 5	NA	NA
Meta/Para Xylene	1,000	19	-	< 10	< 10	< 10	< 10	NA	NA
Methyl bromide	10	0.75	-	< 5	< 5	< 5	< 5	NA	NA
Methyl butyl ketone	300	3.8	-	< 5	< 5	< 5	< 5	NA	NA
Methyl chloride	100	19	-	< 5	< 5	< 5	< 5	NA	NA
Methyl ethyl ketone	300	560	-	< 5	< 5	< 5	< 5	NA	NA
Methyl isobutyl ketone	100	630	-	< 5	< 5	< 5	< 5	NA	NA
Methyl Tertbutyl Ether	70	14	-	< 5	< 5	< 5	< 5	NA	NA
Methylene chloride	3	11	-	< 5	< 5	< 5	< 5	NA	NA
Naphthalene	300	0.17	-	< 5	< 5	< 5	< 5	NA	NA
n-Butylbenzene	100	100	-	< 5	< 5	< 5	< 5	NA	NA
Ortho Xylene	1,000	19	-	< 5	< 5	< 5	< 5	NA	NA
p-Chlorotoluene	100	25	-	< 5	< 5	< 5	< 5	NA	NA
Propylbenzene	100	66	-	< 5	< 5	< 5	< 5	NA	NA
sec-Butylbenzene	100	200	-	< 5	< 5	< 5	< 5	NA	NA
Styrene	100	120	-	< 5	< 5	< 5	< 5	NA	NA
Tert Butyl Alcohol	100	NLE	-	NA	NA	NA	NA	NA	NA
tert-Butylbenzene	100	69	-	< 5	< 5	< 5	< 5	NA	NA
Tetrachloroethene	1	4.1	-	< 5	< 5	< 5	< 5	NA	NA
Toluene	600	110	-	< 5	< 5	< 5	< 5	NA	NA
Total Xylenes	1,000	19	-	< 15	< 15	< 15	< 15	NA	NA
Trans-1,2-Dichloroethene	100	36	-	< 5	< 5	< 5	< 5	NA	NA
Trans-1,3-Dichloropropene	1	NLE	-	< 5	< 5	< 5	< 5	NA	NA
Trichloroethene	1	0.28	-	< 5	< 5	< 5	< 5	NA	NA
Trichlorofluoromethane	2,000	520	-	< 5	< 5	< 5	< 5	NA	NA
Vinyl acetate	7,000	41	-	NA	NA	NA	NA	NA	NA
Vinyl chloride	1	0.019	-	< 5	< 5	< 5	< 5	NA	NA
TIC VOCs (µg/l)									
Total TIC, Volatile	500	NLE	-	ND	ND	ND	ND	NA	NA
Semivolatile Organic Compounds (µg/l)									
1,1'-Biphenyl	400	0.083	-	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	10	0.24	-	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	10	0.049	-	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	600	75	-	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	30	3.6	-	NA	NA	NA	NA	NA	NA
2-Nitroaniline	100	19	-	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	30	0.13	-	NA	NA	NA	NA	NA	NA
3-Nitroaniline	100	NLE	-	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	100	NLE	-	NA	NA	NA	NA	NA	NA
4-Chloroaniline	30	0.37	-	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	100	NLE	-	NA	NA	NA	NA	NA	NA
4-Nitroaniline	5	3.8	-	NA	NA	NA	NA	NA	NA
Acenaphthene	400	53	-	NA	NA	NA	NA	NA	NA
Acenaphthylene	100	NLE	-	NA	NA	NA	NA	NA	NA
Acetophenone	700	190	-	NA	NA	NA	NA	NA	NA
Anthracene	2,000	180	-	NA	NA	NA	NA	NA	NA
Atrazine	3	0.3	-	NA	NA	NA	NA	NA	NA
Benzaldehyde	100	19	-	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	0.1	0.03	-	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.1	0.025	-	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.2	0.25	-	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	100	NLE	-	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	0.5	2.5	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)methane	100	5.9	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)ether	7	0.014	-	NA	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)ether	300	71	-	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	3	5.6	-	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	100	16	-	NA	NA	NA	NA	NA	NA
Caprolactam	5,000	990	-	NA	NA	NA	NA	NA	NA
Carbazole	100	NLE	-	NA	NA	NA	NA	NA	NA
Chrysene	5	25	-	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.3	0.025	-	NA	NA	NA	NA	NA	NA
Dibenzofuran	100	0.79	-	NA	NA	NA	NA	NA	NA
Diethyl phthalate	6,000	1,500	-	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	100	NLE	-	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	700	90	-	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	100	20	-	NA	NA	NA	NA	NA	NA
Fluoranthene	300	80	-	NA	NA	NA	NA	NA	NA
Fluorene	300	29	-	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.02	0.0098	-	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	1	0.14	-	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	40	0.041	-	NA	NA	NA	NA	NA	NA
Hexachloroethane	7	0.33	-	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.2	0.25	-	NA	NA	NA	NA	NA	NA
Isophorone	40	78	-	NA	NA	NA	NA	NA	NA
Naphthalene	300	0.17	-	NA	NA	NA	NA	NA	NA
Nitrobenzene	6	0.14	-	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	10	0.011	-	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	10	12	-	NA	NA	NA	NA	NA	NA
Phenanthrene	100	NLE	-	NA	NA	NA	NA	NA	NA
Pyrene	200	12	-	NA	NA	NA	NA	NA	NA
Pesticides (µg/l)									
4,4'-DDD	0.1	0.032	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
4,4'-DDE	0.1	0.046	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
4,4'-DDT	0.1	0.23	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Aldrin	0.04	0.00092	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Alpha-BHC	0.02	0.0072	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Alpha-Chlordane	0.5	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Beta-BHC	0.04	0.025	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Delta-BHC	100	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Dieldrin	0.03	0.0018	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Endosulfan I	40	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Endosulfan II	40	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Endosulfan sulfate	40	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Endrin	2	0.23	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Endrin aldehyde	100	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Endrin ketone	100	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Gamma-BHC/Lindane	0.03	0.042	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
gamma-Chlordane	NLE	NLE	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Heptachlor	0.05	0.0014	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Heptachlor epoxide	0.2	0.0014	-	< 0.047	< 0.05	< 0.047	< 0.047	NA	NA
Methoxychlor	40	3.7	-	< 0.47	< 0.5	< 0.47	< 0.47	NA	NA
Toxaphene	2	0.071	-	< 0.94	< 1	< 0.94	< 0.94	NA	NA
Inorganics (µg/l)									
Aluminum	200	2,000	121,000	**606**	**94.8 J**	**169**	**33.6 J**	NA	NA
Antimony	6	0.78	20.7	**4.4 J**	< 10	**2.5 J**	< 10	NA	NA
Arsenic	3	0.052	89.3	< 10	**9 J**	**5.4 J**	< 10	NA	**2 J**
Barium	6,000	380	699	**38.3**	**43.1**	**22.6**	**23**	NA	NA
Beryllium	1	2.5	2.1	< 5	< 5	< 5	< 5	NA	NA
Cadmium	4	0.92	9.5	< 1	< 1	< 1	< 1	NA	< 5
Calcium	NLE	NLE	45,400	**67,500**	**37,700**	**31,700**	**51,200**	NA	NA
Chromium	70	2,200	191	**5.3**	**3.9**	**2**	**1.8**	NA	NA
Cobalt	100	0.6	18.3	< 3	**1.2 J**	< 3	< 3	NA	NA
Copper	1,300	80	65.6	**8.4 J**	**2.9 J**	**5 J**	**3.4 J**	NA	NA
Iron	300	1,400	431,000	**3,230**	**14,700**	**1,820**	**98.8 J**	NA	NA
Lead	5	15	22.7	**2.5 J**	< 5	< 5	< 5	< 5	< 5
Magnesium	NLE	NLE	62,700	**5,190**	**8,290**	**3,670**	**4,370**	NA	NA
Manganese	50	43	331	**19.8**	**363**	**52.3**	**1.5 J**	NA	NA
Mercury	2	0.57	0.26	< 0.1	< 0.1	< 0.1	< 0.1	NA	NA
Nickel	100	39	187	< 5	**3.5 J**	< 5	< 5	NA	NA
Potassium	NLE	NLE	137,000	**8,520**	**2,970**	**6,100**	**4,540**	NA	NA
Selenium	40	10	29.6	**6.4 J**	**3.6 J**	**4 J**	**4.4 J**	NA	NA
Silver	40	9.4	ND	**0.893 J**	**0.545 J**	**0.773 J**	**0.601 J**	NA	NA
Sodium	50,000	NLE	21,500	**64,700**	**102,000**	**81,800**	**6,930**	NA	NA
Thallium	2	0.02	5.5	< 10	< 10	< 10	< 10	NA	NA
Vanadium	NLE	8.6	108	**6.4**	**12.3**	**11.2**	**2.3 J**	NA	NA
Zinc	2,000	600	233	86.2 B	**3 J**	30.5 B	**19 J**	NA	NA

TABLE 5
GROUNDWATER SAMPLING RESULTS - COMPARISON TO NJDEP
GROUNDWATER QUALITY CRITERIA AND USEPA TAP WATER RSL
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Loc ID	NJ Ground Water Quality Criteria	2017-06 RSL Tap Water (HQ=0.1)	Weston 1995 Background (Main Post)	Bldg 488 BL-12	Bldg 488 BL-5	Bldg 488 BL-7
Sample ID				Bldg488 BL-12	Bldg488 BL-5	Bldg488 BL-7
Sample Date				12/16/2010	12/16/2010	12/16/2010
Sample Round						
Filtered				Total	Total	Total
Volatile Organic Compounds (µg/l)						
1,1,1,2-Tetrachloroethane	1	0.57	-	< 130	< 130	< 130
1,1,1-Trichloroethane	30	800	-	< 120	< 120	< 120
1,1,2,2-Tetrachloroethane	1	0.076	-	NA	NA	NA
1,1,2-Trichloroethane	3	0.041	-	< 140	< 140	< 140
1,1-Dichloroethane	50	2.8	-	< 120	< 120	< 120
1,1-Dichloroethene	1	28	-	< 150	< 150	< 150
1,1-Dichloropropene	100	NLE	-	NA	NA	NA
1,2,3-Trichlorobenzene	100	0.7	-	NA	NA	NA
1,2,3-Trichloropropane	0.03	0.00075	-	NA	NA	NA
1,2,4-Trichlorobenzene	9	0.4	-	NA	NA	NA
1,2,4-Trimethylbenzene	100	5.6	-	NA	NA	NA
1,2-Dibromo-3-chloropropane	0.02	0.00033	-	NA	NA	NA
1,2-Dibromoethane	0.03	0.0075	-	NA	NA	NA
1,2-Dichlorobenzene	600	30	-	< 130	< 130	< 130
1,2-Dichloroethane	2	0.17	-	< 110	< 110	< 110
1,2-Dichloropropane	1	0.14	-	< 120	< 120	< 120
1,3,5-Trimethylbenzene	100	6	-	NA	NA	NA
1,3-Dichlorobenzene	600	NLE	-	< 160	< 160	< 160
1,3-Dichloropropane	100	37	-	NA	NA	NA
1,4-Dichlorobenzene	75	0.48	-	< 150	< 150	< 150
2,2-Dichloropropane	100	NLE	-	NA	NA	NA
2-Chloroethylvinylether	0	NLE	-	< 240	< 240	< 240
2-Chlorotoluene	100	24	-	NA	NA	NA
Acetone	6,000	1,400	-	< 320	< 320	< 320
Acrolein	5	0.0042	-	< 3210	< 3210	< 3210
Acrylonitrile	2	0.052	-	< 980	< 980	< 980
Benzene	1	0.46	-	< 120	< 120	< 120
Bromobenzene	100	6.2	-	NA	NA	NA
Bromochloromethane	100	8.3	-	NA	NA	NA
Bromodichloromethane	1	0.13	-	< 120	< 120	< 120
Bromoform	4	3.3	-	< 140	< 140	< 140
Carbon disulfide	700	81	-	< 120	< 120	< 120
Carbon tetrachloride	1	0.46	-	< 120	< 120	< 120
Chlorobenzene	50	7.8	-	< 120	< 120	< 120
Chlorodibromomethane	1	0.87	-	< 120	< 120	< 120
Chloroethane	5	2,100	-	< 320	< 320	< 320
Chloroform	70	0.22	-	< 350	< 350	< 350
Cis-1,2-Dichloroethene	70	3.6	-	< 120	< 120	< 120
Cis-1,3-Dichloropropene	1	NLE	-	< 130	< 130	< 130
Cymene	100	NLE	-	NA	NA	NA
Dichlorodifluoromethane	1,000	20	-	< 170	< 170	< 170
Diisoproply Ether	20,000	150	-	< 170	< 170	< 170
Ethyl benzene	700	1.5	-	< 120	< 120	< 120
Hexachlorobutadiene	1	0.14	-	NA	NA	NA
Isopropylbenzene	700	45	-	NA	NA	NA
Meta/Para Xylene	1,000	19	-	< 300	< 300	< 300
Methyl bromide	10	0.75	-	< 370	< 370	< 370
Methyl butyl ketone	300	3.8	-	< 170	< 170	< 170
Methyl chloride	100	19	-	< 270	< 270	< 270
Methyl ethyl ketone	300	560	-	< 220	< 220	< 220
Methyl isobutyl ketone	100	630	-	< 150	< 150	< 150
Methyl Tertbutyl Ether	70	14	-	< 110	< 110	< 110
Methylene chloride	3	11	-	< 260	< 260	< 260
Naphthalene	300	0.17	-	NA	NA	NA
n-Butylbenzene	100	100	-	NA	NA	NA
Ortho Xylene	1,000	19	-	< 140	< 140	< 140
p-Chlorotoluene	100	25	-	NA	NA	NA
Propylbenzene	100	66	-	NA	NA	NA
sec-Butylbenzene	100	200	-	NA	NA	NA
Styrene	100	120	-	< 140	< 140	< 140
Tert Butyl Alcohol	100	NLE	-	< 1640	< 1640	< 1640
tert-Butylbenzene	100	69	-	NA	NA	NA
Tetrachloroethene	1	4.1	-	< 140	< 140	< 140
Toluene	600	110	-	< 120	< 120	< 120
Total Xylenes	1,000	19	-	NA	NA	NA
Trans-1,2-Dichloroethene	100	36	-	< 140	< 140	< 140
Trans-1,3-Dichloropropene	1	NLE	-	< 130	< 130	< 130
Trichloroethene	1	0.28	-	< 110	< 110	< 110
Trichlorofluoromethane	2,000	520	-	< 150	< 150	< 150
Vinyl acetate	7,000	41	-	< 200	< 200	< 200
Vinyl chloride	1	0.019	-	< 220	< 220	< 220
TIC VOCs (µg/l)						
Total TIC, Volatile	500	NLE	-	NA	NA	NA
Semivolatile Organic Compounds (µg/l)						
1,1'-Biphenyl	400	0.083	-	< 420	< 420	< 420
2,4-Dinitrotoluene	10	0.24	-	< 220	< 220	< 220
2,6-Dinitrotoluene	10	0.049	-	< 330	< 330	< 330
2-Chloronaphthalene	600	75	-	< 420	< 420	< 420
2-Methylnaphthalene	30	3.6	-	< 660	< 660	< 660
2-Nitroaniline	100	19	-	< 240	< 240	< 240
3,3'-Dichlorobenzidine	30	0.13	-	< 300	< 300	< 300
3-Nitroaniline	100	NLE	-	< 290	< 290	< 290
4-Bromophenyl phenyl ether	100	NLE	-	< 350	< 350	< 350
4-Chloroaniline	30	0.37	-	< 250	< 250	< 250
4-Chlorophenyl phenyl ether	100	NLE	-	< 350	< 350	< 350
4-Nitroaniline	5	3.8	-	< 180	< 180	< 180
Acenaphthene	400	53	-	< 11	< 11	< 11
Acenaphthylene	100	NLE	-	< 11	< 11	< 11
Acetophenone	700	190	-	< 400	< 400	< 400
Anthracene	2,000	180	-	< 8.4	< 8.4	< 8.4
Atrazine	3	0.3	-	< 390	< 390	< 390
Benzaldehyde	100	19	-	< 400	< 400	< 400
Benzo(a)anthracene	0.1	0.03	-	< 9.8	< 9.8	< 9.8
Benzo(a)pyrene	0.1	0.025	-	< 16	< 16	< 16
Benzo(b)fluoranthene	0.2	0.25	-	< 9.5	< 9.5	< 9.5
Benzo(ghi)perylene	100	NLE	-	< 10	< 10	< 10
Benzo(k)fluoranthene	0.5	2.5	-	< 13	< 13	< 13
Bis(2-Chloroethoxy)methane	100	5.9	-	< 250	< 250	< 250
Bis(2-Chloroethyl)ether	7	0.014	-	< 310	< 310	< 310
Bis(2-Chloroisopropyl)ether	300	71	-	< 390	< 390	< 390
Bis(2-Ethylhexyl)phthalate	3	5.6	-	< 330	< 330	< 330
Butyl benzyl phthalate	100	16	-	< 250	< 250	< 250
Caprolactam	5,000	990	-	< 200	< 200	< 200
Carbazole	100	NLE	-	< 170	< 170	< 170
Chrysene	5	25	-	< 11	< 11	< 11
Dibenz(a,h)anthracene	0.3	0.025	-	< 19	< 19	< 19
Dibenzofuran	100	0.79	-	< 300	< 300	< 300
Diethyl phthalate	6,000	1,500	-	< 170	< 170	< 170
Dimethyl phthalate	100	NLE	-	< 230	< 230	< 230
Di-n-butylphthalate	700	90	-	< 190	< 190	< 190
Di-n-octylphthalate	100	20	-	< 400	< 400	< 400
Fluoranthene	300	80	-	< 8.1	< 8.1	< 8.1
Fluorene	300	29	-	< 9	< 9	< 9
Hexachlorobenzene	0.02	0.0098	-	< 10	< 10	< 10
Hexachlorobutadiene	1	0.14	-	< 130	< 130	< 130
Hexachlorocyclopentadiene	40	0.041	-	< 240	< 240	< 240
Hexachloroethane	7	0.33	-	< 210	< 210	< 210
Indeno(1,2,3-cd)pyrene	0.2	0.25	-	< 16	< 16	< 16
Isophorone	40	78	-	< 250	< 250	< 250
Naphthalene	300	0.17	-	< 12	< 12	< 12
Nitrobenzene	6	0.14	-	< 250	< 250	< 250
N-Nitroso-di-n-propylamine	10	0.011	-	< 440	< 440	< 440
N-Nitrosodiphenylamine	10	12	-	< 220	< 220	< 220
Phenanthrene	100	NLE	-	< 9.4	< 9.4	< 9.4
Pyrene	200	12	-	< 12	< 12	< 12
Pesticides (µg/l)						
4,4'-DDD	0.1	0.032	-	NA	NA	NA
4,4'-DDE	0.1	0.046	-	NA	NA	NA
4,4'-DDT	0.1	0.23	-	NA	NA	NA
Aldrin	0.04	0.00092	-	NA	NA	NA
Alpha-BHC	0.02	0.0072	-	NA	NA	NA
Alpha-Chlordane	0.5	NLE	-	NA	NA	NA
Beta-BHC	0.04	0.025	-	NA	NA	NA
Delta-BHC	100	NLE	-	NA	NA	NA
Dieldrin	0.03	0.0018	-	NA	NA	NA
Endosulfan I	40	NLE	-	NA	NA	NA
Endosulfan II	40	NLE	-	NA	NA	NA
Endosulfan sulfate	40	NLE	-	NA	NA	NA
Endrin	2	0.23	-	NA	NA	NA
Endrin aldehyde	100	NLE	-	NA	NA	NA
Endrin ketone	100	NLE	-	NA	NA	NA
Gamma-BHC/Lindane	0.03	0.042	-	NA	NA	NA
gamma-Chlordane	NLE	NLE	-	NA	NA	NA
Heptachlor	0.05	0.0014	-	NA	NA	NA
Heptachlor epoxide	0.2	0.0014	-	NA	NA	NA
Methoxychlor	40	3.7	-	NA	NA	NA
Toxaphene	2	0.071	-	NA	NA	NA
Inorganics (µg/l)						
Aluminum	200	2,000	121,000	NA	NA	NA
Antimony	6	0.78	20.7	NA	NA	NA
Arsenic	3	0.052	89.3	NA	NA	NA
Barium	6,000	380	699	NA	NA	NA
Beryllium	1	2.5	2.1	NA	NA	NA
Cadmium	4	0.92	9.5	NA	NA	NA
Calcium	NLE	NLE	45,400	NA	NA	NA
Chromium	70	2,200	191	NA	NA	NA
Cobalt	100	0.6	18.3	NA	NA	NA
Copper	1,300	80	65.6	NA	NA	NA
Iron	300	1,400	431,000	NA	NA	NA
Lead	5	15	22.7	NA	NA	NA
Magnesium	NLE	NLE	62,700	NA	NA	NA
Manganese	50	43	331	NA	NA	NA
Mercury	2	0.57	0.26	NA	NA	NA
Nickel	100	39	187	NA	NA	NA
Potassium	NLE	NLE	137,000	NA	NA	NA
Selenium	40	10	29.6	NA	NA	NA
Silver	40	9.4	ND	NA	NA	NA
Sodium	50,000	NLE	21,500	NA	NA	NA
Thallium	2	0.02	5.5	NA	NA	NA
Vanadium	NLE	8.6	108	NA	NA	NA
Zinc	2,000	600	233	NA	NA	NA

Footnote:

1) All historical data collected prior to 2013 are reported as provided by others.

2) NLE = no limit established.

3) ND = not detected in any background sample, no background concentration available.

4) Bold chemical dectection

5) Chemical result qualifiers are assigned by the laboratory and are evaluated and modified (if necessary) during the data validation.

[blank] = detect, i.e. detected chemical result value.

B =Compound detected in the sample at a concentration less than or equal to 5 times (10 times for common lab contaminants) the blank concentration.

J = estimated detected value due to a concetration below the reporting limit or due to discrepancies in meeting certain analyte-specific quality control.

6) Chemical results greater than or equal to the action level (depending on criteria) are highlighted based on the Criteria that are present.

- Cell Shade values represent a result that is above the NJ Ground Water Quality Criteria ####

NJDEP Interim Specific GWQC values are presented for the NJ GWQS where there is not a Specific Ground Water Quality Criteria.
A full list of compounds is available at (http://www.nj.gov/dep/wms/bwqsa/gwqs_interim_criteria_table.htm).

- Cell Shade values represent a result that is above the USEPA 2017-06 RSL Tap Water (HQ=0.1). ###
- Cell Style values represent a result that is above the Weston 1995 Background (Main Post). ###
- Cell Shade values represent a result that is above both the NJ Ground Water Quality Criteria and USEPA 2017-06 RSL Tap Water (HQ=0.1). ###

7) Criteria action level source document and web address.

- The NJ Ground Water Quality Criteria refers to the NJDEP Groundwater Quality Standards - Adopted July 22, 2010
  http://www.state.nj.us/dep/wms/bwqsa/docs/njac79C.pdf
- The 2017-06 USEPA RSL Tap Water (HQ=0.1) refers to the USEPA's Regional Screening Levels (HQ=0.1)
  https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017
- The Weston 1995 Background (Main Post) refers to the FTMM reports.

TABLE 6
GROUNDWATER SAMPLING SUMMARY OF DETECTIONS
AMENDED REMEDIAL INVESTIGATION REPORT FOR FTMM-57
FORT MONMOUTH, NEW JERSEY

Analyte	Maximum Detected Concentration		Location of Maximum Concentration	Sample Date	Number of Samples	Number of Detections	NJDEP GWQS		2017-06 USEPA RSL Tap Water (HQ=0.1)		Weston 1995 Background (Main Post)		Identification of COPCs	
							Action Level	# of Exceedances	Action Level	# of Exceedances	Action Level	# of Exceedances	COPC in Risk Assessment?	Rationale
Volatile Organic Compounds (µg/l)														
Acetone	2.9	J	108MW02	8/19/2013	4	2	6,000	0	1,400	0	-	n/a	No	Less than USEPA Tapwater RSL
Pesticides (µg/l) (No Detects)														
Inorganics (µg/l)														
Aluminum	606		108MW01	8/19/2013	4	4	200	1	2,000	0	121,000	0	No	Less than USEPA Tapwater RSL
Antimony	4.4	J	108MW01	8/19/2013	4	2	6	0	0.78	2	20.7	0	**Yes**	Exceeded USEPA Tapwater RSL
Arsenic	9	J	108MW02	8/19/2013	5	3	3	2	0.052	3	89.3	0	**Yes**	Exceeded USEPA Tapwater RSL
Barium	43.1		108MW02	8/19/2013	4	4	6,000	0	380	0	699	0	No	Less than USEPA Tapwater RSL
Calcium	67,500		108MW01	8/19/2013	4	4	NLE	NLE	NLE	NLE	45,400	2	No	Essential human nutrient, No USEPA Tapwater RSL Established
Chromium	5.3		108MW01	8/19/2013	4	4	70	0	2,200	0	191	0	No	Less than USEPA Tapwater RSL
Cobalt	1.2	J	108MW02	8/19/2013	4	1	100	0	0.6	1	18.3	0	**Yes**	Exceeded USEPA Tapwater RSL
Copper	8.4	J	108MW01	8/19/2013	4	4	1,300	0	80	0	65.6	0	No	Less than USEPA Tapwater RSL
Iron	14,700		108MW02	8/19/2013	4	4	300	3	1,400	3	431,000	0	No	Essential human nutrient
Lead	2.5	J	108MW01	8/19/2013	6	1	5	0	15	0	22.7	0	No	Less than USEPA Tapwater RSL
Magnesium	8,290		108MW02	8/19/2013	4	4	NLE	NLE	NLE	NLE	62,700	0	No	Essential human nutrient, No USEPA Tapwater RSL Established
Manganese	363		108MW02	8/19/2013	4	4	50	2	43	2	331	1	**Yes**	Exceeded USEPA Tapwater RSL
Nickel	3.5	J	108MW02	8/19/2013	4	1	100	0	39	0	187	0	No	Less than USEPA Tapwater RSL
Potassium	8,520		108MW01	8/19/2013	4	4	NLE	NLE	NLE	NLE	137,000	0	No	Essential human nutrient, No USEPA Tapwater RSL Established
Selenium	6.4	J	108MW01	8/19/2013	4	4	40	0	10	0	29.6	0	No	Less than USEPA Tapwater RSL
Silver	0.893	J	108MW01	8/19/2013	4	4	40	0	9.4	0	ND	4	No	Less than USEPA Tapwater RSL
Sodium	102,000		108MW02	8/19/2013	4	4	50,000	3	NLE	NLE	21,500	3	No	Essential human nutrient, No USEPA Tapwater RSL Established
Vanadium	12.3		108MW02	8/19/2013	4	4	NLE	NLE	8.6	2	108	0	**Yes**	Exceeded USEPA Tapwater RSL
Zinc	19	J	108MW04	8/19/2013	4	2	2,000	0	600	0	233	0	No	Less than USEPA Tapwater RSL

TABLE 7
CONSTITUENTS OF CONCERN AND CLEANUP GOALS FOR SOIL
FTMM-57
FORT MONMOUTH, NEW JERSEY

Constituent of Concern	Medium	Remediation Level[(1)] (mg/kg)	NJDEP RDCSRS (mg/kg)
Arsenic	Soil	22.9	19

Notes:

[(1)] The remediation level for arsenic is based on the background value for arsenic as determined in the Final Site Investigation completed by Weston in 1995.

mg/kg = milligrams per kilogram

NJDEP = New Jersey Department of Environmental Protection

RDCSRS = Residential Direct Contact Soil Remediation Standard

TABLE 8
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
AND TO BE CONSIDERED CRITERIA
FTMM-57
FORT MONMOUTH, NEW JERSEY

ARAR	Description
Chemical-Specific:	
N.J.A.C. 7:26D Remediation Standards	New Jersey has promulgated residential direct contact soil remediation standards (RDCSRS) for the contaminants in soil that are referenced in NJAC 7:26D. These values were used as a basis for soil clean up goals that are protective of human health for FTMM-57.
Location-Specific:	
New Jersey Administrative Code (N.J.A.C.) 7:13 Flood Hazard Area Control Act Rules (FHACA)	Floodplain use and limitations which establishes limits on land development within flood hazard areas. Identifies requirements governing human disturbance to the land and vegetation in the flood hazard area and/or riparian zone of a regulated water. FTMM-57 lies within a 100-year floodplain; engineering controls and excavation activities need to be in compliance which require permits and authorization. Pertinent to activities that may occur within the floodplain.
New Jersey Statutes Annotated (N.J.S.A.) 13:19-1 Coastal Area Facility Review Act (CAFRA)	Requires all coastal areas should be dedicated to land uses which promote the public health, safety and welfare, protect public and private property, and are reasonably consistent and compatible with the natural laws governing the physical, chemical and biological environment of the coastal area. Requires CAFRA permit, N.J.A.C. 7:7, N.J.A.C. 7:7E.
Action-Specific:	
RCRA, 42 U.S.Code Chapter 82, Subchapter III (Hazardous Waste Management), §§ 6921–6939g	Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations. Substantive provisions are potentially applicable for determining whether waste is hazardous.
RCRA, 40 Code of Federal Regulation (CFR) 261.3(d) and 329 IAC 3.1 Definition of a hazardous waste	For all hazardous waste related equipment, remove or decontaminate all hazardous waste residues, contaminated containment components, contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous unless 40 CFR 261.3(d) applies.
RCRA, 40 CFR 262.11 (Hazardous Waste Identification), 264.175 (Container Management)	Remedial actions must appropriately identify and manage investigation derive wastes and remedial wastes (that are hazardous wastes) stored onsite, including waste characterization samples to classify waste as hazardous or non-hazardous. Potentially applicable for characterizing waste generated during the remedial action.
RCRA, 40 CFR 262.30, 262.31, 262.32, and 262.33 and 329 IAC 3.1-7 and 329 IAC 3.1-8 Pre-Transportation Requirements	All hazardous waste must be properly packaged, with labels, markings, and placards, prior to transport.

TABLE 8
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
AND TO BE CONSIDERED CRITERIA
FTMM-57
FORT MONMOUTH, NEW JERSEY

ARAR	**Description**
RCRA, 40 CFR 260-268 Off-Site Land Disposal (Subpart C)	Soil and/or sediment that is excavated for off-site disposal and constitutes a hazardous waste must be managed in accordance with the requirements of RCRA.
RCRA, 40 CFR 258 Off-Site Land Disposal (Subpart D)	Criteria for Municipal Solid Waste Landfills, establishes requirements for the operation of landfills accepting non-hazardous solid waste. These requirements are applicable to facilities used for the disposal of non-hazardous soil and/or sediment.
RCRA, 40 CFR 268 Land Disposal Restrictions (Subpart D)	The land disposal restrictions provide a second measure of protection from threats posed by hazardous waste disposal by ensuring that hazardous waste cannot be placed on the land until the waste meets specific treatment standards to reduce the mobility or toxicity of its hazardous constituents. Hazardous waste destined for land disposal must meet the applicable Land Disposal Regulations of 40 CFR 268.
N.J.A.C. 7:26C-7 Administrative Requirements for the Remediation of Contaminated Sites	Provides regulatory requirements for a deed notice. The deed notice includes as-built plans and details of the engineering controls (if used), including the cap, as well as monitoring and maintenance requirements.
N.J.A.C. 7:26E-1.1 Technical Requirements for Site Remediation	New Jersey Technical Rules: remediation performed does not relieve any person from obtaining all permits required by federal, state, or local statute or regulation. Soil Remediation Permit must be obtained.
N.J.A.C. 7:26E- 8 Technical Requirements for Site Remediation	Identifies requirements for institutional controls for contaminated soils left in place; identifies administrative requirements for site remediation that may be applicable. Potentially applicable if chemical residuals in soils left in place are above the residential or industrial soil remediation standards.
TBC Criteria	**Description**
Chemical-Specific:	
USEPA Residential Soil Regional Screening Levels	USEPA resident soil regional screening levels (Target Risk [TR] = 1 x 10^{-6} and Target Hazard Quotient [THQ] = 0.1) were used to determine constituents of potential concern to be in compliance with CERCLA.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirements
RCRA = Resource Conservation and Recovery Act
TCLP = toxicity characteristic leaching procedure

TABLE 9
INITIAL SCREENING OF TECHNOLOGIES FOR SOIL
FTMM-57
FORT MONMOUTH, NEW JERSEY

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
No Action	None	None	No action is taken.	Required for consideration by National Oil and Hazardous Substances Pollution Contingency Plan.
Risk and Hazard Management	Land Use Controls (LUCs)	LUCs	Restrict land use with a Deed Notice or Declaration of Environmental Restriction.	Restricting land use in the contaminated area via application of LUCs is an applicable and viable option.
Containment	Capping	Asphalt Cap	An impervious asphalt layer is paved on an aggregate base layer over the area of contamination. Asphalt capping is one of the most widely used engineering control measures in protecting human health and the environment from hazardous waste in subsurface.	Does not reduce toxicity or volume of contaminants but mitigates risk. Requires extensive State permitting, design and installation due to location in lowland coastal area. Requires long-term maintenance and limits future use. Capping technology could be used in conjunction with other components of a remedial action to ensure compliance with ARARs, such as a Deed Notice. Asphalt cap is applicable and retained for further evaluation.
Treatment	Physical	Solidification/ Stabilization	An established treatment technology often used to reduce the mobility of arsenic in soil. Physically binds or encloses contaminants within a stabilized mass and chemically reduces the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms.	Effectiveness highly dependent on homogenous mixing. Grout injection bottom barriers may be necessary at FTMM 57 because groundwater fluctuates and may be very shallow at times. Would require long-term maintenance, post-cure testing, and implementation of LUCs. Other technologies are more applicable for site conditions and more easily implemented. Because of these limitations, this technology was not retained for further consideration.
		Solvent Extraction/Soil Washing	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system based on particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics.	Appropriate remediation data must be collected to evaluate the applicability of soil washing and the chemicals (if any) that should be added to the washing liquid. Technology results in treated/waste material requiring disposal. Since there are other technologies more applicable to the site conditions, soil washing is not recommended and this approach is not retained for further evaluation.

TABLE 9
INITIAL SCREENING OF TECHNOLOGIES FOR SOIL
FTMM-57
FORT MONMOUTH, NEW JERSEY

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Treatment	Physical	Electro kinetic	Electro kinetic is based on the application of a direct electric current of low intensity to the porous matrix to be decontaminated. The effect of the electric field induces the mobilization and transportation of contaminants through the porous matrix towards the electrodes, where they are collected, pumped out and treated.	Since the COCs are not readily biodegradable and relatively immobile, their elimination from soils cannot be achieved in an unenhanced electro kinetic treatment and in order to achieve an effective removal or elimination of contaminants from soils, their solubility has to be enhanced with the use of co-solvents, surfactants or any other chemical agent. In addition, the costs for installation of electrodes and power supply make this technology not cost-effective and it not recommended for further evaluation.
		Vitrification	High temperature treatment that reduces the mobility of metals by incorporating them into a chemically durable, leach resistant, vitreous mass. The process also may cause contaminants to volatilize, thereby reducing their concentration in the soil.	Typically requires large amounts of energy, can be more expensive than other technologies, and may generate arsenic off-gasses and therefore was not retained for further evaluation.
	Biological	Phytoremediation	Direct use of living green plants for in situ removal, degradation, or containment of contaminants in soil.	Since technology would require long term maintenance and would not destroy arsenic it is impractical and not retained for further evaluation.
Source Removal	Excavation	Mechanical Excavation	Contaminated soil is excavated and properly disposed of. Excavated area is filled in with clean soil and restored to pre-construction conditions.	Removes soil and restores the excavated area.
Disposal	Offsite Disposal	Offsite Disposal	Transport and disposal of excavated soil at offsite permitted disposal facility.	Offsite disposal is necessary for the excavation alternative.

Process Option Retained During Evaluation

Process Option Screened Out During Evaluation

TABLE 10
EVALUATION OF PROCESS OPTIONS FOR SOIL
FTMM-57
FORT MONMOUTH, NEW JERSEY

General Response Actions	Remedial Technology	Process Options	Ratings		
			Effectiveness	Implementability	Cost
No Action	None	None	Low; does not achieve RAOs.	High; no action is needed.	High; no cost.
Risk and Hazard Management	Land Use Controls (LUCs)	LUCs	Moderate; contamination not reduced. Effectiveness to reduce risk depends on continuing to limit access to soil.	High; readily implementable.	Moderate; minimal administrative, five-year inspections and reporting costs.
Containment	Capping	Asphalt Cap	Moderate to High; provides protection by reducing direct contact with impacted soil; will require increased level of truck traffic entering and exiting the site for installation. Requires institutional controls and long-term O&M; would limit land reuse options; does not reduce toxicity, mobility, or volume of contamination.	Moderate; technology well established but specific permitting for location within floodplain would be required. State and community would need to accept impacted material remaining onsite.	Moderate; capital costs associated with cap and minimal costs associated with administrative fees; O&M will be required to retain integrity of cap and reporting requirements.
Source Removal	Excavation	Mechanical Excavation	High; removes all contaminated soil and backfills excavation with clean soil. Demonstrates ability to meet RAOs.	Moderate: technology well established. Approval, coordination and planning required.	Low; high capital costs and low O&M costs.

Ratings

- High
- Moderate to High
- Moderate
- Moderate to Low
- Low

TABLE 11
CRITERIA FOR DETAILED EVALUATION OF REMEDIAL ALTERNATIVES
FTMM-57
FORT MONMOUTH, NEW JERSEY

Criterion		How the Criterion is Applied
Threshold Criteria		
1	Overall Protection of Human Health and the Environment	Assesses the ability of a remedial alternative to eliminate, reduce, or control the risks associated with exposure pathways, including direct contact, potential migration, and risks to ecosystems.
2	Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Evaluates the potential of a remedial alternative to comply with chemical-specific, location-specific, and action-specific ARARs. Compliance with other to-be-considered (TBC) criteria is also evaluated, but is not mandatory.
Primary Balancing Criteria		
3	Long-Term Effectiveness and Permanence	Measures the ability of a remedial alternative to permanently protect human health and the environment.
4	Reduction of Toxicity, Mobility, or Volume Through Treatment	Evaluates the ability of a remedial alternative to permanently or significantly reduce the toxicity, mobility, and volume of the constituents, particularly through treatment.
5	Short-Term Effectiveness	Assesses the protection of human health and the environment during implementation of a remedial alternative.
6	Implementability	Evaluates technical feasibility and the difficulty of applying the remedial alternative at the site, the reliability of the technology, the unknowns associated with the remedial alternative, and the need for treatability studies. Assesses administrative requirements, including regulatory agency approval and the need for permits and waivers. Assesses mobilization needs and the accessibility of equipment and trained personnel required to implement the remedial alternative.
7	Cost	Assesses the capital, operation, and maintenance costs of each remedial alternative.
Modifying Criteria		
8	State Acceptance	Evaluates the technical and administrative issues and concerns the State may have regarding the remedial alternative.
9	Community Acceptance	Evaluates the issues and concerns the public may have regarding the remedial alternative.

Source: 40 CFR 300.430(e) (9) and 300.100(f) (1).

TABLE 12
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
FTMM-57
FORT MONMOUTH, NEW JERSEY

Criteria	Alternative			
	1[a]	2[b]	3[c]	4[d]
Threshold Criteria				
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes
Compliance with ARARs	Not Applicable	Yes	Yes	Yes
Balancing Criteria				
Long-Term Effectiveness and Permanence	Low	Moderate	Moderate to High	High
Reduction of Toxicity, Mobility, or Volume by Treatment	Low	Low	Low	High
Short-Term Effectiveness	High	Moderate	Moderate to Low	Low
Implementability	Not Applicable	High	Moderate to Low	Moderate to Low
Cost (Total Present Value)	$0	$319,000	$771,000	$416,000
Optional Evaluation Factor				
Remedial Time-Frame	0	>30 years	>30 years	6 months

[a] No Action

[b] Land Use Controls

[c] Containment via Asphalt Capping with Alternative 2

[d] Source Removal via Direct Excavation and Backfill

Ratings

High	
Moderate to High	
Moderate	
Moderate to Low	
Low	

APPENDICES

Appendix A – UST NFA Recommendation Memorandum

Appendix B – Regulatory Correspondence

Appendix C – Historical Information

Appendix D – 2017 Soil Boring Logs

Appendix E – Laboratory Analytical Reports

Appendix F – Human Health Risk Assessment

Appendix G – Remedial Alternatives Cost Estimate

APPENDIX A

UST NFA Recommendation Memorandum

MEMORANDUM

SUBJECT: Supplement to the Amended RI/FS Report for FTMM-57 – No Further Action (NFA) Determination for Underground Storage Tanks (USTs)
Building 108 UST Gasoline Release, Fort Monmouth, Oceanport, New Jersey

DATE: 24 April 2020

The Fort Monmouth Team has reviewed existing file information for FTMM-57 and prepared this memorandum for the Administrative Record. Based on the information presented in the Amended Remedial Investigation/Feasibility Study (RI/FS) Report to which this memorandum is attached and this memorandum, we request the Department's concurrence with the Army's determination that no further action is warranted for five FTMM-57 underground storage tanks (USTs; Registration ID Nos. 90010-60 through 90010-64).

FTMM-57 is located on the eastern edge of the Main Post near existing Buildings 484 and 488 and is the site of an Underground Storage Tank (UST) Gasoline Release. FTMM-57 has also been designated as Site 108 based on proximity to the former Building T-108 Motor Pool Office, which was demolished between 1994 and 2004. FTMM-57 is surrounded by Parcel 83 except along the eastern side where it aligns with the property boundary of the former FTMM (Refer to Figures 1 and 2 of the Amended RI/FS Report). Real property records indicate that four gasoline tanks and one kerosene tank with associated pump islands were installed at this location in 1952, and refer to this same area as the Building 109 motor pool gasoline and kerosene service station. Based on historical drawings, gasoline tanks and pump islands were present at this location as early as 1941.

As described in the Underground Storage Tank Closure and Site Investigation Report (Weston 2014, included in Appendix C of the Amended RI/FS Report), there were five underground storage tanks (USTs; Registration ID Nos. 90010-60 through 90010-64) located near Building 488 and former Building 108 (**Figure 1**). UST Nos. 60, 61 and 62 were steel single-wall 5,000-gallon unleaded gasoline tanks. UST No. 63 was a steel single-wall 5,000-gallon diesel fuel tank. UST No. 64 was a steel single-wall 5,000-gallon kerosene tank. The status of former USTs is discussed below and summarized on **Table 1**.

Five USTs were removed from the FTMM-57 site in April 1993 and are summarized below:

- Three 5000-gallon steel gasoline USTs (Registration ID 90010-60, -61, and -62),
- One 5000-gallon steel diesel UST (90010-63), and
- One 5000-gallon steel kerosene UST (90010-64).

Photographs of the tanks during removal are included as **Figure 2**. The fuel dispenser area (located approximately 70 feet south of the tanks) and appurtenant below-ground piping were also removed

(**Figure 3**). Tanks 90010-60 through -63 were located adjacent to one another, and no corrosion holes were noted during removal. Several corrosion holes were noted in kerosene tank 90010-64, which was located immediately northeast of the other tanks. A sheen was noted in the shallow groundwater encountered within the excavation and a discharge notification was made to NJDEP (Discharge Investigation and Corrective Action Report [DICAR] No. 93-4-12-1939-29) in April 1993.

Approximately 221 cubic yards of potentially contaminated soil was removed in April 1993. Post-excavation soil samples were collected from the area of the former USTs, fuel dispenser area, and below ground piping. Post-excavation soil samples were collected from the sidewalls of the excavation above the groundwater. Sample results are detailed in the Amended RI/FS Report.

In 1994, a steel, 1,000-gallon UST that contained No. 2 fuel oil (Registration ID No. 90010-7, designated as UST 108A) located adjacent to former Building 108 was also removed. NJDEP agreed to a No Further Action (NFA) designation for UST 108A on 13 October 2015 (Amended RI Report Appendix B, Correspondence 3). This UST is not associated with FTMM-57 because it was used for heating oil only, and because it was not located near the fuel USTs and dispensers removed in 1993 that were associated with the DICAR release.

The results of the following data collected over time comprise the Amended RI/FS soil results for FTMM-57:

- 1993 soil data collected as part of UST closure sampling;
- 2001 soil data collected for the earlier RI (Versar, 2004);
- 2010 soil data collected in response to NJDEP comments on the earlier RI; and
- 2016 and 2017 results of the field investigations performed by Parsons for adjacent Parcel 83 and UST 482, and for FTMM-57.

The Amended RI/FS presents the data from the above sampling events, specifically that there were no benzene exceedances of the NJDEP comparison criteria in the recent soil samples at FTMM-57, and benzene is no longer present. Based on this information, additional characterization or remediation of soil associated with the USTs is not warranted at FTMM-57. An Unrestricted Use, NFA determination is recommended for the five former UST108 locations with registration IDs 90010-60, -61, -62, -63 and -64 based on the conclusions of the Amended RI/FS Report.

FIGURES:

Figure 1 – UST Locations
Figure 2 – UST Photographs
Figure 3 – USTs and Associated Piping and Dispenser Area

TABLES:

Table 1 – UST Status Summary

REFERENCES CITED

Weston, 1994. Roy F. Weston, Inc. Underground Storage Tank Closure and Site Investigation Report, Building 108, NJDEPE Facility UST No. 0090010, TMS No. 60, 61, 62, 63 and 64. May 31.

Figures

Underground Storage Tank Sites
Main Post
Fort Monmouth, New Jersey
FOUO

0 375 750 1,500 Feet

Legend

- Underground Storage Tank
- Existing Building
- Roadway & Parking
- Water Body
- Post Boundaries

Map Created by:
Fort Monmouth Installation GIO, Environmental Division
Fort Monmouth, New Jersey
Date: January 10, 2011
All drawings must be field verified.
New Jersey State Plane Feet, NAD83

January 10, 2011 H:\GIS\GIS Maps\CH\PR14-IR\IRP Sites Main Post.mxd

Figure 1 - UST Locations

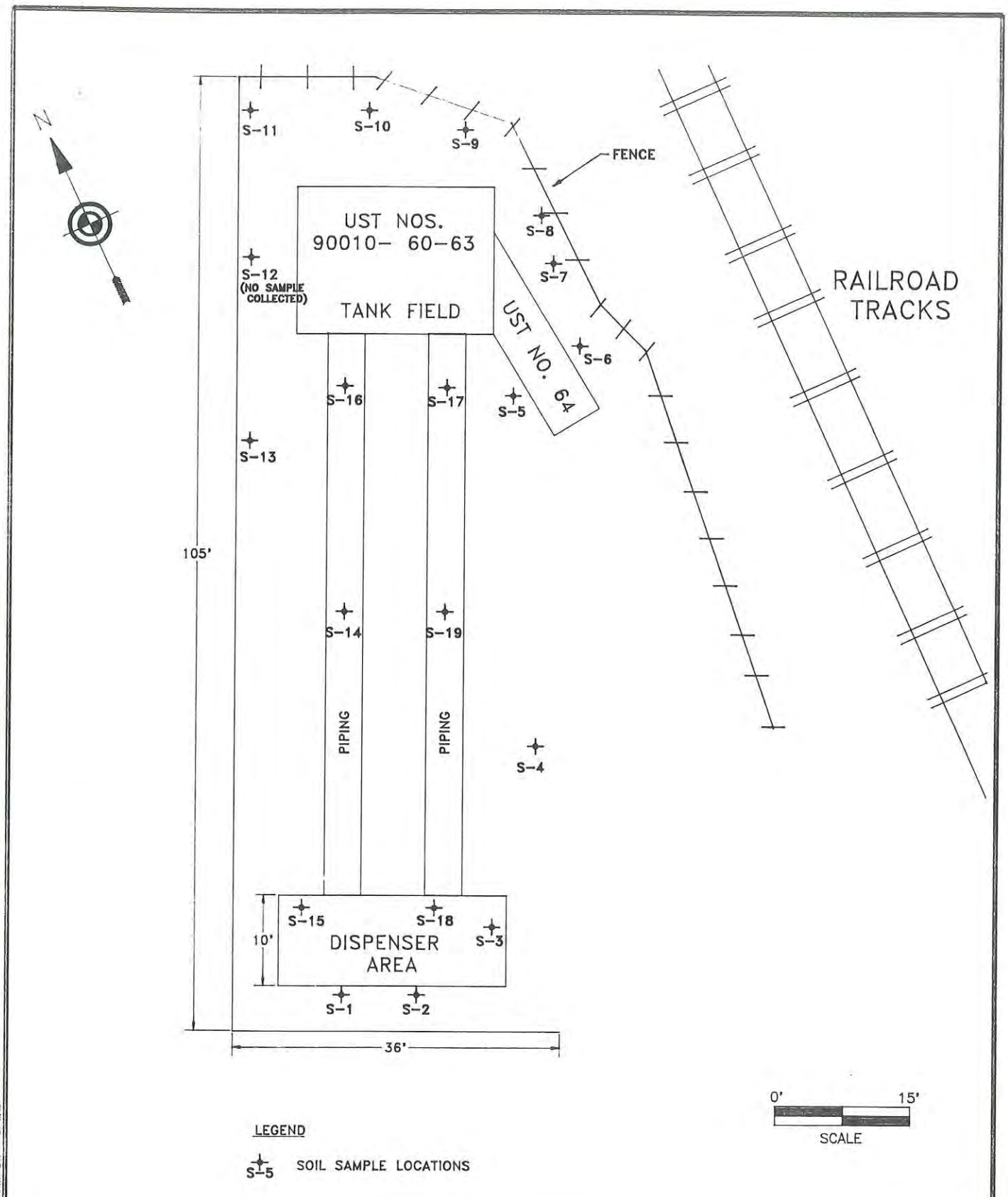
B108

6-28-91 SKip Ewell

B108
#s 1,3,4 - 6K unleaded gas SKip Ewell
#2 - 6K - Diesel
Kero - 6K 6-28-91

Figure 2 - UST Photographs

Figure 3 - USTs and Associated Piping and Dispenser Area



REVISION #: 1 DATE: 5/16/94 PLOT NAME: BLD-180
FILE NAME: BLD-108.DWG DRAWN BY: B. MAC

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: UNDERGROUND STORAGE TANK CLOSURE AND SITE INVESTIGATION REPORT BUILDING 108- UST NOS. 60-64
FORT MONMOUTH NEW JERSEY

CLIENT NAME: U.S. ARMY - FORT MONMOUTH DIRECTORATE OF PUBLIC WORKS

POST-EXCAVATION SOIL SAMPLING LOCATIONS

DATE: 5/17/94

FIGURE #: 2-1

Tables

TABLE 1
UNDERGROUND STORAGE TANK STATUS SUMMARY
FTMM-57
FORT MONMOUTH, NEW JERSEY

Site Name	Residential?	Registration ID	DICAR	Tank Size and Type	Product	Date Tank Removed	No Further Action (NFA) Approved or Requested Status
108	NO	90010-60	93-4-12-1939-29	5,000 gallon steel	GASOLINE	4/12/1993	NFA requested and supporting information included in this FTMM-57 Summary RI/FS Report
108	NO	90010-61	93-4-12-1939-29	5,000 gallon steel	GASOLINE	4/12/1993	NFA requested and supporting information included in this FTMM-57 Summary RI/FS Report
108	NO	90010-62	93-4-12-1939-29	5,000 gallon steel	GASOLINE	4/12/1993	NFA requested and supporting information included in this FTMM-57 Summary RI/FS Report
108	NO	90010-63	93-4-12-1939-29	5,000 gallon steel	DIESEL	4/12/1993	NFA requested and supporting information included in this FTMM-57 Summary RI/FS Report
108	NO	90010-64	93-4-12-1939-29	5,000 gallon steel	KEROSENE	4/12/1993	NFA requested and supporting information included in this FTMM-57 Summary RI/FS Report
108A	NO	90010-7	None	1,000 gallon steel	#2 FUEL OIL	7/14/1994	NFA determination approved in NJDEP letter dated 10/13/2015

APPENDIX B

Regulatory Correspondence

1. NJDEP letter to the Army dated October 20, 2017, re: *Work Plan for FTMM-57 Building 108 UST Gasoline Release, Fort Monmouth, Oceanport, Monmouth County, Preferred ID: G000000032*
2. NJDEP letter to the Army dated November 14, 2016, re: *Annual (Fourth Quarter) 2015 Groundwater Sampling Report dated September 2016, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*
3. NJDEP letter to the Army dated October 13, 2015, re: *No Further Action Request Site Investigation Report Addendum for the ECP Parcel 83 Underground Storage Tanks, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*
4. NJDEP letter to the Army dated July 3, 2014, re: *Final Baseline Groundwater Sampling Report (August 2013), Remedial Investigation/Feasibility Study/Decision Documents, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*
5. NJDEP letter to the Army dated June 24, 2008, re: *Remedial Investigation Report and CEA Information, Site 108 – Main Post, Fort Monmouth, NJ*
6. NJDEP email to the Army dated November 12, 2004, re: *Groundwater Analyses Reduction*
7. Army letter to NJDEP dated November 10, 2004, re: *Reduction of Groundwater Sampling Analyses – Main Post & Charles Woods, Restoration Sites Throughout, Fort Monmouth, New Jersey*

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Northern Field Operations
7 Ridgedale Avenue
Cedar Knolls, NJ 07927
Phone #: 973-631-6401
Fax #: 973-656-4440

BOB MARTIN
Commissioner

October 20, 2017

Mr. William R. Colvin
OACSIM – US Army Fort Monmouth
P O Box 148
Oceanport, NJ 07757

Re Work Plan for FTMM-57 Building 108 UST Gasoline Release
Fort Monmouth
Oceanport, Monmouth County
Preferred ID: G000000032

Dear Mr. Colvin:

The New Jersey Department of Environmental Protection (Department) has completed review of the Work Plan for FTMM-57 Building 108 UST Gasoline Release (Workplan). Based on the review the Department approves the workplan and offers the following comments.

The Department approves the proposed soil sampling (2 soil borings) to further delineate the current concentrations of benzene. These two soil borings will also be used to delineate the PAH contamination in this area. Please note that recently the Department's soils standards for several PAH compounds have changed. Please re-examine previous PAH contaminant levels as they relate to the recent changes. If PAH levels are below the newly revised standards, the Department will not require further PAH investigation at this location.

Thank you and please feel free to contact me if you have any questions.

Sincerely,

A.J. Joshi

C: Jim Moore, BRAC Project Manager
Cristina Grill, Parsons
Kent Friesen, Parsons
File

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
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401 East State Street
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Trenton, NJ 08625-0028
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BOB MARTIN
Commissioner

November 14, 2016

William R. Colvin
BRAC Environmental Coordinator
OACSIM – U.S. Army Fort Monmouth
PO Box 148
Oceanport, NJ 07757

Re: *Annual (Fourth Quarter) 2015 Groundwater Sampling Report* dated *September 2016*
Fort Monmouth
Oceanport, Monmouth County
PI G000000032

Dear Mr. Colvin:

The New Jersey Department of Environmental Protection (NJDEP) has completed review of the referenced report, received September 29, 2016, prepared by Parsons to support the Remedial Investigation (RI), Feasibility Study (FS), and Decision Documents project at Fort Monmouth. An annual ground water sampling event was conducted at twelve (12) FTMM sites between September 30, 2015 and December 15, 2015. Sampling methodologies used included low-flow purging and sampling (LFPS) and passive diffusion bag samplers (PDBS). Comments on each FTMM site are as follows:

FTMM-02 Landfill

Historic sampling results at FTMM-02 have exhibited exceedances of the Ground Water Quality Standard (GWQS) for VOCs. Results from the 2015 annual sampling event exceeded the GWQS for MTBE and TBA in M2MW22. The report recommends biennial sampling of M2MW03, M2MW10 and M2MW22 as part of the biennial sampling requirements for the existing CEA for this site. The exiting CEA will also be revised to include TBA and MTBE. The recommendation is acceptable. At any point where a decision is made to terminate ground water sampling at this parcel, confirmatory sampling using low-flow methodology is required.

FTMM-05 Landfill

Historic sampling results at FTMM-05 have exhibited exceedances of the GWQS for PCE, TCE and vinyl chloride. Results from the 2015 annual sampling event exceeded GWQS for PCE in wells M5MW11, M5MW16, M5MW20 and M5MW23. The report recommends the

establishment of a CEA, with biennial ground water sampling of wells M5MW11, M5MW16, M5MW20 and M5MW23 for VOCs as the "preferred remedy". Although an essential component of certain ground water remedies, a CEA is an institutional control rather than a remedy. A remedial action proposal, e.g. Monitored Natural Attenuation (MNA), in accordance with the applicable requirements of N.J.A.C. 7:26E-5.1, must be submitted to address the ground water contaminants. At such time as the formal proposal for a CEA is to be submitted, the proposal must be accompanied by a CEA/WRA Fact Sheet Form; the form and form instructions may be obtained from the Site Remediation website at www.nj.gov/dep/srp/srra/forms/. Submittal of a draft CEA/WRA Fact Sheet Form is recommended to allow for DEP confirmation of the CEA components and boundaries.

FTMM-08 Landfill

Historic sampling results at FTMM-08 exhibited exceedances of the GWQS for pesticides, benzene, PCE and lead. Results from the 2015 annual sampling event exceeded the GWQS for PCE, lead and pesticides. The 2016 RIR for FTMM-08, however, indicated manganese is also a contaminant of concern which requires monitoring. The submittal recommends the establishment of a CEA, with biennial ground water sampling for the contaminants of concern from selected wells. As above, although an essential component of certain ground water remedies, a CEA is an institutional control rather than a remedy. A remedial action proposal, e.g. Monitored Natural Attenuation (MNA), in accordance with the applicable requirements of N.J.A.C. 7:26E-5.1, must be submitted to address the ground water contaminants. At such time as the formal proposal for a CEA is to be submitted, the proposal must be accompanied by a CEA/WRA Fact Sheet Form; the form and form instructions may be obtained from the Site Remediation website at www.nj.gov/dep/srp/srra/forms/. Submittal of a draft CEA/WRA Fact Sheet Form is recommended to allow for DEP confirmation of the CEA components and boundaries.

FTMM-18 Landfill

Historic sampling results at FTMM-18 exhibited exceedances of the GWQS for benzene and 1,2-DCA. Results from the annual 2015 sampling event exceed the GWQS for benzene in well 296MW06. In the October 2015 RIR for FTMM-18, it was indicated that manganese is also a contaminant of concern, which requires monitoring. The report recommends the establishment of a CEA as the preferred remedy, with biennial ground water sampling for the contaminants of concern from selected wells. As above, although an essential component of certain ground water remedies, a CEA is an institutional control rather than a remedy. A remedial action proposal, e.g. Monitored Natural Attenuation (MNA), in accordance with the applicable requirements of N.J.A.C. 7:26E-5.1 and guidance documents, must be submitted to address the ground water contaminants. At such time as the formal proposal for a CEA is to be submitted, the proposal must be accompanied by a CEA/WRA Fact Sheet Form; the form and form instructions may be obtained from the Site Remediation website at www.nj.gov/dep/srp/srra/forms/. Submittal of a draft CEA/WRA Fact Sheet Form is recommended to allow for DEP confirmation of the CEA components and boundaries.

FTMM-22 - Former Wastewater Treatment Lime Pit

Historic sampling results at FTMM-22 exhibited exceedances of the GWQS for TCE and vinyl chloride. Results from the annual 2015 sampling event also exceeded the GWQS for TCE and vinyl chloride. Long-term ground water monitoring has been suspended while the remedial investigation/feasibility study (RI/FS) is being conducted. Upon completion of the RI/FS, a revised monitoring program will be proposed. The recommendation is acceptable.

FTMM-53 - Former Gas Station at Building 699

Historic sampling results at FTMM-53 exhibited exceedances of the GWQS for benzene, PCE, TCE, TBA, VOC TICs and lead. Results from the 2015 annual sampling event exceeded the GWQS for benzene, PCE, 1,2,4-trimethylbenzene, and VOC TICs. Long-term ground water monitoring has been suspended while the RI/FS is being conducted. Upon completion of the RI/FS, a revised monitoring program will be proposed. The recommendation is acceptable.

FTMM-56 – Building 80 Petroleum Release

Historic sampling results at FTMM-56 exhibited exceedances of the GWQS for pesticides and metals. Recently, one additional round of sampling from two wells was required; results from the 2015 annual sampling event found a single exceedance of the GWQS, of arsenic, however, the arsenic concentration is determined to be representative of background conditions, and no further action for ground water is necessary.

FTMM-57 - Building 108 UST Gasoline Release

Historic sampling results at FTMM-57 exhibited an exceedance of the GWQS for lead. Results from the 2015 annual sampling event were below the GWQS for lead; no further action for ground water is acceptable.

FTMM-58 - Building 2567 UST Gasoline

Historic sampling results at FTMM-58 exhibited exceedances of the GWQS for TBA. Results from the 2015 annual sampling event continue to exceed the GWQS for TBA. The submittal recommends continued sampling of well 2567MW01 and the addition of downgradient well 2567MW05 for TBA. One additional round of sampling is recommended for monitoring of 2567MW03 for TBA to confirm compliance for same. The recommendations are acceptable.

Evaluations regarding potential benzene exceedances relative to FTMM-58 continue under separate investigative efforts.

FTMM-64 - Building 812 UST Gasoline

Historic sampling results at FTMM-64 exhibited exceedances of the GWQS for benzene, vinyl chloride and metals. Although results from the 2015 annual sampling event were below the GWQS for contaminants of concern, due to previous analytical results, the submittal recommends continued annual sampling of well 812MWS04 for VOCs. The recommendation is acceptable. If a decision is made to terminate ground water sampling at FTMM-64, confirmatory sampling using the low-flow methodology will be required.

FTMM-66 - Building 886 Former AST

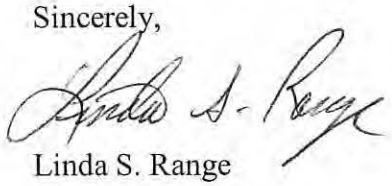
Historic sampling results from wells at FTMM-66 exhibited exceedances of the GWQS for SVOC TICs; results from the 2015 annual sampling event did not exceed the GWQS for SVOC TICs. The submittal recommends the ground water sampling at FTMM-66 be discontinued. The recommendation is acceptable; no further action for ground water is necessary.

FTMM-68 - Building 700 Former Dry Cleaners

Historic sampling results have shown exceedances of the GWQS for PCE, TCE, cis-1,2-DCE and vinyl chloride in ground water. Results from the 2015 annual sampling event confirmed these chlorinated VOCs continue to exceed GSQS in ground water. Long-term ground water monitoring has been suspended until such time as the RI/FS is completed. Upon completion of the RI/FS, a revised monitoring program will be proposed. The recommendation is acceptable.

Please contact this office if you have any questions.

Sincerely,



Linda S. Range

C: James Moore, USACE
Cris Grill, Parsons
Joe Pearson, Calibre
Rick Harrison, FMERA
Joe Fallon, FMERA
Daryl Clark, BGWPA

State of New Jersey

CHRIS CHRISTIE
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BOB MARTIN
Commissioner

October 13, 2015

John Occhipinti
BRAC Environmental Coordinator
OACSIM – U.S. Army Fort Monmouth
PO Box 148
Oceanport, NJ 07757

Re: *No Further Action Request*
Site Investigation Report Addendum for the ECP Parcel 83 Underground Storage Tanks
Fort Monmouth
Oceanport, Monmouth County
PI G000000032

Dear Mr. Occhipinti:

The New Jersey Department of Environmental Protection (Department) has completed review of the referenced report, received August 4, 2015, prepared by Department of the Army Office of Assistant Chief of Staff for Installation Management to provide documentation of the location and status of all USTs identified within the parcel. The NJDEP comments regarding various constituents unrelated to the USTs previously noted in parcel soils are not addressed in this submittal.

Page 2 of 4 of the submittal indicates certain USTs specifically mentioned in previous NJDEP comments are not included in this submittal as there are no USTs associated with the particular buildings, specifically Buildings 66, 281 or 479. In reviewing this submittal, the UST referenced as near Building 281 appears to have been addressed via remedial activities at UST 108-7; see below for comment regarding same. USTs at (former) Buildings 66 and 479 (and 478) are shown in the 1956 Fuel Storage map, Appendix O, of the '07 ECP, as well as indicated as "high potential UHOTs" in Figure 2 of the *July 2014 UHOT Investigation Report.* Unless all tanks, former and/or current, have been evaluated in accordance with the applicable regulations and guidance documents, the NJDEP cannot comment as to the potential absence or presence of a petroleum discharge associated with those tanks.

As indicated in the submittal, numerous underground storage tanks (USTs) have previously received a designation of No Further Action (NFA) required. Based upon a review of the referenced submittal, it is also agreed NFA is necessary for the following USTs:

- UST 49-76 & UST-49-77; #01-05-24-1004-1; each 5000 g gasoline (Attachment E)
- UST 63B aka UST 63-2; 1000 g #2 fuel (Attachment F)
- UST 108A aka 108-7; 1000 g #2 fuel (Attachment I)
- UST 116B aka UST 116-9; #97-04-10-1409-35; 1000 g #2 fuel; NFAed 10/23/00; ECP Parcel 85; additional sampling performed in May 2010 indicates NFA remains appropriate (Attachment J)
- UST 117C aka UST 117-72; #84-04-28-1944-21; 1000 g #2 fuel; ECP Parcel 86 (Attachment K)
- USTs 161 – Parcel 87 (Attachment L)
    - UST 161-68; 550 g waste oil
    - UST 161-14; 1000 g #2 fuel; #93-03-12-2158-30
- UST 167-18; 1000 g #2 diesel (Attachment M)
- USTs 273 aka 009001-65,66 & 67 (Attachment N)
    - UST 273-65; 6000 g diesel
    - UST 273-66; 10,000 gasoline
    - UST 273-67; 10,000 g gasoline
    - Note – the NFA is applicable to the USTs only, not the dispenser/s, which were reported as used with the AST fuel storage system which replaced USTs 273 until subsequent AST closure in 2011
- UST 483-55; #97-03-19-1359-16; previously NFAed 10/23/00; additional sampling performed in May 2010 indicates NFA remains appropriate (Attachment P)

UST 80 aka 80-6 aka FTMM-56 - Parcel 84 (Attachment G)
UST 80-6 was a #2 fuel tank which was granted an NFA by the Department on August 29, 2000. Ground water contamination at FTMM-56 unrelated to #2 fuel was monitored on a quarterly basis for many years. Submittal of analytical results from the additional round of ground water sampling as per the DEP's July 3, 2014 comment letter are pending.

USTs 108-60 through 64 aka FTMM-57 – Parcel 90
Attachment H references five USTs which were removed in April of 1993, and lists just over a page with descriptive bullets of documents reported to include remedial activities relative to these USTs, concluding that reported results support site characterization work is complete. The submittal, however, includes no results; comments regarding adequacy of characterization and recommendations as to additional action are therefore not possible at this time.

UST 482-54 – Parcel 93
As regarding UST 482-54 (#94-08-11-1345-43), which was NFAed in January of 2003, Attachment O appears to indicate TPH contaminated soils remain at levels of 14,100 ppm and 29,400 ppm. As indicated in the email of October 9, 2015, clarification is requested, as a designation of NFA is not appropriate for contamination at this level.

Please contact this office if you have any questions.

Sincerely,

Linda S. Range

Linda S. Range

C: Joe Pearson, Calibre
Rick Harrison, FMERA
Joe Fallon, FMERA
James Moore, USACE
Frank Barricelli, RAB

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Case Management
401 East State Street
P.O. Box 420/Mail Code 401-05F
Trenton, NJ 08625-0028
Phone #: 609-633-1455
Fax #: 609-633-1439

BOB MARTIN
Commissioner

July 3, 2014

Wanda Green
BRAC Environmental Coordinator
OACSIM – U.S. Army Fort Monmouth
PO Box 148
Oceanport, NJ 07757

Re: Final Baseline Groundwater Sampling Report (August 2013)
Remedial Investigation/Feasibility Study/Decision Documents
Fort Monmouth
Oceanport, Monmouth County
PI G000000032

Dear Ms. Green:

The New Jersey Department of Environmental Protection (Department) has completed review of the referenced report, dated March 2014, received on April 7, 2014. The report was prepared by Parsons Government Services Inc. (Parsons), in support of the Remedial Investigation (RI), Feasibility Study (FS), and Decision Documents project at Fort Monmouth.

A baseline ground water sampling event was conducted at 21 "sites" at the Fort Monmouth property in August 2013. The purpose of the sampling event was to re-establish baseline conditions following suspension of ground water sampling in late 2011, as well as to evaluate Fort Monmouth's long-term ground water sampling program, and the current analytical conditions of the ground water at each site. Sampling methodologies used included low-flow and passive diffusion bag samplers (PDBS). At four sites (FTMM-14, 18, 59, 68), only PDBS sampling was conducted. At three sites (FTMM-05, 22, 58) both low-flow and PDBS samples were obtained for comparison purposes. Fourteen (14) sites were only sampled using low-flow. The report states that PDBS concentrations were consistently biased somewhat low compared to the low-flow concentrations. The report concludes, however, that the PDBS results were still similar to the low-flow results and are considered representative of ground water conditions at the sites. Based on this conclusion, the report states that for future ground water sampling, PDBS will be used for all sites where volatile organic compounds (VOCs) are the sole contaminants of concern. Comments are presented below.

Section 3.1; Table 6; Appendices & associated Tables - *The "background concentrations" submitted in the 1995 Weston report were not accepted by the Department as representative of background conditions for Fort Monmouth. The study was not performed in accordance with Departmental protocol and is not a consideration in our evaluations/determinations. As indicated in Section 3.1, background concentrations are evaluated on a site by site basis.*

FTMM-02 Landfill

Historic sampling at this parcel indicated levels of VOCs above the Ground Water Quality Standard (GWQS); metals were previously determined to be reflective of naturally occurring conditions. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for VOCs. The report recommends VOC sampling of wells M2MW03, M2MW11, M2MW21, M2MW22 and M2MW24 for two additional rounds using PDBS. Well M2MW10 will be monitored as a downgradient sentinel well. Although the proposal is acceptable, for wells in which the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. At any point where a decision is made to terminate ground water sampling at this site, confirmatory sampling using low-flow due to PDBS biasing low as compared to low-flow results at the Fort Monmouth site will be required.

FTMM-03 Landfill

Historic sampling at this parcel revealed GWQS exceedances of vinyl chloride and metals. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for vinyl chloride in well 3MW07. Well 3MW02 was not sampled due to low water column and silty conditions, however, Table 4 of Appendix B recommends sampling of 3MW02 for VOCs and metals. The report attributes the presence of vinyl chloride to leaching of PVC piping from well 3MW07. A temporary well point investigation was conducted in 2009 to delineate the vinyl chloride, the results were non-detect, and abandonment of 3MW07 is recommended. The recommendations are acceptable. However, a figure presenting the locations and sampling results from the 2009 temporary well point investigation must be provided to the Department.

FTMM-04 Landfill

Historic sampling at this parcel revealed GWQS exceedances of various metals. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for metals. The metals are attributed to background conditions, and cessation of ground water sampling is recommended. The recommendation is acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-05 Landfill

Historic sampling at this parcel revealed GWQS exceedances of PCE, TCE and vinyl chloride, which the August 2013 sampling, using low-flow and PDBS, confirmed. The report recommends annual VOC sampling of wells M5MW11, M5MW16, M5MW20 and M5MW23 using PDBS. The Department finds the proposal to be acceptable. At any point where a decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS results at this parcel biased low compared to the low-flow results.

FTMM-08 Landfill

Historic sampling at this parcel revealed GWQS exceedances of pesticides, benzene, PCE and lead. The August 2013 sampling of wells using low-flow confirmed the exceedance of the GWQS for PCE and lead. The well with historic pesticide exceedances (697MW01) could not be located and was not sampled. The report recommends annual ground water sampling of well M8MW11 for VOCs and lead, M8MW12, 15, 16 and 24 for VOCs and M8MW17 and 21 for lead only. Monitoring well 697MW01 will be located and sampled for pesticides, lead and VOCs. The recommendation is acceptable.

FTMM-12 Landfill

Historic sampling at this parcel revealed GWQS exceedances of various metals, including arsenic and lead. Historic exceedances of metals except for lead are attributed to background quality. The August 2013 sampling was conducted for lead analysis only. Lead was not detected. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-14 Landfill

Historic sampling at this parcel revealed no GWQS exceedances of VOCs. The August 2013 sampling of wells using PDBS confirmed that there was no exceedance of the GWQS. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data. The Department also notes that on Table 1, well M14MW19 is listed as having 10 feet of total screen length. However, the table also lists the saturated screen length as 13.35 feet. This discrepancy should be clarified.

FTMM-18 Landfill

Historic sampling at this parcel revealed GWQS exceedances of benzene and 1,2-DCA. The August 2013 sampling results of wells using PDBS showed the exceedance of the GWQS for 1,2-DCA in well M18MW22. Well M18MW23 could not be located and was not sampled. The report recommends annual ground water sampling using PDBS for M18MW22 and M18MW23 if it can be located. Every reasonable effort, such as reviewing the NJ State Plane Coordinates of the well, must be made to locate M18MW23. The use of M18MW22 as the sole monitoring well at this parcel will not be acceptable due to the vast difference in historical concentrations between M18MW22 and M18MW23. Historic 2011 benzene concentrations for M18MW23 were 775 ppb and 664 ppb while 2011 concentrations for M18MW22 were 1.81 ppb and 1.65 ppb. The Department cannot approve the use of PDBS sampling only for this parcel. Once M18MW23 is located, the Department can approve the use of both PDBS and low-flow sampling for comparison purposes.

FTMM-22 Former Wastewater Treatment Lime Pit

Historic sampling at this parcel revealed GWQS exceedances of TCE. The August 2013 sampling of wells using low-flow and PDBS confirmed the continued exceedance of the GWQS for TCE in ground water. The report recommends quarterly VOC sampling of wells CW1MW27, CW1MW29, CW1MW31 and CW1MW281 using PDBS. The Department finds the proposal to be acceptable. At any point where a decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS results biasing low compared to low-flow results at the Fort Monmouth site.

FTMM-25 Landfill

Historic sampling at this parcel revealed GWQS exceedances of various metals. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for metals. The metals are attributed to background conditions. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-53 Building 699

Historic sampling at this parcel revealed GWQS exceedances of benzene, PCE, TCE, TBA, VOC TICs and lead. The August 2013 sampling of wells using low-flow showed the exceedance of the GWQS for benzene, xylenes, PCE, 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene and VOC TICs. The report recommends quarterly VOC sampling of wells 699MW01, 699MW04, 699MW06, 699MW09, 699MW16, 699RW03, 699RW05 and 699RW11 using PDBS. The Department finds the proposal to be acceptable. For wells in which the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. At any point where a

decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-54 Building 296

Historic sampling at this parcel revealed GWQS exceedances of benzene, lead and arsenic. The metals are attributed to background conditions. The August 2013 sampling of wells using low-flow showed an exceedance of the GWQS for benzene. The report recommends annual VOC sampling of wells 269MW04 and 296MW06 using PDBS. The Department finds the proposal to be acceptable. For wells in which the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. At any point where a decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-55 Building 290

Historic sampling at this parcel revealed GWQS exceedances of arsenic and lead. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for lead. The metals are attributed to background conditions. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-56 Building 80

Historic sampling at this parcel revealed GWQS exceedances of chlordane, arsenic, lead and cadmium. The August 2013 sampling of wells was conducted for lead only using low-flow. There were no exceedances of lead. The report recommends one additional sampling round of well 80MW02 for chlordane and 80MW05 for lead. The Department finds the recommendation for well 80MW02 to be acceptable. The Department disagrees with the recommendation to sample well 80MW05 for lead only. The last low-flow sampling event in August 2011 had lead, arsenic and cadmium exceeding both the GWQS and background concentrations. Well 80MW05 shall be sampled during the next round for TAL metals.

FTMM-57 Building 108

Historic sampling at this parcel revealed GWQS exceedances of lead. In the August 2013 sampling event, there were no exceedances of lead in ground water. The report recommends two additional sampling rounds of well 108MW04 for lead. The Department finds the recommendation acceptable.

FTMM-58 Building 2567

Historic sampling at this parcel revealed GWQS exceedances of TBA in wells 2567MW01 and 2567MW03. The August 2013 sampling results using low-flow and PDBS were below the GWQS for TBA. The report recommends two annual sampling events for TBA analyses of wells 2567MW01 and 2567MW03 using low-flow. The Department finds the proposal to be acceptable.

FTMM-59 Building 1122

Historic sampling at this parcel revealed no GWQS exceedances for VOCs. The August 2013 sampling results of wells using PDBS showed no exceedance of VOCs. The text of the report recommends VOC sampling of well 1122MW07 for one additional sampling round to confirm the 2013 results because August 2013 was the first time this well was sampled. The Department finds the proposal to be acceptable. The Department also notes that there is a discrepancy between the recommendation in the text and the recommendation in Table 7. Table 7 recommends that sampling at this parcel be discontinued. Table 7 shall be amended to indicate well 1122MW07 will be sampled for VOCs using PDBS methodology.

FTMM-61 Building 283

Historic sampling at this parcel revealed GWQS exceedances of metals, benzene and VOC TICs in 283MW02. The August 2013 sampling of wells using low-flow for VOCs and lead showed no exceedances. The report recommends VOC sampling of well 283MW02 for one additional sampling round using PDBS methodology to confirm the 2013 results. The Department finds the proposal to be conditionally acceptable. If the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. If a decision is made to terminate ground water sampling at this parcel based on PDBS results, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-64 Building 812

Historic sampling at this parcel revealed GWQS exceedances of benzene, vinyl chloride and metals. The August 2013 sampling of wells using low-flow for VOCs and lead showed no exceedances. The report recommends VOC sampling of well 812MW04 for one additional sampling round using PDBS methodology to confirm the 2013 results (however Section 5.0 recommends sampling be continued on an annual basis). The Department finds the proposal to be conditionally acceptable. If the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. If a decision is made to terminate ground water sampling at this

parcel based on PDBS results, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-66 Building 886

Historic sampling at this parcel revealed GWQS exceedances of benzene, VOC TICs, arsenic and lead. The August 2013 sampling results from wells using low-flow showed the exceedance of the GWQS for SVOC TICs. The report recommends that sampling at this parcel be discontinued. The Department finds the recommendation unacceptable. Total SVOC TICs exceeded the GWQS of 500 ppb in wells 886RW01 and 886RW06. Ground water monitoring of wells 886RW01, 886RW06 and 886RW08 shall continue for SVOC+TICs using low-flow methodology.

FTMM-68 Building 700

There are no historic sampling results for this parcel. The August 2013 sampling results of wells using PDBS showed the exceedance of the GWQS for PCE, TCE, cis-1,2-DCE and vinyl chloride in wells 565MW01 and 565MW01D. The report recommends quarterly ground water sampling for VOC+TICs using PDBS for these 2 wells. The Department agrees with the recommendation of quarterly sampling, however, has concerns regarding the use of PDBS for long-term monitoring at this parcel. Unlike the other Fort Monmouth parcels, there are no historical ground water sampling data for comparison with the PDBS results. The DEP's Field Sampling Procedures Manual states that "the intended application of Passive Diffusion Bag Samplers (PDBS) is for long-term monitoring of volatile organic compounds (VOCs) in ground water at well-characterized sites." The Department would find long-term sampling of the wells using PDBS acceptable if low-flow sampling is conducted concurrently once or twice for comparison.

Finally, each of the above comments speak only to the ground water findings and recommendations included in the referenced submittal, rather than to the ground water at the entire site.

Please contact this office if you have any questions.

Sincerely,

Linda S. Range

Linda S. Range

C: Joe Pearson, Calibre
Rick Harrison, FMERA
Julie Carver, Matrix
Frank Barricelli
Daryl Clark, BGWPA

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PUBLICLY FUNDED REMEDIATION ELEMENT
P.O. BOX 413
TRENTON, NJ 08625-0413

JON S. CORZINE
Governor

LISA P. JACKSON
Commissioner

June 24, 2008

Mr. Joseph Fallon, CHMM
Directorate of Public Works
ATTN: IMNE-MON-PWE
167 Riverside Ave.
Fort Monmouth, NJ 07703

RE: Remedial Investigation Report and CEA Information
Site 108 – Main Post
Fort Monmouth, NJ

Dear Mr. Fallon:

The NJDEP Site Remediation Program (SRP) has completed its review of the report titled "Remedial Investigation Report, Site 108", dated August 13, 2004, by Versar Inc. We have also reviewed the Classification Exception Area (CEA) Information for Site 108 that is included in the report titled "Classification Exception Area Information for Various Sites", dated July 12, 2004 by Versar. Our comments are attached.

You or your staff may contact me at 609-633-0766 with any questions on the enclosed comments, or any other site remediation matters at Fort Monmouth.

Sincerely,

Larry Quinn, P.E., CHMM, Site Manager
Bureau of Investigation, Design and Construction

Attachment

NJDEP COMMENTS ON
RI REPORT and CEA INFORMATION for SITE 108
FORT MONMOUTH, NJ

RI Report

1. Arsenic in Soil. The Executive Summary and Section 5.3 state that arsenic was detected in 8 of 9 soil boring locations at concentrations greater than the RDCSCC and that the arsenic is likely attributable to the native soil characteristics or a non-point source distributed throughout the subsurface soils at Site 108. Historic fill should be cited as a likely reason for the arsenic found in soil samples. However, the arsenic levels do constitute a direct contact threat, so at a minimum the Army must propose institutional or engineering controls, and a deed notice. Paving would constitute an acceptable engineering control, but a deed notice would still be required.

2. Figures – General. All detailed site figures must show the former locations of the USTs, piping, and dispenser area. At least one Figure must show those items and the location of all soil borings, post-excavation soil samples, and monitoring wells.

3. Ground Water - General.

   a) The existing monitoring wells cannot adequately monitor potential ground water impacts at Site 108, and thus the remedial investigation of ground water isn't complete. Ground water samples must be collected from beneath the former UST #64, at the locations of borings S-5 and S-7 (where the IGWSCC for benzene was exceeded), and within 10 feet hydraulically downgradient of the former UST piping and dispenser area. NJDEP recommends the use of temporary well points initially. Ground water samples should be analyzed for VO+10 and BN+15.

   b) Based on comment a) above, NJDEP cannot concur with the conclusion that arsenic is the only ground water contaminant of concern at Site 108.

4. Section 3.2 (Sample Collection Activities): The report states that sampling and decontamination procedures were conducted in accordance with the December 1997 Fort Monmouth Standard Sampling Operating Procedure. All future sampling procedures and equipment decontamination must be conducted pursuant to the most recent version of the NJDEP Field Sampling Procedures Manual per the requirements of N.J.A.C. 7:26E-4.4(d).

NJDEP COMMENTS ON
RI REPORT and CEA INFORMATION for SITE 108
FORT MONMOUTH, NJ (continued)

5. Section 7.0. This section recommends no further action (NFA) for arsenic in ground water. The Department acknowledges the results of the fate and transport modeling for arsenic. However, an NFA determination is not acceptable. The Army needs to request approval for a natural ground water remediation remedy, together with the proposed Classification Exception Area (CEA), as detailed in 7:26E-6.3(d) and (e).

6. Ground Water Contour Maps: For future reference, the Contour Map Reporting Form found in Appendix G of the Technical Requirements must be completed and submitted for each ground water contour map included in reports.

CEA Information Report

1. Since the NJDEP has determined that a RI of ground water hasn't been completed, the CEA proposal can't be evaluated now. A revised CEA proposal should be submitted after additional RI work is completed and submitted to NJDEP.

2. The current and projected use of ground water in the proposed CEA must be addressed in the revised CEA proposal.

Guenther, Douglas C MONMOUTH USAG

From: Greg Zalaskus [Greg.Zalaskus@dep.state.nj.us]
Sent: Friday, November 12, 2004 2:03 PM
To: Douglas.Guenther@mail1.monmouth.army.mil
Cc: John Prendergast; Ken Petrone; Joseph.Fallon@mail1.monmouth.army.mil
Subject: Re: GROUNDWATER ANALYSES REDUCTION

Doug: The Department has completed a review of your November 10, 04 letter request to reduce the groundwater sampling analysis for the seven site listed in the November 10, 04 letter. The Department hereby approves your request as submitted. Additionally, the updated "Restoration Program Site Report Status Table" you e-mailed is most appreciated. If you have any questions please contact me.

Sincerely, greg

Gregory Zalaskus, Case Manager
NJDEP/DRMR/BCM
Greg.Zalaskus@dep.state.nj.us
609-984-2065 (direct)
609-633-1439 (fax)
609-633-1455 (main)

>>> "Guenther, Douglas C MONMOUTH USAG"
<Douglas.Guenther@mail1.monmouth.army.mil> 11/10/04 01:28PM >>> Greg,

As discussed, attached is the letter identifying analyses reduction at restoration sites and a summary of submitted site reports pending NJDEP review. A hard copy is on the way. Any questions let me know.

Sincerely,

Douglas C. Guenther

Environmental Protection Specialist

U.S. Army, Directorate of Public Works

Attn: SELFM-PW-EV, Bldg. 173

Fort Monmouth, NJ 07703

Phone: 732-532-0986; Fax: 732-532-6263; DSN: 992-0986

E-mail: Douglas.Guenther@Mail1.Monmouth.Army.mil

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY GARRISON FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5101

REPLY TO
ATTENTION OF

Directorate of Public Works

November 10, 2004

ATTN: Mr. Greg Zalaskus
State of New Jersey
Department of Environmental Protection
Division of Responsible Party Site Remediation
Bureau of Case Management
401 East State Street, 5th Fl., West Wing
PO Box 028
Trenton, New Jersey 08625-0028

RE: **REDUCTION OF GROUNDWATER SAMPLING ANALYSES–MAIN POST&CHARLES WOODS**
Restoration Sites throughout Fort Monmouth, New Jersey

Dear Mr. Zalaskus:

As discussed during our telephone conversation on November 9, 2004, this letter summarizes groundwater sampling revisions at seven active restoration sites on Fort Monmouth property. The Directorate of Public Works (DPW) and TECOM-Vinnell Services (TVS) personnel currently conduct quarterly groundwater monitoring at each of these sites.

The DPW has submitted Remedial Investigation Reports (RIRs), prepared by VERSAR, Inc., requesting no further action (NFA) at four sites including Landfill M-12 (FTMM-12), Landfill M-18/290/296 (FTMM-18/55/54), Landfill M-3 (FTMM-03), and Site 108 (FTMM-57). Two RIRs requesting NFA are pending submittal including Site 80/166 (FTMM-56) and Landfill CW3A (FTMM-25), and one Remedial Action Report for Site 886 (FTMM-66) recommending natural attenuation is also pending submittal.

Initial groundwater sampling at each site consisted of a comprehensive analytical program including volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); pesticides/polychlorinated biphenyls (PCBs); and TAL metals. Analytical results were then examined to establish potential contaminants of concern (COCs). Each site report presents the identified potential COCs based on the comparison of groundwater analytical results to the higher of the Practical Quantitation Limits (PQLs) and the NJDEP Groundwater Quality Criteria (GWQC) for Class II-A aquifers (NJAC 7:9-6, Table 1). Further evaluation of the potential COCs was then performed to assess contaminant occurrence/magnitude, transport (modeling), and risk to receptors, the environment and human health to determine if remedial action was warranted.

Based on report conclusions, Fort Monmouth DPW proposes the following revisions to the current groundwater sampling program at these sites to maintain a compliant and cost effective program. As discussed, proposed changes will be implemented immediately unless otherwise directed by the NJDEP.

The following table summarizes the revised sampling program at these sites:

Submitted No Further Action Requests

Site	Was Analyzed:	Revised Analysis:	Potential Contaminants of Concern
Landfill M-12 (FTMM-12)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for TAL Metals.	Arsenic and lead
Landfill M-18/290/296 (FTMM-18/55/54)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for VOCs and TAL Metals.	Benzene, arsenic, cadmium, chromium and lead
Landfill M-3 (FTMM-03)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for VOCs.	Chlorobenzene
Site 108 (FTMM-57)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for TAL Metals.	Arsenic
No Further Action Requests - Submittal Pending			
Site 80/166 (FTMM-56)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for Pesticides and TAL Metals.	a-chlordane, g-chlordane, arsenic and lead
Landfill CW3A (FTMM-25)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for TAL Metals.	Non-Native Metals
Natural Attenuation Request - Submittal Pending			
Site 886 (FTMM-66)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for VOCs and SVOCs	Benzene and 2-butanone

Groundwater sampling and monitoring will continue at these sites as indicated above, in accordance with NJDEP *Technical Requirements for Site Remediation* (July 1999), NJAC 7:26E, et seq. and *Fort Monmouth Standard Sampling Operating Procedure* (1997), pending NJDEP review of these site documents. I have attached an updated summary table of site reports previously submitted to NJDEP which are pending review.

If you should have any questions or comments, please contact me at (732) 532-0986.

Sincerely,

Douglas C. Guenther
Environmental Protection Specialist
Directorate of Public Works

Attachment: Restoration Program Report Status Table
cc: File

APPENDIX C
Historical Information

UNDERGROUND STORAGE TANK CLOSURE AND SITE INVESTIGATION REPORT BUILDING 108 NJDEPE FACILITY UST NO. 0090010 TMS NO. 60, 61, 62, 63 AND 64 TMS NO. C-91-2844 SPILL CASE NO. 93-1-12-1939-29

31 May 1994

W.O. No.: 03886-088-001

Prepared For:

UNITED STATES ARMY
DIRECTORATE OF PUBLIC WORKS
BUILDING 167
FORT MONMOUTH, NEW JERSEY 07703

Prepared by:

ROY F. WESTON, INC.
Raritan Plaza I - 4th Floor
Edison, New Jersey 08837

WESTON
MANAGERS DESIGNERS/CONSULTANTS

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EXECUTIVE SUMMARY

On 29 September 1992, 8 soil samples were collected from the areas surrounding Underground Storage Tanks (USTs) identified by Nos. 60 to 64. Soil samples were analyzed by U.S. Army Fort Monmouth Environmental Laboratory (FMEL) for total petroleum hydrocarbons (TPHC). These samples were collected as a preliminary screening for soil contamination prior to the removal of the USTs.

On 12 April 1993, the five USTs were closed at U.S. Army Fort Monmouth, in Fort Monmouth, New Jersey. UST Nos. 60 through 64 were located adjacent to Building 108 in the Main Post area of Fort Monmouth. UST Nos. 60 to 62 were single walled steel, 5,000-gallon capacity, unleaded gasoline tanks. UST No. 63 was a single walled steel, 5,000-gallon capacity, diesel fuel tank. UST No. 64 was a single walled steel, 5,000-gallon capacity, kerosene tank. UST Nos. 60 to 63 were located adjacent to each other. UST No. 64 was located southwest of UST No. 63. All Service Environmental, Inc. (ASE) performed the tank closure.

Soils surrounding the tanks were screened visually and with air monitoring instruments for evidence of contamination. The tanks were inspected following removal for cracks, corrosion and puncture holes for indications of historical leakage from the tank. UST Nos. 60 to 63 were found to be in good condition with no corrosion holes. However, several corrosion holes of approximately 1/16 of an inch diameter were noted in UST No. 64. Additionally, a sheen was noted on the groundwater within the excavation surrounding UST No. 64, indicating that a discharge may have occurred from the UST. A discharge was reported to the NJDEPE by the Directorate of Public Works (DPW) on 12 April 1993 (Case # 93-04-12-1939). Groundwater was encountered in the excavation at approximately three feet below surface (BGS).

Excavation of potentially contaminated material from the area surrounding the USTs was performed between 12 April and 3 May 1993. Soil screening samples were submitted to FMEL for TPHC Analysis. Approximately 221 cubic yards of material was excavated.

On 3 May 1993, 18 post-excavation soil samples were collected from the sidewalls directly above the groundwater and analyzed by 21st Century Laboratories for volatile organic compounds plus 15 tentatively identified compounds (VO+15), base neutral compounds plus 15 tentatively identified compounds (BN+15) and lead. Soil samples were analyzed by FMEL for TPHC. Benzene was detected in samples S-7 (4.0 mg/kg) and S-17 (2.5 mg/kg) in concentrations which exceeded the NJDEPE Impact to Ground Water Soil Cleanup Criteria (N.J.A.C. 7:26D, and revisions dated 3 February 1994). Methylene chloride was detected in samples S-5 (1.1B mg/kg), S-14 (2.3JB mg/kg) and S-17 (2.5 mg/kg) in concentrations which exceeded the NJDEPE Impact to Groundwater Soil Cleanup Criteria.

Methylene chloride was detected in the laboratory's quality assurance method blank. The presence of methylene chloride in the method blank indicates laboratory induced contamination of sample may have occurred and is not related to the operation of the UST system. All other samples contained either non-detectable concentrations of contaminants or concentrations of contaminants below the NJDEPE Impact to Ground Water Soil Cleanup Criteria.

On 13 June 1993, three monitoring wells were placed in the area surrounding UST Nos. 60 to 64. One monitoring well (MW-1) was placed upgradient from the USTs and the other two (MW-2 and MW-3) were placed downgradient from the USTs.

On 6 July 1993, one groundwater sample was collected from each monitoring well and analyzed by 21st Century Laboratories for VO+15, BN+15 and lead. Benzene and methylene chloride were detected in MW-3 (10 ug/L and 3J ug/L, respectively), Bis(2-ethylhexyl)phthalate in MW-1 (740B ug/L) and lead in MW-2 (1,030 ug/L) in concentrations which exceeded NJDEPE Class II-A Ground Water Quality Criteria. Bis(2-ethylhexyl)phthalate was detected in the laboratory's quality control method blank sample. The presence of this compound in the method blank sample indicates that the presence of this compound in groundwater sample is attributable to laboratory induced contamination and not to the operation of UST system.

The surrogate recoveries for Monitoring well MW-3 and MW-3 Duplicate were outside of the acceptable range. The results for these wells were considered unreliable and a second set was collected.

On 30 August 1993, one groundwater sample was collected from each monitoring well and analyzed by 21st Century Laboratories for VO+15, BN+15 and lead. Methylene chloride was detected in all samples in concentrations which exceeded NJDEPE Class II-A Ground Water Quality Criteria. All other samples contained either non-detectable concentrations of contaminants or concentrations of contaminants below NJDEPE Class II-A Ground Water Quality Criteria.

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SECTION 1.0

UNDERGROUND STORAGE TANK DECOMMISSIONING ACTIVITIES

1.1 OVERVIEW

On 12 April 1993, five underground storage tanks (USTs), UST Nos. 60 to 64, were closed by removal at Building 108 at U.S. Army Fort Monmouth, New Jersey. UST Nos. 60 to 62 were single walled steel, 5,000-gallon capacity, leaded gasoline tanks. UST. No. 63 was a single walled steel, 5,000-gallon capacity, diesel fuel tank. UST No. 64 was a single walled steel, 5,000-gallon capacity, kerosene tank. UST Nos. 60 to 63 were located adjacent to each other. UST No. 64 was located directly southwest of and within the same excavation as UST No. 63. This report presents the results of the DPW's implementation of the UST Decommissioning /Closure Plan submitted to the New Jersey Department of Environmental Protection and Energy - Division of Hazardous Waste Management (NJDEPE-DHWM) on 12 July 1991 and approved 20 February 1992 (Closure approval No. C-91-2844).

All activities associated with the decommissioning of UST Nos. 60 to 64 complied with all applicable Federal, State and Local laws and ordinances in effect at the date of decommissioning. These laws included but were not limited to: N.J.A.C. 7:14B-1 et seq., N.J.A.C. 5:23-1 et seq., N.J.A.C. 7:26E-1 et seq. and Occupational Safety and Health Administration (OSHA) 29 CFR 1910.146 & 29 CFR 1910.120. All permits including but not limited to the NJDEPE-approved Decommissioning/Closure Plan were posted onsite for inspection. All Service Environmental, Inc., the contractors that conducted the decommissioning activities, are currently registered and certified by the NJDEPE for performing UST closure activities.

The NJDEPE Closure Approval and correspondence with the NJDEPE have been included in Appendix A. The UST Site Assessment Summary Form for UST Nos. 60 to 64 have been included in Appendix B. The UST Site Assessment Summary Form has been signed ~~and sealed~~ CT by Mr. James Ott, Acting Director of DPW, U.S. Army Fort Monmouth.

This UST Closure and Site Investigation Report was prepared by Roy F. Weston Inc. (WESTON®), to assist the United State Army Directorate of Public Works (DPW) in complying with the NJDEPE-Bureau of Underground Storage Tanks (NJDEPE-BUST) regulations. The applicable NJDEPE-BUST regulations at the date of closure were the "Technical Requirements for Site Remediation-Proposed New Rules" (N.J.A.C 7:26E-1 et seq., dated May 1992).

Section 1 of this UST Closure and Site Investigation Report provides a summary of the tank decommissioning activities. Section 2 of this report describes the site investigation activities.

Conclusions and recommendations, including the results of the soil sampling investigation, are presented in Section 3 of this report.

1.2 SITE DESCRIPTION AND UST HISTORY

Building 108 is located off Riverside Avenue in the Main Post area of U.S. Army, Fort Monmouth. A facility location map is provided in Figure 1-1. Building 108 was used as the installation gas station and motor pool and is situated on level ground and adjacent to an asphalt parking area. The gasoline dispenser area was located approximately 70 feet south of the UST field. A pipe chase approximately 60 feet in length connected the dispenser area to the UST field. Figure 1-2 provides a site map of the former UST location and dispenser area.

In February and November of 1990, Tank No. 63 was tightness tested. Testing results indicated that the 5,000-gallon diesel tank was tight. Tightness testing results are attached in Appendix A.

On 12 July 1991, a UST Closure Plan Approval Application and Closure Plan were submitted to NJDEPE. Closure Approval No. TMS C-91-2844 was issued with an effective date of 20 February 1992. The UST Closure Plan Approval Application and Closure Approval are provided in Appendix A.

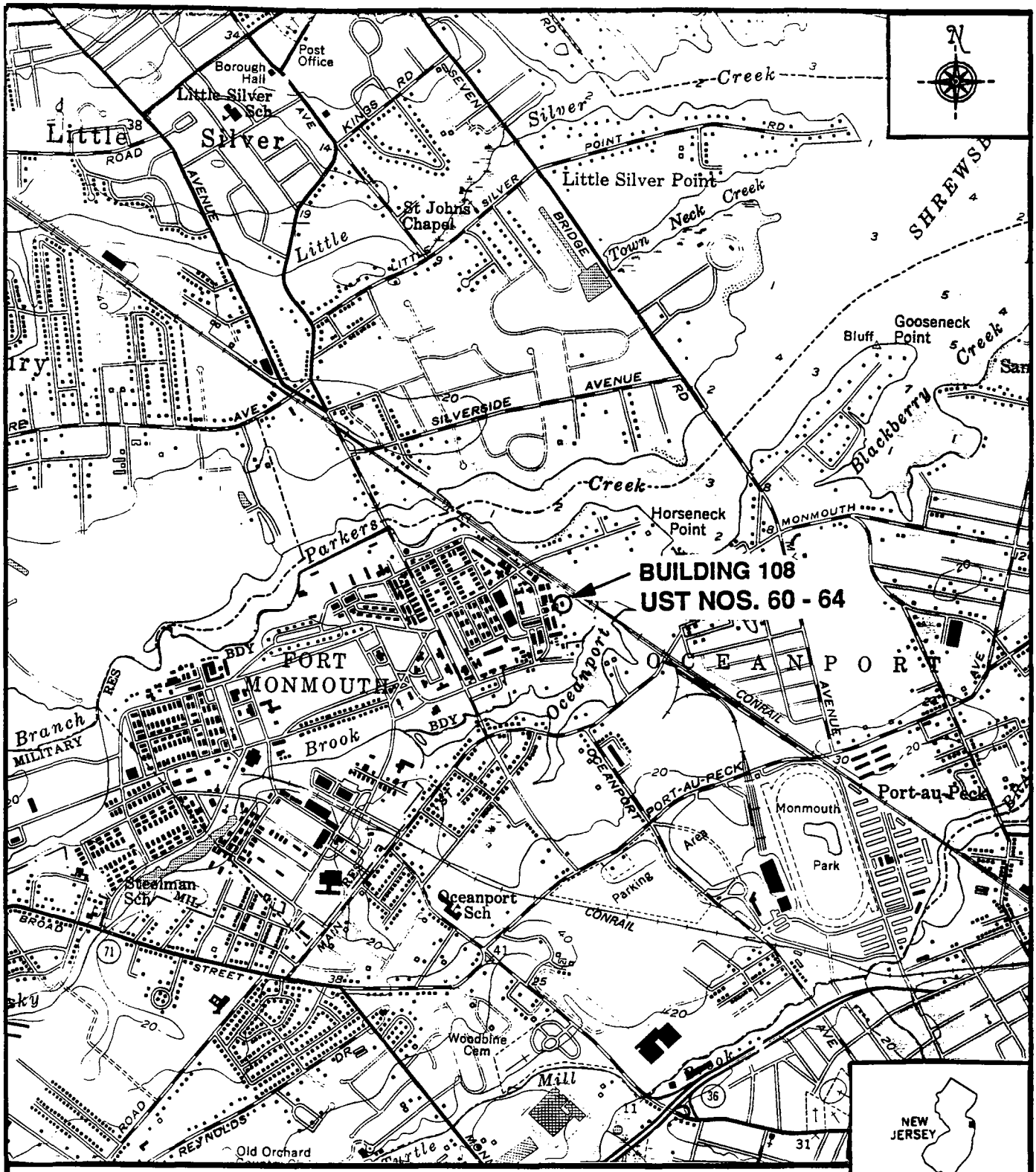
On 29 September 1992, 8 soil samples were collected from the areas surrounding UST Nos. 60 to 64. Soil samples were analyzed by FMEL for total petroleum hydrocarbons (TPHC). These samples were collected as a preliminary screening for soil contamination prior to the removal of the USTs.

Between 26 March and 7 April 1993, Tank fluids were pumped from the USTs for disposal. Tank closures followed with the USTs being removed on 12 April 1993. Tanks were disposed on the 19-20 April 1993. Excavation of potentially contaminated material from the area surrounding the USTs was performed between 12 April and 3 May 1993. Soil screening samples were submitted to FMEL for TPHC analysis. Approximately 221 cubic yards of potentially contaminated soil was excavated.

On 3 May 1993, 18 soil samples were taken from sidewalls and bottom of the UST excavation. Samples were submitted to 21st Century Laboratory for VO+15, BN+15 and lead analysis. TPHC analysis of soil sample was performed by FMEL.

1.3 GEOLOGICAL/HYDROGEOLOGICAL SETTING

The following is a description of the geological/hydrogeological setting of the area surrounding Building 108. Included is a description of the regional geology of the area surrounding Fort Monmouth as well as descriptions of the local geology and hydrogeology of the Main Post area.



REFERENCE: U.S.G.S. QUADRANGLE LONG BRANCH, NJ: PHOTOREVISED 1981
CONTOUR INTERVAL 20 FEET SCALE 1 INCH = 2000 FEET

UST LATITUDE: N 40 Deg. 19 Min. 10 Sec.
UST LONGITUDE: W 74 Deg. 01 Min. 41 Sec.

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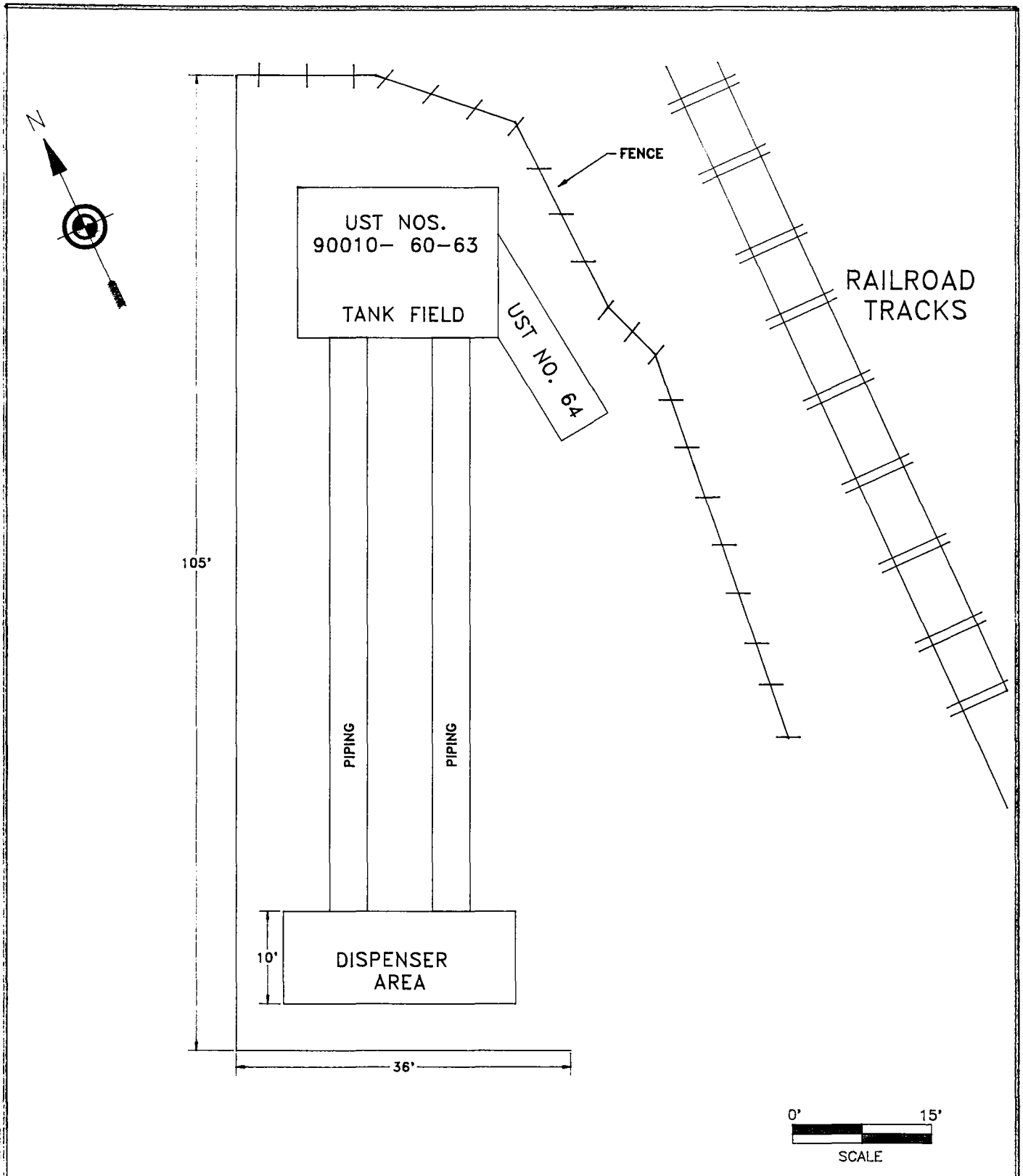
FIGURE 1-1
FACILITY LOCATION MAP
U.S. ARMY - DIRECTORATE OF PUBLIC WORKS
FORT MONMOUTH, NEW JERSEY



REVISION #: 1 DATE: 5/16/94 PLOT NAME: BLD-180
FILE NAME: BLD-108.DWG DRAWN BY: B. MAC

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: UNDERGROUND STORAGE TANK CLOSURE AND SITE INVESTIGATION REPORT BUILDING 108- UST NOS. 60-64
FORT MONMOUTH NEW JERSEY

CLIENT NAME: U.S. ARMY - FORT MONMOUTH DIRECTORATE OF PUBLIC WORKS

SITE MAP

DATE: 5/17/94

FIGURE #: 1-2

1.3.1 Geological Setting

Regional Geology

Monmouth County lies within the New Jersey Section of the Atlantic Coastal Plain physiographic province. The Main Post, Charles Wood, and the Evans areas are located in what may be referred to as the Outer Coastal Plain subprovince, or the Outer Lowlands.

In general, New Jersey, Coastal Plain formations consist of a seaward-dipping wedge of unconsolidated deposits of clay, silt, sand, and gravel. These formations typically strike northeast-southwest with a dip ranging from 10 to 60 feet per mile and were deposited on Precambrian and lower Paleozoic rocks (Zapecza, 1989). These sediments, predominantly derived from deltaic, shallow marine, and continental shelf environments, date from Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

The formations record several major transgressive/regressive cycles and contain units which are generally thicker to the southeast and reflect a deeper water environment. Over 20 regional geologic units are present within the sediments of the Coastal Plain. Regressive, upward-coarsening deposits are usually aquifers (e.g., Englishtown and Kirkwood Formations, and the Cohansey Sand) while the transgressive deposits act as confining units (e.g., the Merchantville, Marshalltown, and Navesink Formations). The individual thicknesses for these units vary greatly (i.e., from several feet to several hundred feet). The Coastal Plain deposits thicken to the southeast from the Fall Line to greater than 6,500 feet in Cape May County (Brown and Zapecza, 1990).

Local Geology

Based on the regional geologic map (Jablonski, 1968), the Cretaceous age Red Bank and Tinton Sands outcrop at the Main Post area. The Red Bank sand conformably overlies the Navesink Formation and dips to the southeast at 35 feet per mile. The upper member (Shrewsbury) of the Red Bank sand is a yellowish-gray to reddish-brown clayey, medium-to-course-grained sand that contains abundant rock fragments, minor mica and glauconite (Jablonski). The lower member (Sandy Hook) is a dark grey to black, medium-to-fine grained sand with abundant clay,mica, and glauconite.

The Tinton sand conformably overlies the Red Bank Sand and ranges from a clayey, medium-to-very coarse grained feldspathic quartz and glauconite sand to a glauconitic coarse sand. The color varies from dark yellowish-orange or light brown to moderate brown and from light olive to grayish olive. Glauconite may constitute 60 to 80 percent of the sand fraction in the upper part of the unit (Minard, 1969). The upper part of the Tinton is often highly oxidized and iron-oxide encrusted (Minard).

Over the last 80 years, the natural topography of Fort Monmouth has been altered by excavation and filling activities by the military. Topographic elevations for the Main Post area range from five feet above mean sea level (MSL) to 31 feet above MSL.

A subsurface Profile of the USTs located at Building 108 is provided in Figure 1-3.

1.3.2 Hydrogeological Setting

Hydrogeology

The water table aquifer at the Main Post area is identified as part of the "composite confining units", or minor aquifers. The minor aquifers include the Navesink formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation, and the basal clay of the Kirkwood Formation.

Based on records from wells drilled at the Main Post area, around water is typically encountered at depths of two to nine feet below ground surface (BGS). According to Jablonski, wells drilled in the Red Bank and Tinton Sands may produce from 2 to 25 gallons per minute (gpm). Some well owners have reported acidic water that requires treatment to remove iron.

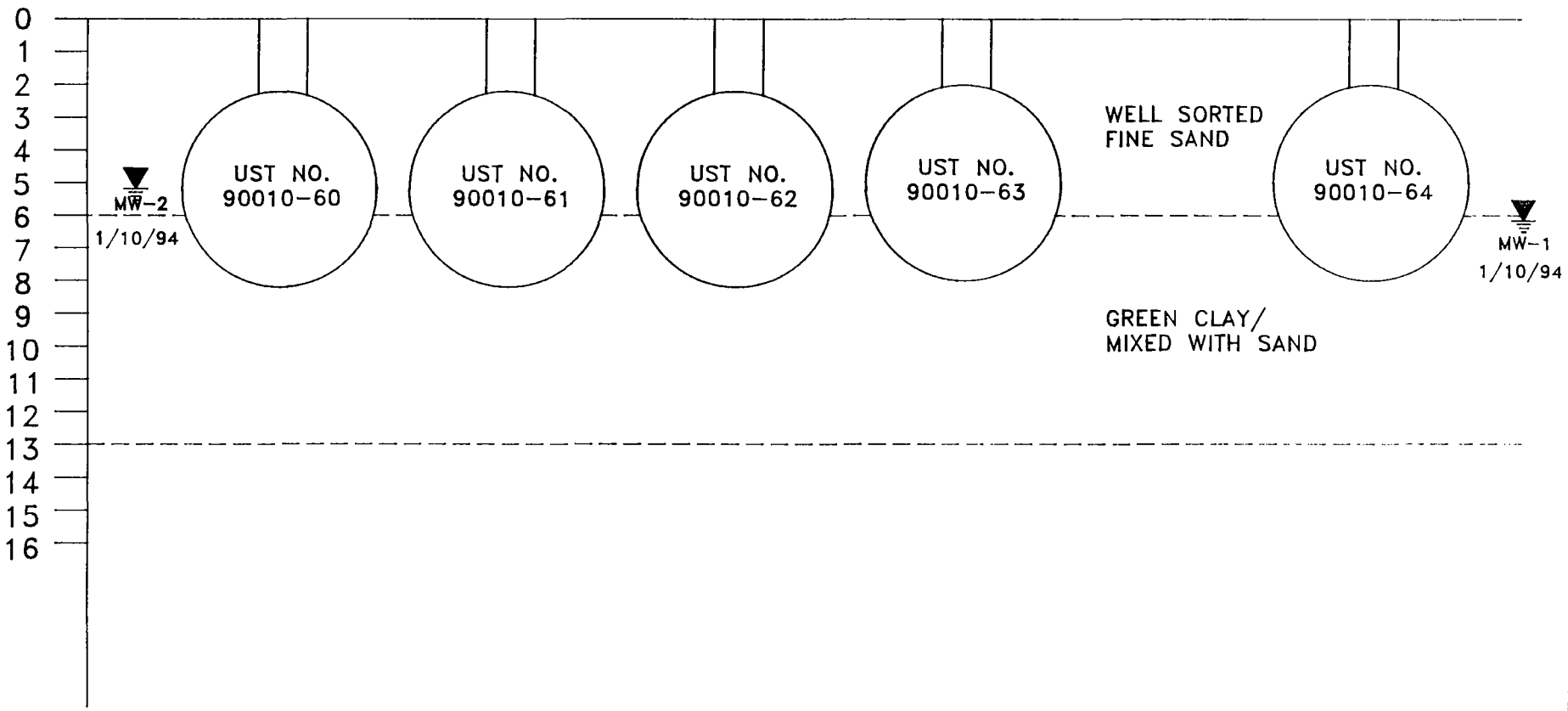
Shallow groundwater is locally influenced within the Main Post area by the following factors:

- tidal influence (based on proximity to the Atlantic Ocean, rivers and tributaries),
- topography,
- nature of the fill material within the Main Post area,
- presence of clay and silt lenses in the natural overburden deposits, and
- local groundwater recharge areas (i.e. stream, lakes).

Due to the fluvial nature of the overburden deposits (i.e. sand and clay lenses), shallow groundwater flow direction is best determined on a case-by-case basis. This is consistent with lithologies observed in borings installed within the Main Post area, which primarily consisted of fine-to-medium grained sands, with occasional lenses or laminations of silt and/or clay.

On June 13, 1993, three monitoring wells were placed in the area surrounding UST Nos. 60 to 64. One monitoring well (MW-1) was placed upgradient from the USTs and the other two (MW-2 and MW-3) were placed downgradient from the USTs. The monitoring well permit, monitoring well records, and Form B for each well are provided in Appendix C.

Building 108 is less than 1/2 mile southwest of Parkers Creek, the nearest water body, the groundwater flow in the area of Building 108 has been determined to be in a westerly direction. A table of water level elevations collected from the three monitoring wells located in the area of Building 108 is provided in Table 1-1. The Atlantic Ocean is located approximately 3.5 miles east of the site.



REVISION #: 0000 DATE: 5/16/94
FILE NAME: B108-XXX.DWG DRAWN BY: B. MAC

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
UNDERGROUND STORAGE TANK CLOSURE AND SITE INVESTIGATION REPORT
BUILDING 108 – UST NOS. 60–64
FORT MONMOUTH, NEW JERSEY

CLIENT NAME: U.S. ARMY – FORT MONMOUTH DIRECTORATE OF PUBLIC WORKS

SUBSURFACE PROFILE

DATE: 5/16/94

FIGURE #: 1–3

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TABLE 1-1

WATER LEVEL ELEVATIONS FOR MONITORING WELLS MW-1, MW-2 AND MW-3 COLLECTED ON 10 JANUARY 1994

Monitoring Well Permit Number	Time of Collection	Ground Surface Elevation (feet)	Depth to Water (feet)	Groundwater Surface Elevation (feet)
29-29739 (MW-1)	10:15 am	11.85	5.63	6.22
29-29740 (MW-2)	10:20 am	10.89	5.85	5.04
29-29741 (MW-3)	10:23 am	8.16	2.54	5.62

1.3.3 Offsite Groundwater Usage

In compliance with the NJDEP regulations, WESTON conducted a well search to identify all irrigation, monitoring, domestic, industrial and public supply wells within one half mile of U.S. Army Fort Monmouth. The file search produced records for 104 wells. The well search summary table includes the following information on surrounding wells: well identification number; well owner; well address; total depth (feet BGS); casing length (feet); static water level elevation (feet BGS); use code; and NJDEPE permit number. In addition, a summary table of all U.S. Army wells located at Fort Monmouth, which includes the following information: well number, NJDEPE permit number; New Jersey State Plane Coordinates; casing elevation and, elevation of ground well records for the nearest identified offsite well have also been included, if available. This information is included in Appendix D.

A review of the well records indicated that the majority of the wells within the area of concern are used for monitoring purposes. There are 90 monitoring wells. A domestic well (Permit Number 29-23608), owned by Redacted - Privacy Act is the closest to the site in the downgradient flow direction. The well is located at 92 Sunnybank Drive, approximately 3,200 feet northwest of the site.

1.4 HEALTH AND SAFETY

Before, during, and after all activities, hazards at the work site which may have posed a threat to the health and safety of all personnel who were involved with, or were affected by, the decommissioning of the UST system were minimized. All areas which posed, or may have been suspected to pose a vapor hazard were monitored by a qualified individual utilizing approved equipment. The trained individual ascertained if the area was properly vented to render the area safe, as defined by OSHA.

1.5 REMOVAL OF UNDERGROUND STORAGE TANK

1.5.1 General Procedures

During 12 April 1993, UST Nos. 60 to 64 were closed by removal at Building 108 on the Main Post of Fort Monmouth. Tank closure activities were conducted as follows:

- All underground obstructions (utilities,... etc.) were marked out by the contractor performing the closure prior to excavation activities.
- Surface materials (i.e., asphalt, concrete, etc.) were excavated and staged for recycling/disposal in accordance with applicable laws and regulations.
- Each tank's atmosphere was inerted.

- Access ways on top of the tank were opened.
- Licensed tank closure contractor personnel entered the tanks to visually inspect and manually clean the insides of the tanks.
- All wastes (tank bottom sludge and tank rinsate) generated during cleaning were collected and disposed.
- Post closure soil samples were collected for laboratory analysis.
- The tanks were removed from the excavation and staged on plastic sheeting.
- Soil excavated during the tank closure was transported to Soil Remediation of Philadelphia for characterization and disposal/reuse.
- The excavation was backfilled with clean fill material to the original surface grade.
- A Sub-Surface Evaluator from the DPW was present during all closure activities.

1.5.2 Underground Storage Tank Excavation

Soil was excavated to expose the USTs and the associated piping. The piping was not removed/disturbed until all free product was drained into the USTs. The USTs were rendered vapor free by purging prior to any cutting or access. After removal of the associated piping, the manway from each UST was opened to allow for proper cleaning. Due to the existence of manways in each UST, cutting was not necessary. The USTs were completely emptied of all liquids prior to removal. The majority of the liquids were transported by Casie Protank Environmental Services, Inc. and disposed of at Casie Ecology Oil Salvage in Vineland, New Jersey. Casie is a licensed hazardous waste transporter (USEPA ID No. NJD045995693). Approximately 512 gallons of the 5,300 gallons disposed was transported by Casie/Protank to S & W Wastes Inc. in South Kearny, New Jersey. The land disposal notification and certification form for the liquid indicates that the material was incinerated. Hazardous waste manifests were completed and can be found in Appendix E. All of the openings in the tanks were plugged except for one hole (manway).

After the USTs were removed from the excavation, they were staged on polyethylene sheeting and examined for cracks, corrosion or puncture holes. The presence or absence of holes was documented by the Sub-Surface Evaluator. UST Nos. 60 to 63 were found to be in good condition with no corrosion holes. However, several corrosion holes of approximately 1/16 of an inch diameter were noted in UST No. 64. In additional, a sheen and small amounts of product were noted on the groundwater surface in the excavation surrounding UST No. 64, indicating that a historical discharge may have occurred from the UST. A discharge was reported

to the NJDEPE by the DPW on 12 April 1993 (Case No. 93-04-12-1939). Groundwater was present in the excavation at approximately three feet BGS.

Soils surrounding the UST were screened visually and with a Photoionization Detector (PID) for evidence of contamination. Approximately 221 cubic yards of contaminated soil were removed from the area surrounding UST Nos. 60 to 64. The potentially contaminated soil was manifested and transported by Allied Environmental, Inc. to Soil Remediation of Philadelphia for recycling.

1.6 UNDERGROUND STORAGE TANK TRANSPORTATION AND DISPOSAL:

The tanks were transported by All Service Environmental, Inc. to Mazza and Sons, Inc., for recycling in compliance with all applicable regulations and laws. The Tank Reclamation Certificates are provided in Appendix F.

The contractor labelled the UST prior to transport with the following information:

- Site of origin;
- Contact person;
- NJDEPE UST Facility ID number;
- Name of transporter/contact person; and,
- Destination site/contact person.

1.7 MANAGEMENT OF EXCAVATED SOILS:

Approximately 221 cubic yards of contaminated soil were removed from the area surrounding UST Nos. 60 to 64 and placed on and covered with polyethylene sheets. Potentially contaminated soils were transported to the T-80 yard and stockpiled separately from other excavated material. Potentially contaminated soils will be transported to Soil Remediation of Philadelphia. All soils free of evidence of contamination were backfilled into the excavation following removal of the USTs.

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SECTION 2.0

SITE INVESTIGATION ACTIVITIES

2.1 OVERVIEW:

The Site Investigation was managed and carried out by U.S ARMY DPW personnel. All analyses were performed and reported by U.S. Army Fort Monmouth Environmental Laboratory and 21st Century Environmental, which are NJDEPE-certified testing laboratories. All sampling was performed under the direct supervision of a NJDEPE Certified Sub-Surface Evaluator according to the methods described in the NJDEPE Field Sampling Procedures Manual (May 1992). Sampling frequency and parameters analyzed complied with the NJDEPE-BUST document "Technical Requirements for Site Remediation-Proposed New Rules" (May 1992) which was the applicable regulation at the date of closure. All records of the site investigation activities are maintained by Fort Monmouth DPW: Environmental Office.

The following Parties participated in closure and site investigation activities.

- Closure Contractor No. 1: All Service Environmental, Inc.
  Contact Person: Mark Turoff
  Phone Number: (914) 365-0800
  NJDEPE Company Certification No.: 3100194

- Subsurface Evaluator: Charles Appleby
  Employer: U.S. Army, Fort Monmouth
  Phone Number: (908) 532-6224
  NJDEPE Certification No.: 2056

- Subsurface Evaluator: Dinker Desai
  Employer: U.S. Army, Fort Monmouth
  Phone Number: (908) 532-1475
  NJDEPE Certification No.: 2266

- Transporter: Casie Protank Environmental Services, Inc.
  Contact Person: Greg Call
  Phone Number: (609) 696-4401
  USEPA I.D. Transporter No: NJD045995693

- Analytical Laboratory: 21st Century Environmental, Inc.
  Contact Person: Richard W. Lynch
  Phone Number: (609) 467-9521
  NJDEPE Laboratory Certification No.: 08031

- Analytical Laboratory: U.S. Army Fort Monmouth Environmental Testing Laboratory
  Contact Person: Brian McKee
  Phone Number: (609) 532-4359
  NJDEPE Laboratory Certification No.: 13461

2.2 FIELD SCREENING/MONITORING

All soils that were excavated as part of the removal of the UST were screened using a PID, for evidence of contamination. Soils were also inspected visually for evidence of contamination (staining, free product, etc..). Soils on the sidewalls and base of the excavation were screened with a PID by an individual under the direct supervision of the NJDEPE Certified Sub-Surface Evaluator. Evidence of contamination was noted during excavation of soils surrounding the UST and soils were subsequently removed.

2.3 SOIL AND GROUNDWATER SAMPLING

Between 29 September 1992 and 29 April 1993, 29 soil samples were collected for screening of soils surrounding UST Nos. 60 to 64. The samples were analyzed by FMEL for TPHC. Sketches of the sample locations cannot be accurately related to former UST or piping locations. Sampling locations for preclosure samples are therefore not provided on sample location drawings. Based on the results of the sampling events, all soils were collected from areas excavated during the tank closures.

On 3 May 1993, following the removal of UST Nos. 60 to 64, 18 post-excavation soil samples were collected from the sidewalls directly above the groundwater and analyzed by FMEL for TPHC, and by 21st Century Environmental Laboratories for VO+15, BN+15 and lead.

On 6 July 1993 and 30 August 1993, one groundwater sample was collected from each monitoring well (total of six groundwater samples) and analyzed by 21st Century Environmental Laboratories for VO+15, BN+15 and lead. A summary of sampling activities including parameters analyzed is provided in Table 2-1. Figure 2-1 depicts the location of the post-excavation soil samples. Figure 2-2 depicts the locations of the monitoring wells. The post-excavation soil samples were collected using decontaminated stainless steel scoops and groundwater samples were collected using decontaminated teflon bailers. Following soil and groundwater sampling activities, the samples were chilled and delivered to the applicable testing laboratory.

The frequency of sampling and parameters analyzed were consistent with the applicable NJDEPE regulations at the date of closure, which were the "Technical Requirements for Site Remediation-Proposed New Rules" (NJAC 7:26E-1 et seq., dated May 1992).

TABLE 2-1

SUMMARY OF POST-EXCAVATION SOIL SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Lab ID No.	Date of Collection	Matrix	Sample Type	Analytical Parameters	Sampling Method
Site 1	1176.1	4/12/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
Site A	1185.1	4/23/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
Site B	1185.2	4/23/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
Site C	1185.3	4/23/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop

Abbreviations:

TPHC: - Total Petroleum Hydrocarbons.

TABLE 2-1 (CONTINUED)

SUMMARY OF POST-EXCAVATION SOIL SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Lab ID No.	Date of Collection	Matrix	Sample Type	Analytical Parameters	Sampling Method
S-1	1188.1	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-2	1188.2	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-3	1188.3	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-4	1188.4	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-5	1188.5	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-6	1188.6	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-7	1188.7	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-8	1188.8	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-9	1188.9	4/27/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop

Abbreviations:

TPHC: - Total Petroleum Hydrocarbons.

TABLE 2-1 (CONTINUED)

SUMMARY OF POST-EXCAVATION SOIL SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Lab ID No.	Date of Collection	Matrix	Sample Type	Analytical Parameters	Sampling Method
S-A	1189.1	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-B	1189.2	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-C	1189.3	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-D	1189.4	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-E	1189.5	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-F	1189.6	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-G	1189.7	4/29/93	Soil	Preliminary Assessment	TPHC	Stainless Steel Scoop
S-H	1189.8	4/29/93	Soil	Preliminary assessment	TPHC	Stainless Steel Scoop

Abbreviation:

TPHC: - Total Petroleum Hydrocarbons.

TABLE 2-1 (CONTINUED)

SUMMARY OF POST-EXCAVATION SOIL SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Lab ID No.	Date of Collection	Sample Location	Sample Depth (Feet Bgs)	Matrix	Sample Type	Analytical Parameters	Sampling Method
S-1	1191.1	5/3/93	Side Wall	3-4	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-2	1191.2	5/3/93	Side Wall	3-4	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-3	1191.3	5/3/93	Side Wall	3-4	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-4	1191.4	5/3/93	Side Wall	1	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-5	1191.5	5/3/93	Side Wall	6	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-6	1191.6	5/3/93	Side Wall	5	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-7	1191.7	5/3/93	Side Wall	7	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-8	1191.8	5/3/93	Side Wall	6	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-9	1191.9	5/3/93	Side Wall	5	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-10	1191.10	5/3/93	Side Wall	5	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop

Abbreviations:

TPHC: - Total Petroleum Hydrocarbons.
BN+15: - Base Neutral Acid Analysis Plus 15 tentatively identified compounds.
VO+15: - Volatile Organic Analysis Plus 15 tentatively identified compounds.

TABLE 2-1 (CONTINUED)

SUMMARY OF POST-EXCAVATION SOIL SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Lab ID No.	Date of Collection	Sample Location	Sample Depth (Feet Bgs)	Matrix	Sample Type	Analytical Parameters	Sampling Method
S-11	1191.11	5/3/93	Side Wall	5	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-13	1191.13	5/3/93	Side Wall	1.5	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-14	1191.14	5/3/93	Side Wall	3	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-15	1191.15	5/3/93	Side Wall	3-4	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-16	1191.16	5/3/93	Side Wall	6	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-17	1191.17	5/3/93	Side Wall	6	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-18	1191.18	5/3/93	Side Wall	3-4	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop
S-19	1191.19	5/3/93	Side Wall	3	Soil	Post-Excavation	TPHC, BN+15, VO+15, LEAD	Stainless Steel Scoop

Abbreviations:

TPHC: - Total Petroleum Hydrocarbons.
BN+15: - Base Neutral Acid Analysis Plus 15 tentatively identified compounds.
VO+15: - Volatile Organic Analysis Plus 15 tentatively identified compounds.
BGS: - Below Ground Surface

TABLE 2-1 (CONTINUED)

SUMMARY OF POST-EXCAVATION SOIL SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Date of Collection	Matrix	Sample Type	Analytical Parameters	Sampling Method
C92-994	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-995	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-996	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-997	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-998	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-999	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-1000	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop
C92-1001	9/29/92	Soil	Post-Excavation	TPHC	Stainless Steel Scoop

Abbreviation:

TPHC: - Total Petroleum Hydrocarbons.

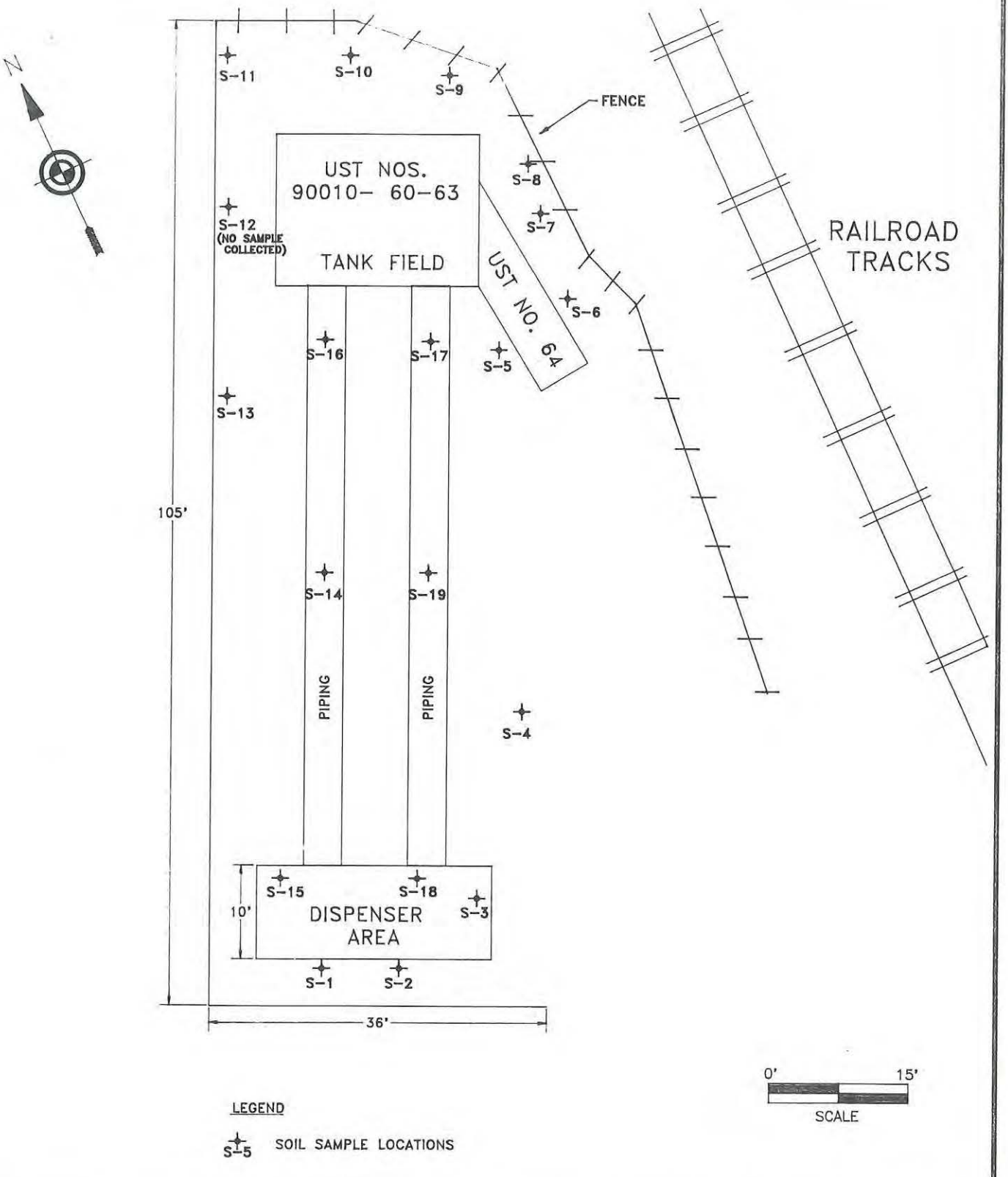
TABLE 2-2

SUMMARY OF GROUNDWATER SAMPLING
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.	Date of Collection	Matrix	Sample Type	Analytical Parameters	Sampling Method
MW-1	7/6/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer
MW-2	7/6/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer
MW-3	7/6/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer
MW-1	8/30/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer
MW-2	8/30/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer
MW-3	8/30/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer
MW-3 (Dup)	8/30/93	Aqueous	Monitoring Well	Lead, BN+15, VO+15	Decontaminated Teflon Bailer

Abbreviations:

BN+15: - Base neutral acid analysis plus 15 tentatively identified compounds.
VO+15: - Volatile organic analysis plus 15 tentatively identified compounds.



REVISION #: 1 DATE: 5/16/94 PLOT NAME: BLD-180
FILE NAME: BLD-108.DWG DRAWN BY: B. MAC

WESTON MANAGERS DESIGNERS/CONSULTANTS

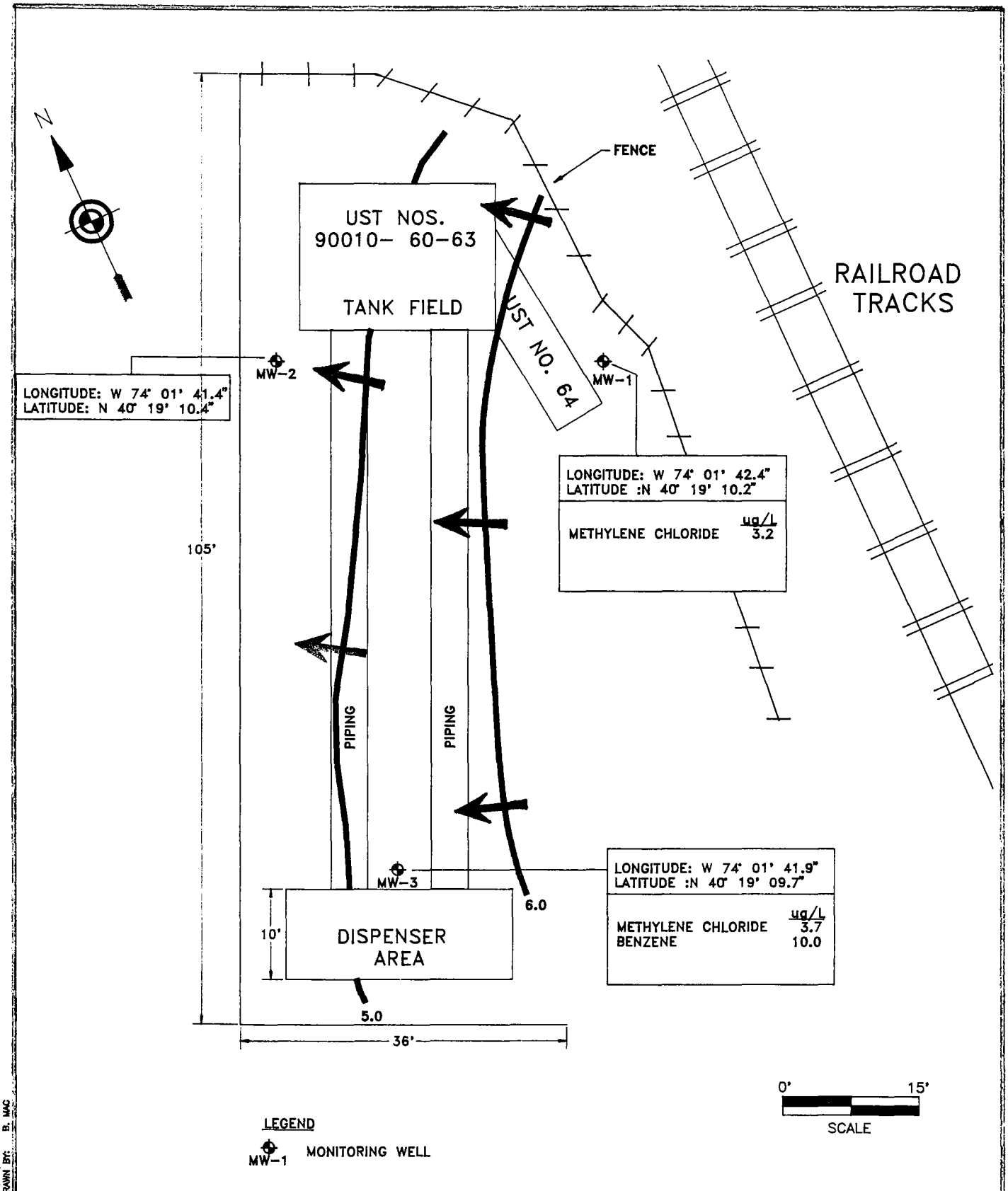
PROJECT NAME: UNDERGROUND STORAGE TANK CLOSURE AND SITE INVESTIGATION REPORT BUILDING 108- UST NOS. 60-64
FORT MONMOUTH NEW JERSEY

CLIENT NAME: U.S. ARMY - FORT MONMOUTH DIRECTORATE OF PUBLIC WORKS

POST-EXCAVATION SOIL SAMPLING LOCATIONS

DATE: 5/17/94

FIGURE #: 2-1



REVISION #: 1 DATE: 5/18/94 PLOT NAME: BLD-180
FILE NAME: BLD-108.DWG DRAWN BY: B. MAC

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
UNDERGROUND STORAGE TANK CLOSURE
AND SITE INVESTIGATION REPORT
BUILDING 108- UST NOS. 60-64
FORT MONMOUTH NEW JERSEY
CLIENT NAME: U.S. ARMY - FORT MONMOUTH
DIRECTORATE OF PUBLIC WORKS

WELL LOCATION
AND GROUNDWATER
CONTOUR MAP

DATE: 5/17/94

FIGURE #: 2-2

SECTION 3.0

CONCLUSIONS AND RECOMMENDATIONS

3.1 SOIL AND GROUNDWATER SAMPLING RESULTS

To evaluate soil conditions following removal of the USTs and associated soils, the post-excavation sample results were compared to NJDEPE Impact to Ground Water Soil Cleanup Criteria (N.J.A.C. 7:26D and revisions dated 3 February 1994). Summaries of analytical results for soils are presented in Table Nos. 3-1 to 3-5. Table 3-6 provides abbreviations, data qualifiers and notes used in Table Nos. 3-1 to 3-5.

To evaluate groundwater conditions following removal of the USTs and associated soils, analytical results from the groundwater samples were compared to NJDEPE Class II-A Ground Water Quality Criteria (N.J.A.C. 7:9-6.4, 6.8 and Table 1). A summary of the analytical results and comparison to NJDEPE Class II-A Ground Water Quality Criteria is provided in Table Nos. 3-7 and 3-8.

A summary of the analytical methods used and quality assurance information is provided in Table 3-9. The analytical data package summary is provided in Appendix G. The full data package, including associated quality control and chromatograph data is on file at U.S. Army Fort Monmouth, DPW.

Soil

Analytical results of soil samples collected between 29 September 1992 and 29 April 1993, for screening of soil around the USTs, indicated concentrations of TPHC in all samples. The results of these analyses helped to guide the excavation of potentially contaminated soils.

Analytical results of post-excavation soil samples collected 3 May 1993 indicated concentrations of benzene in samples Nos. S-5 (1.1 mg/kg) and S-7 (4.0 mg/kg) and methylene chloride in several samples [S-5 (1.1B mg/kg), S-14 (2.3JB mg/kg) and S-17 (2.5 mg/kg)] which exceeded the proposed NJDEPE Impact to Ground Water Soil Quality Criteria. Methylene chloride was detected in the laboratory's quality assurance method blank. The presence of methylene chloride in the method blank indicates laboratory induced contamination of soil sample which is not related to the operation of the UST system. All other samples contained either non-detectable concentrations of contaminants or concentrations of contaminants below the proposed NJDEPE Impact to Ground Water Soil Cleanup Criteria.

Groundwater

Analytical results of groundwater samples collected 6 July 1993 indicated concentrations of benzene and methylene chloride in MW-3 (10 ug/L and 3 ug/L, respectively), bis(2-ethylhexyl)phthalate in MW-1 (740 ug/L) and lead in MW-2 (1030 ug/L) in concentrations which exceeded NJDEPE Class II-A Ground Water Quality Criteria. Bis(2-ethylhexyl)phthalate was detected in the laboratory's quality control method blank samples. The presence of this compounds in the method blank sample indicates that the presence of this compound in groundwater sample is attributable to laboratory induced contamination and not to the operation of UST system.

The surrogate recoveries for monitoring well MW-3 and MW-3 Duplicate were outside of the acceptable range. The results for these wells were considered unreliable and a second set was taken on 30 August 1993.

Analytical results of groundwater samples collected 30 August 1993 indicated concentrations of methylene chloride which exceeded NJDEPE Class II-A Ground Water Quality Criteria. All other samples contained either non-detectable concentrations of contaminants or concentrations of contaminants below NJDEPE Class II-A Ground Water Quality Criteria.

3.2 CONCLUSIONS AND RECOMMENDATIONS:

Due to the presence of Benzene in soil samples No. 5, No. 7 and No. 17, it is recommended that additional material be excavated and soil samples taken to confirm that the area is below cleanup criteria. The area, however, is adjacent to a railroad track. An evaluation of how the excavation will affect the railroad track's stability should be performed prior to the excavation. If the excavation will put the railroad track at risk, no further action will be performed.

Groundwater will be monitored for one year on a quarterly basis, due to the first round results and the potential for benzene to be present in the soil. During the first quarter, two samples will be taken within 30 days and the results averaged with the 30 August 1993 results. The results of the analysis and recommendations for further action will be provided to NJDEPE in an addendum to this report.

TABLE 3-1

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		C92-994	C92-995	C92-996	C92-997	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		S-1	S-2	S-3	S-4	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	
Date of Collection		9/29/92	9/29/92	9/29/92	9/29/92	
Analytical Parameter	Units					
TPHC	mg/kg	66.1	344.8	453.1	455.1	NC *

Sample ID No.		C92-998	C92-999	C92-1000	C92-1001	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		S-5	S-A	S-B	S-C	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	
Date of Collection		9/29/92	9/29/92	9/29/92	9/29/92	
Analytical Parameter	Units					
TPHC	mg/kg	231.7	24	41	44.6	NC *

Abbreviations:

NC*: - No cleanup criterion has been proposed by NJDEPE; however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.
PA: - Preliminary Assessment
TPHC: - Total petroleum hydrocarbons
mg/kg: - Milligrams per kilogram

TABLE 3-2

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		SITE 1	SITE A	SITE B	SITE C	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1176.1	1185.1	1185.2	1185.3	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	
Date of Collection		4/12/93	4/23/93	4/23/93	4/23/93	
Analytical Parameters	Units					
TPHC	mg/kg	198	17.9	15.3	17.4	NC*

Abbreviations:

TPHC: - Total Petroleum hydrocarbons.
mg/kg: - Milligrams per Kilograms.
PA: - Preliminary Assessment.
NC*: - No cleanup criterion has been proposed for TPHC by NJDEPE, however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.

TABLE 3-3

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-1	S-2	S-3	S-4	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1188.1	1188.2	1188.3	1188.4	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	
Date of Collection		4/27/93	4/27/93	4/27/93	4/27/93	
Analytical Parameters	Units					
TPHC	mg/kg	264	261	218	103	NC*

Sample ID No.		S-5	S-6	S-7	S-8	S-9	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1188.5	1188.6	1188.7	1188.8	1188.9	
Matrix		Soil	Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	PA	
Date of Collection		4/27/93	4/27/93	4/27/93	4/27/93	4/27/93	
Analytical Parameters	Units						
TPHC	mg/kg	176	326	1,560	84.7	142	NC*

Abbreviations:

TPHC: - Total Petroleum hydrocarbons.
mg/kg: - Milligrams per Kilograms.
PA: - Preliminary Assessment.
NC*: - No cleanup criterion has been proposed for TPHC by NJDEPE, however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.

TABLE 3-4

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-A	S-B	S-C	S-D	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1189.1	1189.2	1189.3	1189.4	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	
Date of Collection		4/29/93	4/29/93	4/29/93	4/29/93	
Analytical Parameters	Units					
TPHC	mg/kg	2020	1690	21	679	NC*

Sample ID No.		S-E	S-F	S-G	S-H	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1189.5	1189.6	1189.7	1189.8	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PA	PA	PA	PA	
Date of Collection		4/29/93	4/29/93	4/29/93	4/29/93	
Analytical Parameters	Units					
TPHC	mg/kg	357	57.1	175	287	NC*

Abbreviations:

TPHC: - Total Petroleum hydrocarbons.
mg/kg: - Milligrams per Kilograms.
PA: - Preliminary Assessment.
NC*: - No cleanup criterion has been proposed for TPHC by NJDEPE, however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.

TABLE 3-5

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-1	S-2	S-3	S-4	S-5	S-6	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.1	1191.2	1191.3	1191.4	1191.5	1191.6	
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units							
TPHC	mg/kg	3.82	1.93	10.8	27.5	2970	333	NC*
Base Neutral Compounds								
Acenaphthene	mg/kg	.062J	ND	1.1	.095J	.59	.089J	100
Pyrene	mg/kg	.22J	ND	2.4	.45	1.1	1.1	100
Bis(2-ethylhexyl)phthalate	mg/kg	1.1J	.37J	.28J	.16J	4.3	.11J	100
Dibenzofuran	mg/kg	.043J	ND	.81	.044J	.40	.082J	NC
Anthracene	mg/kg	.083J	ND	1.7	.22J	.88	.34J	100
Fluoranthene	mg/kg	0.36J	ND	4.9	.66	2.6	2.7	100
Fluorene	mg/kg	.069J	ND	1.1	.09J	.65	.12J	100
Phenanthrene	mg/kg	.3J	ND	4.4	.66J	3.2	.87	NC
Naphthalene	mg/kg	.24J	ND	.41	.041J	6.0	.082J	100
2-Methylnaphthalene	mg/kg	.13J	ND	.21J	.054J	4.7	.074J	NC
Chrysene	mg/kg	.16J	ND	2.2	.36	.77	1.2	500
Benzo(a)anthracene	mg/kg	.14J	ND	2.3	.35	.78	1.2	500

Direct Contact

ppm

3400
1700
49
NC
10000
2300
2300
NC
230
NC
9
0.9

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-1	S-2	S-3	S-4	S-5	S-6	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.1	1191.2	1191.3	1191.4	1191.5	1191.6	
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units							
Base Neutral Compounds								
Benzo(b)fluoranthene	mg/kg	.2J	ND	1.8	.22J	.10J	.95	50
Dibenzo(a,h)anthracene	mg/kg	ND	ND	.35J	.074J	.10J	.3	100
Benzo(a)pyrene	mg/kg	.13J	.25J	1.8	.34J	.57	1.1	100
Indeno(1,2,3-cd)pyrene	mg/kg	.09J	ND	1.1	.19J	.28J	.68	500
Benzo(g,h,i)perylene	mg/kg	.082J	ND	1.0	.21J	.30J	.67	NC

Direct Contact ~~PPB~~ ppm

0.9
0.66
0.66
0.90

Abbreviations:
NC* - No cleanup criterion has been proposed by NJDEPE, however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.
NC: - No groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ND: - Not detected.
TPHC: - Total Petroleum Hydrocarbons.
PE: - Post Excavation.
mg/kg: - Milligrams per Kilograms.

Data Qualifier:
J: - Indicates an estimated value.

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-7	S-8	S-9	S-10	S-11	S-13	S-14	NJDEPE Impact to Groundwater Soil Cleanup Criteria	
Lab ID No.		1191.7	1191.8	1191.9	1191.10	1191.11	1191.13	1191.14		
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Type		PE	PE	PE	PE	PE	PE	PE		
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93		
Analytical Parameter	Units									
TPHC	mg/kg	230	26	128	35.9	50.8	158	380	NC*	NC
Base Neutral Compounds										
Acenaphthene	mg/kg	ND	ND	ND	ND	ND	ND	.4	100	3400
Pyrene	mg/kg	ND	.074J	.22J	.13J	.46	.14J	1.5	100	1700
Bis(2-ethylhexyl)phthalate	mg/kg	.15J	4.6	.23J	.58	.67	.069J	.071J	100	49
Dibenzofuran	mg/kg	ND	ND	ND	ND	ND	ND	.32J	NC	NC
Anthracene	mg/kg	ND	ND	.074J	.041J	.096J	ND	.78	100	10000
Fluoranthene	mg/kg	ND	.14J	.44	.23J	.86	.023J	4.3	100	2300
Fluorene	mg/kg	ND	ND	ND	ND	ND	ND	.49	100	2300
Phenanthrene	mg/kg	ND	.085J	.39J	.11J	.38J	.1J	2.6	NC	NC
Naphthalene	mg/kg	ND	ND	.042J	ND	ND	ND	.24J	100	230
2-Methylnaphthalene	mg/kg	.044J	ND	ND	ND	ND	ND	.37J	NC	NC
Benzo(a)anthracene	mg/kg	ND	.05J	.17J	.12J	.44	.12J	1.0	500	0.9

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-7	S-8	S-9	S-10	S-11	S-13	S-14	NJDEPE Impact to Groundwater Soil Cleanup Criteria	
Lab ID No.		1191.7	1191.8	1191.9	1191.10	1191.11	1191.13	1191.14		
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Type		PE	PE	PE	PE	PE	PE	PE		
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93		
Analytical Parameter	Units									
Base Neutral Compounds										
Chrysene	mg/kg	ND	.055J	.19J	.14J	.46	.14J	1.0	500	9
Benzo(b)fluoranthene	mg/kg	ND	.063J	ND	.11J	.65	.12J	ND	50	0.9
Dibenzo(a,h)anthracene	mg/kg	ND	ND	ND	ND	.13J	ND	.25J	100	0.66
Benzo(a)pyrene	mg/kg	ND	ND	.12J	.11J	.4	.12J	.87	100	0.66
Indeno(1,2,3-cd)pyrene	mg/kg	ND	ND	.092J	.089J	.26J	.079J	.49	500	0.9
Benzo(g,h,i)perylene	mg/kg	ND	ND	.11J	.093J	.28J	.087J	.53J	NC	NC

Abbreviations:

NC* - No cleanup criterion has been proposed by NJDEPE, however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.
NC: - No groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ND: - Not detected.
TPHC: - Total Petroleum Hydrocarbons.
PE: - Post Excavation.
mg/kg: - Milligrams per Kilograms.

Data Qualifier:

J: - Indicates an estimated value.

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-15	S-16	S-17	S-18	S-19	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.15	1191.16	1191.17	1191.18	1191.19	
Matrix		Soil	Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units						
TPHC	mg/kg	5.22	1100	340	ND	46.1	NC
Base Neutral Compounds							
Acenaphthene	mg/kg	ND	.5J	.16J	ND	.79	100
Pyrene	mg/kg	ND	.9J	.36J	.043J	3.4	100
Bis(2-ethylhexyl)phthalate	mg/kg	ND	24	1.3	ND	.079J	100
Dibenzofuran	mg/kg	ND	.26J	.078J	ND	.54	NC
Anthracene	mg/kg	ND	.69J	.23J	ND	1.7	100
Fluoranthene	mg/kg	ND	2.2	.97	.092J	12.0	100
Fluorene	mg/kg	ND	.58J	.16J	ND	1.0	100
Phenanthrene	mg/kg	ND	2.8	.89	ND	2.9	NC
Naphthalene	mg/kg	ND	4.8	.9	ND	.23J	100
2-Methylnaphthalene	mg/kg	ND	8.4	1.3	ND	.18J	NC
Benzo(a)anthracene	mg/kg	ND	.42J	.19J	ND	2.3	500

3400
~~4~~ 1700
49
nc
10000
2300
2300
nc
230
nc
0.9

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-15	S-16	S-17	S-18	S-19	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.15	1191.16	1191.17	1191.18	1191.19	
Matrix		Soil	Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units						
Base Neutral Compounds							
Chrysene	mg/kg	ND	.43J	.21	ND	2.4	500
Benzo(b)fluoranthene	mg/kg	ND	ND	.19J	ND	2.3	50
Dibenzo(a,h)anthracene	mg/kg	ND	ND	ND	ND	ND	100
Benzo(a)pyrene	mg/kg	ND	.27J	1.3	ND	2.1	100
Indeno(1,2,3-cd)pyrene	mg/kg	ND	ND	.21J	ND	ND	500
Benzo(g,h,i)perylene	mg/kg	ND	.14J	.079J	ND	ND	NC

Direct Contact

9
0.9
0.66
0.66
0.9
NC

Abbreviations:

NA: - Not analyzed.
NC: - No cleanup criterion has been proposed by NJDEPE, however, the proposed NJDEPE subsurface cleanup criterion for total organic compounds is 10,000 mg/kg.
NC: - No groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ND: - Not detected.
TPHC: - Total Petroleum Hydrocarbons.
PE: - Post Excavation.
mg/kg: - Milligrams per Kilograms.

Data Qualifier:
J: - Indicates an estimated value.

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-1	S-2	S-3	S-4	S-5	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.1	1191.2	1191.3	1191.4	1191.5	
Matrix		Soil	Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units						
Volatile Organic Compounds							
Acetone	mg/kg	0.004JB	0.005JB	0.005JB	ND	0.6	100
Methylene Chloride	mg/kg	0.071J	0.0061JB	0.0069B	0.0035JB	1.1B	1
Chloroform	mg/kg	ND	ND	ND	ND	ND	1
Benzene	mg/kg	ND	ND	ND	ND	1.0	1
O-Xylene	mg/kg	ND	ND	ND	ND	0.87	NC
Toluene	mg/kg	ND	ND	ND	ND	0.76	500
Ethylbenzene	mg/kg	ND	ND	ND	ND	7.6	100
M & P Xylenes	mg/kg	ND	ND	ND	ND	30.0	NC
Inorganics							
Lead	mg/kg	30.7	ND	9.05	ND	16.3	NC

Direct Contact ppm

1000
49
19
3
~~NC~~
1000
1000
100

410

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-6	S-7	S-8	S-9	S-10	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.6	1191.7	1191.8	1191.9	1191.10	
Matrix		Soil	Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units						
Volatile Organic Compounds							
Acetone	mg/kg	0.004JB	0.3JB	0.029JB	ND	ND	100
Chloroform	mg/kg	ND	ND	ND	0.013	ND	1
Methylene Chloride	mg/kg	0.0044J	0.98B	0.02JB	0.0042JB	0.0042JB	1
Benzene	mg/kg	ND	4.0	ND	ND	ND	1
O-Xylene	mg/kg	ND	0.45J	ND	ND	ND	NC
Toluene	mg/kg	ND	ND	ND	ND	ND	500
Ethylbenzene	mg/kg	ND	0.89J	ND	ND	ND	100
M & P Xylenes	mg/kg	ND	2.0	ND	ND	ND	NC
Inorganic Compound							
Lead	mg/kg	52.1	12.4	ND	58.2	55.8	NC

Direct Contact

1000
19
49
3
~~4~~ total 4/0
1000
1000

100

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-11	S-13	S-14	S-15	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.11	1191.13	1191.14	1191.15	
Matrix		Soil	Soil	Soil	Soil	
Sample Type		PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units					
Volatile Organic Compounds						
Acetone	mg/kg	0.0046JB	ND	ND	0.039B	100
Methylene Chloride	mg/kg	0.0042JB	0.005JB	2.3JB	0.0056JB	1
Chloroform	mg/kg	ND	ND	ND	ND	1
Benzene	mg/kg	ND	ND	ND	0.0035J	1
O-Xylene	mg/kg	ND	ND	1.4J	ND	NC
Toluene	mg/kg	ND	ND	ND	0.0017J	500
Ethylbenzene	mg/kg	ND	ND	1.1J	0.0077J	100
M & P Xylenes	mg/kg	ND	ND	6.2		NC
Inorganic Compound						
Lead	mg/kg	155	14.8	28.8	11.0	NC

Direct Contact

1000
49
19
3
1000
1000
factor 410
100

TABLE 3-5 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR SOILS
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		S-16	S-17	S-18	S-19	Trip Blank	Field Blank	NJDEPE Impact to Groundwater Soil Cleanup Criteria
Lab ID No.		1191.16	1191.17	1191.18	1191.19	TB	FB	
Matrix		Soil	Soil	Soil	Soil	Aqueous	Aqueous	
Sample Type		PE	PE	PE	PE	PE	PE	
Date of Collection		5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	5/3/93	
Analytical Parameter	Units							
Volatile Organic Compounds								
Acetone	mg/kg	ND	ND	ND	ND	ND	0.25B	100
Methylene Chloride	mg/kg	0.87	1.0	0.87	0.49	2.4J	0.0041J	1
Chloroform	mg/kg	ND	ND	ND	ND	ND	ND	1
Benzene	mg/kg	0.76J	2.5	ND	ND	ND	ND	1
O-Xylene	mg/kg	69	ND	1.2	ND	ND	ND	NC
Toluene	mg/kg	9.5	ND	0.92	ND	ND	ND	500
Ethylbenzene	mg/kg	21	0.34J	0.85	ND	ND	ND	100
M & P Xylenes	mg/kg	170	1.9	3.4	0.025J	ND	ND	NC
Inorganic Compound						ND	ND	
Lead	mg/kg	12.3	21.8	10.4	174	ND	ND	NC

Direct Contact

1000
49
14
3
1000
1000
total 410
100

TABLE 3-5 (CONTINUED)

ABBREVIATIONS, DATA QUALIFIERS AND NOTES
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Abbreviations:

PE: - Post Excavation.
NC: - No groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ND: - Not detected.
mg/kg: - Milligrams per Kilogram.
ug/kg: - Micrograms per Kilogram.

Data Qualifiers:

J: - Indicates an estimated value.
B: - Indicates also present in blank.

TABLE 3-6

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		MW-1	MW-2	MW-3	NJDEPE Class II-A Groundwater Cleanup Criteria
Lab ID No.		A2530	A2531	A2533	
Matrix		Aqueous	Aqueous	Aqueous	
Sample Type		MW	MW	MW	
Date of Collection		7/6/93	7/6/93	7/6/93	
Analytical Parameter	Units				
Lead	ug/L	ND	1030	ND	5
Base Neutral Compounds					
Butylbenzylphthalate	ug/L	3.5J	ND	4.5J	100
Pyrene	ug/L	120J	2.3J	ND	200
Bis(2-ethylhexyl)phthalate	ug/L	740B	2.2J	ND	3
Di-n-butylphthalate	ug/L	ND	2.3J	ND	900
Fluoranthene	ug/L	ND	2.1J	ND	300
Chrysene	ug/L	ND	1.1J	ND	NC
Diethylphthalate	ug/L	ND	1.9J	ND	5,000
Phenanthrene	ug/L	ND	1.1J	ND	NC
Acetone	ug/L	6.3JB	3.6JB	4.1JB	700

TABLE 3-6 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		MW-1	MW-2	MW-3	NJDEPE Class II-A Groundwater Cleanup Criteria
Lab ID No.		A2530	A2531	A2533	
Matrix		Aqueous	Aqueous	Aqueous	
Sample Type		MW	MW	MW	
Date of Collection		7/6/93	7/6/93	7/6/93	
Analytical Parameter	Units				
Volatile Organic Compounds					
m & p Xylenes	ug/L	3.8J	ND	3.4J	NC
Methylene Chloride	ug/L	ND	ND	3J	2
Methyl Tertiary Butyl Ether	ug/L	ND	.0013	1.2	NC
Benzene	ug/L	ND	ND	10	0.2
O-Xylene	ug/L	ND	ND	2.4J	NC

Abbreviations:
MW: - Monitoring Well.
NC: - No NJDEPE Class II-A groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ND: - Not detected.
ug/L: - Micrograms per liter.

Data Qualifiers:

J: - Indicates an estimated value.
B: - Indicates also present in blank.

TABLE 3-7

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		MW-1	MW-2	MW-3	MW-3 (Dup)	NJDEPE Class II-A Groundwater Cleanup Criteria
Lab ID No.		A3809	A3810	A3811	A3812	
Matrix		Aqueous	Aqueous	Aqueous	Aqueous	
Sample Type		MW	MW	MW	MW	
Date of Collection		8/30/93	8/30/93	8/30/93	8/30/93	
Analytical Parameter	Units					
Volatile Organic Compounds						
Acetone	ug/L	10 B	8.3 JB	2.2 JB	2.4 JB	700
m & p Xylenes	ug/L	4.6 J	ND	ND	ND	NC
Methylene Chloride	ug/L	3.2 J	1.6 J	3.2 J	3.7 J	2
Methyl Tertiary Butyl Ether	ug/L	ND	14	11	11	NC
Toluene	ug/L	1.4 J	ND	ND	ND	1,000
Benzene	ug/L	ND	ND	ND	ND	0.2

Abbreviations:
MW: - Monitoring Well
NC: - No NJDEPE Class II-A groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ug/L: - Micrograms per liter.

Data Qualifiers:
ND: - Not detected.
J: - Indicates an estimated value.
B: - Indicates also present in blank.

TABLE 3-7 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Sample ID No.		MW-1	MW-2	MW-3	MW-3 (Dup)	NJDEPE Class II-A Groundwater Cleanup Criteria
Lab ID No.		A3809	A3810	A3811	A3812	
Matrix		Aqueous	Aqueous	Aqueous	Aqueous	
Sample Type		MW	MW	MW	MW	
Date of Collection		8/30/93	8/30/93	8/30/93	8/30/93	
Analytical Parameter	Units					
Inorganic						
Lead	ug/L	ND	ND	ND	ND	10
Base Neutral Compounds						
Butylbenzylphthalate	ug/L	ND	32	62	49	100
1,4-Dichlorobenzene	ug/L	17	ND	ND	ND	75
Bis(2-ethylhexyl)phthalate	ug/L	4.0 J	2.1 J	ND	ND	30
Di-n-butylphthalate	ug/L	1.9 J	1.5 J	2.0 J	1.6 J	900
Benzyl alcohol	ug/L	1.3 J	2.2 J	6.7 J	6.3 J	NC

Abbreviations:
MW: - Monitoring Well.
NC: - No NJDEPE Class II-A groundwater cleanup criterion has been proposed for this analyte by NJDEPE.
ND: - Not detected.
J: - Indicates an estimated value.
B: - Indicates also present in blank.
ug/L: - Micrograms per liter.

TABLE 3-8

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Analytical Parameter	No. of Samples Collected	Matrix	Date Collected	Date Analysis Completed	Preservation Method	USEPA SW-486 Analytical Method
TPHC	8	S	9/29/92	9/30/92	Cool to 4°C	418.1
TPHC	1	S	4/12/93	4/12/93	Cool to 4°C	418.1
TPHC	3	S	4/23/93	4/23/93	Cool to 4°C	418.1
TPHC	9	S	4/27/93	4/27/93	Cool to 4°C	418.1
TPHC	8	S	4/29/93	4/29/93	Cool to 4°C	418.1

Analytical Parameter	No. of Samples Collected	Matrix	Date Collected	Date Analysis Completed	Preservation Method	USEPA SW-846 Analytical Method
TPHC	18	S	5/3/93	5/4/93	Cool to 4°C	418.1
VOCs	18	S	5/3/93	5/4/93	Cool to 4°C	USEPA-CLP-IFB
BNAs	18	S	5/3/93	5/4/93	Cool to 4°C	8270
LEAD	18	S	5/3/93	5/4/93	Cool to 4°C	6010

Abbreviations:

USEPA-CLP-IFB - Volatile samples were analyzed using the method cited in the USEPA-CLP-IFB version 2/88. The CLP volatile method is based on USEPA Method 624 and SW-846.
TPHC: - Total Petroleum Hydrocarbons.
VOCs: - Volatile Organic Compounds.
BNAs: - Base Neutral Acid Extractable Compounds.
C: - Celsius.

TABLE 3-8 (CONTINUED)

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE (MONITORING WELLS)
BUILDING NO. 108
UST NOS. 60 TO 64
FORT MONMOUTH, NEW JERSEY

Analytical Parameter	No. of Samples Collected	Matrix	Date Collected	Date Analysis Completed	Preservation Method	USEPA SW-846 Analytical Method
Lead	3	Aqueous	7/6/93	7/13/93	Cool to 4°C	418.1
VOCs	3	Aqueous	7/6/93	7/13/93	Cool to 4°C	USEPA-CLP-IFB
BNAs	3	Aqueous	7/6/93	7/13/93	Cool to 4°C	8270

Analytical Parameter	No. of Samples Collected	Matrix	Date Collected	Date Analysis Completed	Preservation Method	USEPA SW-846 Analytical Method
Lead	3	Aqueous	8/30/93	9/3/93	Cool to 4°C	418.1
VOCs	3	Aqueous	8/30/93	9/3/93	Cool to 4°C	USEPA-CLP-IFB
BNAs	3	Aqueous	8/30/93	9/24/93	Cool to 4°C	8270

Abbreviations:

USEPA-CLP-IFB - Volatile samples were analyzed using the method cited in the USEPA-CLP-IFB version 2/88. The CLP volatile method is based on USEPA Method 624 and SW-846.
TPHC: - Total Petroleum Hydrocarbons.
VOCs: - Volatile Organic Compounds.
BNAs: - Base Neutral Acid Extractable Compounds.
C: - Celsius.

FINAL

Remedial Investigation Report

Site 108

U. S. Army Garrison Fort Monmouth
Fort Monmouth, New Jersey

Directorate of Public Works

August 13, 2004

Versar, Inc.
201 Gibraltar Road, Suite 100
Horsham, Pennsylvania 19044

Contract No. DACA 51-00-D-004
Delivery Order No. 19

United States Army
Fort Monmouth, New Jersey

Remedial Investigation Report

Site 108

Fort Monmouth, New Jersey

August 13, 2004

PREPARED BY:

201 GIBRALTAR ROAD, SUITE 100
HORSHAM, PA 19044

August 13, 2004

VERSAR PROJECT NO. 4936.119

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EXECUTIVE SUMMARY

VERSAR, Inc. (Versar) has been contracted by the United States (U.S.) Army Garrison, Fort Monmouth (Fort Monmouth), Directorate of Public Works (DPW), Fort Monmouth, New Jersey to prepare a Remedial Investigation Report (RIR) to document groundwater and surface water conditions at Site 108 located in the Main Post Area of Fort Monmouth, New Jersey. This report addresses the remedial investigation activities performed at this site to investigate groundwater conditions from April 1997 through August 2001. The New Jersey Department of Environmental Protection (NJDEP) case number for groundwater contamination at Site 108 is 93-04-12-1939-29.

Site 108 is located in the eastern part of the Main Post Area of Fort Monmouth, east of Riverside Avenue in the vicinity of buildings 63, 484 and 488 (**Figure 2-2**). Site 108 is located approximately 400 feet northwest of Oceanport Creek and 180 feet west of the New Jersey Transit Railroad. Two Underground Storage Tank (UST) closures have been performed at Site 108 as part of the DPW's UST management program. The groundwater monitoring program associated with the DPW's UST management program includes four wells (108-MW1, 108-MW2, 108-MW3 and 108-MW4) at Site 108 that were installed in September 1993 and August 1995.

The *UST Closure and Site Investigation* (SI) *Report for Building 108, NJDEPE Facility No. 090010, TMS No. 60, 61, 62, 63 and 64, Fort Monmouth, New Jersey*, prepared by Roy F. Weston, Inc. (Weston) for the DPW, dated May 1994 (**Appendix A**), documents the removal of five USTs (UST Nos. 60 through 64) located north of building 488, which is north of former Building 108 (**Figure 2-4**). Between September 29, 1992 and April 29, 1993, 29 pre-excavation soil samples were collected that revealed detections of Total Petroleum Hydrocarbons (TPHC) in each sample. On May 3, 1993, 18 post-excavation soil samples were collected that revealed benzene above proposed NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC) in two of the post-excavation samples.

In response to the observation of potentially contaminated soil, an observed sheen on groundwater, and the presence of free product during the removal of UST Nos. 60 through 64, three shallow monitoring wells (108-MW1, 108-MW2 and 108-MW3) were installed at Site 108 in June 1993. On July 6, 1993 and again on August 30, 1993, one groundwater sample was collected from each well for a total of six groundwater samples. The groundwater samples were analyzed for volatile organic compounds (VOCs) plus 15 tenatively identified compounds (TICs), semi-volatile organic compounds (SVOCs) plus 15 TICs and lead. The results showed that benzene, bis(2-ethylhexyl)phthalate, lead and methylene chloride each were detected above the NJDEP Class II-A Groundwater Quality Criteria (GWQC).

In May 1995, shallow monitoring well 108-MW4 was installed upgradient of monitoring wells 108-MW1, 108-MW2 and 108-MW3 at Site 108.

Groundwater sampling results for wells at Site 108 after August 1993 and before April 1997 were addressed in a letter report as an addendum to the 1994 Weston Closure and SI Report. The results presented in this letter addendum are not available for review.

The *UST Closure and Site Investigation Report for Former Building 108, UST No. 090010-7*, prepared by Smith Technologies Corporation, dated February 1996, (**Appendix B**), documents the removal of one UST (No. 7) located immediately adjacent to former Building 108 (**Figure 2-4**). On July 14, 1994, UST No. 7 was drained, removed and disposed offsite. To evaluate soil conditions following removal of UST No. 7 and associated piping, post-excavation soil samples were collected from eight locations on July 14, 1994 and analyzed for TPHC. TPHC was detected in five of the eight samples below the NJDEP soil cleanup criteria.

In 1995, Weston conducted soil sampling, monitoring well installation and sampling and geophysical surveying as part of an SI of the Fort Monmouth military installation. Weston established background concentrations for soil and groundwater for the Fort Monmouth Installation, as reported in the Weston SI Report (1995) (**Appendix D**).

As presented in the Weston SI Report, several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. A low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of entrained sediments on the dissolved phase metals concentrations at Fort Monmouth.

Fort Monmouth DPW has conducted a Remedial Investigation (RI), including a groundwater sampling program, to define the areal extent of potential pollutants and evaluate impacts to groundwater in the vicinity of Site 108. Remedial investigation activities were performed from April 1997 and continued through August 2001. The results of these investigations are presented in this report.

A total of four monitoring wells (108-MW1, 108-MW2, 108-MW3 and 108-MW4) comprise the quarterly groundwater monitoring program conducted by the DPW. As part of the remedial investigation of Site 108, quarterly groundwater monitoring was conducted from April 1997 through February 2001, and a Geoprobe® investigation was conducted in March 2001.

Monitoring wells 108-MW1, 108-MW2, 108-MW3 and 108-MW4 were sampled during the 16 quarterly groundwater sampling rounds and two low-flow rounds, for a total of 18 quarterly sampling events. The groundwater samples were analyzed for VOCs plus 15 TICs, SVOCs plus 15 TICs, pesticides, polychlorinated biphenyls (PCBs) and Target Analyte List (TAL) metals. During the 18 quarterly sampling events, one VOC and nine TAL metals were detected in groundwater samples at concentrations above their respective NJDEP GWQC. Arsenic is identified as the only contaminant of concern (COC) at Site 108, because of the magnitude of its exceedances, the frequency of its occurrences and its wide-ranging results.

On March 8, 2001, the DPW conducted supplemental soil sampling at Site 108. Supplemental soil sampling was conducted based on detections of elevated arsenic concentrations in monitoring well samples collected at the site. A total of 27 subsurface soil samples and three duplicate samples were collected from nine distinct Geoprobe® borings. The soil samples were collected from each Geoprobe® boring at depth intervals of 0 to 6 inches, 12 to 18 inches and 24 to 30 inches below ground surface (bgs) and were analyzed for arsenic and lead. Even though lead is not considered a potential COC at Site 108, the supplemental soil samples were analyzed for lead for comparison purposes.

The results of the soil sampling do not support a localized source of arsenic or lead contamination in subsurface soil at the site. Arsenic was detected in 8 of 9 soil boring locations at concentrations greater than the Residential Direct Contact Soil Cleanup Criteria (RDCSCC), but only a single location indicated an arsenic concentration that exceeds the RDCSCC by more than one order of magnitude. Therefore, the arsenic is likely attributable to the native soil characteristics or a non-point source distributed throughout the subsurface soils at Site 108. It is unlikely that either soil constituent is adversely affecting the quality of shallow groundwater at Site 108.

The RI also included the collection of groundwater depth measurements, the performance of slug tests, evaluation of aquifer classification, and the completion of a sensitive receptor survey. The results of the field and laboratory investigations were used to develop a conceptual site model to provide a basis for the development of a three-dimensional computer model. The conceptual site model considers the site-specific topography, groundwater recharge, groundwater flow conditions and the geologic formations present at the site. A MODFLOW computer model was used to simulate groundwater flow and contaminant transport beneath the site. The purpose of developing a groundwater model for Site 108 was to predict the migration of the identified COC, arsenic, in site groundwater.

Due to the low concentrations of arsenic in groundwater at Site 108 and the slow migration rates for the COC in the groundwater, there is little potential for significant COC impact by migration into Oceanport Creek. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by the COC near the ground surface. In addition, the sensitive receptor survey indicates that there are no domestic or irrigation wells close enough to Site 108 to be adversely impacted by COC migration.

Further groundwater monitoring and remedial investigation activities at Site 108 are not required. No Further Action (NFA) is recommended with respect to soil and groundwater at the site.

1.0 INTRODUCTION

Versar has been contracted by the U.S. Army Garrison, Fort Monmouth, DPW, Fort Monmouth, New Jersey to prepare an RIR to document groundwater and surface water conditions at Site 108 located in the Main Post Area of Fort Monmouth, New Jersey. This report addresses the remedial investigation activities performed at this site to investigate groundwater conditions from April 1997 through August 2001. The NJDEP case number for groundwater contamination at Site 108 is 93-04-12-1939-29.

1.1 Objectives

The objectives of this RIR are to define aquifer chemical and physical characteristics and to determine the requirement for further remedial activities at Site 108. The remedial investigation was conducted in accordance with NJDEP *Technical Requirements for Site Remediation* (July 1999), NJAC 7:26E, et seq.

The remedial investigation and subsequent preparation of the RIR encompassed the following:

- Characterization of groundwater quality at Site 108 through quarterly groundwater sampling events conducted from April 1997 through January 2001.
- Characterization of Site 108 groundwater quality during two low-flow sampling events in September and October 2000.
- Supplemental subsurface soil sampling at Site 108 to assess whether the incidences of metal compounds in the groundwater are the result of localized soil contamination.
- Comparison of the groundwater sample results with the NJDEP GWQC and subsurface soil sample results with NJDEP soil cleanup criteria for Site 108.
- Investigation and evaluation of the designated aquifer uses, the associated aquifer classification, and the appropriate groundwater quality criteria for groundwater resources beneath Site 108. The NJDEP GWQC specify the quality criteria and designated uses for groundwater and also contain technical and general policies to ensure that the designated uses can be adequately protected.
- Performance of slug tests at Site 108 during August 2001 to characterize the hydraulic conductivity and groundwater flow regime.
- Development of a groundwater flow and transport model for Site 108 based on the hydrogeologic data, field investigation programs and technical research to evaluate the migration of potential COCs beneath Site 108.
- Formulation of a NFA proposal for consideration by the NJDEP based on the results of field and laboratory investigations and the hydrogeologic conditions at Site 108. The rationale for the NFA proposal is presented in this RIR.

1.2 Report Organization

This report is organized to minimize repetition. **Section 2.0** provides background information and a general description of Site 108 located in the Main Post Area of Fort Monmouth. **Section 3.0** describes and summarizes the field activities conducted at Site 108 including groundwater sampling from monitoring wells, supplemental soil sampling from Geoprobe® borings, and aquifer testing. **Section 4.0** presents the physical characterization of Site 108 including lithology and groundwater conditions. The chemical characterization of Site 108 is presented in **Section 5.0**, which includes groundwater, the determination of potential COCs, and supplemental soil sample results. **Section 6.0** discusses the potential for contaminant migration in the vicinity of Site 108, and presents groundwater modeling involving the COCs. Conclusions and recommendations for Site 108 are presented in **Section 7.0**. References used in this RIR are provided in **Section 8.0**.

2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

The following sections describe the background and environmental setting of the area surrounding Fort Monmouth and Site 108. Included is a description of the location of Site 108, its background, current conditions and environmental setting.

2.1 Site Location and Description

Fort Monmouth is located in the central-eastern portion of New Jersey in Monmouth County, approximately 45 miles south of New York City and 70 miles northeast of Philadelphia (**Figure 2-1**). In addition to the Main Post, the installation includes two subposts, the Charles Wood Area and the Evans Area. The Main Post encompasses approximately 630 acres and is bounded by State Highway 35, Parkers Creek, Lafetra Brook, the New Jersey Transit Railroad and a residential area to the south. The post was established in 1918 during World War I (WWI) as an Army Signal Corps training center. The Main Post currently provides administrative, training, and housing support functions, as well as providing many of the community facilities for Fort Monmouth. The primary mission of Fort Monmouth is to provide command, administrative, and logistical support for Headquarters, U.S. Army Communications and Electronics Command (CECOM). CECOM is a major subordinate command of the U.S. Army Materiel Command (AMC) and is the host tenant at Fort Monmouth.

Site 108 is located in the eastern part of the Main Post Area of Fort Monmouth, east of Riverside Avenue in the vicinity of buildings 63, 484 and 488 (**Figure 2-2**). Site 108 is located approximately 400 feet northwest of Oceanport Creek and approximately 180 feet west of the New Jersey Transit Railroad.

2.2 Site Background

In the early 1990s, the DPW developed a UST program for managing approximately 506 USTs located throughout the Fort Monmouth installation (Main Post, Charles Wood and Camp Evans Areas). This program was created to work toward replacing the use of heating oil as a major energy source and to convert to natural gas. The DPW's approach involved installing new gas lines, new boilers that could be gas fed and removing the non-regulated (residential) USTs. Since 1990, approximately 97 percent of the aforementioned USTs at Fort Monmouth have been removed.

As part of the DPW's UST management program, two UST closure reports (dated May 1994 and February 1996) have been submitted to the NJDEP regarding USTs in the immediate vicinity of Site 108. These two reports are presented in **Appendix A** and **Appendix B** and are discussed below.

The groundwater monitoring program presented in this report includes four wells (108-MW1, 108-MW2, 108-MW3 and 108-MW4) installed in September 1993 and August 1995, as part of the UST closures. The locations of these four monitoring wells are

shown in **Figure 2-3**. A well construction summary is provided in **Table 2-1**. Monitoring well records are provided in **Appendix C**.

2.2.1 UST Closure and Site Investigation Report for Building 108 (Roy F. Weston, Inc., May 1994)

According to the *UST Closure and Site Investigation* (SI) *Report for Building 108, NJDEPE Facility No. 090010, TMS No. 60, 61, 62, 63 and 64, Fort Monmouth, New Jersey*, prepared by Roy F. Weston, Inc. (Weston) for the DPW, dated May 1994 (**Appendix A**), there were five USTs (UST Nos. 60 through 64) located north of building 488, which is north of former Building 108 (**Figure 2-4**). UST Nos. 60, 61 and 62 were single-walled steel, 5,000-gallon unleaded gasoline tanks. UST No. 63 was a single-walled steel 5,000-gallon diesel fuel tank. UST No. 64 was a single-walled steel 5,000 gallon capacity kerosene tank.

In February and November 1990, UST No. 63 was tightness tested. Testing indicated that the 5,000-gallon diesel tank was tight indicating that the tank was in good condition. There is no documentation of tightness testing performed on any of the remaining four USTs.

In September 1992, eight pre-excavation soil samples were collected from the areas surrounding UST Nos. 60 through 64 as preliminary screening for soil contamination prior to the removal of these five USTs. The samples were analyzed for TPHC. The results of this preliminary screening are not available for review.

In March and April 1993, the five USTs were drained, removed and disposed offsite. In addition to the UST removals, approximately 221 cubic yards of potentially contaminated soil was removed and disposed offsite. UST Nos. 60, 61 and 62 were observed to be in good condition. The condition of UST No. 63 was not documented in the UST Closure Report (Weston, 1994).

Field screening was performed by a NJDEP certified subsurface evaluator using an organic vapor analyzer (OVA) and visual observations. Several corrosion holes of approximately 1/16 of an inch diameter were noted in UST No. 64. In addition, a sheen and small amounts of product were noted on the groundwater surface in the excavation surrounding UST No. 64. On April 12, 1993, a discharge was reported to the NJDEP, and Case Number 93-04-12-29 was assigned. Soil and groundwater samples were collected in regard to the closure of UST Nos. 60 through 64 are described below:

Soil Sampling

Between September 29, 1992 and April 29, 1993, a second set of 29 pre-excavation soil samples were collected for screening of soils surrounding UST Nos. 60 through 64. On May 3, 1993, following the removal of the five USTs and excavation of potentially contaminated soil, 18 post-excavation soil samples were collected from the sidewalls of

the excavation directly above groundwater. Both rounds samples were analyzed for TPHC, VOCs plus 15 TICs, SVOCs plus 25 TICs and lead.

TPHC was detected in each of the 29 pre-excavation soil samples collected between September 29, 1992 and April 29, 1993. Concentrations ranged from 15.3 mg/kg in sample SITE B to 2,020 mg/kg is sample S-A.

Benzene was detected above proposed NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC) in two post-excavation samples collected on May 3, 1993, at concentrations of 1.1 mg/kg and 4.0 mg/kg.

Methylene chloride was also detected in post-excavation soil samples collected at Site 108; however, methylene chloride was detected in laboratory blank samples, indicating laboratory contamination.

There were no other VOCs, SVOCs or lead concentrations detected in the pre- or post-excavation soil sampling rounds at concentrations exceeding the IGWSCC.

Groundwater Sampling

In response to the observation of potentially contaminated soil, sheen on groundwater, and free product during the UST removal of UST Nos. 60 through 64, three shallow monitoring wells (108-MW1, 108-MW2 and 108-MW3) were installed at Site 108 in June 1993. Wells 108-MW1, 108-MW2 and 108-MW3 were constructed to a maximum finished depth of 13.0 feet. These wells were screened from a depth of 3.0 feet below ground surface (bgs) to 13.0 feet bgs with 4-inch diameter 10-slot PVC.

On July 6, 1993 and on August 30, 1993, one groundwater sample was collected from each well (108-MW1, 108-MW2 and 108-MW3) for a total of six groundwater samples. The groundwater samples were analyzed for VOCs plus 15 TICs, SVOCs plus 15 TICs and lead. The following groundwater concentrations exceeded the NJDEP Class II-A GWQC:

- In the groundwater sample collected from well 108-MW1 on July 6, 1993, ***bis(2-ethylhexyl)phthalate*** (a common laboratory contaminant) was detected above the GWQC/1993 of 30 ug/L at a concentration of 740 ug/L.
- In the groundwater sample collected from well 108-MW2 on July 6, 1993, ***lead*** was detected above the GWQC/1993 of 5 ug/L at a concentration of 1030 ug/L.
- In the groundwater sample collected from well 108-MW3 on July 6, 1993, ***benzene*** was detected above the GWQC/1993 of 0.2 ug/L at a concentration of 10 ug/L.
- In groundwater samples collected from wells 108-MW1 and 108-MW3 on August 30, 1993, ***methylene chloride*** (a common laboratory contaminant) was detected above the GWQC at concentrations ranging from 3.2 to 3.7 ug/L.

Groundwater sample results for wells 108-MW1, 108-MW2 and 108-MW3, as presented in the 1994 Weston report, are included in **Appendix A**.

In May 1995, shallow monitoring well 108-MW4 was installed at Site 108. Well 108-MW4 was installed north (upgradient) of wells 108-MW1 through 108-MW3 (**Figure 2-3**) and was constructed to a maximum finished depth of 12 feet. Well 108-MW4 was screened from a depth of 2.0 feet bgs to a maximum depth of 12.0 feet bgs with 20-slot PVC.

Groundwater sampling results for wells at Site 108 after August 1993 and before April 1997 were addressed in a letter report as an addendum to the 1994 Weston Closure and SI Report. The results presented in this letter addendum are not available for review.

2.2.2 UST Closure and Site Investigation Report for Former Building 108 (Smith Technologies Corporation, February 1996)

According to the *UST Closure and Site Investigation Report for Former Building 108, UST No. 090010-7*, prepared by Smith Technologies Corporation, dated February 1996, (**Appendix B**), there was one UST (No. 7) located immediately adjacent to former Building 108 (**Figure 2-4**). UST No. 7 was a steel 1,000-gallon tank that contained No. 2 fuel oil. On July 14, 1994, UST No. 7 was drained, removed and disposed offsite.

One small hole was observed during the inspection by the subsurface evaluator. In soils surrounding the UST, no evidence of contamination was observed visually or with an OVA. To evaluate soil conditions following removal of UST No. 7 and associated piping, post-excavation soil samples were collected from eight locations on July 14, 1994 and analyzed for TPHC. TPHC was detected in five of the eight samples at concentrations ranging from 26.2 mg/kg to 192.0 mg/kg, below the NJDEP soil cleanup criteria of 10,000 mg/kg.

Based on visual inspection of the UST, field screening of subsurface soils and analytical results of collected soil samples, the DPW concluded that no significant historical discharges were associated with UST No. 7 or associated piping.

2.2.3 Site Investigation Report for Main Post and Charles Wood Areas – (Weston, 1995)

As part of an SI of the Fort Monmouth military installation, Weston conducted soil sampling, monitoring well installation and sampling and geophysical surveying. In addition to sampling soil and groundwater at sites throughout the Main Post and Charles Wood areas of Fort Monmouth, Weston established background concentrations for soil and groundwater for the Fort Monmouth installation, as reported in the Weston SI Report (1995) (**Appendix D**). These background concentrations have been used by the DPW for comparing sample results for native constituents of soil and groundwater (see **Section 5.3**).

As presented in the Weston SI Report, several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrained in the collected groundwater samples.

A low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of entrained sediments on the dissolved phase metals concentrations at Fort Monmouth. Using a low-flow sampling methodology to reduce the presence of entrained sediment has generally yielded substantial reductions in the dissolved phase concentrations of metals, such as arsenic, antimony, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, silver, thallium and vanadium at Fort Monmouth sites. Significant decreases in the concentrations of metals characteristic of glauconitic sand also were observed. These included aluminum, barium, calcium, copper, iron, magnesium, manganese, nickel, potassium, sodium and zinc.

2.3 Site Conditions

On June 20, 2001, Versar conducted a site walk to assess conditions at Site 108. The site consists of Building 484, which is used by the DPW as office space and equipment storage, and a parking used for storage of construction and army vehicles. Site photographs were taken during the site walk at Site 108 and are included in **Appendix E**.

2.4 Environmental Setting

The following is a description of the geological/hydrogeological setting of the area surrounding Site 108. Included is a description of the regional geology of the area surrounding Fort Monmouth, as well as descriptions of the local geology and hydrogeology of the Main Post.

2.4.1 Regional and Local Geology

Monmouth County lies within the New Jersey Section of the Atlantic Coastal Plain physiographic province. Site 108 is located in what may be referred to as the Outer Coastal Plain subprovince, or the Outer Lowlands. The geologic map of New Jersey is provided as **Figure 2-5**.

In general, New Jersey Coastal Plain formations consist of a seaward-dipping wedge of unconsolidated deposits of clay, silt, sand and gravel. These formations typically strike northeast-southwest with a dip ranging from 10 to 60 feet per mile and were deposited on Precambrian and lower Paleozoic rocks (Zapecza, 1989). These sediments, predominantly derived from deltaic, shallow marine, and continental shelf environments,

date from Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

The formations include several major transgressive/regressive cycles and contain units, which are generally thicker to the southeast and reflect a deeper water environment. More than 20 regional geologic units are present within the sediments of the Coastal Plain. Regressive, upward coarsening deposits are usually aquifers (e.g., Englishtown and Kirkwood Formations, and the Cohansey Sand), while the transgressive deposits act as confining units (e.g., the Merchantville, Marshalltown and Navesink Formations). The individual thickness for these units varies greatly (i.e., from several feet to several hundred feet). The Coastal Plain deposits thicken to the southeast from the Fall Line (i.e., a boundary zone between older, resistant rocks and younger, softer plain sediments) to greater than 6,500 feet in Cape May County (Brown and Zapecza, 1990).

Based on the regional geologic map (Jablonski, 1968), the Cretaceous age Red Bank and Tinton Sands outcrop at the Main Post area. The Red Bank Sand conformably overlies the Navesink Formation and dips to the southeast at 35 feet per mile. The upper member (Shrewsbury) of the Red Bank Sand is a yellowish-gray to reddish brown clayey, medium-to-coarse-grained sand that contains abundant rock fragments, minor mica and glauconite (Jablonski). The lower member (Sandy Hook) is a dark gray to black, medium-to-fine grained sand with abundant clay, mica and glauconite.

The Tinton Sand conformably overlies the Red Bank Sand and ranges from a clayey medium to very coarse-grained feldspathic-quartz and glauconite-sand to a glauconitic-coarse sand. The color varies from dark yellowish orange or light brown to moderate brown and from light olive to grayish olive. Glauconite may constitute 60 to 80 percent of the sand fraction in the upper part of the unit. The upper part of the Tinton Sand is often highly oxidized and iron oxide encrusted (Minard, 1969). Groundwater occurs beneath the site at a depth of approximately 2 to 12 feet bgs.

The Kirkwood Formation (part of the Kirkwood-Cohansey system) crops out southeast of the Main Post and dips to the southeast at a slope of 20 feet per mile (Jablonski, 1968). The Kirkwood Formation consists of alternating layers of sand and clay. The upper unit is a light gray to yellowish-brown, fine-grained quartz sand with quartz nodules and small pebbles. The lower unit is a brown silt in Monmouth County (Jablonski, 1968).

As presented in the *Site Investigation Report - Main Post and Charles Wood Areas, Fort Monmouth, New Jersey*, prepared by Weston, Inc, dated December 1995 (Weston SI), several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium, and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrained in the collected groundwater samples.

As presented in **Appendix C**, the lithologic logs from four monitoring well installations at Site 108 indicate that the lithology at Site 108 consists of fill and native material. The fill encountered in Site 108 monitoring well borings is composed of brown sand, silt, cobbles and a trace of cinders. The native material encountered at Site 108 consists of greenish gray to black clay with sand. The maximum depth of fill ranged from approximately 3 feet at well 108-MW4 to approximately 6 feet at well 108-MW1. The lithology of the native material is consistent with the upper member of the Red Bank Sand (Shrewsbury Formation), as described in Minard (1969). The water level was approximately 4 feet bgs during the construction of the four monitoring wells at Site 108. Further discussion of the subsurface conditions at Site 108 is presented in **Section 4.0**.

2.4.2 Hydrogeology

Fort Monmouth lies in the Atlantic and Eastern Gulf Coastal Plain groundwater region (Meisler et al., 1988). This groundwater region is underlain by undeformed, unconsolidated to semi-consolidated sedimentary deposits. The chemistry of the water near the surface is variable with low dissolved solids and high iron concentrations. The water chemistry in areas underlain by glauconitic sediments (such as Red Bank, Tinton and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum and iron. The sediments in the area of Fort Monmouth were deposited in fluvial-deltaic to near shore environments.

The water table aquifer in the Main Post area is identified as part of the "Navesink-Hornerstown Confining Units," or minor aquifers. The minor aquifers include the Navesink formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation and the basal clay of the Kirkwood Formation. These geologic formations comprise a "Composite Confining Bed" for the Wenonah Mount Laurel Aquifer (Zapecza, 1984).

Wells installed in the Red Bank and Tinton Sands produce 2 to 25 gallons per minute (gpm) (Jablonski, 1968). Groundwater is typically encountered at the Main Post and in the surrounding areas at shallow depths below ground surface (2 to 9 feet bgs). Water in the surficial aquifer generally flows east toward the Atlantic Ocean.

As presented in **Figure 2-6**, Fort Monmouth is located within the outcrop area of the "Navesink-Hornerstown Confining Unit" (Martin, 1998), which also includes the Red Bank Sand, Tinton Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation, and the basal clay of the Kirkwood Formation. The Navesink-Hornerstown Confining Unit is approximately 125 feet thick at Site 108.

Based on a review of the NJDEP Ground Water Quality Standards (NJAC 7:9-6), January 7, 1993, VERSAR has determined that the site is underlain by a Class III-A aquifer. A formal presentation of this finding was made to the NJDEP on November 21, 2003. The primary designated use for Class III-A groundwater is the release or transmittal of groundwater to adjacent classification areas and surface water, as relevant. Secondary

designated uses in Class III-A include any reasonable use. Further discussion of the Class III-A aquifer designation is presented in **Section 6.3**.

Shallow groundwater may be locally influenced within the Main Post area by the following factors:

- Tidal influence (based on proximity to the Atlantic Ocean, rivers and tributaries)
- Topography
- Nature of the fill material within the Main Post area
- Presence of clay and silt lenses in the natural overburden deposits
- Local groundwater recharge areas (i.e., streams, lakes)
- Roadways, utility conduits and stormwater culverts

Due to the fluvial nature of the overburden deposits (i.e., sand and clay lenses), shallow groundwater flow direction is best determined on a case-by-case basis. The groundwater in the vicinity of Site 108 appears to be flowing in a southeast direction toward Oceanport Creek.

2.4.3 Soils

According to the U.S. Department of Agriculture (USDA), Soil Conservation Service, Monmouth County Soil Survey (April 1989), the majority of the Main Post is covered by urban land (**Figure 2-7**). The soil survey describes urban land as areas where concrete, asphalt, buildings, shopping centers, airports or other impervious surfaces cover 80 percent or more of the surface. In addition, the survey indicated that the natural subsurface soils have largely been replaced with artificial or foreign fill materials (developed land with disturbed soils).

The following soil series and classification units are mapped in the Main Post area:

- DoB Downer sandy loam (with 2 to 5 percent slopes)
- FrB Freehold sandy loam (with 2 to 5 percent slopes)
- FUB Freehold sandy loam/urban land complex (with 0 to 10 percent slopes)
- HV Humaquepts, frequently flooded
- KvA Kresson loam (with 0 to 5 percent slopes)
- UA Udorthents, smoothed
- UD Udorthents – urban land complex (with 0 to 3 percent slopes).

The Downer series soils are well-drained soils that are found on uplands and terraces. The soils are formed in acid, silty coastal plain sediments. The Freehold soils are also well drained and are formed in acid, loamy, coastal plain sediments that, by volume, are 1 to 10 percent glauconite and are found on uplands. The Humaquepts soils are somewhat poorly- to very poorly- drained soils that are formed in stratified, sandy, or loamy sediments of fluvial origins. The Humaquepts soils are located on the floodplain and are subject to flooding several times each year. The Kresson loam is a nearly level to gently

sloping soil and is somewhat poorly drained. The soil is found on low divides and in depressions.

The Udorthents soils have been altered by excavation or filling activities. In filled areas, these soils consist of loamy material that is more than 20 inches thick. The filled areas include floodplain, tidal marshes and areas with moderately, well drained to very poorly drained soils. Some Udorthent soils contain concrete, asphalt, metal and glass. The soils in the vicinity of Site 108 are classified as UD – Udorthents – urban land complex, with 0 to 3 percent slopes (**Figure 2-7**).

2.4.4 Topography and Surface Drainage

Over the last 80 years, the natural topography of Fort Monmouth has been altered by excavation and filling activities conducted by the military. The land surface at the Main Post is relatively flat and ranges in elevation from approximately 4 feet above mean sea level (amsl) in the east at Oceanport Creek to 32 feet amsl at the western end of the post, near Highway 35. The eastern half of the post is generally 10 feet amsl in elevation.

Surface water runoff from the western part of the Main Post flows into the Lafetra Creek to the north or into the Mill Creek to the south. The USGS topographic map (**Figure 2-1**) shows the Lafetra Creek as Parkers Creek Branch and Mill Creek as Wampum. Both Mill Creek and Lafetra Creek originate off-post. Mill Creek is channelized and flows along the southern boundary of the Main Post, turning north just past the Auto Craft Shop. Lafetra Creek forms the northern boundary of the Main Post and joins Mill Creek to form Parkers Creek. Parkers Creek flows eastward along the northern boundary and joins Oceanport Creek east of the post. Most of Parkers Creek, Oceanport Creek, Lafetra Creek and Mill Creek are tidally influenced.

The U.S. Fish and Wildlife Service (FWS) National Wetland Inventory Long Branch quadrangle maps indicate the presence of wetlands at the Main Post. Parkers Creek and Oceanport Creek are classified as estuarine intertidal aquatic beds. The area of Parkers Creek and the part of Oceanport Creek/Husky Brook are classified as estuarine intertidal emergent wetlands. Lafetra Creek and Mill Creek are classified as riverine lower perennial open water/unknown bottom.

Site 108 is located approximately 400 feet west of Oceanport Creek, which empties to the east into the Shrewsbury River. The USGS topographic map (**Figure 2-1**) shows that the land surface of the site is relatively flat at an elevation of less than 20 feet amsl. Surface water runoff from the Site 108 is likely to flow east into Oceanport Creek.

3.0 SITE ACTIVITIES

Fort Monmouth DPW has conducted remedial investigation activities, including a groundwater sampling program, to define the areal extent of potential pollutants and evaluate impacts to groundwater in the vicinity of Site 108. Remedial investigation activities were performed from April 1997 and continued through August 2001. These activities were managed by the Fort Monmouth DPW and performed by TECOM-Vinnell Services (TVS) and Versar. The details of remedial investigation activities that occurred at Site 108 are described in the following sections.

3.1 Well Installation

A total of four monitoring wells (108-MW1, 108-MW2, 108-MW3 and 108-MW4) comprise the quarterly groundwater monitoring program conducted by the DPW. As discussed in **Section 2.2**, three of the four wells (108-MW1, 108-MW2 and 108-MW3) were installed in June 1993, during the UST closure and site investigations for UST Nos. 090010-60 through 090010-64. The remaining well, 108-MW4, was installed by the DPW in August 1995. Monitoring well construction details are discussed in **Section 2.2** and are summarized in **Table 2-1**. Well boring logs and monitoring well records are provided in **Appendix C**.

3.2 Sample Collection Activities

As part of the remedial investigation of Site 108, quarterly groundwater monitoring was conducted from April 1997 through February 2001, and a Geoprobe® investigation was conducted in March 2001. Sampling activities were performed in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (December 1997). Laboratory analyses of the samples collected at Site 108 were conducted at the Fort Monmouth Environmental Testing Laboratory (FMETL), a New Jersey certified laboratory (Certification No. 13461).

3.2.1 Groundwater Sample Collection Activities

Monitoring wells 108-MW1, 108-MW2, 108-MW3 and 108-MW4 were sampled during 16 rounds of quarterly groundwater sampling. A total of 114 groundwater samples, including 13 duplicate samples, 16 field blanks and 16 trip blanks for quality assurance/quality control (QA/QC), were collected from the four monitoring wells at Site 108. The quarterly groundwater samples were analyzed as follows:

- During the first quarterly sampling round, groundwater samples were analyzed for VOCs plus 15 TICs using United States Environmental Protection Agency (USEPA) Method 624 and lead using USEPA Method 3113B.
- During the second quarterly sampling round, groundwater samples were analyzed for VOCs plus 15 TICs using USEPA Method 624, SVOCs plus 25 TICs using USEPA Method 625, pesticides and PCBs using USEPA Method 608, and TAL metals using USEPA Methods 3111D, 3111B, 3112B, 3113B and 3120B.

- During quarterly sampling rounds #3 through #16, groundwater samples were analyzed for VOCs plus 15 TICs using USEPA Method 624, SVOCs plus 25 TICs using USEPA Method 625, pesticides and PCBs using USEPA Method 608, and TAL metals using USEPA Methods 3112B and 3120B.

A summary of the groundwater sampling activities, including rounds, well IDs, sample IDs, sample locations, collection/analysis date, analytical parameters and analysis method, is provided in **Table 3-1**. Copies of the groundwater sampling chain-of-custody forms and laboratory data sheets are presented in **Appendix F**. The results of the quarterly groundwater monitoring program for Site 108 are discussed in **Section 5.1** and are presented in **Table 5-1**.

As discussed in **Section 2.2.3**, a low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of entrained sediments on the dissolved phase metals concentrations at Fort Monmouth. In consideration of the potential benefits of the low-flow sampling procedure, two additional rounds of low-flow sampling were conducted on September 8, 2000 (Low Flow #1), and October 6-10, 2000 (Low Flow #2), using a low-flow groundwater sampling technique. A total of 14 samples, including three duplicate samples and three field blanks, were collected and analyzed only for TAL metals to determine whether elevated pesticides and PCBs or metal concentrations observed in the groundwater samples at Site 108 are due to entrained soil particles (e.g., high turbidity), rather than dissolved phased groundwater constituents. The samples were analyzed by the FMETL for TAL metals utilizing USEPA Methods 3120B and 3112B. The results of the low-flow sampling rounds for Site 108 are discussed in **Sections 5.1** and presented in **Table 5-1**.

Sampling equipment was thoroughly decontaminated before and after each use, in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (1997). Following collection, groundwater samples were immediately placed in laboratory-supplied bottleware. The sample containers were labeled, sealed, packed in ice and transported to the FMETL under proper chain-of-custody procedures.

During each of the monitoring well sampling rounds, aquifer chemical characteristics including pH, temperature, conductivity and dissolved oxygen were recorded prior to sampling. These chemical characteristics are included in the laboratory data packages. The aquifer pH data is presented in **Section 5.4,** summarized in **Table 5-5** and discussed in **Section 6.1.2**.

3.2.2 Supplemental Soil Sampling Activities

On March 8, 2001, the DPW conducted supplemental soil sampling at Site 108. Supplemental soil sampling was conducted based on detections of elevated arsenic concentrations in monitoring well samples collected at Site 108. A total of 27 subsurface soil samples and three duplicate samples were collected from nine distinct Geoprobe® borings. The soil samples were collected from each Geoprobe® boring at depth intervals

of 0 to 6 inches, 12 to 18 inches and 24 to 30 inches bgs. The locations of the nine Geoprobe® borings are shown in **Figure 3-1**.

The sample containers were labeled, sealed, packed in ice and transported to the FMETL under proper chain-of-custody procedures. Sampling equipment was thoroughly decontaminated before and after each use in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (1997). The soil samples were collected and immediately placed in laboratory-supplied bottleware. A summary of the supplemental soil sampling activities, including sample IDs, collection/analysis dates, analytical parameters and analysis method is provided in **Table 3-2**. Copies of the supplemental soil sample chain-of-custody forms for the laboratory analyses are presented in **Appendix G**. The supplemental soil samples were analyzed by the FMETL for arsenic and lead using USEPA Methods 7060A, 7420 and 3051A. The supplemental soil sampling results are discussed in **Section 5.3**.

3.3 Groundwater Depth Measurements

During each of the groundwater monitoring rounds conducted at Site 108 (including the 16 quarterly monitoring rounds and two low-flow rounds), measurements of depth to water was recorded with an accuracy of 0.01 feet. These depth to groundwater measurements, recorded from April 1997 through February 2001, are presented in **Table 3-3**. The groundwater elevation at each well was calculated by subtracting the measured depth to groundwater from the elevation of the top of the well casing. Groundwater elevations are discussed in **Section 4.2**.

3.4 Slug Testing Procedures

Versar conducted slug testing at the four monitoring wells located at Site 108 on August 14, 2001. Slug testing was performed to estimate hydrogeologic properties, such as groundwater velocity, of the shallow soils at this site to be used for contaminant transport modeling. The equipment used to perform the slug testing included a Hermit Environmental Data Logger (Model 1000C), a 10-psi pressure transducer and a 4-foot long, 3.5-inch diameter PVC slug.

Slug testing was performed by first recording the depth to top of groundwater, then placing the slug and the transducer into the well and allowing the water to equilibrate to a level close to the original water level. The new water level was set as the reference water level for the data logger during the slug test. The slug was then removed and the data logger recorded the changing water level with time. The collected data were then transferred to a personal computer for later review and reduction. The raw data are presented in **Appendix H**. The results are discussed in **Section 4.2**.

3.5 Sensitive Receptors/Well Search

Searches were conducted using various databases and historical information to identify receptors and groundwater wells that may be potentially affected by Site 108. An Offsite Receptor Report (dated October 24, 2001) was prepared for a two-mile radius surrounding a central point of the Main Post (less than 1 mile from Site 108) by Environmental Data Resources, Inc. (EDR).

In addition, a search of the comprehensive well database maintained by the NJDEP Well Permitting and Regulations Section of the Bureau of Water Allocation was performed to identify groundwater wells that may potentially be affected by Site 108. The search was performed for a one-mile radius surrounding a point at the center of Site 80/166 (addressed in a separate RIR). Site 108 is located approximately 750 feet from Site 80/166.

A copy of the sensitive receptor survey is provided in **Appendix I,** and a copy of the well search summary is provided in **Appendix J**. The results of the sensitive receptor survey and well search are discussed in **Section 6.2**.

4.0 SITE PHYSICAL CHARACTERISTICS

The following sections represent the findings of the Site 108 geologic and hydrogeologic characterization program. These sections include a detailed discussion of the physical properties of the unconsolidated soil, bedrock and groundwater underlying the study area. Groundwater elevation data collected by the DPW from April 1997 through February 2001 are presented in this section.

4.1 Lithology

Geologic cross section A-A' was prepared for Site 108. The cross section location map is included as **Figure 4-1**. The data used to construct the cross section are presented in **Table 4-1**. The geologic cross section A-A' is shown in **Figure 4-2**. The boring logs used to create the cross section data tables are contained in **Appendix C**.

Geologic cross section A-A' depicts the profiles for monitoring wells 108-MW1, 108-MW3 and 108-MW4. The lithology encountered at Site 108 includes fill and native material. Well 108-MW2 is not included in this geologic cross section; however, the lithology encountered in this well is similar to the lithology of wells 108-MW1, 108-MW3 and 108-MW4 (see **Appendix C**). The native material encountered at Site 108 consists of greenish gray to black clay mixed with sand. The lithology of this native material is consistent with the Upper Red Bank Sand (Shrewsbury Formation) as described in Minard (1969). The fill encountered in the well borings at Site 108 consisted of well-sorted sand with silt and some cobbles and ranged from 3 to 6 feet bgs. Cinders were also observed in the boring of well 108-MW4.

4.2 Groundwater Flow

During the groundwater sampling program at Site 108 (16 quarterly rounds and two low-flow sampling rounds), groundwater was encountered in monitoring wells at Site 108 at depths ranging from 1.62 to 10.68 feet bgs (**Table 3-3**) with a slight gradient toward the east in the direction of the New Jersey Transit Railroad. Groundwater velocity and flow directions were predicted based on the groundwater elevation data and slug test results (see below), as well as the interpretation of groundwater contour maps prepared for selected sampling events.

4.2.1 Groundwater Flow Direction

In accordance with NJAC 7:26E-3.13(d)2iv, 16 groundwater contour maps were generated based on groundwater depth measurements from the four monitoring wells during each of the quarterly groundwater sampling rounds (**Figures 4-3a** through **4-3p**). Groundwater underlying Site 108 consistently flows to the east towards Oceanport Creek. No significant variations in groundwater flow conditions were observed in these 16 groundwater contour maps. Groundwater elevation data are presented in **Table 3-3**.

4.2.2 Hydrogeologic Properties

As discussed in **Section 3.4**, Versar conducted slug testing of the four monitoring wells located at Site 108 on August 14, 2001. Versar used the computer software *Aquifer Test* by Waterloo Hydrogeologic, Inc. (version 3.01, 2001) to reduce the slug testing data using the Bouwer-Rice methodologies. Data plots generated by Aquifer Test are presented in **Appendix H**. A summary of the calculated conductivity values is presented in **Table 4-2**.

The calculated conductivity values range from 3.7 feet/day at monitoring well 108-MW1 to 31.7 feet/day at well 108-MW3, with a calculated geometric mean of 8.9 feet/day. The variability in the range of hydraulic conductivities is associated with the shallow depth of the monitoring wells, partial penetration into the aquifer and the heterogeneous nature of the fill material at Site 108. The geometric mean is used for analysis instead of the average due to the commonly high range of variability in hydraulic conductivity measurements.

The groundwater flow gradient for Site 108 was estimated using the groundwater elevation data discussed above. The groundwater flow gradient (i) is calculated by measuring the distance (L) between two equipotential lines h_1 and h_2 using the following equation:

$$i = \frac{h_1 - h_2}{L}$$

The groundwater flow gradient for Site 108, based on water level measurements collected on January 24, 2001, was estimated at approximately 0.03 feet per foot.

Groundwater flow velocity (v) in the vicinity of Site 108 was then estimated using the groundwater flow gradient (i), an estimated hydraulic conductivity (K) for the surrounding soils based on the slug test results, and an assumed porosity (α) in the following equation:

$$v = \frac{Ki}{\alpha}$$

The hydraulic conductivity (K) used in the calculation, 8.9 feet/day, is the geometric mean based on the results of slug testing performed by Versar (**Table 4-2**). The porosity (α) was estimated at 40% using average values for silt and sands (Heath, USGS, 1989). The groundwater velocity for Site 108 was calculated to be approximately 0.68 feet per day (approximately 250 feet per year).

5.0 SITE CHEMICAL CHARACTERIZATION

This section includes a discussion of the chemical characterization of Site 108 based on the various samples collected and analyzed during 16 quarterly rounds and two low-flow sampling rounds of monitoring well sampling and supplemental soil sampling. Monitoring well sampling was conducted between April 1997 and February 2001. Supplemental soil sampling was conducted in March 2001. DPW personnel were responsible for the collection of samples during this remedial investigation. Sample analyses were performed by the FMETL.

5.1 Groundwater Sample Results

This section presents a discussion of the results of laboratory analyses performed for the 18 rounds of groundwater samples collected from April 1997 through February 2001 from the four monitoring wells (108-MW1 through 108-MW4) at Site 108. These 18 rounds are a combination of 16 quarterly rounds conducted at Site 108, and two additional low-flow rounds (**Table 3-1**). The groundwater samples were collected and analyzed for VOCs plus 15 TICs, SVOCs plus 25 TICs, pesticides, PCBs and TAL metals. The two low-flow sampling rounds were conducted on September 8, 2000 (Low Flow #1), and October 6-10, 2000 (Low Flow #2) using a low-flow groundwater sampling technique for TAL metals. As discussed in **Section 2.2.3**, a low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of suspended sediments on the dissolved phase metals concentrations at Site 108.

As discussed in **Section 2.4.2**, Fort Monmouth is underlain by a Class III-A aquifer. The appropriate groundwater quality criteria for Class III-A are the criteria for the most stringent classification for vertically or horizontally adjacent groundwaters that are not Class III-A (NJAC 7:9-6.7e). The NJDEP criteria used for comparison of groundwater analytical results were the higher of the Practical Quantitation Limits (PQLs) and the NJDEP GWQC for Class II-A aquifers (NJAC 7:9-6, Table 1).

During the 18 quarterly sampling events, a total of four VOCs were detected in site groundwater. One VOC was detected at a concentration that exceeded its GWQC in at least one sample, while the remaining three VOCs were detected below their respective GWQC. A total of six SVOCs were detected in site groundwater below their respective GWQC. A total of two pesticides were detected in site groundwater below their respective GWQC. No PCBs were detected in site groundwater. A total of 23 metals were detected in site groundwater. Nine metals were detected at concentrations that exceed their respective GWQC in at least one sample, while the remaining 14 metals were detected below their respective GWQC.

The analyte exceedances of the appropriate GWQC in groundwater samples are presented in four subsections: VOCs (**5.1.1**), SVOCs (**5.1.2**), Pesticides and PCBs (**5.1.3**) and Metals (**5.1.4**). Analytes detected in groundwater samples at Site 108 at concentrations above the NJDEP criteria are bold and highlighted in **Table 5-1**. The chain-of-custody

forms for groundwater samples and laboratory data sheets are provided in **Appendix F**. **Figure 5-1** shows the contaminant distribution for groundwater within the area of Site 108.

5.1.1 VOCs

During 18 quarterly sampling events, one VOC was detected in site groundwater at a concentration that exceeded its GWQC in at least one sample.

Methylene chloride was detected at concentrations exceeding the GWQC of 2.0 ug/L in two rounds of sampling collected at three monitoring well locations. Concentrations ranged from 2.46 ug/L (sampling round #6) in 108-MW1 to 3.09 ug/L (sampling round #1) in 108-MW3.

5.1.2 SVOCs

No SVOCs were detected above the appropriate GWQC at the site.

5.1.3 Pesticides and PCBs

No pesticides or PCBs were detected above the appropriate GWQC at the site.

5.1.4 Metals

During 18 quarterly sampling events, nine metals were detected in groundwater samples at concentrations above their respective NJDEP GWQC.

Aluminum was detected at concentrations exceeding the GWQC of 200 ug/L in 16 rounds of sampling collected at four monitoring well locations. Concentrations ranged from 228 ug/L (Low Flow #1) in 108-MW1 to 55,100 ug/L (sampling round #15) in 108-MW4.

Arsenic was detected at concentrations exceeding the GWQC of 8.0 ug/L in 17 rounds of sampling collected at four monitoring well locations. Concentrations ranged from 8.5 ug/L (sampling round #13) in 108-MW3 to 63.2 ug/L (sampling round #5) in 108-MW2.

Cadmium was detected at concentrations exceeding the GWQC of 4.0 ug/L in two rounds of sampling collected at one monitoring well location. Concentrations ranged from 5.1 ug/L (sampling round #4) in 108-MW4 to 8.09 ug/L (sampling round #8) in 108-MW4.

Chromium was detected at concentrations exceeding the GWQC of 100 ug/L in five rounds of sampling collected at three monitoring well locations. Concentrations ranged from 149 ug/L (sampling round #9) in 108-MW4 to 363 ug/L (sampling round #15) in 108-MW4.

Iron was detected at concentrations exceeding the GWQC of 300 ug/L in 17 rounds of sampling collected at four monitoring well locations. Concentrations ranged from 388 ug/L (Low Flow #1) in 108-MW4 to 104,000 ug/L (sampling round #15) in 108-MW4.

Lead was detected at concentrations exceeding the GWQC of 10 ug/L in 14 rounds of sampling collected at four monitoring well locations. Concentrations ranged from 11.2 ug/L (sampling round #7) in 108-MW1 to 197 ug/L (sampling round #12) in 108-MW4.

Manganese was detected at concentrations exceeding the GWQC of 50 ug/L in 17 rounds of sampling collected at four monitoring well locations. Concentrations ranged from 55.4 ug/L (sampling round #11) in 108-MW1 to 10,250 ug/L (sampling round #2) in 108-MW2.

Sodium was detected at concentrations exceeding the GWQC of 50,000 ug/L in 13 rounds of sampling collected at three monitoring well locations. Concentrations ranged from 50,020 ug/L (sampling round #3) in 108-MW2 to 68,500 ug/L (Low Flow #1) in 108-MW2.

Thallium was detected at concentrations exceeding the GWQC of 10 ug/L in one round of sampling collected at one monitoring well location (108-MW1) at a concentration of 10.6 ug/L (sampling round #15).

5.2 Contaminants of Concern

In order to determine the potential COCs in groundwater at Site 108, the first step was to identify exceedances of the NJDEP criteria (GWQC) in monitoring well samples collected at Site 108. These exceedances are presented in **Section 5.1** above and in **Table 5-1**. There was one groundwater constituent identified as a COC at Site 108 (arsenic) as discussed in this section.

There were several factors that were used to eliminate or identify analytes as COCs. These factors include the magnitude and frequency of the exceedances, comparisons to low-flow sample results (for metals only), and comparisons to established background concentrations (see **Section 2.2.3**). **Table 5-2** summarizes the process used to identify COCs in groundwater at Site 108.

There was one VOC (methylene chloride) that was detected in groundwater at concentrations exceeding the NJDEP GWQC. Methylene chloride is not considered to be a potential COC at Site 108 because methylene chloride concentrations have not exceeded the NJDEP GWQC since September 1998. (Methylene chloride is also a common laboratory contaminant).

There were no SVOCs, pesticides or PCBs detected at concentrations exceeding the GWQC. Therefore no SVOCs, pesticides or PCBs are considered COCs at Site 108.

There were nine metals that were detected in groundwater at Site 108 at concentrations exceeding the NJDEP GWQC (aluminum, arsenic, cadmium, chromium, iron, lead, manganese, sodium and thallium). The specific exceedances and the identification of each of these metals as a potential contaminant of concern are discussed below.

As discussed in **Section 2.2.3**, a low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of suspended sediments on the dissolved phase metals concentrations at Site 108. The nine different metals that were detected in Site 108 groundwater at concentrations exceeding the New Jersey GWQC are distinguished below into background and non-native metals. The indigenous metals are compared to the Main Post Maximum Background Concentrations (MBC) identified in the Weston SI (1995) and are presented in **Tables 5-1** and **5-2**. The non-native metals are discussed in relation to the New Jersey GWQC only.

Of the nine metals detected in Site 108 groundwater that exceed the GWQC, four metals (aluminum, iron, manganese and sodium) are common background constituents in Monmouth County soils. The water chemistry in areas underlain by glauconitic sediments (such as Red Bank, Tinton and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum and iron. Elevated concentrations of these metals are routinely observed in groundwater samples collected at Fort Monmouth. In consideration of these facts, the groundwater analytical results for these eight metals were compared to their respective MBCs of 121,000 ug/L (aluminum), 431,000 ug/L (iron), 331 ug/L (manganese) and 21,500 ug/L (sodium), as follows:

- Aluminum is not considered to be a COC because aluminum was not detected at concentrations exceeding the MBC.
- Iron is not considered to be a COC because iron was not detected at concentrations exceeding the MBC.
- Manganese is not considered to be a COC because manganese has not been detected at concentrations exceeding the MBC since February 1999.
- Sodium is not considered to be a COC due to the proximity of Site 108 to sea water.

There were five non-native metals that exceeded the GWQC (arsenic, cadmium, chromium, lead and thallium). One of these metals (thallium) is not considered a COC because thallium exceeded the GWQC in only one sample collected at Site 108. The remaining four non-native metals (arsenic, cadmium, chromium and lead) were compared to sample results collected during the low-flow sampling rounds.

Two separate rounds of sampling (September 6-7, 2000 and October 11-12, 2000) were performed during the quarterly groundwater sampling program using the low-flow groundwater sampling technique as discussed in **Section 3.2.1**. This technique was used to determine if the detected metal concentrations observed in the groundwater samples are a function of entrained sediments suspended in the groundwater during the course of well purging and sampling activities, or an accurate representation of dissolved phase aquifer/groundwater conditions. These comparisons provided the following results:

- Arsenic concentrations exceeded the GWQC in samples collected during both of the low-flow sampling rounds. Arsenic was also detected at concentrations exceeding the GWQC during each of the 16 quarterly sampling rounds at Site 108. Based on these results, arsenic is considered to be a potential COC at Site 108.
- Cadmium was not detected during the two low-flow sampling rounds (September and October 2000) and is therefore not considered to be a COC at Site 108.
- Chromium was not detected above the groundwater criteria of 100 ug/L during either of the two low-flow sampling rounds (September and October 2000). Based on these results, chromium is not considered to be a COC at Site 108.
- There were no exceedances of lead during either of the two low-flow sampling rounds. Lead was detected below the groundwater quality criteria of 10 ug/L in only one sample collected during the two low-flow sampling rounds (4.1 ug/L in well 108-MW4, collected during the 2nd low-flow sampling round in October 2000). Based on these results, lead is not considered to be a COC at Site 108.

Based on the magnitude of the exceedances, the frequency of occurrences, and the wide-ranging results, one metal (arsenic) is identified as a COC at Site 108 and is given further consideration with regard to contaminant migration potential in **Section 6.0** of this RIR. No other COCs were identified in groundwater at Site 108. The concentrations of arsenic in groundwater at Site 108 are summarized on **Figure 5-1** and in **Table 5-3**.

The method detection limits (MDLs) for each of the sample results in which there was a non-detect (ND) result are included in **Table 5-3**. The method detection limit for each analysis is included in the laboratory data packages. These method detection limits were used in the groundwater model as discussed in **Section 6.1.3**.

5.3 Supplemental Soil Sampling Results

After identifying arsenic as a COC in site groundwater, the DPW collected soil samples from nine Geoprobe® borings at Site 108. From each of these nine borings, the DPW collected three soil samples at depth intervals of 0 to 6 inches, 12 to 18 inches and 24 to 30 inches bgs. The soil samples were analyzed by the FMETL for arsenic and lead using EPA methods 7060A, 7420 and 3051A. Even though lead is not considered a potential COC at Site 108, the supplemental soil samples were analyzed for lead for comparison purposes. The analytical results for supplemental soil samples collected from Site 108 are summarized in **Table 5-4** and **Figure 5-2**.

Arsenic was detected at concentrations exceeding the RDCSCC of 20 mg/kg in 14 soil samples collected at eight separate Geoprobe® boring locations. Concentrations ranged from 15.56 mg/kg (24-30 inches) at boring location #9 to 297.03 mg/kg (24-30 inches) at boring location #8.

Lead was detected at concentrations below the RDCSCC of 400 mg/kg in 27 soil samples collected at nine separate Geoprobe® boring locations. Concentrations ranged from 1.33 mg/kg (12-18 inches) at boring location #3 to 166 mg/kg (24-30 inches) at boring location #8.

The results of the soil sampling do not support a localized source of arsenic or lead contamination in subsurface soil at Site 108. Lead was not detected above the RDCSCC at any soil boring sample location. Arsenic was detected in 8 of 9 soil boring locations at concentrations greater than the RDCSCC, but only a single location indicated an arsenic concentration that exceeds the RDCSCC by more than one order of magnitude (in boring location #8 at a depth of 24-30 inches bgs). Therefore, the arsenic is likely attributable to native soil characteristics or a non-point source distributed throughout the subsurface soils at Site 108. It is unlikely that either soil constituent is adversely affecting the quality of shallow groundwater at Site 108.

5.4 Aquifer pH

During each of the monitoring well sampling rounds, the pH of the groundwater was recorded prior to sampling. The average pH ranged from 6.61 in well 108-MW3 to 7.07 in well 108-MW4. The aquifer pH measurements are shown in **Table 5-5**. The pH data is included in the laboratory data packages (**Appendix F**). The aquifer pH is discussed in **Section 6.1**.

6.0 CONTAMINANT MIGRATION AND GROUNDWATER USE DESIGNATION

The purpose of developing a groundwater model for Site 108 was to predict the migration of the identified COC, arsenic, in site groundwater. For the model area, initial concentrations of arsenic were assigned based on groundwater quality sample results (**Section 5.1**), and predictions of the migration and change in arsenic concentration over time were made. The initial arsenic concentrations, as well as future predictions (results) of the model simulation, are presented graphically. The time required to achieve compliance with the NJDEP criteria was then estimated.

6.1 Groundwater Model Development

A conceptual site model was developed for Site 108 to provide a basis for the computer model development. The conceptual site model includes the topography, groundwater recharge, groundwater flow conditions and the geologic formations in the ground. The parameters used in the groundwater flow model were based on Fort Monmouth survey data, published literature about the hydrogeology of the region and field measurements of groundwater elevation at Site 108 (discussed in **Section 4.2**).

The USGS Modular Three-Dimensional Groundwater Flow Model, MODFLOW, was chosen for additional groundwater modeling for arsenic in order to incorporate the effects of dispersion, 3-dimensional groundwater flow and retardation due to sorption.

6.1.1 Conceptual Site Model

The land surface at the Main Post is relatively flat and ranges in elevation from 4 feet amsl in the east at Oceanport Creek to 32 feet amsl at the western end of the post, near Highway 35. The eastern half of the post is generally 10 feet amsl in elevation. Site 108 is located approximately 500 feet northwest of Oceanport Creek. The USGS topographic map (**Figure 2-1**) shows that the land surface of the site is relatively flat at an elevation of less than 20 feet amsl. Surface water runoff from Site 108 is likely to flow east into Oceanport Creek.

According to Jablonski (1968), the average precipitation for Monmouth County is 44.67 inches per year. After precipitation reaches the ground, the water cycle begins and the water is lost to the atmosphere through evapotranspiration, discharged to receiving waters as surface runoff, or percolates into the soil as groundwater recharge. Groundwater is then separated into water utilization and groundwater flow ("base flow"). The average groundwater recharge for Site 108 was calculated from Jablonski (1968) to be approximately 13.28 inches per year, which is the sum of the base flow (11.56 inches per year), utilization from groundwater (0.84 inches per year), and the utilization from surface water (0.88 inches per year). As an approximation to natural conditions, the

recharge of 13.28 inches was applied to the entire MODFLOW model area as an approximation.

As discussed in **Section 2.4.1**, the geologic formations that outcrop at the Fort Monmouth Army Base include the Tinton and Red Bank Sands, as well as the Hornerstown Formation. These formations, along with the Navesink Formation, are part of the Navesink-Hornerstown Confining Unit that overlies the Wenonah-Mount Laurel Aquifer (Zapecza, 1990). A cross section of the New Jersey Coastal plain that shows these formations is presented in **Figure 6-1.**

The lithology encountered at Site 108 includes fill and native material (refer to **Appendix C**, Boring Logs). The native material encountered at Site 108 consists of greenish gray to black clay mixed with sand. The lithology of this native material is consistent with the Upper Red Bank (Shrewsbury) Formation (Minard, 1969). The fill encountered in the well borings at Site 108 consisted of well-sorted sand with silt and some cobbles. Cinders were also observed in the boring of well 108-MW4.

Groundwater was encountered in both the fill and native soils in each monitoring well at depths ranging from 1.62 to 10.68 feet bgs **(Table 3-3**) with a hydraulic gradient indicating flow east toward Oceanport Creek (**Figure 4-3a** through **4-3p**). The groundwater flow gradient for Site 108 was estimated to be 0.03 feet per foot. The calculated conductivity values range from 3.7 feet/day at monitoring well 108-MW1 to 31.7 feet/day at well 108-MW3, with a calculated geometric mean of 8.9 feet/day. The groundwater velocity for Site 108 was calculated to be approximately 0.68 feet per day (approximately 250 feet per year).

6.1.2 MODFLOW Input Parameters

Visual MODFLOW Version 2.8.2 (Waterloo Hydrogeologic, Inc.) was used to simulate the groundwater flow at Site 108, and *MT3D 1999* (1999, Papadopolos & Associates, Inc.) was used to simulate the movement of the arsenic over time at Site 108. *Surfer for Windows Version 7* (Golden Software, Inc.) was used to create the map of the ground surface that was used in the simulation and the map of the initial arsenic concentration. The input parameters for the MODFLOW model for Site 108 are presented in **Table 6-1**.

Physical Boundaries and Grid

The model grid for Site 108 is presented in **Figure 6-2** with topographic contours shown as brown lines, Oceanport Creek highlighted as solid brown (groundwater constant head boundary condition of 0 feet amsl), and the Fort Monmouth Base Map shown in black. The Fort Monmouth Base Map was used to determine the location of Oceanport Creek.

The model area for Site 108 was 2,400 feet (West to East) by 2,400 feet (South to North). This area was divided into a grid with 132 columns and 131 rows. The grid cells are 20 by 20 feet in the majority of the model area and 10 feet by 10 feet in the vicinity of the Site 108 monitoring wells. Ground surface elevation points were obtained from the Fort

Monmouth topographic survey map, and the surface elevation in Oceanport Creek was assumed to be at an elevation of 0 feet amsl. The ground surface was obtained for each of the MODFLOW grid cells by importing topographic data into *Visual MODFLOW*, which uses the "kriging" method to estimate topographic elevations in each model grid-values from a set of topographic measurements.

The groundwater recharge for Site 108 was estimated to be 13.28 inches, as discussed in **Section 6.1.1**. The recharge of 13.28 inches was applied to the entire MODFLOW model area as an approximation. Surface water drainage through storm sewers was not addressed in the MODFLOW model. The grid cells that are located within Oceanport Creek were designated the boundary condition of 0 feet amsl for the groundwater head.

The porosity and specific yield of 0.4 and 0.2, respectively, were taken from Heath (USGS, 1989). The bulk density of 46.7 kg/feet^3 was derived from the porosity (0.4), and a typical soil particle density of 2.65 g/ml (Brady and Weil 1996).

Groundwater Flow Parameters

The model area for Site 108 was divided into seven layers, which relate to three published hydrogeologic units and one 5 foot layer of surficial fill (an average range of fill depths). As noted in **Section 4.1**, the lithology presented in geologic cross section A-A' (**Figure 4-2**) includes both fill and native material. **Figure 6-3** presents a cross section of the model area showing these layers. Each color on this figure represents a different hydrogeologic unit and a different hydraulic conductivity. Four hydrogeologic units (surficial fill, the Navesink-Hornerstown Confining Unit, the Mount Laurel Aquifer and the Marshalltown-Wenonah Confining Unit) were used in the MODFLOW simulation for Site 108. Conductivity values for the lower three hydrogeologic units were taken to be the geometric mean of published conductivity values (Martin, 1998). The thicknesses of these lower four layers correspond to the published thicknesses of geologic formations (as presented in Zapecza, 1990, plates 16, 17 and 18). The five model layers are discussed below:

- The top layer, identified as Layer 1, is 5 feet thick, and corresponds to fill material. The fill thickness of 5 feet was assigned to the entire model area as a simplification. This assumed thickness approximates the observations of fill in monitoring well borings at Site 108. Layer 1 was assigned a hydraulic conductivity of 8.9 feet per day, which is the geometric mean of the conductivity values obtained from slug tests (described in **Sections 3.4 and 4.2.2**).
- Layer 2 (approximately 25 feet thick), and Layer 3 (110 feet thick) correspond to the Navesink-Hornerstown Confining Unit. This confining unit was divided into two layers to identify potential contamination within 20 feet of the ground surface and to accurately predict the effects of dispersion in the model. Layers 2 and 3 were assigned a hydraulic conductivity of 0.12 feet per day. The thickness of the Navesink-Hornerstown Confining Unit is 125 feet at Site 108 (**Figure 2-6**).
- Layer 4, which corresponds to the Wenonah-Mount Laurel Aquifer, was assigned a thickness of 75 feet and a hydraulic conductivity of 15.96 feet per day.

- The bottom layer, Layer 5, corresponds to the Marshalltown-Wenonah Confining Unit and was assigned the thickness of 10 feet. The hydraulic conductivity of 0.00018 feet per day was assigned to this lowermost layer.

Contaminant Transport Inputs: Initial Concentrations

The physical and chemical parameters that effect contaminant transport were set up for arsenic, which is the COC at Site 108. The contaminant transport parameters include initial concentrations of the arsenic, dispersivity, bulk density, sorption type and sorption coefficients. The initial concentrations of arsenic in site groundwater in each well is discussed in **Section 5** and summarized in **Table 5-3**. The initial concentration map for arsenic in site groundwater in MODFLOW is portrayed in **Figure 6-4**.

The initial concentration maps for arsenic were derived for each of the MODFLOW grid cells by entering average groundwater concentrations into *Visual MODFLOW*. The average concentrations were derived from the groundwater sampling results obtained between April 1997 and January 2001 (**Table 5-1**). Points outside of the Site 108 monitoring wells were entered into MODFLOW as half the MDL for arsenic (0.5 ug/L was used based on the MDL of 1.0 ug/L for arsenic).

Contaminant Transport Inputs: Aquifer Characteristics

The contaminant transport simulation for Site 108 incorporated the sorption of arsenic to the solid soil particles. The sorption coefficient, K_d, represents the fraction of a particular substance that is "sorbed" to the soil (absorption and/or adsorption) versus that fraction dissolved in the groundwater. The linear isotherm portrayed in the following equation describes the simplest relationship involving sorption:

$$S = K_d C,$$

where S represents the sorbed fraction and C represents the dissolved concentration, and the sorption coefficient, K_d, is a constant that does not vary with the dissolved concentration. The ratio of the groundwater velocity to the velocity of a dissolved substance is called the "retardation factor," or R_d. The retardation factor can be calculated using the following equation:

$$R_d = 1 + (\rho_d / \alpha) * (K_d),$$

where R_d is the retardation factor, ρ_d is the bulk density of the soil, α is the porosity, and K_d is the sorption coefficient (Domenico and Schwartz, 1998). The contaminant transport simulation was conducted using a linear isotherm and K_d values from the USEPA (1996). The K_d for arsenic was based on a pH of 6.8, which was close to observed pH measurements in groundwater at Site 108 (**Section 5.4**). As shown in **Table 6-1**, the retardation factor for arsenic at Site 108 is 74.

Dispersion was incorporated in the model to predict the effects of dilution of arsenic at Site 108. The longitudinal dispersivity of 24.3 feet was used in the model, which was calculated using the method published by the EPA (2001). The longitudinal dispersivity is a function of the plume size of 100 feet.

6.1.3 MODFLOW Calibration

The model was first run to simulate the groundwater conditions at Site 108, without the contaminant transport simulation. **Figure 6-5** shows the flow directions and groundwater elevation contours that were predicted during model calibration. These conditions represent steady-state, which was achieved by running the model until the head change variation was less than 0.01 feet between iterations. **Figure 6-6** presents a comparison of the groundwater elevations simulated in the model ("Calculated Heads") and field measurements ("Observed Heads") conducted on February 8, 2001 at Site 108 (see **Table 3-3** for groundwater elevation data). The model calibration results shown in **Figures 6-6** provide evidence that the model accurately predicts groundwater flow conditions at Site 108 and that the output (predictions) of the model match closely with field measurements.

6.1.4 MODFLOW Results

The migration of the arsenic in groundwater at Site 108 was simulated in MODFLOW, using the grid setup and input parameters discussed above. The MODFLOW simulation was run for a simulated time of 10 years (3,650 days). The MODFLOW results are presented in **Figures 6-7** and **6-8**. The estimated times for COCs that are metals at Site 108 to achieve compliance with NJDEP groundwater standards are presented in **Table 6-2**.

For arsenic, the predicted concentrations at 10 years exceeded the respective NJDEP groundwater criteria. The estimated times for compliance with the NJDEP criteria for arsenic concentration at well 108-MW1 is greater than 1,000 years. The results of the groundwater modeling indicate that COC migration will be minimal due to low hydraulic conductivity and strong retardation by the soils.

6.2 Sensitive Receptor Survey Results

The sensitive receptor survey was completed by performing two tasks: an Offsite Receptor Report and an NJDEP well record search.

Offsite Receptor Report

An Offsite Receptor Report (dated October 24, 2001) was prepared for Site 108 by Environmental Data Resources, Inc. (EDR) of Southport, Connecticut. A copy of the Offsite Receptor Report, identifying sensitive receptors in the area, is provided in **Appendix I**.

The Offsite Receptor Report indicates that there are two schools (Steelman School, Wolf Hill Elementary School and Meadowbrook Elementary School) located less than one mile from Site 108. These three schools are located between one half and one mile of Site 108.

Well Record Search

A search of the comprehensive well database maintained by the NJDEP Well Permitting and Regulations Section of the Bureau of Water Allocation was performed by Versar to identify groundwater wells that may be potentially affected by arsenic at Site 108. The search was performed for a one-mile radius surrounding a point approximately 750 feet from Site 108.

The well records obtained during the well search are provided in **Appendix J** and are summarized in **Table 6-3**. The wells designated for domestic or irrigation uses are presented in **Figure 6-9**. There was one domestic well identified by records within 1,000 feet of Site 108 with the following information (though actual water use and physical presence were not verified):

- NJDEP Permit #2904513
- Original Owner: Rumson Country Club
- Permit Date: 10/16/64
- Location: N40°19'06" W74°01'33"
- Depth of well: 350 feet
- Approximate distance from Site 108: 550 feet (southeast, across Oceanport Creek)

Due to the significant distance of Site 108 from this one sensitive receptor, as well as the ongoing monitoring of Oceanport Creek adjacent to the impacted area, the concern for sensitive receptors is minimal. The probability that any well in the vicinity of the site is being used for consumptive purposes is low, thus minimizing health-based risks associated with ingestion. Furthermore, based on the MODFLOW model predictions, arsenic will not migrate beyond the boundaries of Site 108, and would seep into Oceanport Creek before reaching the one identified receptor. Therefore, no sensitive receptors are likely to be impacted by the presence of arsenic in the groundwater beneath Site 108.

6.3 Aquifer Classification

Upon review of the NJDEP Groundwater Quality Standards (NJAC 7:9-6), January 7, 1993, Site 108 is found to be underlain by a Class III-A aquifer. The primary designated use for Class III-A groundwater is the release or transmittal of groundwater to adjacent classification areas and surface water, as relevant. Secondary designated uses in Class III-A include any reasonable uses. For an area to be classified as a Class III-A aquifer, the groundwater must meet the following characteristics:

- Class III-A groundwater includes portions of the saturated zones (that meet the criteria below) of the Woodbury Formation, Merchantville Formation, Marshalltown Formation, Navesink Formation, Hornerstown Formation, aquitard formations of the Potomac-Raritan-Magothy aquifer system and the Kirkwood aquifer system, portions of the glacial moraine and glacial lake deposits, and other geologic units having the characteristics of an aquitard. Class III-A areas have the following characteristics (NJAC 7:9-6.5):
  - The average thickness of a Class III-A aquifer must be at least 50 feet;
  - Typical hydraulic conductivity of a Class III-A aquifer is approximately 0.1 feet/day or less; and
  - The aerial extent defined as Class III-A must be at least 100 acres.

The shallow aquifer at Fort Monmouth meets each of the four criteria listed above. These criteria are discussed below:

- As presented in **Figure 2-6**, Fort Monmouth is located within the outcrop area of the "Navesink-Hornerstown Confining Unit" (Martin, 1998), which also includes the Red Bank Sand, Tinton Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation and the basal clay of the Kirkwood Formation (see **Section 2.4.2**). **Figure 2-6** illustrates that the thickness of the Hornerstown-Navesink Confining Unit, which is in the vicinity of Fort Monmouth, is approximately 125 feet.
- Published hydraulic conductivities (Martin, 1998) for the Navesink-Hornerstown Confining Unit yield a geometric mean of 0.12 feet per day, which was the conductivity used in the MODFLOW Model (**Section 6.1.2**) and which is consistent with an aquitard.
- The area of Fort Monmouth is greater than 100 acres.

6.4 Contaminant Migration Summary

At Site 108, arsenic was identified as a COC in groundwater using the NJDEP GWQC for Class II-A aquifers. The Class II-A criteria were used for comparison with site-specific data obtained from the various sampling rounds because the Groundwater Quality Standards (NJAC 7:9-6.7e) state that the groundwater quality criteria to be used for Class III-A aquifers are the most stringent criteria associated with vertically or horizontally adjacent ground waters that are not Class III-A.

Groundwater modeling and a sensitive receptor survey were conducted to determine whether groundwater from Site 108 could impact surface water, off-site domestic wells and the subsurface groundwater aquifers. The groundwater modeling shows the impact of arsenic migration in groundwater at Site 108 will be minimal due to low hydraulic conductivity and sorption of the arsenic to the soil (retardation). The results of the groundwater modeling and sensitive receptor survey are summarized below:

- Due to the low concentrations of the identified COC (arsenic) at Site 108, and the very slow migration rates for this metal in the groundwater, there is little potential for significant impact by migration (seepage) into Oceanport Creek.
- The closest aquifer, the Wenonah-Mount Laurel Aquifer, is located approximately 125 feet bgs. The results of the groundwater modeling indicate that this aquifer is too deep to be affected by the COC near the ground surface at Site 108, and that the vertical exchange of groundwater between the aquifers (leakage) is minimal.
- The sensitive receptor survey indicates that the closest downstream domestic well is approximately 550 feet from Site 108, across Oceanport Creek, which is too far to be impacted by COC migration. The potential migration of the COC from Site 108 to this well in any reasonable time period is not possible.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Geologic publications show that Site 108 is located within an aquitard (the Navesink-Hornerstown Confining Unit). The low hydraulic conductivity of the aquitard and the thickness of the aquitard at Site 108 conform to the requirements of a Class III-A aquifer, as specified in the NJDEP Groundwater Quality Standards (NJAC 7:9-6, January 7, 1993).

The analytical results for the groundwater samples collected between April 1997 and January 2001 indicate that arsenic concentrations in groundwater exceed the GWQC at Site 108 and arsenic is considered a COC. The Class II-A criteria were used for comparison with site-specific data obtained from the various sampling rounds because the Groundwater Quality Standards (NJAC 7:9-6.7e) state that the groundwater quality criteria to be used for Class III-A aquifers are the most stringent criteria associated with vertically or horizontally adjacent ground waters that are not Class III-A.

In addition, due to the low concentrations of arsenic in groundwater at Site 108 and the slow migration rates for the COC in the groundwater, there is little potential for significant COC impact by migration into Oceanport Creek. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by the COC near the ground surface. In addition, the sensitive receptor survey indicates that there are no domestic or irrigation wells close enough to Site 108 to be adversely impacted by COC migration.

NFA is recommended with regard to arsenic contamination in groundwater at Site 108 (NJDEP Case No. 93-4-12-1939-29).

8.0 REFERENCES

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TABLES

Table 2-1
Well Construction Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	NJDEP Permit Number	Northing	Easting	Elevation of Inner Casing Survey Mark	Elevation of Ground Surface	Hole Diameter	Total Depth of Well	Depth to Top of Screen	Screen Length	Screen Diameter	Screen Material	Date of Construction
Units	**--**	**ft**	**ft**	**ft (amsl)[1]**	**ft (amsl)[1]**	**in**	**ft (bgs)[2]**	**ft (bgs)[2]**	**ft**	**in**	**--**	**--**
108-MW1	29-29739	541684.193	623725.94	11.85	8.48	12	13.0	3.0	10.0	4.0	10 Slot PVC	6/13/1993
108-MW2	29-29740	541706.213	623800.791	10.89	7.65	12	13.0	3.0	10.0	4.0	10 Slot PVC	6/14/1993
108-MW3	29-29741	541636.381	623762.373	8.16	8.26	12	13.0	3.0	10.0	4.0	10 Slot PVC	6/13/1993
108-MW4	29-33762	541733.142	623706.198	12.77	9.77	12	12.0	2.0	10.0	4.0	20 Slot PVC	8/16/1995

Notes:

Where a difference in reported data exists between a monitoring well permit and the corresponding boring log, data from the permit was used.

[1]amsl = above mean sea level

[2]bgs = below ground surface

NA = Not available

Well locations were recorded using Trimble GPS equipment in August 2001.

Table 3-1
Groundwater Sample Collection Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
	2459.01	Trip Blank	04/17/97	04/29/97	aqueous	Blank	VOCs +15	Method 624
	2459.02	Field Blank	04/17/97	04/29/97	aqueous	Blank	VOCs +15; Lead	Method 624; Method 3113B
	2459.03	108-MW1	04/17/97	04/22/97	aqueous	GW	VOCs +15; Lead	Method 624; Method 3113B
1	2459.04	108-MW2	04/17/97	04/22/97	aqueous	GW	VOCs +15; Lead	Method 624; Method 3113B
	2459.05	108-MW3	04/17/97	04/22/97	aqueous	GW	VOCs +15; Lead	Method 624; Method 3113B
	2459.06	108-MW4	04/17/97	04/22/97	aqueous	GW	VOCs +15; Lead	Method 624; Method 3113B
	2459.07	Duplicate	04/17/97	04/22/97	aqueous	GW	VOCs +15; Lead	Method 624; Method 3113B
	2923.01	Trip Blank	08/21/97	08/26/97	aqueous	Blank	VOCs +15	Method 624
	2923.02	Field Blank	08/21/97	08/26/97	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B,
	2923.03	108-MW1	08/21/97	08/25/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B,
2	2923.04	108-MW2	08/21/97	08/25/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B,
	2923.05	108-MW3	08/21/97	08/25/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B,
	2923.06	108-MW4	08/21/97	08/25/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B,
	2923.07	Duplicate	08/21/97	08/26/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B,
	3171.01	Trip Blank	11/21/97	11/24/97	aqueous	Blank	VOCs +15	Method 624
	3171.02	Field Blank	11/21/97	11/24/97	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3171.03	108-MW1	11/21/97	11/24/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
3	3171.04	108-MW2	11/21/97	11/24/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3171.05	108-MW3	11/21/97	11/24/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3171.06	108-MW4	11/21/97	12/02/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3171.07	Duplicate	11/21/97	12/02/97	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3378.01	Trip Blank	03/02/98	03/06/98	aqueous	Blank	VOCs +15	Method 624
	3378.02	Field Blank	03/02/98	03/06/98	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3378.03	108-MW1	03/02/98	03/06/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
4	3378.04	108-MW2	03/02/98	03/06/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3378.05	108-MW3	03/02/98	03/06/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3378.06	108-MW4	03/02/98	03/06/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3378.07	Duplicate	03/02/98	03/06/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3578.01	Trip Blank	05/19/98	06/01/98	aqueous	Blank	VOCs +15	Method 624
	3578.02	Field Blank	05/19/98	06/01/98	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3578.03	108-MW1	05/19/98	06/01/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
5	3578.04	108-MW2	05/19/98	06/01/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3578.05	108-MW3	05/19/98	06/01/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3578.06	108-MW4	05/19/98	06/01/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3578.07	Duplicate	05/19/98	06/01/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3906.01	Trip Blank	09/23/98	10/05/98	aqueous	Blank	VOCs +15	Method 624
	3906.02	Field Blank	09/23/98	10/05/98	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3906.03	Duplicate	09/23/98	10/05/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
6	3906.04	108-MW1	09/23/98	10/05/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3906.05	108-MW2	09/23/98	10/05/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3906.06	108-MW3	09/23/98	10/05/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3906.07	108-MW4	09/23/98	10/05/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B

Table 3-1
Groundwater Sample Collection Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
7	4076.01	Trip Blank	11/20/98	11/24/98	aqueous	Blank	VOCs +15	Method 624
	4076.02	Field Blank	11/20/98	11/24/98	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4077.01	108-MW1	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4077.02	108-MW2	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4077.03	108-MW3	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4077.04	108-MW4	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
8	4268.01	Trip Blank	02/10/99	02/16/99	aqueous	Blank	VOCs +15	Method 624
	4268.02	Field Blank	02/10/99	02/16/99	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4269.01	108-MW1	02/10/99	02/16/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4269.02	108-MW2	02/10/99	02/16/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4269.03	108-MW3	02/10/99	02/16/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4269.04	108-MW4	02/10/99	02/16/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
9	4514.01	Trip Blank	05/26/99	05/28/01	aqueous	Blank	VOCs +15	Method 624
	4514.02	Field Blank	05/26/99	05/28/01	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4515.01	108-MW1	05/26/99	05/28/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4515.02	108-MW2	05/26/99	05/28/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4515.03	108-MW3	05/26/99	05/28/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4515.04	108-MW4	05/26/99	05/28/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
10	4776.01	108-MW1	09/08/99	09/10/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4776.02	108-MW2	09/08/99	09/10/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4776.03	108-MW3	09/08/99	09/10/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4776.04	108-MW4	09/08/99	09/10/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4776.05	Field Blank	09/08/99	09/10/99	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4776.06	Duplicate	09/08/99	09/10/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4776.07	Trip Blank	09/08/99	09/10/99	aqueous	Blank	VOCs +15	Method 624
	4827.01	108-MW1	09/29/99	09/29/99	aqueous	GW	Mercury analysis used in place of 4776.01	Method 3112B
	4827.02	108-MW2	09/29/99	09/29/99	aqueous	GW	Mercury analysis used in place of 4776.02	Method 3112B
	4827.03	108-MW3	09/29/99	09/29/99	aqueous	GW	Mercury analysis used in place of 4776.03	Method 3112B
	4827.04	108-MW4	09/29/99	09/29/99	aqueous	GW	Mercury analysis used in place of 4776.04	Method 3112B
11	5022.04	108-MW1	12/17/99	12/23/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5022.05	108-MW2	12/17/99	12/22/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5022.06	108-MW3	12/17/99	12/23/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5022.07	108-MW4	12/17/99	12/23/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5022.01	Trip Blank	12/17/99	12/22/99	aqueous	Blank	VOCs +15	Method 624
	5022.02	Field Blank	12/17/99	12/22/99	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5022.03	Duplicate	12/17/99	12/22/99	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
12	5194.01	Trip Blank	02/23/00	02/23/00	aqueous	Blank	VOCs +15	Method 624
	5194.02	Field Blank	02/23/00	02/23/00	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5194.03	Duplicate	02/23/00	02/23/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5194.04	108-MW1	02/23/00	02/23/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5194.05	108-MW2	02/23/00	02/24/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5194.06	108-MW3	02/23/00	02/24/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5194.07	108-MW4	02/23/00	02/24/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B

Table 3-1
Groundwater Sample Collection Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
13	5405.01	Trip Blank	05/09/00	05/10/00	aqueous	Blank	VOCs +15	Method 624
	5405.02	Field Blank	05/09/00	05/10/00	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5405.03	Duplicate	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5405.04	108-MW1	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5405.05	108-MW2	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5405.06	108-MW3	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5405.07	108-MW4	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
14	5603.01	Trip Blank	08/04/00	08/09/00	aqueous	Blank	VOCs +15	Method 624
	5603.02	Field Blank	08/04/00	08/09/00	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5603.03	Duplicate	08/04/00	08/09/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5603.04	108-MW1	08/04/00	08/09/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5603.05	108-MW2	08/04/00	08/09/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5603.06	108-MW3	08/04/00	08/09/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5603.07	108-MW4	08/04/00	08/09/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
Low Flow 1	5700.01	Field Blank	09/08/00	09/28/00	aqueous	Blank	TAL metals	Methods 3112B and 3120B
	5700.03*	Duplicate	09/08/00	09/28/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5700.02*	108-MW1	09/08/00	09/28/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5700.04*	108-MW4	09/08/00	09/28/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5700.05*	108-MW2	09/08/00	09/28/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5700.06*	108-MW3	09/08/00	09/28/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
Low Flow 2	5774.01	Field Blank	10/06/00	10/18/00	aqueous	Blank	TAL metals	Methods 3112B and 3120B
	5774.02*	Duplicate	10/06/00	10/18/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5774.03*	108-MW1	10/06/00	10/18/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5774.04*	108-MW4	10/06/00	10/18/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5777.01	Field Blank	10/10/00	10/18/00	aqueous	Blank	TAL metals	Methods 3112B and 3120B
	5777.02*	Duplicate	10/10/00	10/18/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5777.03*	108-MW2	10/10/00	10/18/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
	5777.04*	108-MW3	10/10/00	10/18/00	aqueous	GW	TAL metals	Methods 3112B and 3120B
15	5829.04*	108-MW4	11/02/00	11/07/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5829.01*	108-MW1	11/02/00	11/07/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5829.02*	108-MW2	11/02/00	11/07/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5829.03*	108-MW3	11/02/00	11/07/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5829.05*	Duplicate	11/02/00	11/07/00	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5829.06*	Field Blank	11/02/00	11/07/00	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5829.07*	Trip Blank	11/02/00	11/07/00	aqueous	Blank	VOCs +15	Method 624
16	658	Trip Blank	02/08/01	02/09/01	aqueous	Blank	VOCs +15	Method 624
	659	Field Blank	02/08/01	02/09/01	aqueous	Blank	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	660	Duplicate	02/08/01	02/09/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	661	108-MW1	02/08/01	02/09/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	662	108-MW2	02/08/01	02/09/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	663	108-MW3	02/08/01	02/09/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	664	108-MW4	02/08/01	02/09/01	aqueous	GW	VOCs+15; SVOCs+25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	906	108-MW4	02/16/01	02/23/01	aqueous	GW	BNA +25; TAL metals;	Method 625; Methods 3112B and 3120B

Notes:
*Low Flow Sampling Method was used to collect sample
BNA+25: Base/Neutral and Acid plus 25 parameters
GW : Groundwater
SVOCs+25: Semi-volatile Organic Compounds + 25 Tenatively Identified Compounds
TCL+15 : Target Compound List plus 15 parameters
TAL metals : Target Analyte List metals
VOCs+15: Volatile Organic Compounds + 15 Tenatively Identified Compounds

Table 3-2
Supplementary Soil Investigation Sampling Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Sample ID	Boring Location	Sample Depth	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
1326	1	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1327	1	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1328	1	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1329	2	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1330	2	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1331	2	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1332	3	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1333	3	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1334	3	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1335	4	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1336	4	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1337	4	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1338	5	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1339	5	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1340	5	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1341	6	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1342	6	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1343	6	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1344	7	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1345	7	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1346	7	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1347	8	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1348	8	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1349	8	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1350	9	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1351	9	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1352	9	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1353	FD	0-6"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1354	FD	12-18"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A
1355	FD	24-30"	3/8/2001	3/16/2001	soil	SB	Arsenic and Lead	Methods 7060A, 7420, and 3051A

Notes:
SB: Soil Boring
FD: Field Duplicate

Table 3-3
Groundwater Elevation Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
108-MW1	11.85	04/17/97	5.90	5.95	08/21/97	6.10	5.75	11/21/97	7.01	4.84	03/02/98	5.90	5.95
108-MW2	10.89	04/17/97	5.75	5.14	08/21/97	5.80	5.09	11/21/97	5.90	4.99	03/02/98	5.35	5.54
108-MW3	8.16	04/17/97	2.50	5.66	08/21/97	2.80	5.36	11/21/97	2.90	5.26	03/02/98	1.90	6.26
108-MW4	12.77	04/17/97	6.85	5.92	08/21/97	6.08	6.69	11/21/97	7.30	5.47	03/02/98	6.25	6.52

Notes:
1) Elev.: Elevation in feet
above mean sea level.
2) Depth to water: depth in feet
from the inner casing survey mark.
3) NS: Not Sampled
4) (?): Questionable Measurement
5) NA: Not Applicable

Table 3-3
Groundwater Elevation Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
108-MW1	11.85	05/19/98	5.79	6.06	09/23/98	8.03	3.82	11/20/98	8.50	3.35	02/10/99	5.58	6.27
108-MW2	10.89	05/19/98	5.43	5.46	09/23/98	7.05	3.84	11/20/98	7.77	3.12	02/10/99	5.63	5.26
108-MW3	8.16	05/19/98	1.65	6.51	09/23/98	4.86	3.3	11/20/98	5.81	2.35	02/10/99	2.36	5.8
108-MW4	12.77	05/19/98	6.28	6.49	09/23/98	8.85	3.92	11/20/98	9.36	3.41	02/10/99	6.54	6.23

Notes:
1) Elev.: Elevation in feet
above mean sea level.
2) Depth to water: depth in feet
from the inner casing survey mark.
3) NS: Not Sampled
4) (?): Questionable Measurement
5) NA: Not Applicable

Table 3-3
Groundwater Elevation Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
108-MW1	11.85	05/26/99	6.16	5.69	09/08/99	7.66	4.19	12/17/99	3.35	8.5	02/23/00	2.98	8.87
108-MW2	10.89	05/26/99	5.78	5.11	09/08/99	6.86	4.03	12/17/99	5.62	5.27	02/23/00	5.53	5.36
108-MW3	8.16	05/26/99	2.79	5.37	09/08/99	4.07	4.09	12/17/99	2.62	5.54	02/23/00	2.23	5.93
108-MW4	12.77	05/26/99	7.05	5.72	09/08/99	8.51	4.26	12/17/99	3.75	9.02	02/23/00	3.41	9.36

Notes:
1) Elev.: Elevation in feet
above mean sea level.
2) Depth to water: depth in feet
from the inner casing survey mark.
3) NS: Not Sampled
4) (?): Questionable Measurement
5) NA: Not Applicable

Table 3-3
Groundwater Elevation Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
108-MW1	11.85	05/09/00	3.61	8.24	08/04/00	1.88	9.97	09/08/00	3.34	8.51	10/06/00	3.15	8.7
108-MW2	10.89	05/09/00	10.68(?)	NA	08/04/00	5.23	5.66	09/08/00	5.9	4.99	10/10/00	5.9	4.99
108-MW3	8.16	05/09/00	2.75	5.41	08/04/00	1.62	6.54	09/08/00	2.9	5.26	10/10/00	2.5	5.66
108-MW4	12.77	05/09/00	4.03	8.74	08/04/00	2.62	10.15	09/08/00	4	8.77	10/06/00	3.7	9.07

Notes:
1) Elev.: Elevation in feet
above mean sea level.
2) Depth to water: depth in feet
from the inner casing survey mark.
3) NS: Not Sampled
4) (?): Questionable Measurement
5) NA: Not Applicable

Table 3-3
Groundwater Elevation Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
108-MW1	11.85	11/02/00	4.6	7.25	02/08/01	2.37	9.48	02/16/01	3.67	8.18
108-MW2	10.89	11/02/00	6.66	4.23	02/08/01	5.41	5.48	NS	NS	NS
108-MW3	8.16	11/02/00	3.65	4.51	02/08/01	1.92	6.24	NS	NS	NS
108-MW4	12.77	11/02/00	5.02	7.75	02/08/01	2.97	9.8	NS	NS	NS

Notes:
1) Elev.: Elevation in feet
above mean sea level.
2) Depth to water: depth in feet
from the inner casing survey mark.
3) NS: Not Sampled
4) (?): Questionable Measurement
5) NA: Not Applicable

Table 3-3
Groundwater Elevation Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	**Maximum Depth to Water**	**Minimum Depth to Water**	**Minimum Groundwater Elev.**	**Maximum Groundwater Elev.**	**Average Groundwater Elev.**
108-MW1	11.85	8.50	1.88	3.35	9.97	6.61
108-MW2	10.89	10.68	5.23	0.21	5.66	4.61
108-MW3	8.16	5.81	1.62	2.35	6.54	5.26
108-MW4	12.77	9.36	2.62	3.41	10.15	6.84

Notes:
1) Elev.: Elevation in feet
above mean sea level.
2) Depth to water: depth in feet
from the inner casing survey mark.
3) NS: Not Sampled
4) (?): Questionable Measurement
5) NA: Not Applicable

Table 4-1
Data for Geologic Cross-Section A-A'
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Units	108 MW04	108 MW01	108 MW03
Elevation of Top of Casing	ft (amsl)	12.77	11.85	8.16
Elevation of Ground Surface	ft (amsl)	9.77	8.48	8.26
Elevation of Top of Screen	ft (amsl)	7.77	5.48	5.26
Elevation of Groundwater (4/17/97)	ft (amsl)	5.92	5.95	5.66
Elevation of Top of Unit 3	ft (amsl)	6.77	2.48	3.26
Elevation of Bottom of Well	ft (amsl)	-2.23	-4.52	-4.74
Distance from Point A on Cross-Section	ft	0	44	110

Explanation of Units (see Minard, 1969):

Surface Materials:
Units 1 and 2 (not in table) = well-sorted sand with silt and some cobbles, trace cinders (fill)

Upper Red Bank Formation (Shrewsbury):
Unit 3 = greenish gray to black clay mixed with sand

Notes:
All measurements in feet.
amsl: above mean sea level

Table 4-2
Slug Testing Results Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID	Date	Depth to Static Water Level	DTW at t=0	b	DTW Adjustment	Hydraulic Conductivity (feet/day)
108-MW1	8/14/2001	5.150	6.132	6.868	1.617	3.7
108-MW2	8/14/2001	7.550	9.464	3.536	3.624	19.1
108-MW3	8/14/2001	3.820	6.264	6.736	2.200	31.7
108-MW4	8/14/2001	4.180	6.245	5.755	0.076	2.74
Geometric Mean of Hydraulic Conductivity (feet/day):						**8.9**

Notes:
DTW = Depth To Water
Depth to Static Water Level was estimated by subtracting 0.3 ft. from the measured DTW at the end of each test.
b = height of water in well at the beginning of the test.
DTW Adjustment = factor by which raw data was adjusted so final hermit data point equals final measured DTW.

Table 5-1
Groundwater Quality Sampling Results
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID			108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1
Lab Sample ID	**NJDEP**	**Site Specific**	2459.03	2923.03	3171.03	3378.03	3578.03	3906.04	4077.01	4269.01	4515.01	4776.01[4]	5022.04	5194.04	5405.04	5603.04	5829.01	661	5700.02	5774.03
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01	09/08/00	10/06/00
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	low flow 1	low flow 2
Volatiles																				
Acetone	**700**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Carbon Disulfide[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Chlorobenzene	**4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Methylene Chloride	**2**	**N/A**	**2.92**	ND	ND	ND	ND	**2.46**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Semi-Volatiles																				
bis(2-Ethylhexyl)phthalate	**30**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Diethylphthalate	**5000**	**N/A**	ND	ND	23.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	**900**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Naphthalene[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Benzoic Acid[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Pesticides and PCBs																				
4,4'-DDE	**0.1**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	**0.4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals																				
Aluminum	**200**	**121000**	NS	**1159**	**1103**	**2720**	**26460**	**18200**	**1390**	**26600**	**13500**	**6450**	**2900**	**1550**	**1230**	120	**2010**	98.2	**228**	**541**
Antimony	**20**	**N/A**	NS	5	ND	ND	4.8	ND	ND	2.85	2.58	4.16	4.37	ND	ND	5.59	3.19	ND	4.21	ND
Arsenic	**8**	**N/A**	NS	**10**	ND	6	**26.1**	**33**	4.44	**13.9**	**15.5**	**10.2**	ND	ND	ND	5.67	ND	6.06	4.81	ND
Barium	**2000**	**699**	NS	70	44.5	44	95.6	119	42.9	91.7	76.5	61.9	42.4	28.2	50.2	61.7	63.5	25.5	63.9	57.2
Beryllium	**20**	**N/A**	NS	0.12	ND	ND	1.3	1.2	ND	0.727	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	**4**	**N/A**	NS	ND	1.2	ND	0.8	ND	ND	0.563	1.95	1.65	1.29	ND	ND	ND	ND	ND	ND	ND
Calcium	**NLE**	**45400**	NS	63730	75590	44550	71760	71700	70700	68900	80500	101000	75800	62400	73500	97200	98400	50400	111000	88700
Chromium	**100**	**N/A**	NS	**165**	7	11.7	56.3	76.7	8.11	61.8	50.9	27.1	8.91	8.51	6	1.41	7.53	2.98	ND	4.47
Cobalt	**NLE**	**N/A**	NS	ND	ND	ND	1.8	4	0.641	3.26	2.13	1.78	0.849	ND	ND	0.563	ND	ND	0.781	ND
Copper	**1000**	**65.6**	NS	21	9	19	32.3	42	ND	37.4	24.2	24.2	4.9	ND	12.1	ND	3.5	24.8	ND	ND
Iron	**300**	**431000**	NS	**4440**	**2564**	**6980**	**34830**	**53300**	**5430**	**37900**	**25000**	**14000**	**4120**	**4040**	**2680**	**639**	**3900**	**972**	**805**	**1760**
Lead	**10**	**N/A**	3	**11.7**	**17**	**33**	**90**	**125**	**11.2**	**83**	**47.5**	**24.4**	6.1	3.41	5.16	3.55	8.14	ND	ND	ND
Magnesium	**NLE**	**62700**	NS	171	8740	5420	11430	11700	7880	11300	10700	11200	8290	7030	8030	9380	10400	5260	10800	9340
Manganese	**50**	**331**	NS	**9080**	30.3	**111.4**	**251**	**620**	**118**	**443**	**302**	**87.5**	**55.4**	22.5	32.9	**192**	**77.8**	13.6	**198**	**110**
Mercury[4]	**2**	**N/A**	NS	ND	ND	ND	0.2	0.1	0.29	ND	ND	ND	ND	ND	ND	ND	ND	1.37	ND	ND
Nickel	**100**	**187**	NS	ND	6.6	3.3	7.7	11.2	3.61	8.04	4.93	2.94	ND	1.01	1.37	ND	ND	1.12	ND	1.46
Potassium	**NLE**	**137000**	NS	12890	7040	4360	10950	11100	5350	6730	8580	9710	7500	6530	9950	18900	13000	7980	16100	13900
Selenium	**50**	**N/A**	NS	ND	ND	ND	ND	ND	ND	9.3	4.72	3.68	6.22	5.65	ND	ND	4.48	ND	ND	ND
Silver	**NLE**	**N/A**	NS	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.2	ND	ND	ND	ND
Sodium	**50000**	**21500**	NS	**50510**	18410	11350	14290	14900	19000	21200	20600	**28900**	16900	16100	18500	14200	19900	10100	**24400**	18100
Thallium	**10**	**N/A**	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**10.6**	ND	ND	ND
Vanadium	**NLE**	**N/A**	NS	300	4	11	45.9	57	4.86	39	36.3	18.1	6.18	5.82	5.74	1.69	5.24	2.17	1.09	2.27
Zinc	**5000**	**233**	NS	130	103	170	408	442	129	251	245	156	65.8	67.4	114	110	129	74.1	90.7	82.7

Notes

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

[1] Fort Monmouth Site-specific Groundwater Maximum Background Concentrations (MBCs), background (native) metals only (Weston SI Report, 1995)

[2] Low Flow Sampling Method used to collect sample

[3] Interim Criteria used as NJDEP criteria

[4] Mercury analyses from samples 4827.01-04 replaced mercury results for samples 4776.01-04.

Table 5-1
Groundwater Quality Sampling Results
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID			108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2
Lab Sample ID	**NJDEP**	**Site Specific**	2459.04	2923.04	3171.04	3378.04	3578.04	3906.05	4077.02	4269.02	4515.02	4776.02(4)	5022.05	5194.05	5405.05	5603.05	5829.02	662	5700.05	5777.03
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01	09/08/00	10/10/00
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	low flow 1	low flow 2
Volatiles																				
Acetone	**700**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9	ND	ND	14.88	ND	ND	ND	NS	NS
Carbon Disulfide[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Chlorobenzene	**4**	**N/A**	3.2	ND	2.18	2.26	1.94	ND	1.69	1.67	ND	ND	ND	ND	ND	ND	1.46	1.34	NS	NS
Methylene Chloride	**2**	**N/A**	**3.03**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Semi-Volatiles																				
bis(2-Ethylhexyl)phthalate	**30**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Diethylphthalate	**5000**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	**900**	**N/A**	ND	ND	17.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Naphthalene[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Benzoic Acid[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Pesticides and PCBs																				
4,4'-DDE	**0.1**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	**0.4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals																				
Aluminum	**200**	**121000**	NS	**348.8**	**2076**	**1246**	**1429**	**4810**	**6040**	**7690**	**1370**	**332**	**1810**	168	**1060**	**1050**	**649**	115	**396**	**1120**
Antimony	**20**	**N/A**	NS	2.4	ND	ND	ND	ND	ND	ND	ND	ND	4.92	ND	ND	4.05	ND	ND	ND	ND
Arsenic	**8**	**N/A**	NS	**22**	**24**	**25**	**63.2**	**61**	**47.6**	**31.6**	**33.8**	**10**	**14**	7.92	**29.8**	**8.52**	**26.2**	**34.5**	**29.7**	**26.1**
Barium	**2000**	**699**	NS	ND	31.1	26.7	30	50.4	46.9	51.6	38.8	29.3	29	13.9	30.8	36.7	25.5	21.9	21.7	25.7
Beryllium	**20**	**N/A**	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	**4**	**N/A**	NS	ND	ND	ND	ND	ND	1.04	ND	0.943	3	3.56	ND	ND	ND	ND	ND	ND	ND
Calcium	**NLE**	**45400**	NS	22850	15270	12890	12760	34200	12200	13200	27300	21800	21100	20900	18100	39400	14500	16700	13200	14600
Chromium	**100**	**N/A**	NS	**152**	12.5	5.8	3.5	14.8	30.1	23.5	8.37	4.06	8.71	1.29	6.66	4.49	5.26	3.67	ND	5.16
Cobalt	**NLE**	**N/A**	NS	ND	1.6	1.8	1.1	0.7	3.06	2.28	1.87	1.93	1.77	0.839	1.83	1.81	0.964	ND	1.42	1.21
Copper	**1000**	**65.6**	NS	17	21	9	5.3	19	ND	8.14	42.9	167	61.1	5.29	9.29	ND	185	ND	ND	150
Iron	**300**	**431000**	NS	**25600**	**33600**	**27450**	**46980**	**45400**	**49000**	**40700**	**34900**	**12400**	**21400**	**17700**	**39500**	**12300**	**25100**	**35300**	**29400**	**31600**
Lead	**10**	**N/A**	3	4.2	**17**	ND	3.6	9	8.05	3.42	5.1	7.04	ND	ND	ND	5.9	2.47	ND	ND	ND
Magnesium	**NLE**	**62700**	NS	213	7680	6850	6008	8360	6680	6360	10500	7240	8020	4480	8860	6200	7050	8600	7340	7940
Manganese	**50**	**331**	NS	**10250**	**213.5**	**204.7**	**159**	**110**	**220**	**202**	**225**	**130**	**167**	**102**	**260**	**232**	**198**	**238**	**221**	**230**
Mercury[4]	**2**	**N/A**	NS	ND	0.5	ND	0.4	ND	0.32	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND
Nickel	**100**	**187**	NS	ND	2.9	2.9	3.1	5.4	6.18	5.79	3.19	2.66	ND	0.859	2.39	1.45	3.06	ND	ND	ND
Potassium	**NLE**	**137000**	NS	2350	2190	ND	2405	11200	3060	2610	2310	2140	2020	2150	1520	5720	1310	787	842	1130
Selenium	**50**	**N/A**	NS	ND	ND	ND	ND	ND	4.29	9.5	ND	ND	ND	3.45	ND	6.08	8.02	ND	7.1	ND
Silver	**NLE**	**N/A**	NS	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	322	ND	ND	ND	ND
Sodium	**50000**	**21500**	NS	**52520**	**50020**	**53840**	**45210**	**61700**	**68000**	**63700**	**59000**	**24900**	**46300**	**38600**	**61500**	**29400**	**55500**	**54800**	**68500**	**62500**
Thallium	**10**	**N/A**	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**NLE**	**N/A**	NS	300	10	7	10.4	19	25.4	20.5	8	2.11	7.04	3.75	7.3	15.6	4.92	1.06	2.72	4.09
Zinc	**5000**	**233**	NS	10	75	4	35.6	70	157	132	45.9	182	50.7	170	35.9	172	75.4	11.9	16.7	20

Notes

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

[1] Fort Monmouth Site-specific Groundwater Maximum Background Concentrations (MBCs), background (native) metals only (Weston SI Report, 1995)

[2] Low Flow Sampling Method used to collect sample

[3] Interim Criteria used as NJDEP criteria

[4] Mercury analyses from samples 4827.01-04 replaced mercury results for samples 4776.01-04.

Table 5-1
Groundwater Quality Sampling Results
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID			108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3
Lab Sample ID	**NJDEP**	**Site Specific**	2459.05	2923.05	3171.05	3378.05	3578.05	3906.06	4077.03	4269.03	4515.03	4776.03(4)	5022.06	5194.06	5405.06	5603.06	5829.03	663	5700.06	5777.04
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01	09/08/00	10/10/00
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	low flow 1	low flow 2
Volatiles																				
Acetone	**700**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Carbon Disulfide[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Chlorobenzene	**4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Methylene Chloride	**2**	**N/A**	**3.09**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Semi-Volatiles																				
bis(2-Ethylhexyl)phthalate	**30**	**N/A**	ND	ND	ND	1.86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Diethylphthalate	**5000**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	**900**	**N/A**	ND	ND	3.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene[3]	**100**	**N/A**	ND	1.46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Naphthalene[3]	**100**	**N/A**	ND	1.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Benzoic Acid[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Pesticides and PCBs																				
4,4'-DDE	**0.1**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	**0.4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals																				
Aluminum	**200**	**121000**	NS	**429.4**	133	167	**1658**	**766**	**1170**	**1170**	**1370**	**947**	**408**	**2130**	**345**	**370**	95.2	ND	135	148
Antimony	**20**	**N/A**	NS	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.87	ND	ND	ND	ND
Arsenic	**8**	**N/A**	NS	6	6	6	**38.4**	**31**	**18.7**	**9.74**	**15.8**	**13.9**	5.54	**26.4**	**8.5**	**32.2**	5.77	7.03	6.08	ND
Barium	**2000**	**699**	NS	ND	20.9	28.3	33.9	23	29.8	24.5	22.8	78.1	15.7	30.9	31.2	31.4	19.1	21.5	15	17.1
Beryllium	**20**	**N/A**	NS	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	**4**	**N/A**	NS	ND	ND	ND	ND	ND	1.06	ND	1.29	1.1	1.45	ND	ND	ND	ND	ND	ND	ND
Calcium	**NLE**	**45400**	NS	9870	7490	6620	11080	9460	8330	14500	17900	11700	13000	20300	33800	26900	16700	34800	13400	14500
Chromium	**100**	**N/A**	NS	29	1.1	ND	3.9	3.5	7.64	5.79	6.51	4.96	2.36	9.93	2.68	4.05	1.77	4.72	ND	1.08
Cobalt	**NLE**	**N/A**	NS	ND	2.3	2	3.2	1.1	2	1.47	1.84	1.22	1.67	1.33	1.34	1.45	1.35	4.71	0.712	0.662
Copper	**1000**	**65.6**	NS	39	63	17	85.5	26	ND	280	41.9	27.1	38.6	ND	24.2	ND	19.7	24.2	ND	78.2
Iron	**300**	**431000**	NS	**11090**	**13880**	**11050**	**41850**	**33800**	**30700**	**15300**	**17000**	**14700**	**9390**	**43800**	**16700**	**33700**	**8580**	**8570**	**7300**	**2450**
Lead	**10**	**N/A**	1.8	3.7	**16**	ND	5.6	ND	ND	ND	ND	ND	ND	ND	ND	1.65	ND	ND	ND	ND
Magnesium	**NLE**	**62700**	NS	270	3530	3290	3750	3790	3710	3780	3740	3000	3040	9450	6110	11500	4100	5660	2510	2630
Manganese	**50**	**331**	NS	**3370**	**148.7**	**147.2**	**241**	**171**	**173**	**126**	**89.5**	**79.2**	**80.5**	**245**	**151**	**257**	**119**	**96.8**	**61.2**	40.6
Mercury[4]	**2**	**N/A**	NS	ND	0.5	ND	0.3	ND	0.3	ND	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND
Nickel	**100**	**187**	NS	ND	4.6	2.6	4.6	3.4	2.81	6.41	3.03	ND	ND	0.762	5.95	ND	3.12	1.78	ND	ND
Potassium	**NLE**	**137000**	NS	4630	ND	ND	3673	2280	1740	2120	3140	2400	2980	1970	4300	1630	1880	3380	2310	2120
Selenium	**50**	**N/A**	NS	ND	ND	ND	ND	ND	ND	6.2	ND	ND	ND	ND	ND	ND	4.69	ND	ND	ND
Silver	**NLE**	**N/A**	NS	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	**50000**	**21500**	NS	**56620**	**25710**	18990	**28280**	**37000**	**39000**	**40600**	**42600**	**38100**	**30600**	**56700**	**46600**	**43200**	**37600**	**38300**	**26200**	**22900**
Thallium	**10**	**N/A**	NS	ND	ND	ND	ND	ND	ND	ND	8.72	ND	ND	ND	ND	ND	5.49	ND	ND	ND
Vanadium	**NLE**	**N/A**	NS	400	ND	ND	12.4	6	5.5	5.64	11.3	4.79	4.67	8.72	7.75	4.04	2.85	2.1	0.941	0.996
Zinc	**5000**	**233**	NS	346	198	155	561	368	227	167	222	84.9	98.6	41.5	139	30.3	114	133	24	72.5

Notes

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

[1] Fort Monmouth Site-specific Groundwater Maximum Background Concentrations (MBCs), background (native) metals only (Weston SI Report, 1995)

[2] Low Flow Sampling Method used to collect sample

[3] Interim Criteria used as NJDEP criteria

[4] Mercury analyses from samples 4827.01-04 replaced mercury results for samples 4776.01-04.

Table 5-1
Groundwater Quality Sampling Results
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID			108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4
Lab Sample ID	**NJDEP**	**Site Specific**	2459.06	2923.06	3171.06	3378.06	3578.06	3906.07	4077.04	4269.04	4515.04	4776.04(4)	5022.07	5194.07	5405.07	5603.07	5829.04	664	906	5700.04	5774.04
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01	02/16/01	09/08/00	10/06/00
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16	low flow 1	low flow 2
Volatiles																					
Acetone	**700**	**N/A**	ND	ND	ND	ND	7.79	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.77	3.57	NS	NS	NS
Carbon Disulfide[3]	**100**	**N/A**	2.67	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS
Chlorobenzene	**4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS
Methylene Chloride	**2**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS
Semi-Volatiles																					
bis(2-Ethylhexyl)phthalate	**30**	**N/A**	ND	ND	ND	ND	ND	ND	24.59	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	NS
Diethylphthalate	**5000**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	NS
Di-n-butylphthalate	**900**	**N/A**	ND	ND	10.84	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	NS
2-Methylnaphthalene[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	NS
Naphthalene[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	NS	NS
Benzoic Acid[3]	**100**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.17	ND	ND	ND	NS	ND	NS	NS
Pesticides and PCBs																					
4,4'-DDE	**0.1**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.036	NS	NS	NS
Endosulfan I	**0.4**	**N/A**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.118	ND	ND	NS	NS	NS
Metals																					
Aluminum	**200**	**121000**	NS	**4700**	**7718**	**3081**	**8095**	**12300**	**54400**	**5300**	**26500**	**13200**	**10300**	**36100**	**6270**	**2460**	**55100**	NS	60.9	175	**546**
Antimony	**20**	**N/A**	NS	1.8	ND	ND	ND	ND	ND	ND	2.67	2.79	4.33	6.21	ND	4.46	ND	NS	ND	ND	ND
Arsenic	**8**	**N/A**	NS	7	**13**	**9**	**14.3**	**27**	**52.6**	2.91	**28.5**	6.87	**16.8**	**41.6**	ND	4.34	**45.4**	NS	2.48	ND	ND
Barium	**2000**	**699**	NS	180	50.5	37.3	54.7	142	216	48.1	145	58.6	42.3	132	20.2	51.7	206	NS	42.9	20.5	21.1
Beryllium	**20**	**N/A**	NS	1.77	ND	ND	0.6	1.6	3.51	ND	1.78	0.591	0.571	2.63	ND	ND	4.04	NS	ND	ND	ND
Cadmium	**4**	**N/A**	NS	ND	ND	**5.1**	0.6	0.7	2.66	**8.09**	1.19	1.6	3.64	ND	ND	ND	ND	NS	ND	ND	ND
Calcium	**NLE**	**45400**	NS	28150	19290	16920	16640	27900	30500	20400	26800	20000	39200	28200	26100	29500	40200	NS	48600	17400	18200
Chromium	**100**	**N/A**	NS	78	51.4	13.3	34.3	63.4	**231**	16.9	**149**	38.5	91.6	**217**	18.8	17.3	**363**	NS	3.98	ND	4.53
Cobalt	**NLE**	**N/A**	NS	ND	1.3	ND	1.6	3.5	5.91	ND	3.67	1.45	2.84	9.1	ND	0.737	6.6	NS	ND	ND	ND
Copper	**1000**	**65.6**	NS	45	27	19	20.8	56	71	19.1	39.5	29.4	35	49.9	ND	22.7	79.5	NS	2.9	ND	4.99
Iron	**300**	**431000**	NS	**1080**	**15800**	**5023**	**13410**	**27000**	**75100**	**5270**	**44600**	**12800**	**20100**	**71900**	**5580**	**5650**	**104000**	NS	**717**	**388**	**1000**
Lead	**10**	**N/A**	**24**	**122.4**	**35**	**16**	**34.4**	**99**	**163**	7.18	**82**	**21**	**34.9**	**197**	ND	**13.2**	**143**	NS	1.26	ND	4.1
Magnesium	**NLE**	**62700**	NS	184	5170	3420	4668	6800	13500	4290	9470	5370	3640	11700	5600	4760	17300	NS	6940	2370	2510
Manganese	**50**	**331**	NS	**5640**	34.8	**93.2**	**70.3**	**149**	**208**	20	**104**	25.6	47.2	**239**	16.7	23.5	**239**	NS	19.3	12.9	15.4
Mercury[4]	**2**	**N/A**	NS	0.5	ND	ND	0.3	0.4	0.82	ND	ND	ND	ND	0.6	ND	ND	0.31	NS	ND	ND	ND
Nickel	**100**	**187**	NS	ND	15.5	4.8	5.5	10.5	19.6	4.22	10.7	2.3	2.92	17.6	ND	2.08	25.4	NS	2.29	ND	2.81
Potassium	**NLE**	**137000**	NS	5800	6790	4820	8643	13600	18900	8470	14100	10500	23300	16600	10200	10400	25600	NS	18700	7910	5790
Selenium	**50**	**N/A**	NS	ND	ND	ND	ND	ND	5.69	4.9	6.36	ND	ND	ND	ND	ND	6.47	NS	ND	ND	ND
Silver	**NLE**	**N/A**	NS	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	1.17	ND	ND
Sodium	**50000**	**21500**	NS	13610	12110	13100	9416	13400	14700	13900	10800	8590	14400	5870	11100	10900	11100	NS	**39700**	8790	7080
Thallium	**10**	**N/A**	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND
Vanadium	**NLE**	**N/A**	NS	300	25	7	18.3	45	115	9.83	82.3	21.3	45.3	109	10	9.56	175	NS	1.35	ND	2.05
Zinc	**5000**	**233**	NS	405	173	128	207	398	659	81.1	333	104	82.6	581	ND	89.5	615	NS	66.7	58.3	57.1

Notes

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

[1] Fort Monmouth Site-specific Groundwater Maximum Background Concentrations (MBCs), background (native) metals only (Weston SI Report, 1995)

[2] Low Flow Sampling Method used to collect sample

[3] Interim Criteria used as NJDEP criteria

[4] Mercury analyses from samples 4827.01-04 replaced mercury results for samples 4776.01-04.

Table 5-2
Determination of Potential Contaminants of Concern in Groundwater
Site 108 - Main Post
Fort Monmouth, New Jersey

Analyte	NJDEP Criteria[1]	Site Specific Groundwater MBC[2]	Maximum Result	No. of NJDEP Criteria Exceedences	No. of Site Maximum Background Exceedences	Comments
Volatiles						
Acetone	**700**	**N/A**	14.88	0	N/A	No exceedance of NJDEP criteria
Carbon Disulfide[3]	**100**	**N/A**	2.67	0	N/A	No exceedance of NJDEP criteria
Chlorobenzene	**4**	**N/A**	3.2	0	N/A	No exceedance of NJDEP criteria
Methylene Chloride	**2**	**N/A**	**3.09**	**4**	**N/A**	**Not a COC: three exceedances in April 1997 and one exceedance in September 1998. There have been no exceedances since 1998. Methylene chloride is a common laboratory contaminant**
Semi-Volatiles						
bis(2-Ethylhexyl)phthalate	**30**	**N/A**	24.59	0	N/A	No exceedance of NJDEP criteria
Diethylphthalate	**5000**	**N/A**	23.69	0	N/A	No exceedance of NJDEP criteria
Di-n-butylphthalate	**900**	**N/A**	17.3	0	N/A	No exceedance of NJDEP criteria
2-Methylnaphthalene	**100**	**N/A**	1.46	0	N/A	No exceedance of NJDEP criteria
Naphthalene	**100**	**N/A**	1.07	0	N/A	No exceedance of NJDEP criteria
Benzoic Acid	**100**	**N/A**	5.17	0	N/A	No exceedance of NJDEP criteria
Pesticides/PCBs						
4,4'-DDE	**0.1**	**N/A**	0.036	0	N/A	No exceedance of NJDEP criteria
Endosulfan I	**0.4**	**N/A**	0.118	0	N/A	No exceedance of NJDEP criteria
Metals						
Aluminum	**200**	**121000**	**55100**	**56**	**0**	**Not a COC: no exceedance of the Site Specific MBC.**
Antimony	**20**	**N/A**	6.21	0	N/A	No exceedance of NJDEP criteria
Arsenic	**8**	**N/A**	**63.2**	**40**	**N/A**	**COC: Exceeded the NJDEP criteria during Low-Flow sampling at monitoring well 108-MW2 (September and October 2000).**
Barium	**2000**	**699**	216	0	0	No exceedance of NJDEP criteria
Beryllium	**20**	**N/A**	4.04	0	N/A	No exceedance of NJDEP criteria
Cadmium	**4**	**N/A**	**8.09**	**2**	**N/A**	**Not a COC: only two exceedances of NJDEP criteria. Not detected during Low-Flow sampling (September and October 2000).**
Calcium	**NLE**	**45400**	111000	N/A	17	No NJDEP Groundwater Criteria

Table 5-2
Determination of Potential Contaminants of Concern in Groundwater
Site 108 - Main Post
Fort Monmouth, New Jersey

Analyte	NJDEP Criteria[1]	Site Specific Groundwater MBC[2]	Maximum Result	No. of NJDEP Criteria Exceedences	No. of Site Maximum Background Exceedences	Comments
Chromium	**100**	**N/A**	**363**	**6**	**N/A**	**Not a COC: no exceedances during Low-Flow sampling (September and October 2000).**
Cobalt	**NLE**	**N/A**	9.1	N/A	N/A	No NJDEP Groundwater Criteria
Copper	**1000**	**65.6**	280	0	8	No exceedance of NJDEP criteria
Iron	**300**	**431000**	**104000**	**68**	**0**	**Not a COC: no exceedance of the Site Specific MBC.**
Lead	**10**	**N/A**	**197**	**24**	**N/A**	**Not a COC: no exceedances during Low-Flow sampling (September and October 2000).**
Magnesium	**NLE**	**62700**	17300	N/A	0	No exceedance of NJDEP criteria
Manganese	**50**	**331**	**10250**	**54**	**6**	**Not a COC: no exceedances of Site-Specific MBC since February 1999.**
Mercury	**2**	**N/A**	1.37	0	N/A	No exceedance of NJDEP criteria
Nickel	**100**	**187**	25.4	0	0	No exceedance of NJDEP criteria
Potassium	**NLE**	**137000**	25600	N/A	0	No NJDEP Groundwater Criteria
Selenium	**50**	**N/A**	9.5	0	N/A	No exceedance of NJDEP criteria
Silver	**NLE**	**N/A**	**322**	**N/A**	**N/A**	No NJDEP Groundwater Criteria
Sodium	**50000**	**21500**	**68500**	**15**	**37**	**Sodium is not of concern due to proximity of site to seawater.**
Thallium	**10**	**N/A**	**10.6**	**1**	**N/A**	**Not a COC: only one exceedence of NJDEP Criteria.**
Vanadium	**NLE**	**N/A**	400	N/A	N/A	No NJDEP Groundwater Criteria
Zinc	**5000**	**233**	659	0	13	No exceedance of NJDEP criteria

Notes:

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

COC = Potential Contaminant of Concern. Arsenic is the only COC for Site 108.

N/A = Not Applicable

Exceeds NJDEP GWQC =

ND: Analyte not detected in sample

NLE: No limit established for this analyte

[1]Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

[2]Fort Monmouth Summary of Site-specific Groundwater Maximum Background Concentrations (MBC);
MBCs are shown for background (native) metals only (Weston SI Report, 1995).

[3]Interim Criteria used as NJDEP criteria

Table 5-3
Groundwater Quality Sample Results Summary for Arsenic
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID			108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1	108-MW1
Lab Sample ID	**NJDEP**	**Site Specific**	2459.03	2923.03	3171.03	3378.03	3578.03	3906.04	4077.01	4269.01	4515.01	4776.01[4]	5022.04	5194.04	5405.04	5603.04	5829.01	661
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Metals																		
Arsenic	**8**	**N/A**	NS	**10**	0.5	6	**26.1**	**33**	4.44	**13.9**	**15.5**	**10.2**	0.5	0.5	0.5	5.67	0.5	6.06
MDL					1								1	1	1		1	

Well ID			108-MW1	108-MW1
Lab Sample ID	**NJDEP**	**Site Specific**	5700.02	5774.03
Sample Date	**Criteria**	**MBC[1]**	09/08/00	10/06/00
		Round No.	low flow 1	low flow 2
Metals				
Arsenic	**8**	**N/A**	4.81	0.5
MDL				1

Well ID			108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2	108-MW2
Lab Sample ID	**NJDEP**	**Site Specific**	2459.04	2923.04	3171.04	3378.04	3578.04	3906.05	4077.02	4269.02	4515.02	4776.02[4]	5022.05	5194.05	5405.05	5603.05	5829.02	662
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Metals																		
Arsenic	**8**	**N/A**	NS	**22**	**24**	**25**	**63.2**	**61**	**47.6**	**31.6**	**33.8**	**10**	**14**	7.92	**29.8**	**8.52**	**26.2**	**34.5**
MDL																		

Well ID			108-MW2	108-MW2
Lab Sample ID	**NJDEP**	**Site Specific**	5700.05	5777.03
Sample Date	**Criteria**	**MBC[1]**	09/08/00	10/10/00
		Round No.	low flow 1	low flow 2
Metals				
Arsenic	**8**	**N/A**	**29.7**	**26.1**
MDL				

Well ID			108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3	108-MW3
Lab Sample ID	**NJDEP**	**Site Specific**	2459.05	2923.05	3171.05	3378.05	3578.05	3906.06	4077.03	4269.03	4515.03	4776.03[4]	5022.06	5194.06	5405.06	5603.06	5829.03	663
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Metals																		
Arsenic	**8**	**N/A**	NS	6	6	6	**38.4**	**31**	**18.7**	**9.74**	**15.8**	**13.9**	5.54	**26.4**	**8.5**	**32.2**	5.77	7.03
MDL																		

Well ID			108-MW3	108-MW3
Lab Sample ID	**NJDEP**	**Site Specific**	5700.06	5777.04
Sample Date	**Criteria**	**MBC[1]**	09/08/00	10/10/00
		Round No.	low flow 1	low flow 2
Metals				
Arsenic	**8**	**N/A**	6.08	0.5
MDL				1

Table 5-3
Groundwater Quality Sample Results Summary for Arsenic
Site 108 - Main Post
Fort Monmouth, New Jersey

Well ID			108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4	108-MW4
Lab Sample ID	**NJDEP**	**Site Specific**	2459.06	2923.06	3171.06	3378.06	3578.06	3906.07	4077.04	4269.04	4515.04	4776.04[4]	5022.07	5194.07	5405.07	5603.07	5829.04	664
Sample Date	**Criteria**	**MBC[1]**	04/17/97	08/21/97	11/21/97	03/02/98	05/19/98	09/23/98	11/20/98	02/10/99	05/26/99	09/08/99	12/17/99	02/23/00	05/09/00	08/04/00	11/02/00	02/08/01
		Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Metals																		
Arsenic	**8**	**N/A**	NS	7	**13**	**9**	**14.3**	**27**	**52.6**	2.91	**28.5**	6.87	**16.8**	**41.6**	0.5	4.34	**45.4**	NS
MDL															1			

Well ID			108-MW4	108-MW4	108-MW4
Lab Sample ID	**NJDEP**	**Site Specific**	906	5700.04	5774.04
Sample Date	**Criteria**	**MBC[1]**	02/16/01	09/08/00	10/06/00
		Round No.	16	low flow 1	low flow 2
Metals					
Arsenic	**8**	**N/A**	2.48	0.5	0.5
MDL				1	1

Notes

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb)

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP Criteria are shaded and **bold**

MDL: Minimum Detection Limit

N/A: Not Applicable NS: Not Sampled

[1] Fort Monmouth Site-specific Groundwater Maximum Background Concentrations (MBCs), background (native) metals only (Weston SI Report, 1995)

Table 5-4
Supplemental Soil Sample Results
Site 108 - Main Post
Fort Monmouth, New Jersey

Lab Sample ID	NJDEP RDCSCC* (mg/Kg)	1326	1327	1328	1329	1330	1331	1332	1333	1334
Boring Location		1	1	1	2	2	2	3	3	3
Sample Depth		0-6"	12-18"	24-30"	0-6"	12-18"	24-30"	0-6"	12-18"	24-30"
Sample Date		03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01
Arsenic	20	**108.46**	**30.96**	9.3	ND	7.81	**44.06**	**98.11**	ND	ND
Lead	400	10.6	6.49	7.74	2.55	1.98	11.9	13.9	1.33	15.2

Lab Sample ID	NJDEP RDCSCC* (mg/Kg)	1335	1336	1337	1338	1339	1340	1341	1342	1343
Boring Location		4	4	4	5	5	5	6	6	6
Sample Depth		0-6"	12-18"	24-30"	0-6"	12-18"	24-30"	0-6"	12-18"	24-30"
Sample Date		03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01
Arsenic	20	4.95	**195.74**	ND	**27.55**	**28.31**	**57.92**	17.86	18.37	**22.99**
Lead	400	8.97	8.32	16.3	11.9	10	6.52	9.28	10.4	9.07

Lab Sample ID	NJDEP RDCSCC* (mg/Kg)	1344	1345	1346	1347	1348	1349	1350	1351	1352
Boring Location		7	7	7	8	8	8	9	9	9
Sample Depth		0-6"	12-18"	24-30"	0-6"	12-18"	24-30"	0-6"	12-18"	24-30"
Sample Date		03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01
Arsenic	20	**30.62**	**32.9**	7.5	**24.37**	**68.51**	**297.03**	16.98	ND	15.56
Lead	400	8.91	23	10.6	6.29	14.3	166	11.8	1.99	11.4

NOTES:

*New Jersey Department of Environmental Protection Residential Direct Contact Soil Cleanup Criteria per NJAC 7:26D.

All concentrations are reported in milligrams per kilogram (mg/Kg) or parts per million (ppm).

Exceedances of the NJDEP RDCSCC are highlighted and printed in **bold-faced** type.

ND: Analyte not detected in sample.

Table 5-5
Aquifer pH
Site 108 - Main Post
Fort Monmouth, New Jersey

108-MW1	
Sample Date	pH
04/17/97	6.32
08/21/97	8.3
11/21/97	6.5
03/02/98	7.52
05/19/98	7.17
09/23/98	6.59
11/20/98	7.06
02/10/99	6.83
05/26/99	7.29
09/08/99	6.82
12/17/99	6.82
02/23/00	6.87
05/09/00	6.8
08/04/00	6.71
09/08/00	6.62
10/06/00	6.38
11/02/00	7.84
02/08/01	7.34
Min:	6.32
Max:	7.84
Average:	7.01

108-MW2	
Sample Date	pH
04/17/97	6.32
08/21/97	6.91
11/21/97	6.61
03/02/98	7.35
05/19/98	6.76
09/23/98	6.26
11/20/98	6.64
02/10/99	6.22
05/26/99	6.88
09/08/99	6.3
12/17/99	6.34
02/23/00	6.89
05/09/00	6.9
08/04/00	6.12
09/08/00	5.96
10/10/00	6.66
11/02/00	7.47
02/08/01	6.65
Min:	5.96
Max:	7.47
Average:	6.64

108-MW3	
Sample Date	pH
04/17/97	7.3
08/21/97	8.06
11/21/97	6.31
03/02/98	7.4
05/19/98	6.41
09/23/98	6.1
11/20/98	6.25
02/10/99	6.31
05/26/99	6.75
09/08/99	6.07
12/17/99	6.09
02/23/00	6.9
05/09/00	6.95
08/04/00	6.57
09/08/00	5.67
10/10/00	6.42
11/02/00	7.42
02/08/01	6.52
Min:	5.67
Max:	8.06
Average:	6.61

108-MW4	
Sample Date	pH
04/17/97	8.18
08/21/97	8.24
11/21/97	7.22
03/02/98	7.79
05/19/98	7.20
09/23/98	6.43
11/20/98	6.42
02/10/99	6.71
05/26/99	7.88
09/08/99	6.48
12/17/99	9.36
02/23/00	6.88
05/09/00	6.93
08/04/00	6.13
09/08/00	5.92
10/06/00	5.88
11/02/00	7.7
02/08/01	6.79
02/16/01	6.7
Min:	5.88
Max:	9.36
Average:	7.07

Table 6-1
MODFLOW Input Parameters
Site 108 - Main Post
Fort Monmouth, New Jersey

Software used for Modelling
Waterloo Hydrogeologic *Visual Modflow Version 2.7.2*
Golden Software, Inc. *Surfer for WindowsVersion 6*
Papadopulos & Associates, Inc. *MT3D 96*

Grid			
Model Area:	*Min*	*Max*	*Range*
X (Easting, NJ Nad 83):	*622100*	*624500*	*2400*
Y (Northing, NJ Nad 83):	*539800*	*542200*	*2400*
Number of Columns:	132		
Number of Rows:	131		
Default Grid Size:	20' x 20'		
Grid Size near 108 site:	10' x 10'		

Units used in model	
Length	feet
Time	day
Hydraulic Conductivity	Feet per day (ft/day)
Recharge	Inches per year (in./year)
Concentration	Micrograms per Liter (ug/L), equivalent to Parts Per Billion (ppb)
Mass	kg
Volume	ft^3

Ground Surface
The ground surface elevations were obtained from the Fort Monmouth Nad83 topographic survey.
The river was assigned to elevation of zero (0) ft.
The ground surface used in the model was interpolated from elevation points using Golden Software Surfer.

Table 6-1
MODFLOW Input Parameters
Site 108 - Main Post
Fort Monmouth, New Jersey

Layer properties			
Number of Layers:	5		
Layer Number	Formation	Thickness	Porosity*
Layer 1	Fill	5 ft	0.40
Layer 2	Navesink-Hornerstown Confining Unit	15 ft	0.40
Layer 3	Navesink-Hornerstown Confining Unit	110 ft	0.40
Layer 4	Wenonah-Mount Laurel Aquifer	75 ft	0.40
Layer 5	Marshalltown-Wenonah Confining Unit	10 ft	0.40
**Porosity estimated from Dominico and Schwarts (1998), Table 2.1.*			

Recharge	
Majority of Area:	13.28 in. / year
Selected Area:	0 in./year in paved area south of M-18 site
Recharge applied to:	Highest Active Cells
Source:	Jablonski, 1968, Ground-Water Resources of Monmouth County, New Jersey, USGS Special Report No. 23. *The recharge used for the model was taken to be the sum of the groundwater base flow and water utilization.*

Constant Head Boundary Condition)	
Location:	Oceanport Creek was assigned the constant-head boundary condition of 0 ft amsl.

Table 6-1
MODFLOW Input Parameters
Site 108 - Main Post
Fort Monmouth, New Jersey

Hydraulic Conductivity (K)		
The geometric means were used for the layers specified below:		
Fill:	*From Slug tests conducted August 14, 2001.*	
(Layer 1)	Well	K
	108-MW1	3.7
	108-MW2	19.1
	108-MW3	31.7
	108-MW4	2.74
Geometric Mean:		**8.9**
Navesink-Hornerstown		*From Martin (1998)*
Confining Unit:		2
(Layers 2 and 3)		5.00E-04
		1.30E-01
		9
		3.00E-03
		2.00E-02
		8.00E-02
		6.70E-01
		4
		5.60E-02
Geometric Mean:		**0.12**

Hydraulic Conductivity (K) (Continued)	
Wenonah Formation:	*From Martin (1998)*
(Layer 4)	17
	13
	19
	13
	19
Geometric Mean:	**15.964987**
Marshaltown Wenonah	*From Martin (1998)*
Confining Unit:	2.60E-04
(Layer 5)	1.30E-01
	4.90E-04
	5.70E-06
	2.40E-05
	1.50E-05
Geometric Mean:	**0.00018**
Source:	Martin, Mary, 1998, Groundwater Flow in the New Jersey Coastal Plain, USGS Professional Paper 1404-H.

Table 6-1
MODFLOW Input Parameters
Site 108 - Main Post
Fort Monmouth, New Jersey

Contaminant Transport Inputs

Dispersivity: 24.3 ft

Source for dispersivity: Gelhar and Others, Water Resources, v. 28, p. 1955-1974,
The dispersivity used is the geometric mean of the upper and lower results from 109 dispersivity tests worldwide.

Bulk Density: 46.7 kg/ft3

Sorption type: Linear Isotherm

Sorption Constants Used in Model (Kd):

Source	COC	Kd (ml/g)	Kd (ft3/kg)	**Calculated Rd**
(1)	Arsenic	2.90E+01	1.02E+00	**74**

Source:

(1)United States Environmental Protection Agency (USEPA). 1996.
Soil Screening Guidance: Technical Background Document.
Office of Solid Waste and Emergency Response. Washington, D.C. EPA/540/R-95/128.
Note: Kd for arsenic used for aquifer pH of 6.8.

Table 6-1
MODFLOW Input Parameters
Site 108 - Main Post
Fort Monmouth, New Jersey

Contaminant Transport Inputs (Continued):

Method for Determining Inititial Concentrations for each Contaminant of Concern:

Contaminant of Concern	NJDEP Cleanup Criteria[(1)]	Average Detection	Maximum Result	Wells with Number of Exceedances	Method for Determining Initial Concentrations
Arsenic	8	19.7	63.2	108-MW1 [6] 108-MW2-[16] 108-MW3-[9] 108-MW4-[9]	Initial concentration map derived from average concentrations (see below).

Notes:

[(1)]Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per N.J.A.C. 7:9-6

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

Table 6-1
MODFLOW Input Parameters
Site 108 - Main Post
Fort Monmouth, New Jersey

Contaminant Transport Inputs (Continued):

Average Concentrations for Each Contaminant of Concern:

Contaminant of Concern	NJDEP Cleanup Criteria[(1)]	MDL	108-MW1 Average Concentration	108-MW2 Average Concentration	108-MW3 Average Concentration	108-MW4 Average Concentration
ARSENIC	8	1	19.703	8.548	3.495	5.288

Notes:

[(1)]Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per N.J.A.C. 7:9-6

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

MDL: Minimum Detection Limit.

Bold with Shading: average concentration exceeds the NJDEP Criteria.

Samples with a Non-Detect result (ND) were assigned the concentration of 0.5 * MDL for the calculation of average concentrations.

Table 6-2
MODFLOW Results
Site 108 - Main Post
Fort Monmouth, New Jersey

Contaminant of Concern	NJDEP Criteria (ug/L)[(1)]	Well used for Calculation	Change of Concentration over 10 year simulation (see Figure 6-8)	**Estimated Time for Compliance (Years)**
Arsenic	8	108-MW1	0.0056 ug/L per year	**>1,000**

Notes:

[(1)]Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Table 6-3
Well Search Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

NJDEP Permit Number	Depth (feet)	Use*	Permit Date	Lattitude	Longitude
2900961	50	D	10/27/1953	401920	740106
2901016	150	D	12/24/1953	401839	740240
2901400	54	D	4/19/1955	401920	740040
2902505	100	D	10/10/1957	401906	740226
2902774	124	D	9/22/1958	401933	740226
2903015	60	G	8/20/1959	401906	740119
2903369	100	D	8/8/1960	401933	740213
2904271	60	D	2/13/1964	401933	740213
2904513	350	D	10/16/1964	401906	740133
2904519	60	D	10/15/1964	401933	740053
2904782	50	D	8/5/1965	401839	740240
2904815	50	D	9/10/1965	401906	740053
2904817	50	D	9/10/1965	401853	740040
2904855	50	D	10/15/1965	401853	740040
2905009	70	D	3/21/1966	401853	740119
2905084	50	D	5/31/1966	401933	740133
2905673	100	D	1/22/1969	401839	740226
2906131	70	D	12/18/1970	401906	740040
2906460	50	D	4/25/1972	401906	740106
2906499	50	D	5/22/1972	401920	740106
2906510	50	D	6/7/1972	401839	740200
2906958	85	D	4/18/1973	401933	740106
2907172	85	D	9/5/1973	401933	740106
2907264	50	D	10/18/1973	401933	740106
2908438	60	D	8/3/1976	401853	740200
2908810	50	D	5/12/1977	401839	740146
2910282	80	D	9/11/1979	401920	740053
2911063	25	M	3/31/1981	401906	740213
2911064	25	M	3/31/1981	401906	740213
2911065	25	M	3/31/1981	401906	740213
2911066	25	M	3/31/1981	401906	740213
2911067	25	M	3/31/1981	401906	740213
2911068	25	M	3/31/1981	401906	740213
2911772	100	H	12/22/1981	401906	740240
2911855	175	I	2/17/1982	401920	740053
2912553	25	M	1/21/1983	401846	740152
2912554	25	M	1/21/1983	401846	740152
2912555	25	M	1/21/1983	401846	740152
2912598	80	R	2/1/1983	401832	740126
2912785	10	M	6/2/1983	401939	740219
2912786	10	M	6/2/1983	401939	740219
2912787	10	M	6/2/1983	401939	740219
2912788	10	M	6/2/1983	401939	740219
2912789	10	M	6/2/1983	401939	740219
2912790	10	M	6/2/1983	401939	740219
2912792	10	M	6/2/1983	401939	740219
2912793	10	M	6/2/1983	401939	740219
2912794	10	M	6/2/1983	401939	740219
2912795	10	M	6/2/1983	401939	740219
2912796	10	M	6/2/1983	401939	740219
2912797	10	M	6/2/1983	401939	740219
2912798	10	M	6/2/1983	401939	740219
2913696	10	M	8/5/1984	401939	740219
2913697	10	M	8/5/1984	401939	740219
2913698	25	M	8/5/1984	401939	740219
2913825	35	M	6/20/1985	401819	740152
2913978	35	M	6/20/1985	401920	740040
2914157	60	D	9/15/1984	401846	740139
2914244	120	D	10/5/1984	401819	740219

NJDEP Permit Number	Depth (feet)	Use*	Permit Date	Lattitude	Longitude
2914980	200	R	5/5/1985	401912	740246
2915005	80	D	7/18/1985	401846	740059
2915421	100	D	9/20/1985	401859	740046
2916628	12	M	6/11/1986	401939	740232
2916629	12	M	6/11/1986	401939	740232
2916630	12	M	6/11/1986	401939	740232
2919474	200	D	10/26/1987	401920	740133
2919537	60	D	11/9/1987	401920	740053
2919952	80	D	2/16/1988	401920	740040
2920242	80	R	4/12/1988	401839	740106
2920243	15	Z	4/12/1988	401839	740106
2920244	15	Z	4/12/1988	401839	740106
2920245	60	Z	4/12/1988	401839	740106
2920246	15	Z	4/12/1988	401839	740106
2920248	15	Z	4/12/1988	401839	740106
2921780	190	G	11/10/1988	401853	740133
2922063	100	R	2/10/1989	401920	740053
2922181	150	G	2/9/1989	401933	740133
2922236	60	D	2/28/1989	401920	740053
2922526	190	G	4/7/1989	401933	740133
2922549	180	G	4/12/1989	401839	740133
2923608	200	D	10/18/1989	401933	740226
2923677	30	M	11/3/1989	401906	740226
2923678	30	M	11/3/1989	401906	740226
2923679	30	M	11/3/1989	401906	740226
2923680	30	M	11/3/1989	401906	740226
2924557	60	D	4/10/1990	401920	740053
2924639	30	M	4/27/1990	401906	740226
2924640	30	M	4/27/1990	401906	740226
2924953	10	M	6/27/1990	401853	740200
2924954	10	M	6/27/1990	401853	740200
2924955	10	M	6/27/1990	401853	740200
2924956	10	M	6/27/1990	401853	740200
2925357	20	M	10/12/1990	401839	740213
2925453	15	M	11/7/1990	401906	740119
2925454	15	M	11/7/1990	401906	740119
2925455	15	M	11/7/1990	401906	740119
2925456	15	M	11/7/1990	401906	740119
2925457	15	M	11/7/1990	401906	740119
2925506	70	I	11/20/1990	401906	740040
2926778	40	M	8/29/1991	401946	740200
2926925	20	M	9/24/1991	401906	740200
2926926	20	M	9/24/1991	401906	740200
2926927	20	M	9/24/1991	401906	740200
2926928	20	M	9/24/1991	401906	740200
2926929	20	M	9/24/1991	401906	740200
2926930	20	M	9/24/1991	401906	740200
2926931	20	M	9/24/1991	401906	740200
2926938	20	M	9/25/1991	401920	740200
2926939	20	M	9/25/1991	401920	740200
2926940	20	M	9/25/1991	401906	740200
2926941	20	M	9/25/1991	401906	740200
2926942	20	M	9/25/1991	401906	740200
2928031	20	E	5/14/1992	401906	740200
2928907	20	M	10/13/1992	401906	740200
2928992	20	M	10/27/1992	401920	740200
2928993	20	M	10/27/1992	401920	740200
2928994	20	M	10/27/1992	401920	740200
2928995	20	M	10/27/1992	401920	740200

Table 6-3
Well Search Summary
Site 108 - Main Post
Fort Monmouth, New Jersey

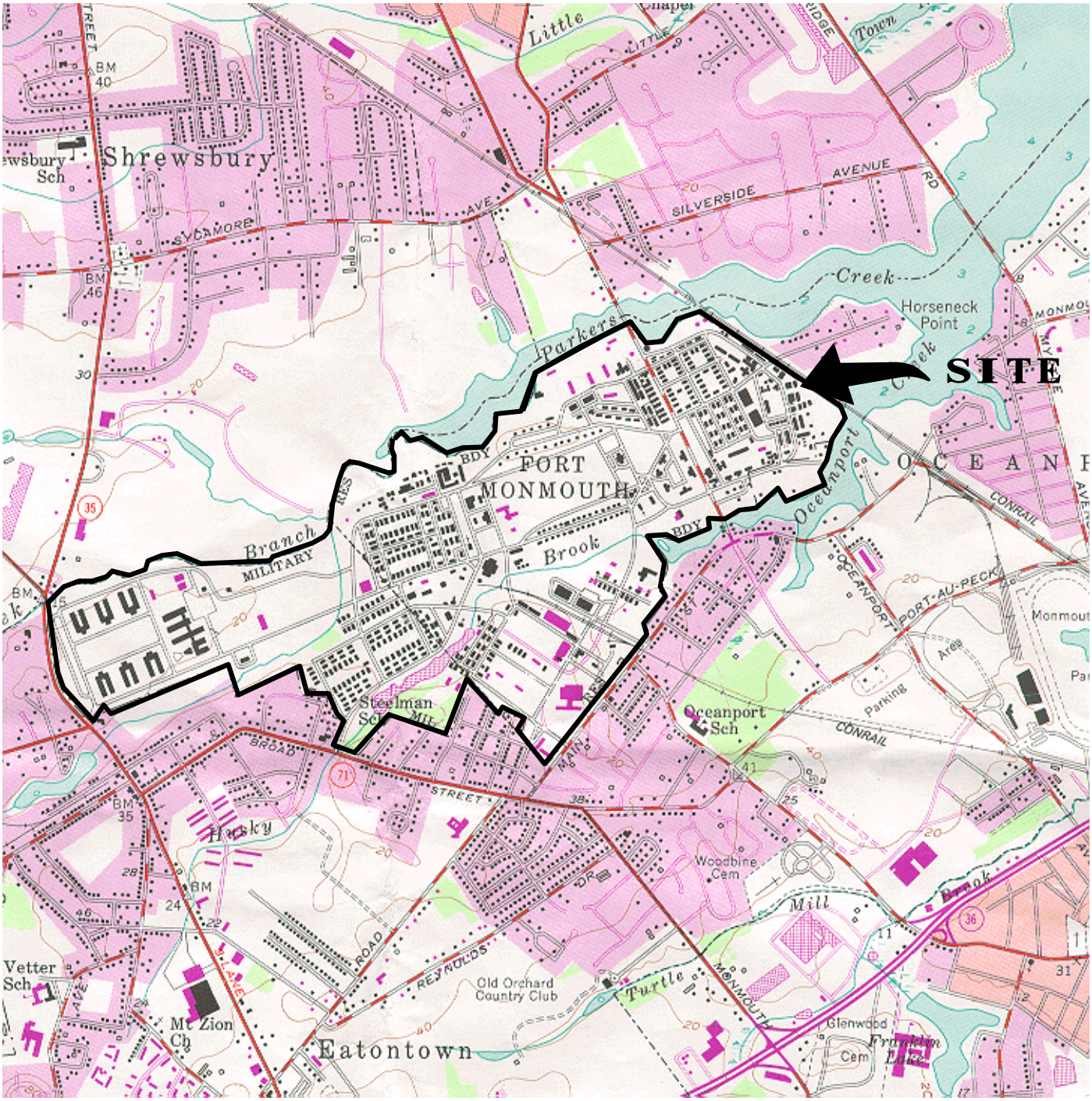
NJDEP Permit Number	Depth (feet)	Use*	Permit Date	Lattitude	Longitude
2929739	20	M	6/3/1993	401920	740146
2929740	20	M	6/3/1993	401920	740146
2929741	20	M	6/3/1993	401920	740146
2930322	100	1	10/12/1993	401906	740040
2930957	15	M	4/5/1994	401906	740200
2930961	15	M	4/5/1994	401853	740240
2930962	15	M	4/5/1994	401906	740200
2930963	15	M	4/5/1994	401906	740200
2930964	15	M	4/5/1994	401906	740200
2930973	15	M	4/5/1994	401906	740240
2930974	15	M	4/5/1994	401906	740240
2930975	15	M	4/5/1994	401920	740240
2930976	15	M	4/5/1994	401920	740240
2930980	15	M	4/5/1994	401906	740240
2931158	25	M	5/4/1994	401853	740200
2931159	25	M	5/4/1994	401853	740200
2931440	200	G	6/9/1994	401933	740106
2931552	30	G	6/30/1994	401853	740133
2931772	15	M	8/3/1994	401906	740240
2931773	15	M	8/3/1994	401906	740240
2931774	15	M	8/3/1994	401906	740240
2931775	15	M	8/3/1994	401906	740240
2932576	25	M	11/29/1994	401853	740226
2932577	25	M	11/29/1994	401853	740226
2932578	25	M	11/29/1994	401853	740226
2932579	25	M	11/29/1994	401853	740226
2932580	25	M	11/29/1994	401853	740226
2932581	25	M	11/29/1994	401853	740226
2932582	25	M	11/29/1994	401853	740226
2932583	25	M	11/29/1994	401853	740226
2933754	20	M	7/19/1995	401906	740200
2933755	20	M	7/19/1995	401906	740200
2933989	20	M	8/18/1995	401920	740240
2934702	40	B	12/15/1995	401920	740146
2934857	50	B	2/8/1996	401920	740146
2935504	70	D	6/5/1996	401906	740040
2935731	25	M	7/17/1996	401826	740119
2935732	25	M	7/17/1996	401826	740119
2935833	15	M	8/2/1996	401920	740106
2936864	175	D	4/23/1997	401920	740119
2936995	40	B	5/27/1997	401826	740119
2937878	120	G	11/14/1997	401853	740200
2938172	30	M	2/11/1998	401826	740226
2938340	100	G	3/18/1998	401920	740053
2938652	60	G	5/14/1998	401920	740119
2938811	60	G	6/15/1998	401906	740106
2939550	300	H	10/21/1998	401826	740226

Notes:
Source: State of New Jersey Department of Environmental Protection - Well Permitting and Regulations Section of the Bureau of Water Allocation, Trenton, NJ.
Search date: 6 August 2001.
Well search was performed for a 1-mile radius surrounding the center point of Site 80/166, U.S. Army Garrison Fort Monmouth, Fort Monmouth, New Jersey. Site 108 is approximately 750 feet from Site 80/166.

80/166 Location: latitude = North 40° 19' 03",
longitude = West 74° 01' 43".

***Well Use Codes**
A - Unknown/Well Record Use Only
B - Boring
C - Commercial
D - Domestic (Potable)
E - Recovery/Decontamination Pollution Control/Leachate with Pump Capacity
F - Fire
G - Irrigation
H - Heat Pump/Geothermal (Return Well)
I - Industrial
J - Injection
K - Inclinometer
L - Livestock
M - Monitoring Well (Observation)
N - Public Non Community
O - Oil/Gas Exploration
P - Public Supply
Q - Recharge
R - Replacement (Replacement Codes: 1 - Domestic; 2 - Public Community, 5 - Irrigation)
S - Closed Loop
T - Test
U - Non Public (Supply)
V - Gas Vent
W - Dewatering
X - Agricultural/Horticultural/IrrigationWells
Y - Cathodic Protection
Z - Piezometer

FIGURES



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QUADRANGLE LOCATION

Mapped, edited and published by the Geological Survey

Figure 2-1
Site Location Map
Site 108
Fort Monmouth, New Jersey

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Horsham, PA 19044
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N
VERY TALL GRASS ANB BRUSH
BRUSH
BRUSH
T-482
T-484
T-485
273
276
277
278
279
280
281
282
283
284
285
288
289
FLAG
FLAG
FLAG
CB.
MB
MH
RT 35
FORMER
BUILDING 108
ROAD (PAVED)
ROAD/TRAILS (UNPAVED)
RAILROAD TRACKS
APPROXIMATE BOUNDARY
BASE BOUNDARY
WOODED AREA
TREE/BUSH
LIGHT POLE
UTILITY POLE
BROOK/CREEK
MARSHY AREA
NOTES:
REV.
REVISIONS
APPROVED
DATE
DRAWN BY
TITLE:
FIGURE 2-2
SITE LAYOUT
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY
DRAWN BY: PS
DATE DRAWN: 01 AUG 01
CHECKED BY:
DATE CHECKED:
APPROVED BY:
DATE APPROVED:
DRAWING NO.: FIG 2-2
FILE NO.: 108 FIG 2-2
SCALE: 1" = 60'
SHEET OF
REV.: A
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N
VERY TALL GRASS ANB BRUSH
BRUSH
BRUSH
T 482
T 484
T 485
273
276
277
278
279
280
281
282
283
284
285
288
FLAG
FLAG
FLAG
CB.
MB
MH
108-MW1
108-MW2
108-MW3
108-MW4
FORMER
BUILDING 108
ROAD (PAVED)
ROAD/TRAILS (UNPAVED)
FENCE
BUILDING
APPROXIMATE BOUNDARY
BASE BOUNDARY
RAILROAD TRACKS
WOODED AREA
TREE/BUSH
LIGHT POLE
UTILITY POLE
BROOK/CREEK
MARSHY AREA
NOTES:
= MONITORING WELL LOCATION
REV.
REVISIONS
APPROVED
DATE
DRAWN BY
TITLE:
FIGURE 2-3
MONITORING WELL LOCATION MAP
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY
DRAWN BY: JM
DATE DRAWN: 02 JUL 01
CHECKED BY:
DATE CHECKED: 02 JUL 01
APPROVED BY:
DATE APPROVED:
DRAWING NO.: FIGURE 2-3
FILE NO.: 108 FIGURE 2-3
SCALE: 1" = 60'
SHEET 1 OF 1
REV.:
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HORSHAM, PA 19044
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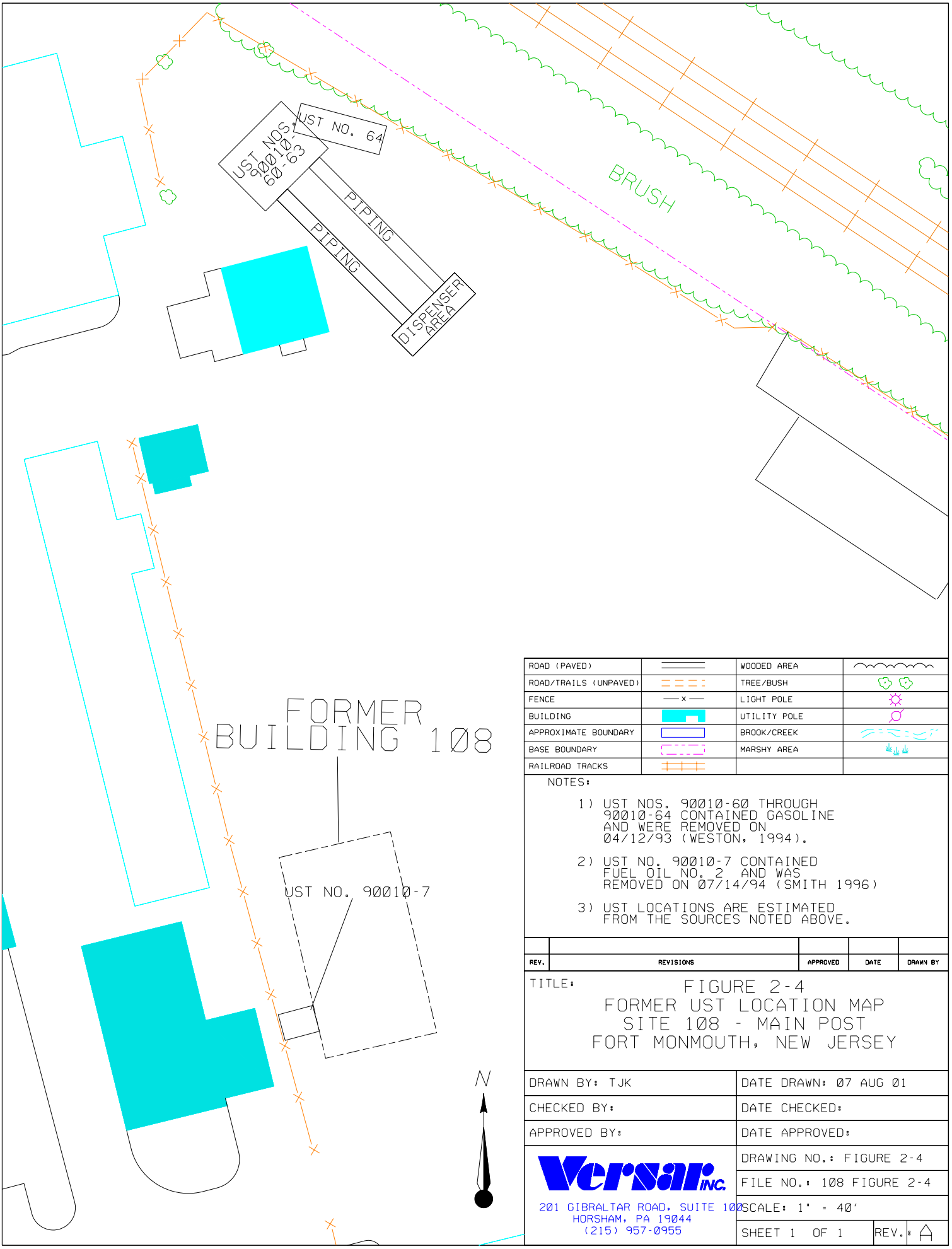

ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE	—x—	LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	
RAILROAD TRACKS			

NOTES:

1) UST NOS. 90010-60 THROUGH 90010-64 CONTAINED GASOLINE AND WERE REMOVED ON 04/12/93 (WESTON, 1994).

2) UST NO. 90010-7 CONTAINED FUEL OIL NO. 2 AND WAS REMOVED ON 07/14/94 (SMITH 1996)

3) UST LOCATIONS ARE ESTIMATED FROM THE SOURCES NOTED ABOVE.

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 2-4
FORMER UST LOCATION MAP
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 07 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING NO.: FIGURE 2-4
	FILE NO.: 108 FIGURE 2-4
	SCALE: 1" = 40'
	SHEET 1 OF 1 REV.: A

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Geologic Map of New Jersey

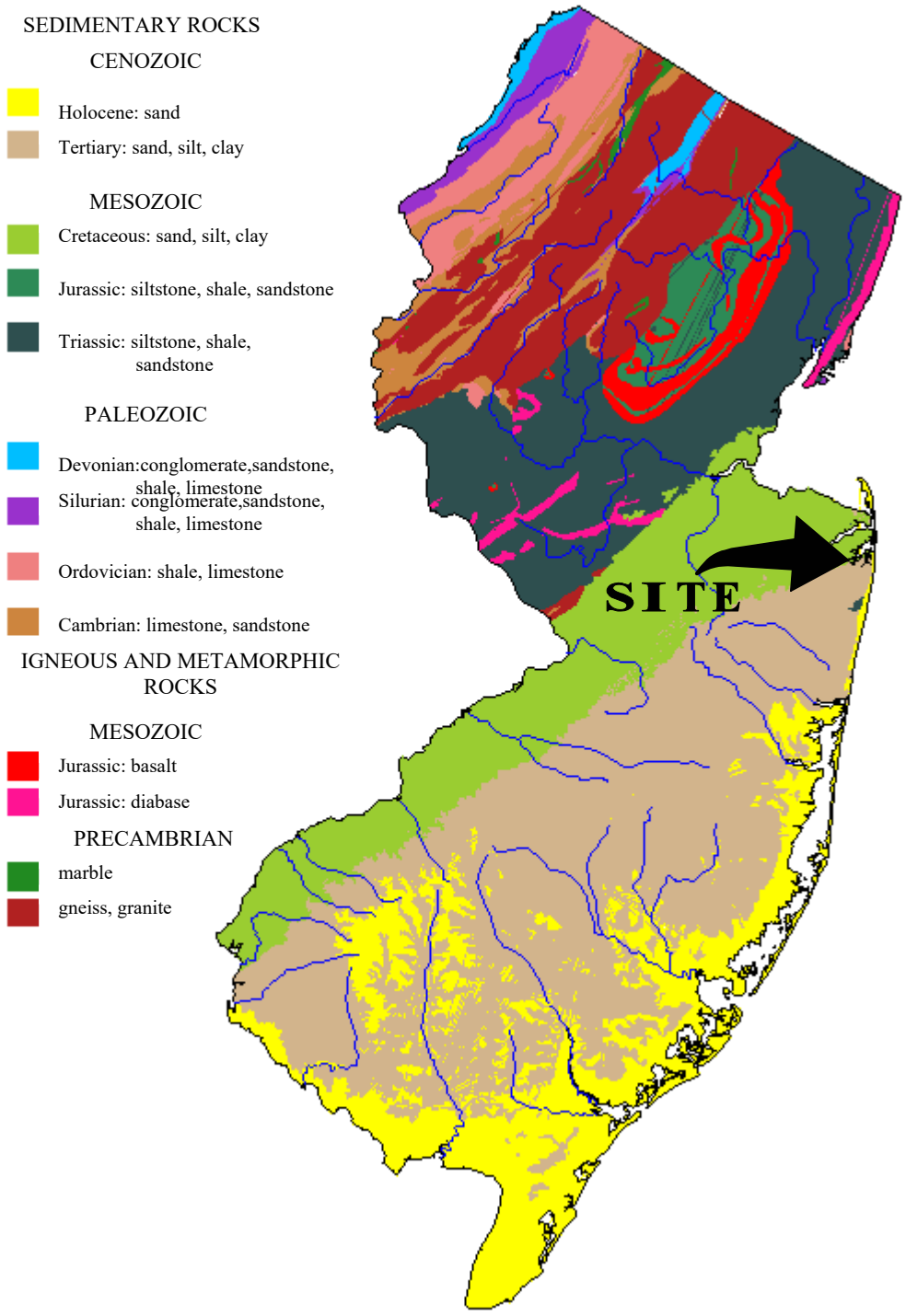

FIGURE 2-5
Geologic Map of New Jersey
Site 108
Fort Monmouth, New Jersey

Source: New Jersey Geologic Survey, 1994, *Geologic Map of New Jersey*.

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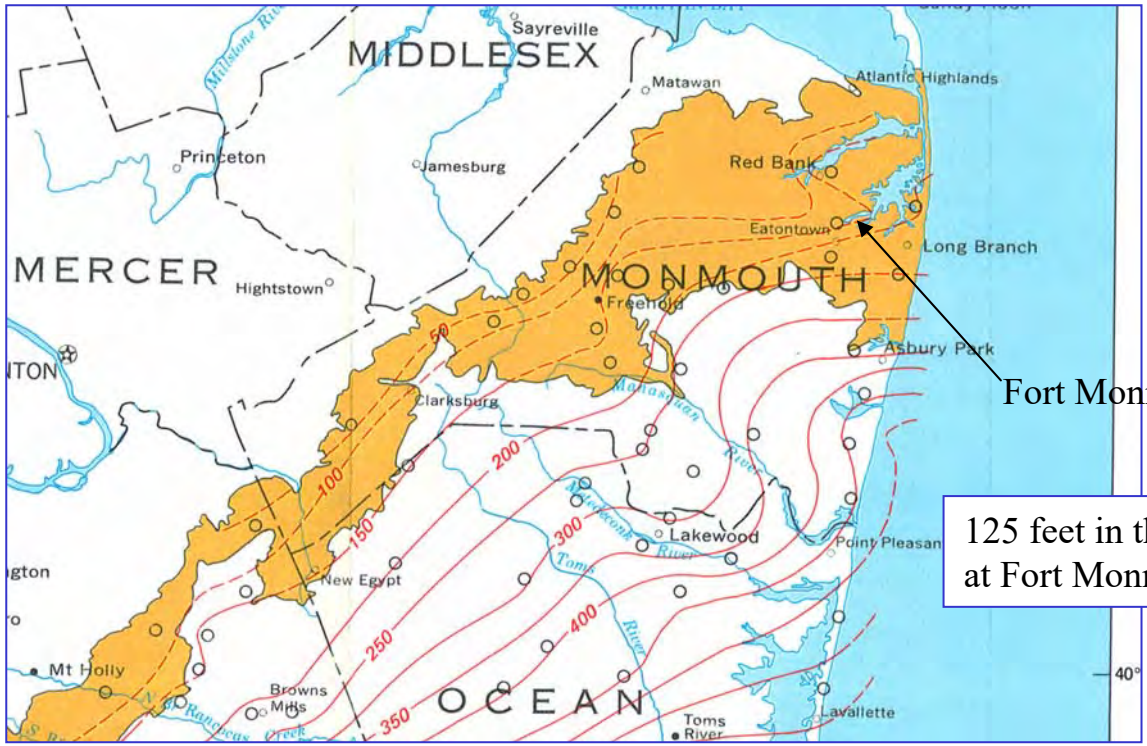

EXPLANATION

Outcrop area of the Navesink Formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, Vincentown Formation, and Manasquan Formation

600 — Line of equal thickness of the composite confining bed Dashed where approximately located. Interval 50 feet

Well location

Source: Zapecza, O. 1989. *Hydrogeologic Framework of the New Jersey Coastal Plain.* USGS Professional Paper 1404-B. U.S. Government Printing Office, Washington, DC.

FIGURE 2-6

Outcrop and Thickness of Composite Confining Unit
Site 108
Fort Monmouth, New Jersey

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US Department of Agriculture
Soil Conservation Service
Soil Survey of Monmouth County, NJ
April 1989

Figure 2-7
Soil Map of Monmouth County
Site 108
Fort Monmouth, New Jersey

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ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE		LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	
RAILROAD TRACKS			

NOTES:

= MONITORING WELL LOCATION

= GEOPROBE BORING LOCATION

SB = SOIL BORING

24-30" (SB)

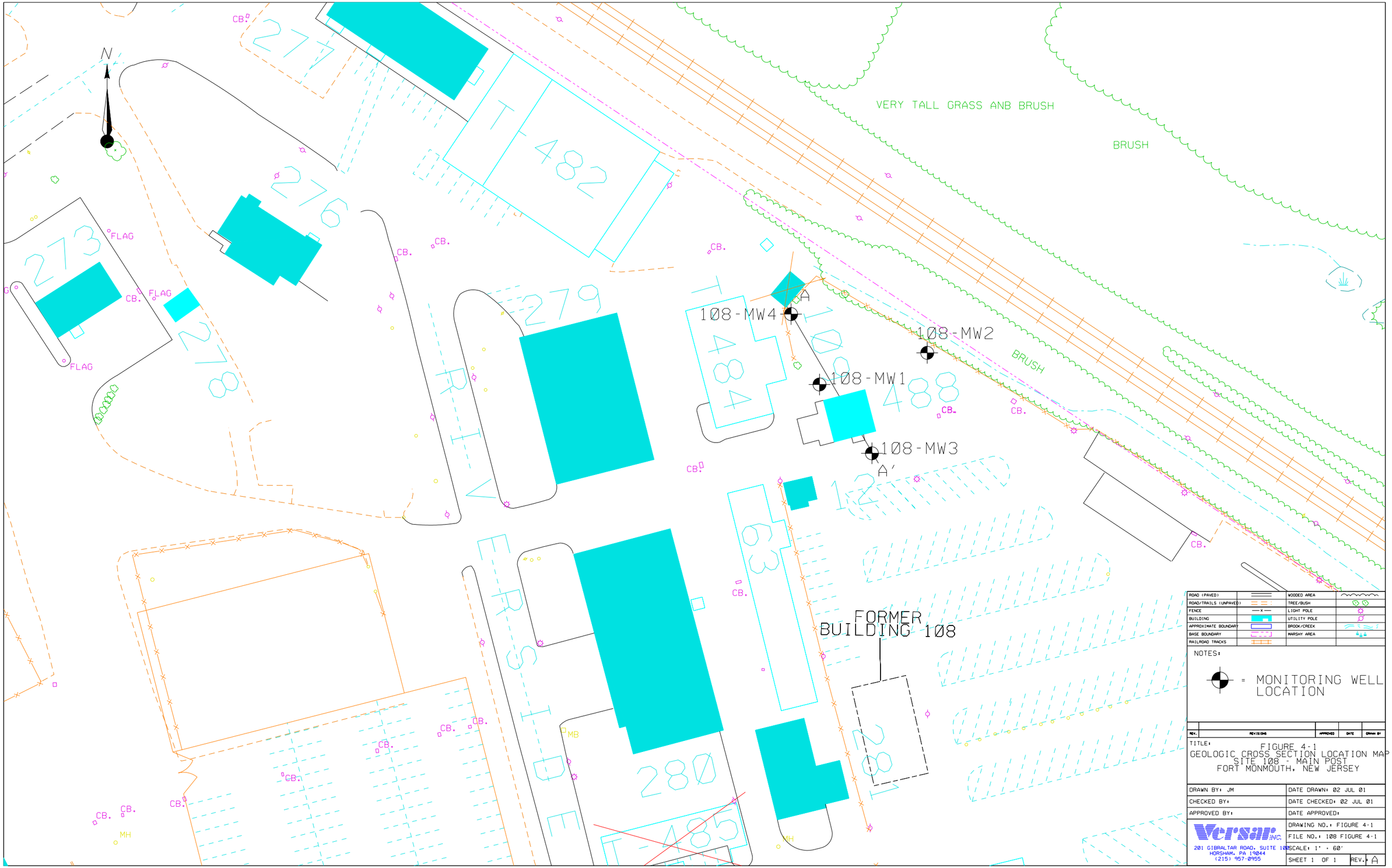
SAMPLE DEPTH — SAMPLE TYPE

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 3-1
GEOPROBE BORING LOCATION MAP
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: JM	DATE DRAWN: 17 JUL 01
CHECKED BY:	DATE CHECKED: 17 JUL 01
APPROVED BY:	DATE APPROVED:
Versar INC.	DRAWING NO.: 108 FIG.3-1
2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007-6894 (215) 788-7844	FILE NO.: 108 FIG.3-1
	SCALE: 1" = 60'
	SHEET OF REV.: A


N
VERY TALL GRASS ANB BRUSH
BRUSH
BRUSH
T 482
T 484
T 485
T 488
273
276
278
279
280
FLAG
FLAG
CB.
MB
MH
108-MW4
108-MW2
108-MW1
108-MW3
A
A'
FORMER
BUILDING 108
ROAD (PAVED)
ROAD/TRAILS (UNPAVED)
FENCE
BUILDING
APPROXIMATE BOUNDARY
BASE BOUNDARY
RAILROAD TRACKS
WOODED AREA
TREE/BUSH
LIGHT POLE
UTILITY POLE
BROOK/CREEK
MARSHY AREA
NOTES:
= MONITORING WELL LOCATION
REV.
REVISIONS
APPROVED
DATE
DRAWN BY
TITLE:
FIGURE 4-1
GEOLOGIC CROSS SECTION LOCATION MAP
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY
DRAWN BY: JM
DATE DRAWN: 02 JUL 01
CHECKED BY:
DATE CHECKED: 02 JUL 01
APPROVED BY:
DATE APPROVED:
DRAWING NO.: FIGURE 4-1
FILE NO.: 108 FIGURE 4-1
SCALE: 1" = 60'
SHEET 1 OF 1
REV.: A
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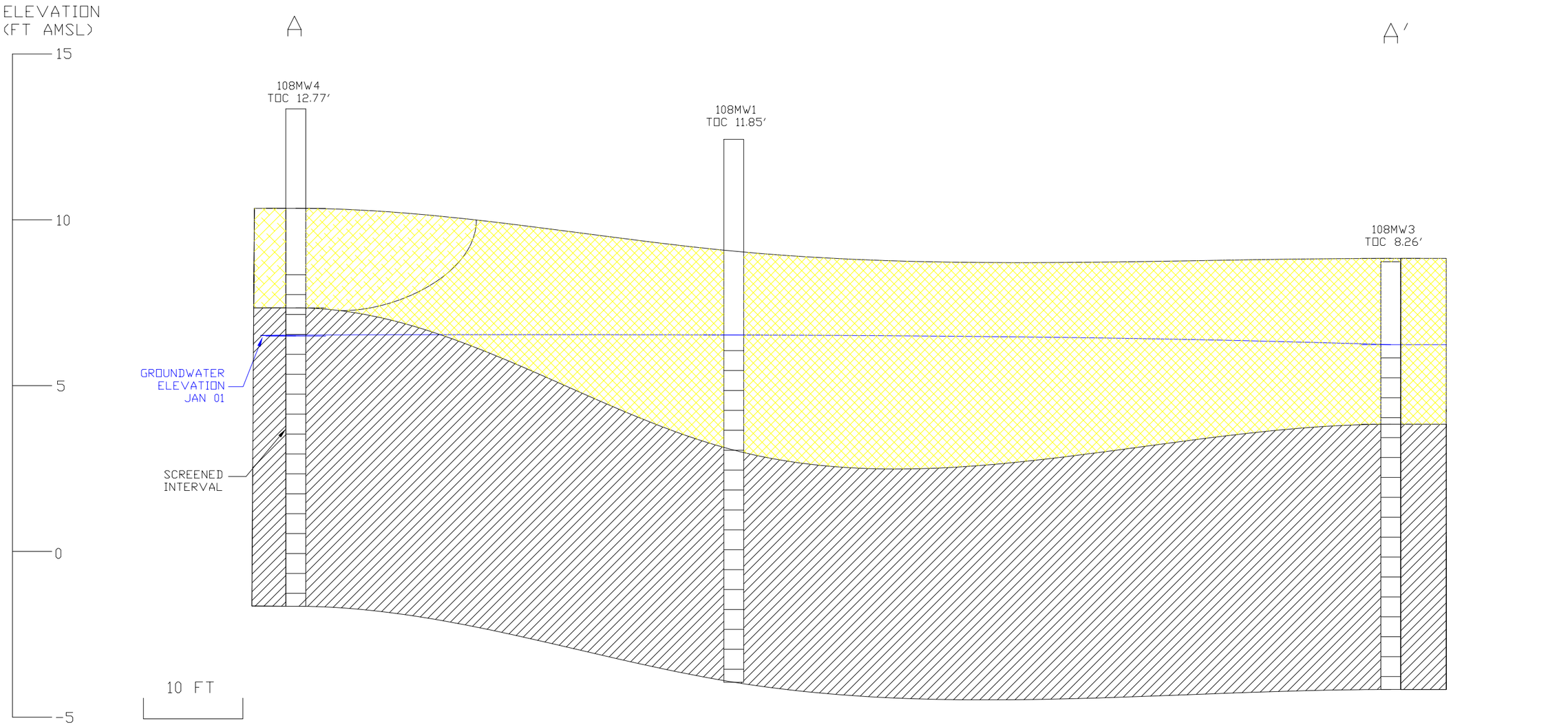

NOTES:

1) CROSS SECTION LINE (A TO A') IS SHOWN ON FIGURE 4-1.

2) VERTICAL SCALE: 1" = 3'.
HORIZONTAL SCALE: 1" = 10'.
VERTICAL EXAGGERATION = 3.33.

3) ELEV. = ELEVATION OF INNER WELL CASING SURVEY MARK (FEET ABOVE MEAN SEA LEVEL).

4) GROUNDWATER ELEVATION SHOWN IN FEET AMSL.

5) EACH OF THE WELLS HAS A DIAMETER OF 4 INCHES, WHICH IS ENLARGED ON THIS DRAWING FOR PRESENTATION.

6) BOUNDARIES ARE DASHED WHERE INFERRED.

UNIT	SYMBOL	DESCRIPTION
(1)		SAND WITH SOME COBBLES - FILL
(2)		WELL-SORTED SAND WITH SILT - FILL
(3)		GREENISH-GRAY TO BLACK SILTY CLAY

REV.	REVISIONS	APPROVED	DRAWN BY

TITLE:
FIGURE 4-2
GEOLOGIC CROSS SECTION A TO A'
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: PS/TJK	DATE DRAWN: 10 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-2
	FILE No.: 108 FIG. 4-2
	SCALE: 1" = 10' (VERT:1"=3')
	SHEET 1 OF 1 REV.: A

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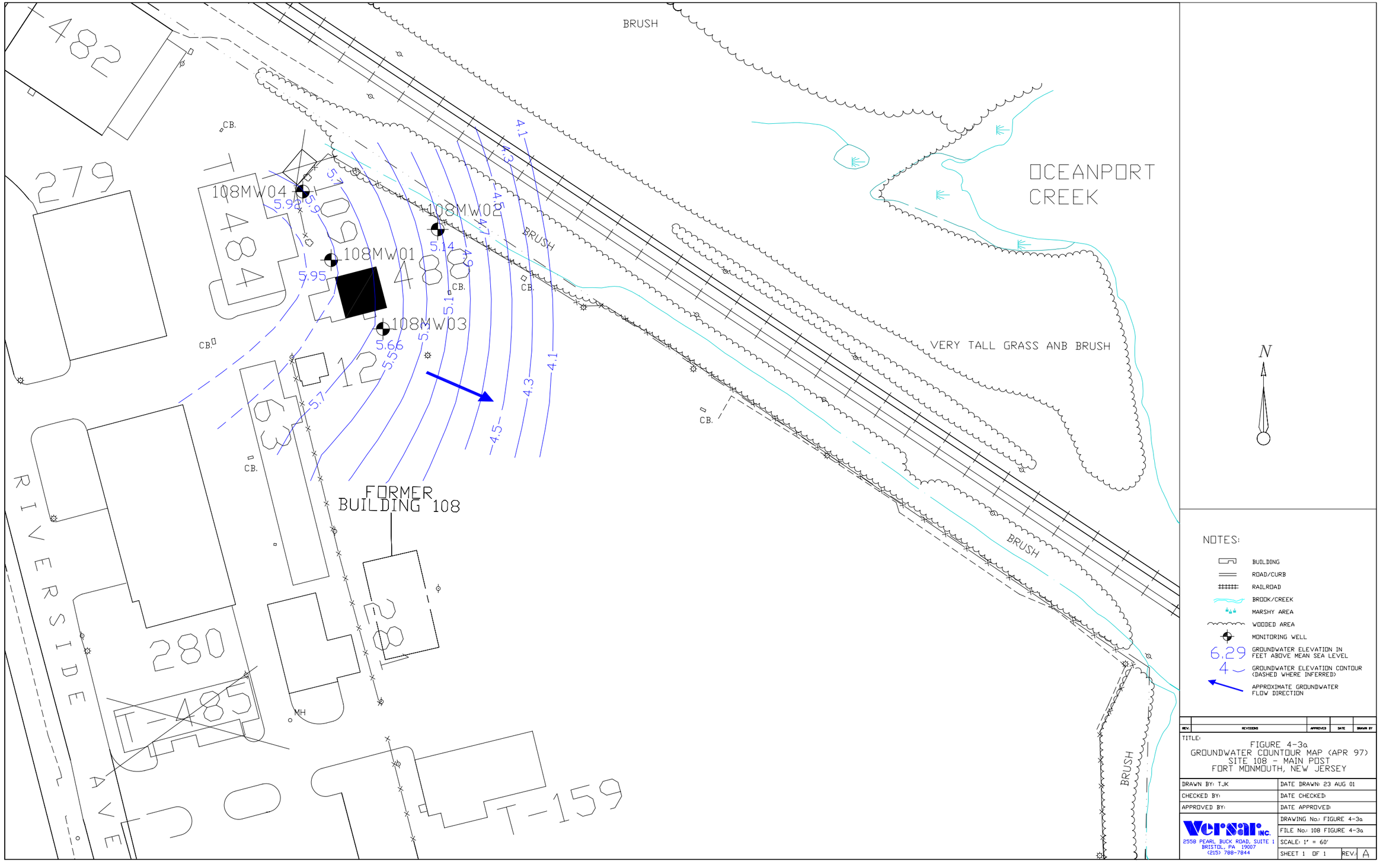

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:
FIGURE 4-3a
GROUNDWATER COUNTOUR MAP (APR 97)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3a
	FILE No.: 108 FIGURE 4-3a
	SCALE: 1" = 60'
	SHEET 1 OF 1 — REV.: A

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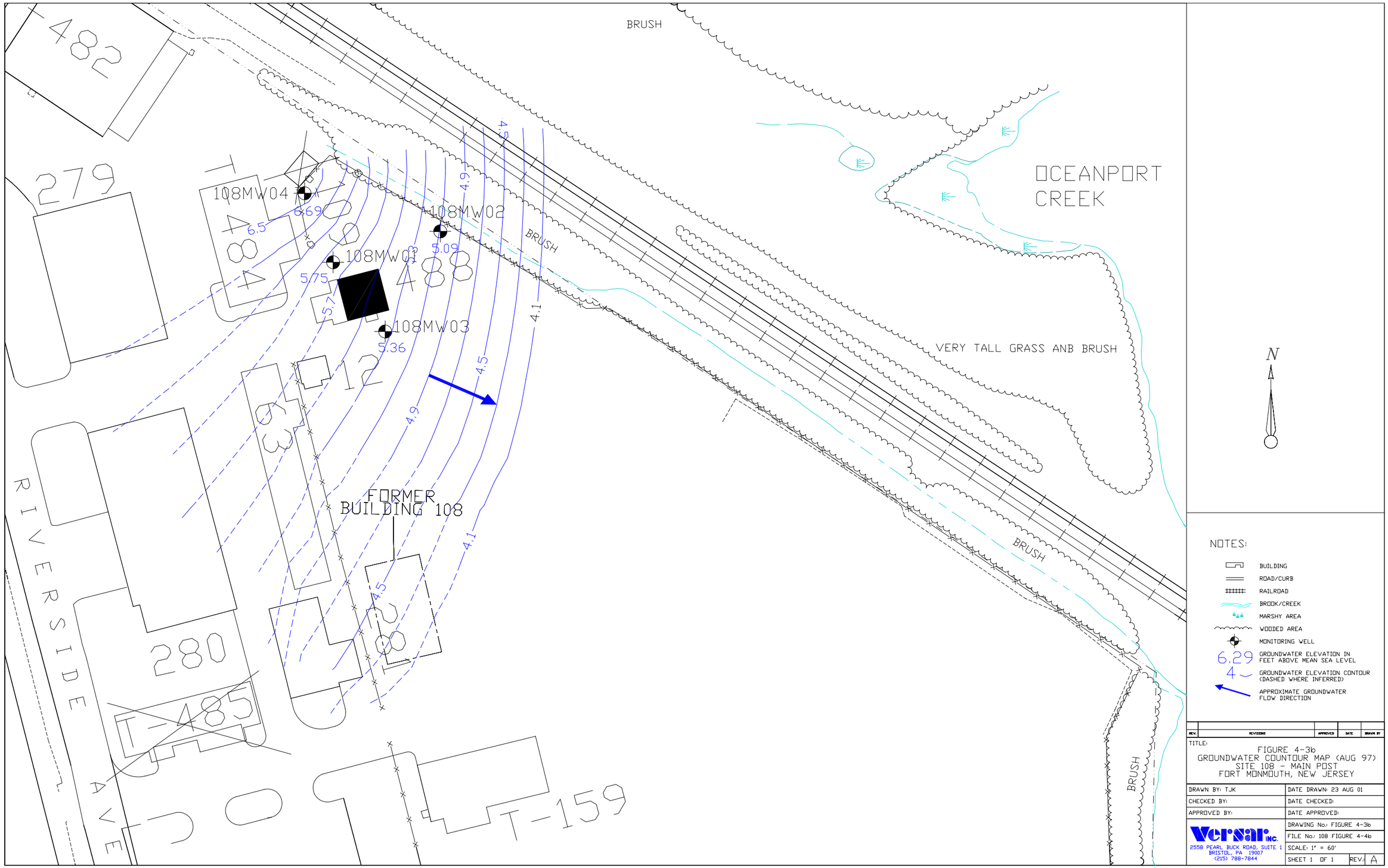

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3b
GROUNDWATER COUNTOUR MAP (AUG 97)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3b
	FILE No.: 108 FIGURE 4-4b
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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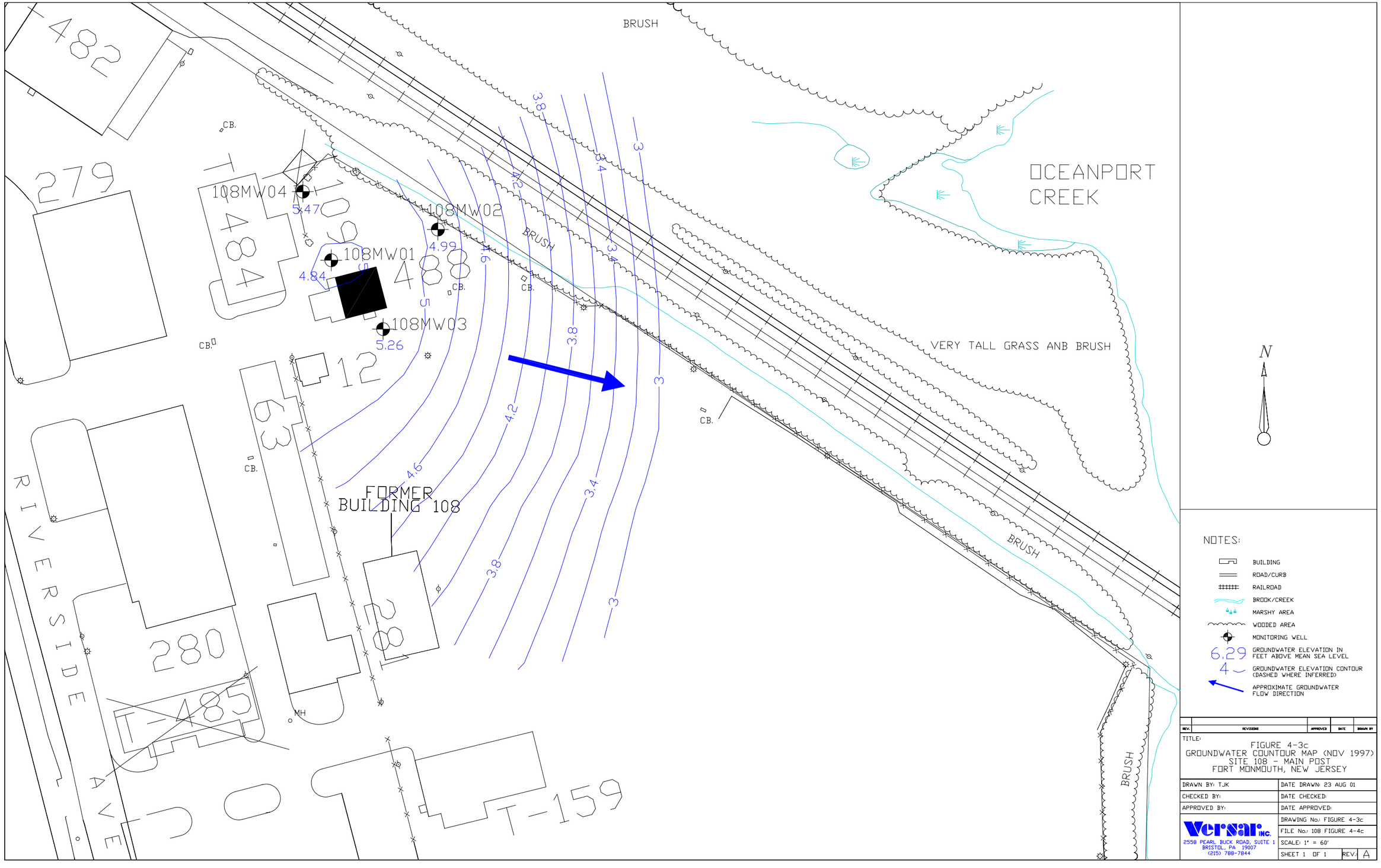

N

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3c
GROUNDWATER COUNTOUR MAP (NOV 1997)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3c
	FILE No.: 108 FIGURE 4-4c
	SCALE: 1" = 60'
	SHEET 1 OF 1 — REV.: A

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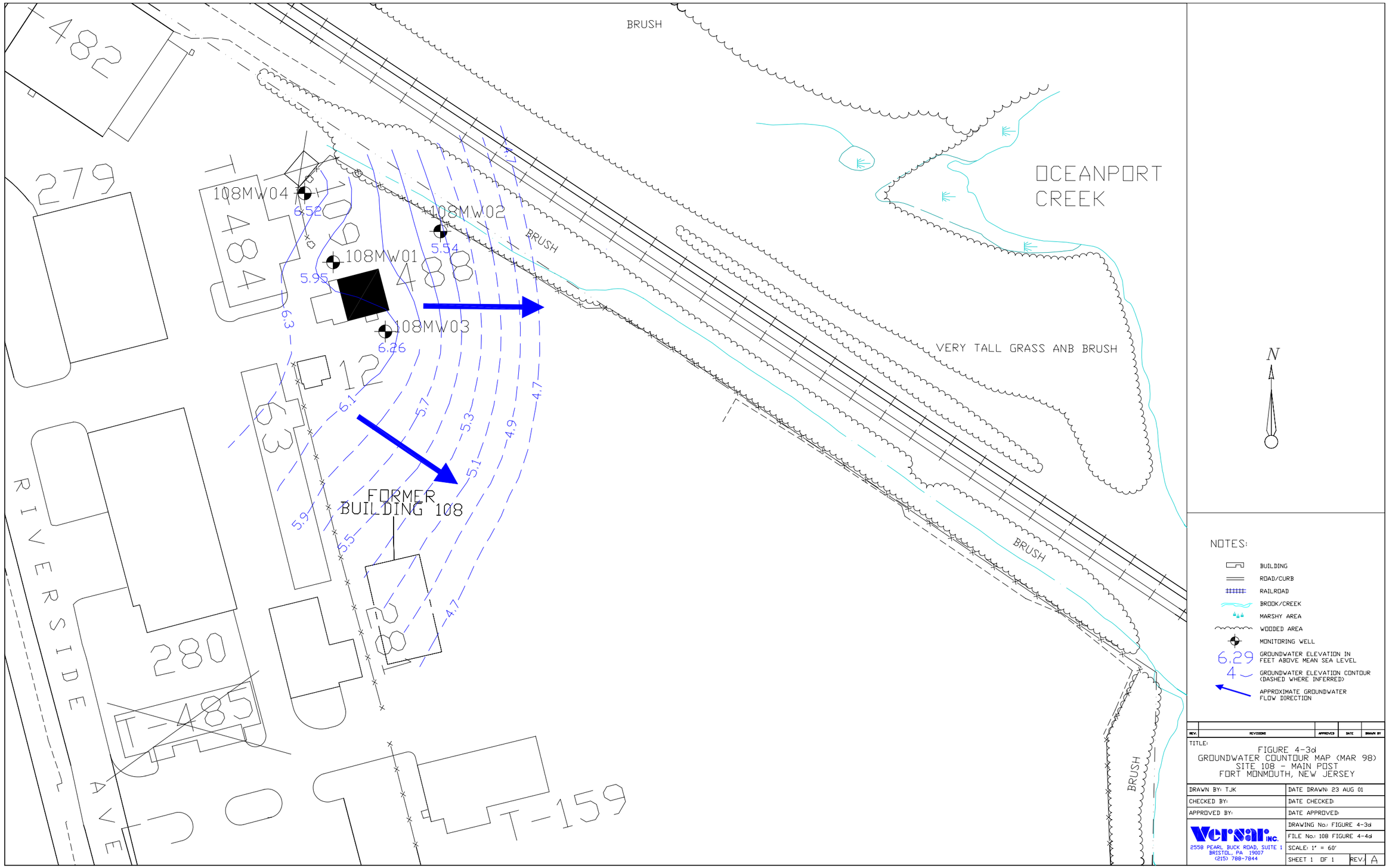

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:
FIGURE 4-3d
GROUNDWATER COUNTOUR MAP (MAR 98)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3d
	FILE No.: 108 FIGURE 4-4d
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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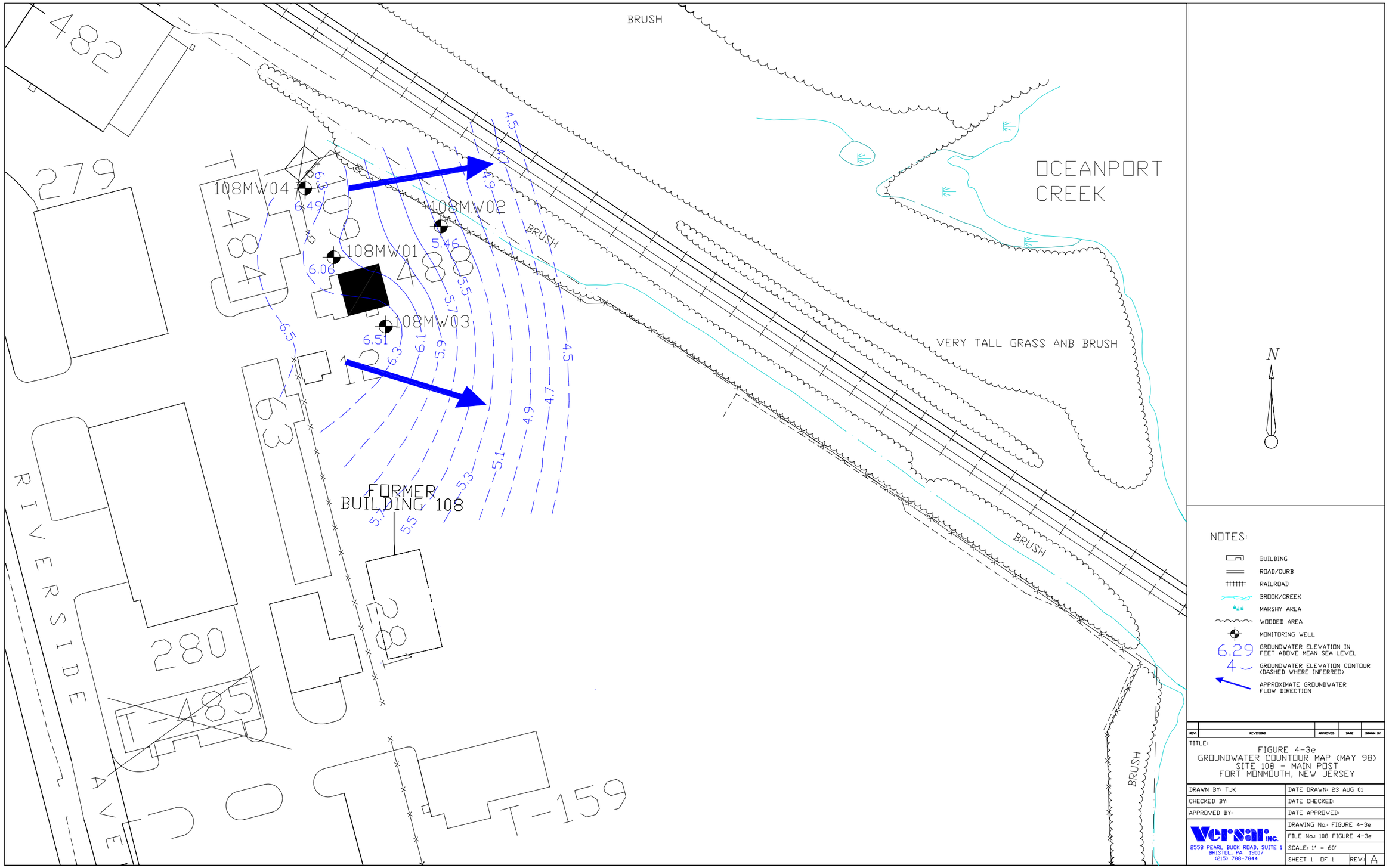

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:
FIGURE 4-3e
GROUNDWATER COUNTOUR MAP (MAY 98)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3e
	FILE No.: 108 FIGURE 4-3e
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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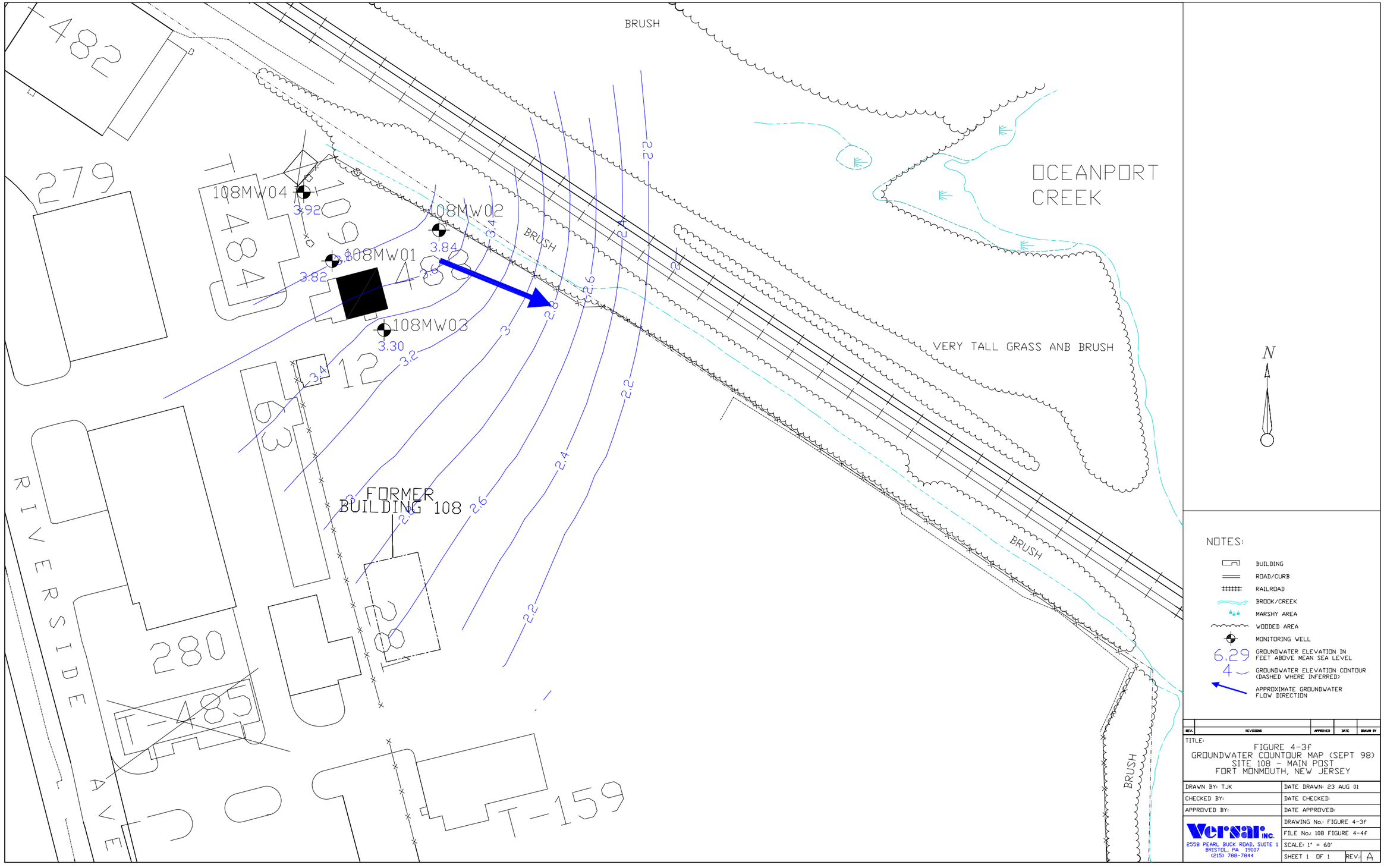

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3f
GROUNDWATER COUNTOUR MAP (SEPT 98)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3f
	FILE No.: 108 FIGURE 4-4f
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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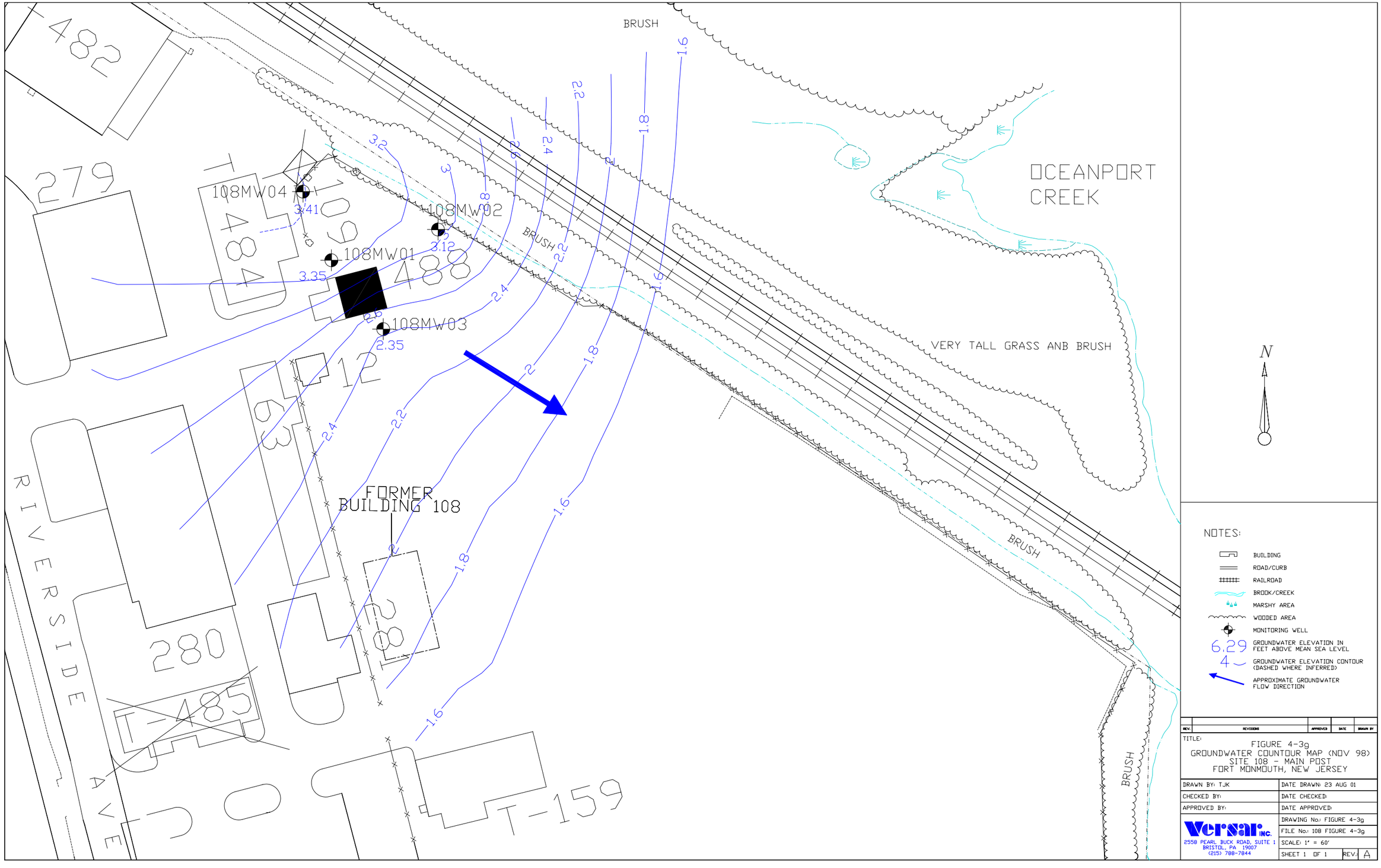

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3g
GROUNDWATER COUNTOUR MAP (NOV 98)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3g
	FILE No.: 108 FIGURE 4-3g
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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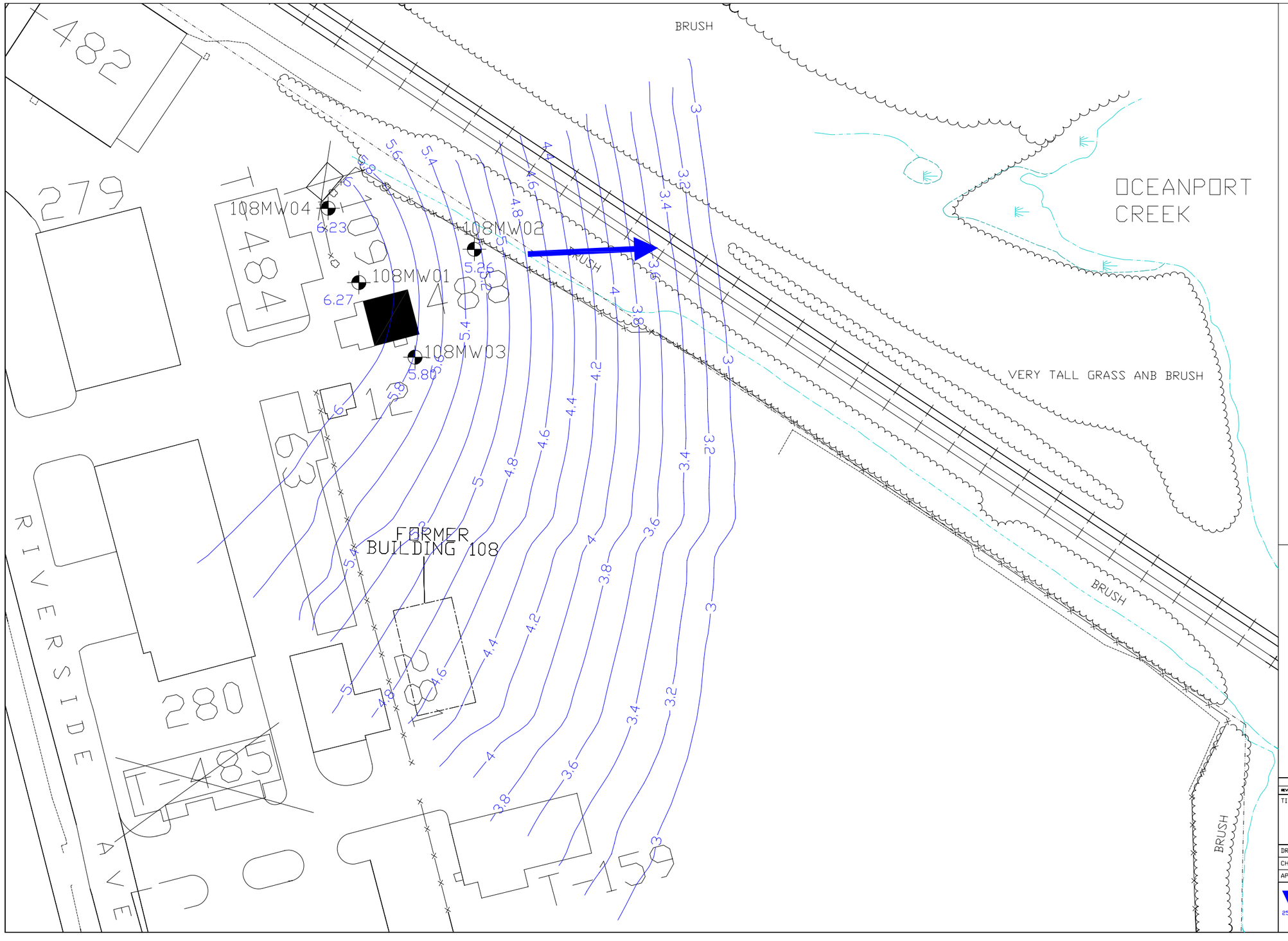

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3h
GROUNDWATER COUNTOUR MAP (FEB 99)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3h
	FILE No.: 108 FIGURE 4-3h
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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BRISTOL, PA 19007
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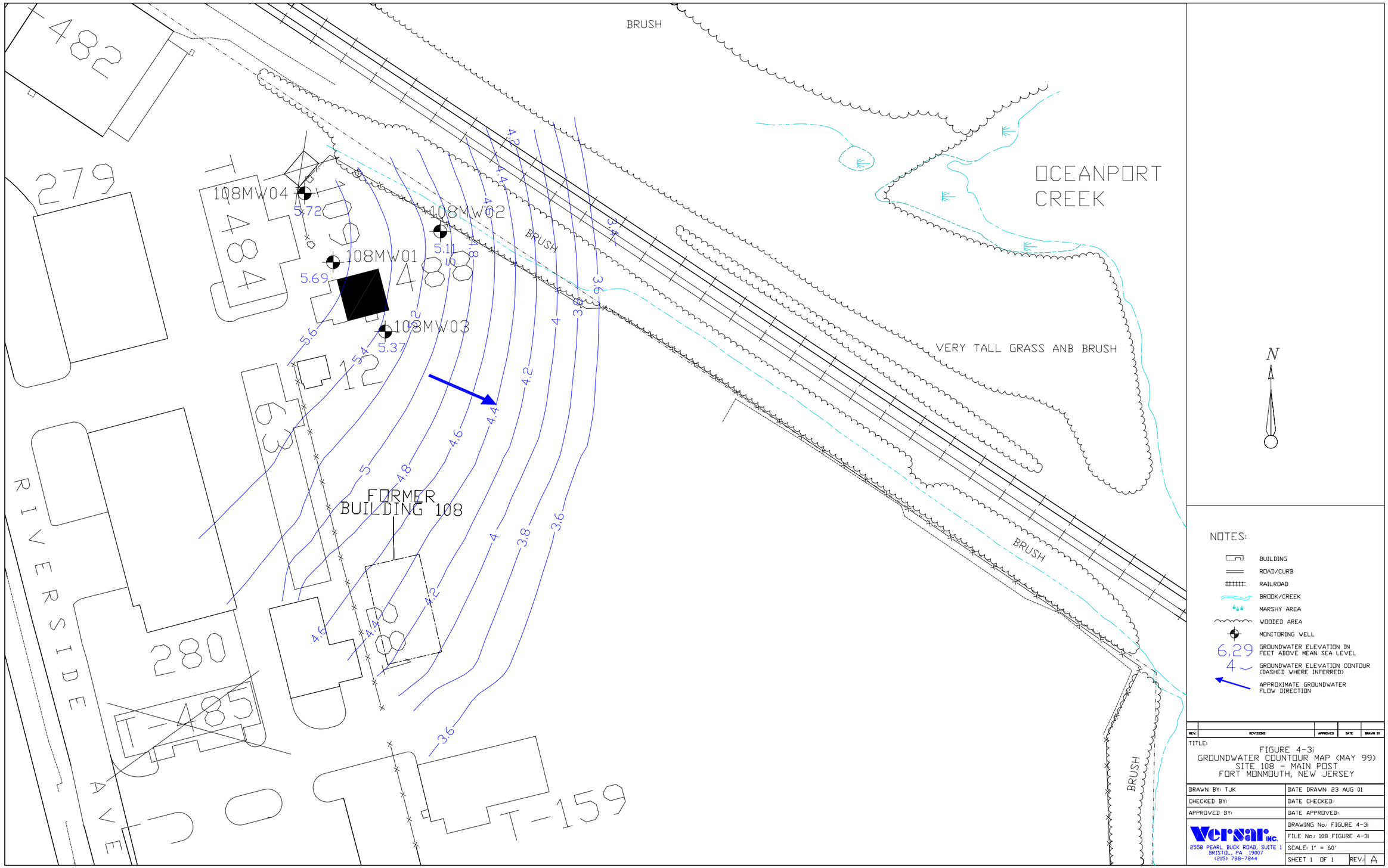

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:
FIGURE 4-3i
GROUNDWATER COUNTOUR MAP (MAY 99)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3i
	FILE No.: 108 FIGURE 4-3i
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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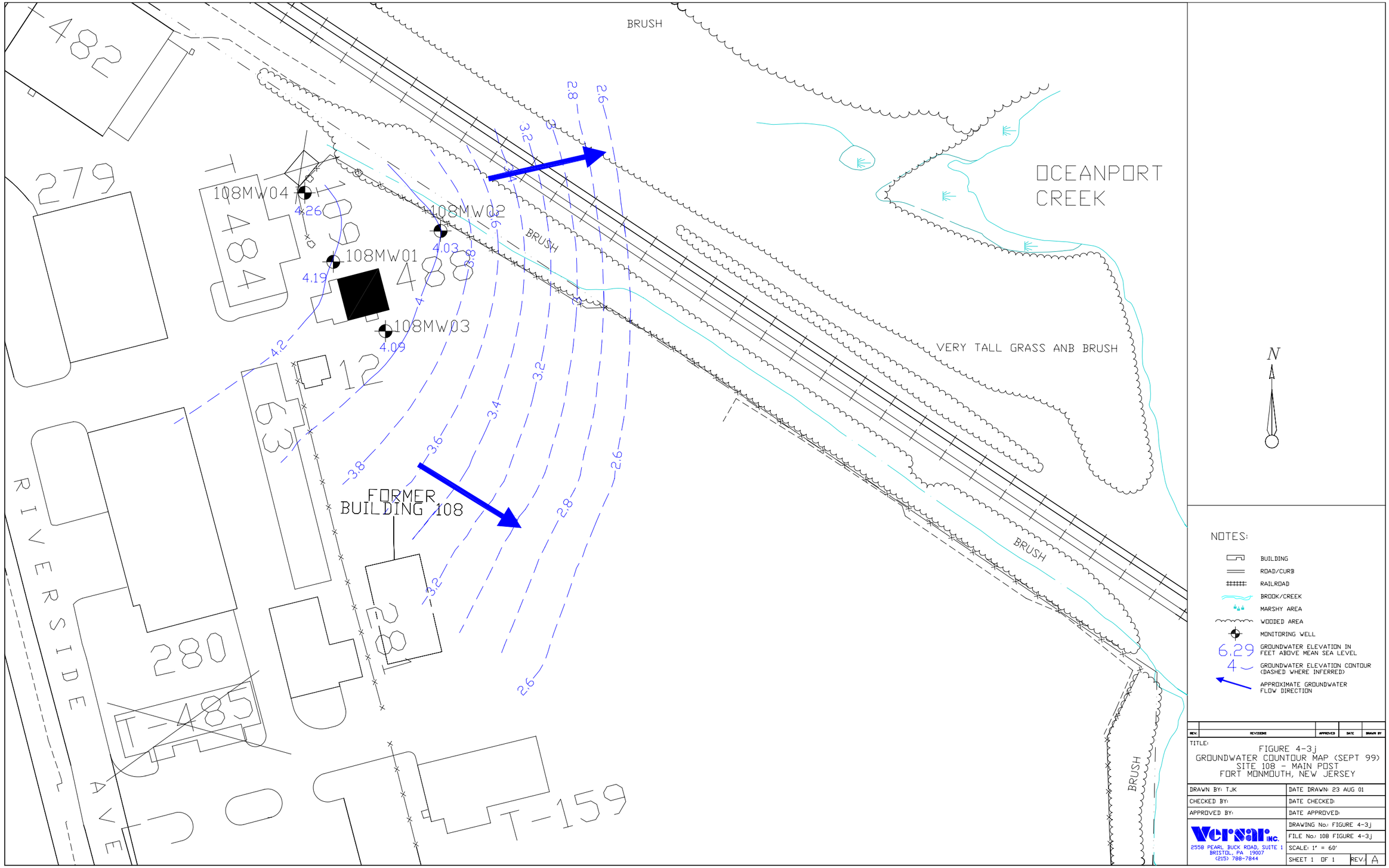

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3j
GROUNDWATER COUNTOUR MAP (SEPT 99)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3j
	FILE No.: 108 FIGURE 4-3j
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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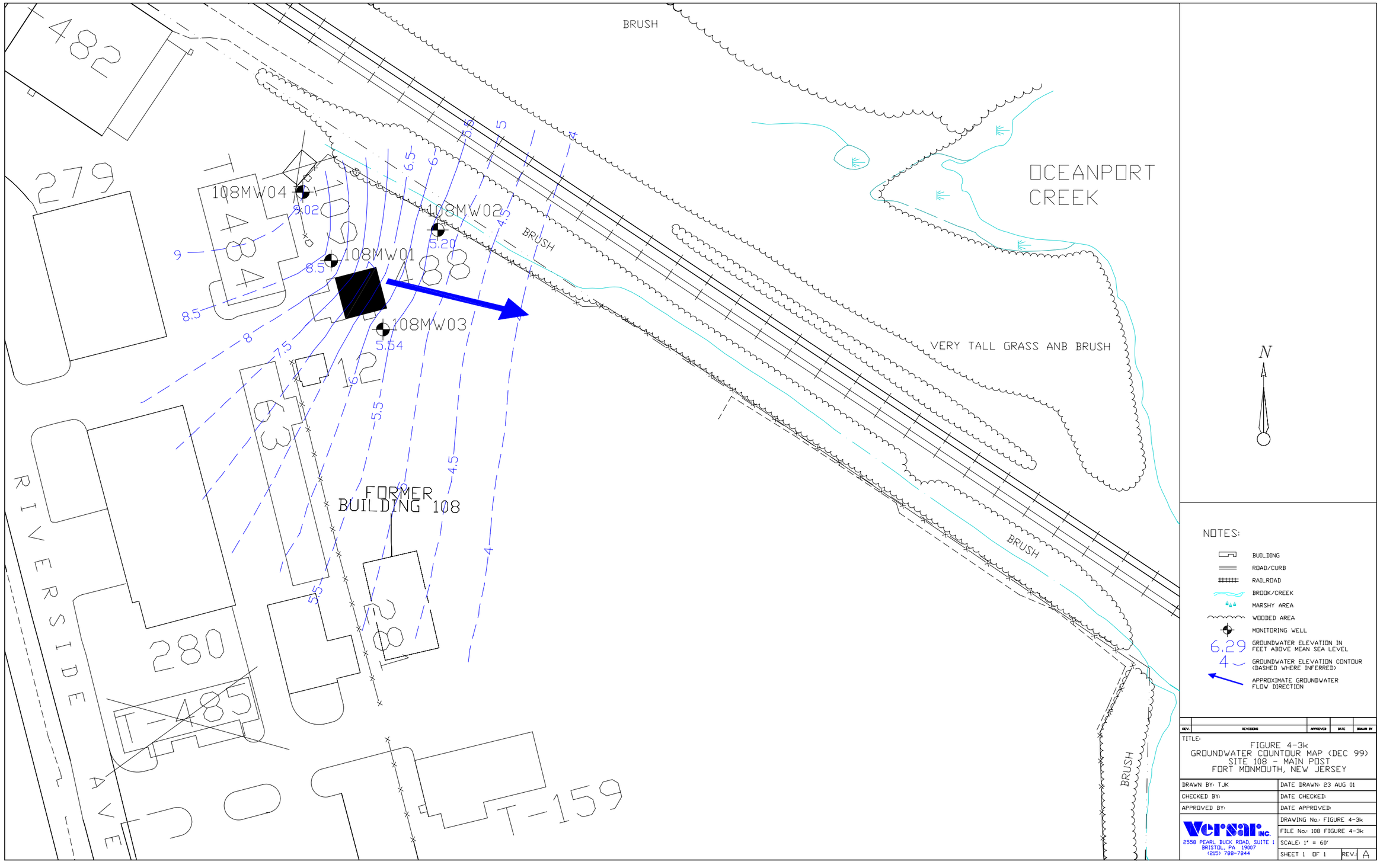

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3k
GROUNDWATER COUNTOUR MAP (DEC 99)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3k
	FILE No.: 108 FIGURE 4-3k
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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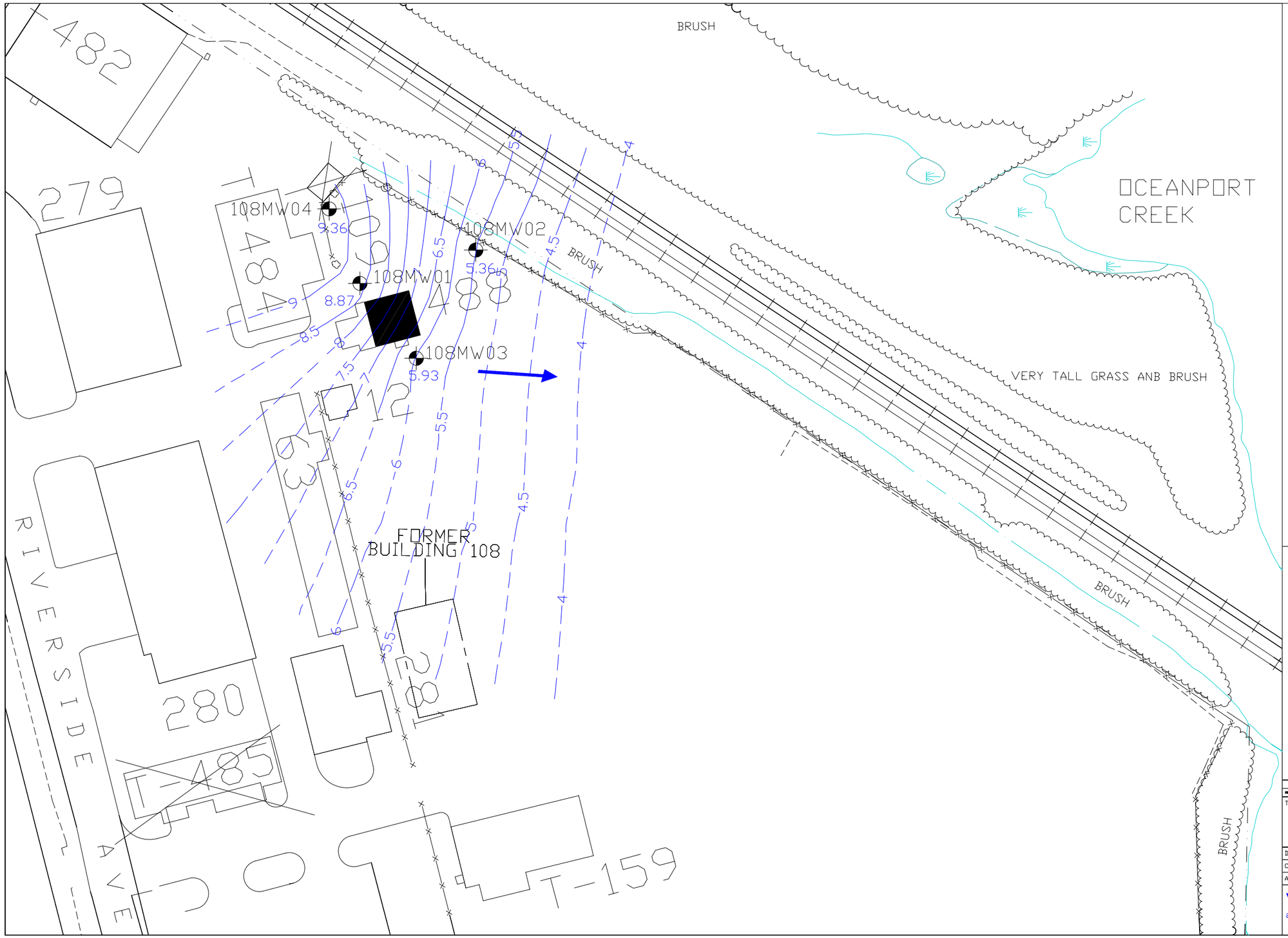

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3l
GROUNDWATER COUNTOUR MAP (FEB 00)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3l
	FILE No.: 108 FIGURE 4-3l
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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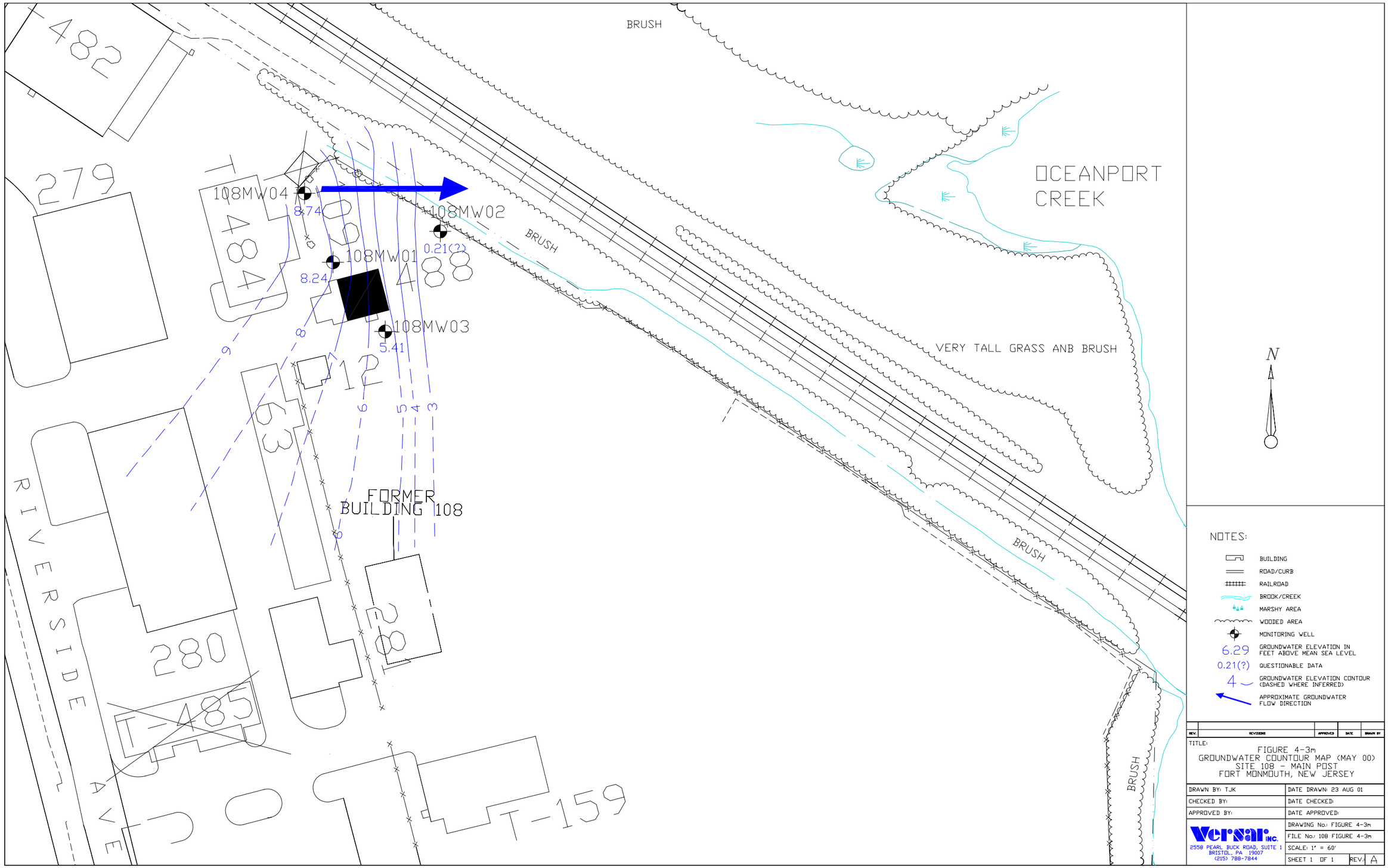

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 0.21(?) — QUESTIONABLE DATA
- 4 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3m
GROUNDWATER COUNTOUR MAP (MAY 00)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3m
	FILE No.: 108 FIGURE 4-3m
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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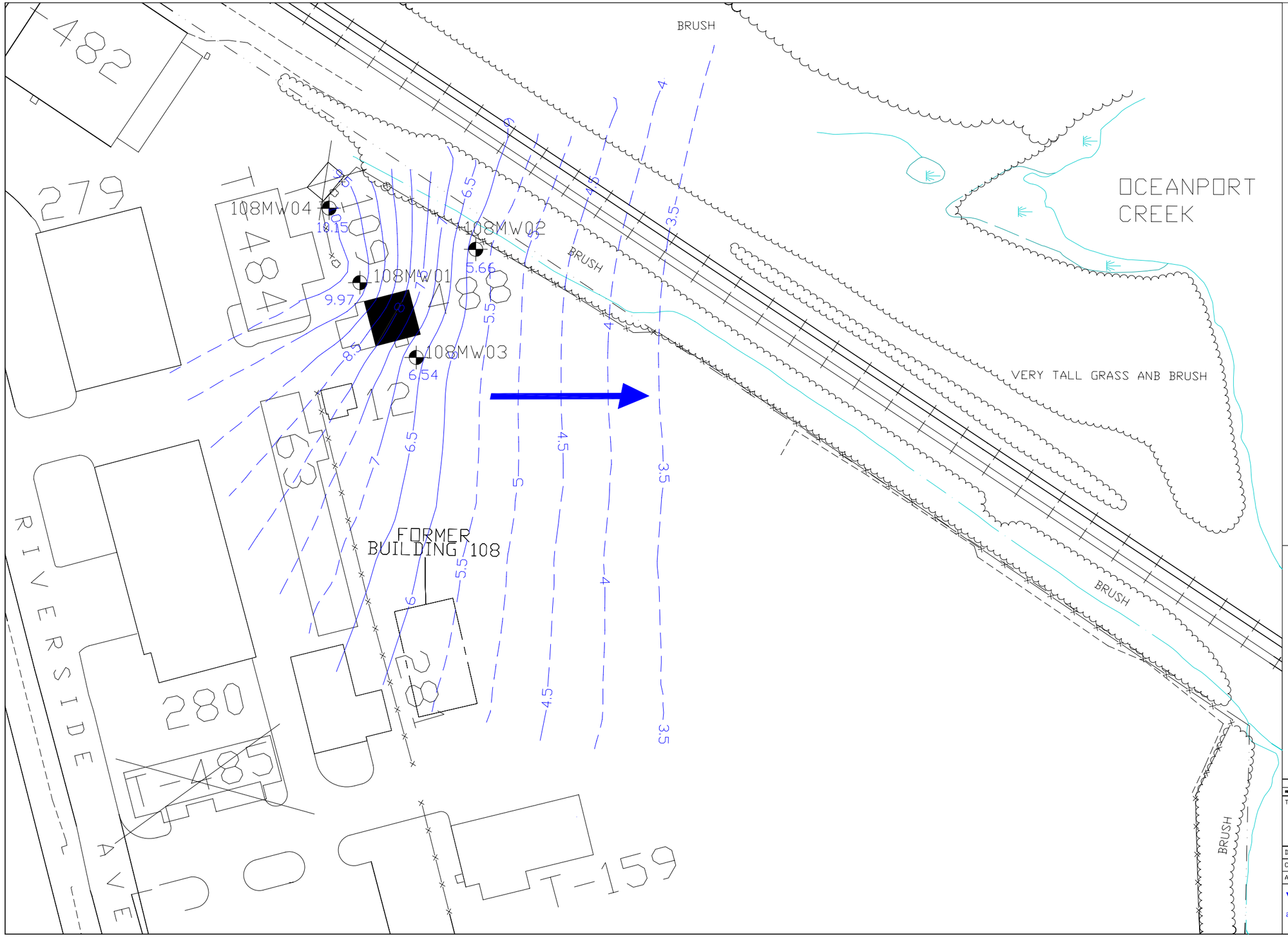

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3n
GROUNDWATER COUNTOUR MAP (AUG 00)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3n
	FILE No.: 108 FIGURE 4-3n
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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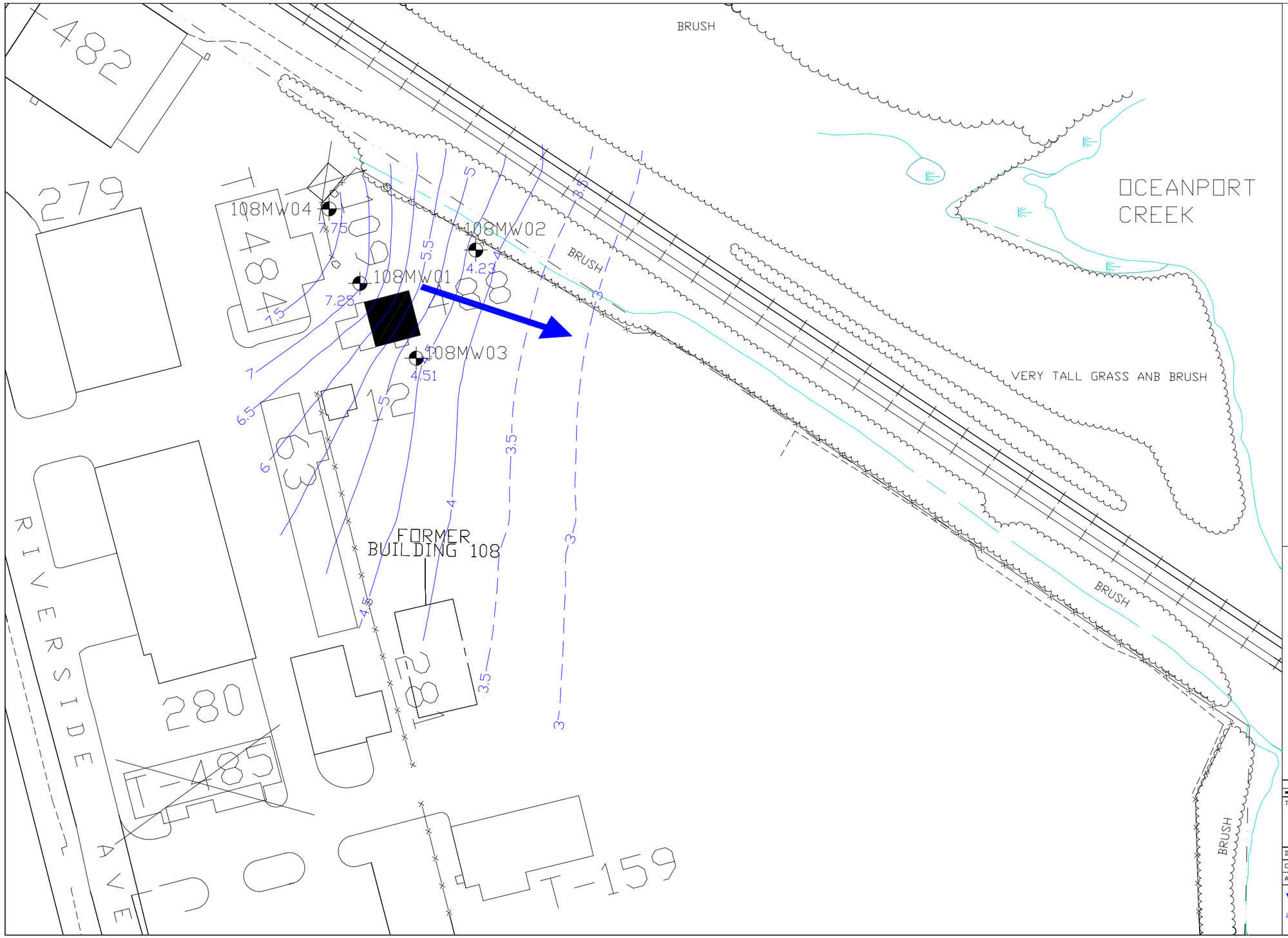

N

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:
FIGURE 4-3o
GROUNDWATER COUNTOUR MAP (NOV 00)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3o
	FILE No.: 108 FIGURE 4-3o
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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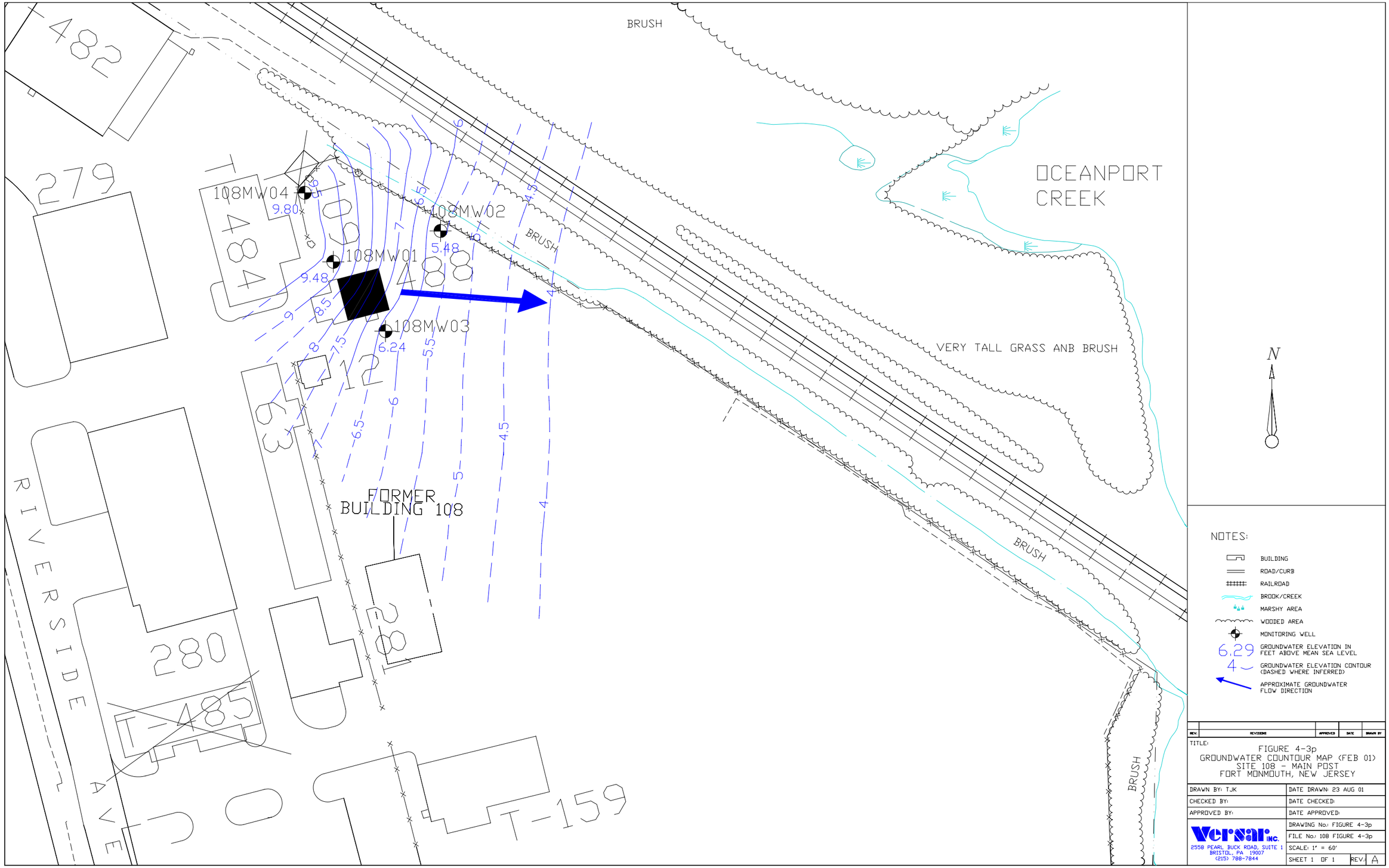

NOTES:

- BUILDING
- ROAD/CURB
- RAILROAD
- BROOK/CREEK
- MARSHY AREA
- WOODED AREA
- MONITORING WELL
- 6.29 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 4 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 4-3p
GROUNDWATER COUNTOUR MAP (FEB 01)
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK	DATE DRAWN: 23 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIGURE 4-3p
	FILE No.: 108 FIGURE 4-3p
	SCALE: 1" = 60'
	SHEET 1 OF 1 REV.: A

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VERY TALL GRASS ANB BRUSH

BRUSH

VERY TALL GRAS

N

108MW04

CONTAMINANT OF CONCERN	NJDEP CRITERIA (UG/L)	4/17/97	8/21/97	11/21/97	3/2/98	5/19/98	9/23/98	11/20/98	2/10/99	5/26/99	9/8/99	12/17/99	2/23/00	5/9/00	8/4/00	11/2/00	2/8/01	9/8/00	10/6/00
XYLENE	9	NS	7	15	7	14.2	17.4	12.6	2.21	28.5	6.87	4.6	4.6	ND	4.24	48.4	NS	2.48	ND	ND

108MW02

CONTAMINANT OF CONCERN	NJDEP CRITERIA (UG/L)	4/17/97	8/21/97	11/21/97	3/2/98	5/19/98	9/23/98	11/20/98	2/10/99	5/26/99	9/8/99	12/17/99	2/23/00	5/9/00	8/4/00	11/2/00	2/8/01	9/8/00	10/6/00
XYLENE	9	NS	94	94	94	49.2	49.2	49.2	94.2	49.2	49	49	7.93	49.2	49.2	49.2	49.2	247	247

108MW01

CONTAMINANT OF CONCERN	NJDEP CRITERIA (UG/L)	4/17/97	8/21/97	11/21/97	3/2/98	5/19/98	9/23/98	11/20/98	2/10/99	5/26/99	9/8/99	12/17/99	2/23/00	5/9/00	8/4/00	11/2/00	2/8/01	9/8/00	10/6/00
XYLENE	9	NS	1.8	ND	9	24.1	9	4.44	1.05	1.05	1.85	ND	ND	NS	5.67	NS	6.36	4.81	ND

108MW03

CONTAMINANT OF CONCERN	NJDEP CRITERIA (UG/L)	4/17/97	8/21/97	11/21/97	3/2/98	5/19/98	9/23/98	11/20/98	2/10/99	5/26/99	9/8/99	12/17/99	2/23/00	5/9/00	8/4/00	11/2/00	2/8/01	9/8/00	10/6/00
XYLENE	9	NS	9	9	9	24.1	9	49.2	49.2	49.2	49.2	9.84	49.2	49.2	49.2	9.77	9.83	6.88	ND

CB.

MB

MH

FORMER
BUILDING 108

280

T-482

T-485

T-159

ROAD (PAVED)		WOODED AREA	
ROAD/TRAILS (UNPAVED)		TREE/BUSH	
FENCE	—x—	LIGHT POLE	
BUILDING		UTILITY POLE	
APPROXIMATE BOUNDARY		BROOK/CREEK	
BASE BOUNDARY		MARSHY AREA	
RAILROAD TRACKS			

NOTES:

1.) ALL CONCENTRATIONS ARE GIVEN IN MICROGRAMS PER LITER (UG/L), EQUIVALENT TO PARTS PER BILLION (PPB).
2.) NJDEP CLEANUP CRITERIA: HIGHER OF PRACTICAL QUANTITION LIMITS (PQLS) AND GROUNDWATER QUALITY STANDARDS (GWQS) PER N.J.A.C. 7:9-6.
3.) EXCEEDANCES OF THE NJDEP CLEANUP CRITERIA ARE HIGHLIGHTED AND PRINTED IN BOLD-FACED TYPE.
4.) ND: ANALYTE NOT DETECTED IN SAMPLE.
5.) SAMPLES COLLECTED USING LOW-FLOW SAMPLING ARE SHOWN IN GREEN TYPEFACE.

REV.	REVISIONS	APPROVED	DATE	DRAWN BY

TITLE:

FIGURE 5-1
GROUNDWATER CONTAMINANT DISTRIBUTION
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: JMM	DATE DRAWN: 21 AUG 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING NO.: FIGURE 5-1
	FILE NO.: 108 FIG 5-1
	SCALE: 1" = 20'
	SHEET OF REV.:

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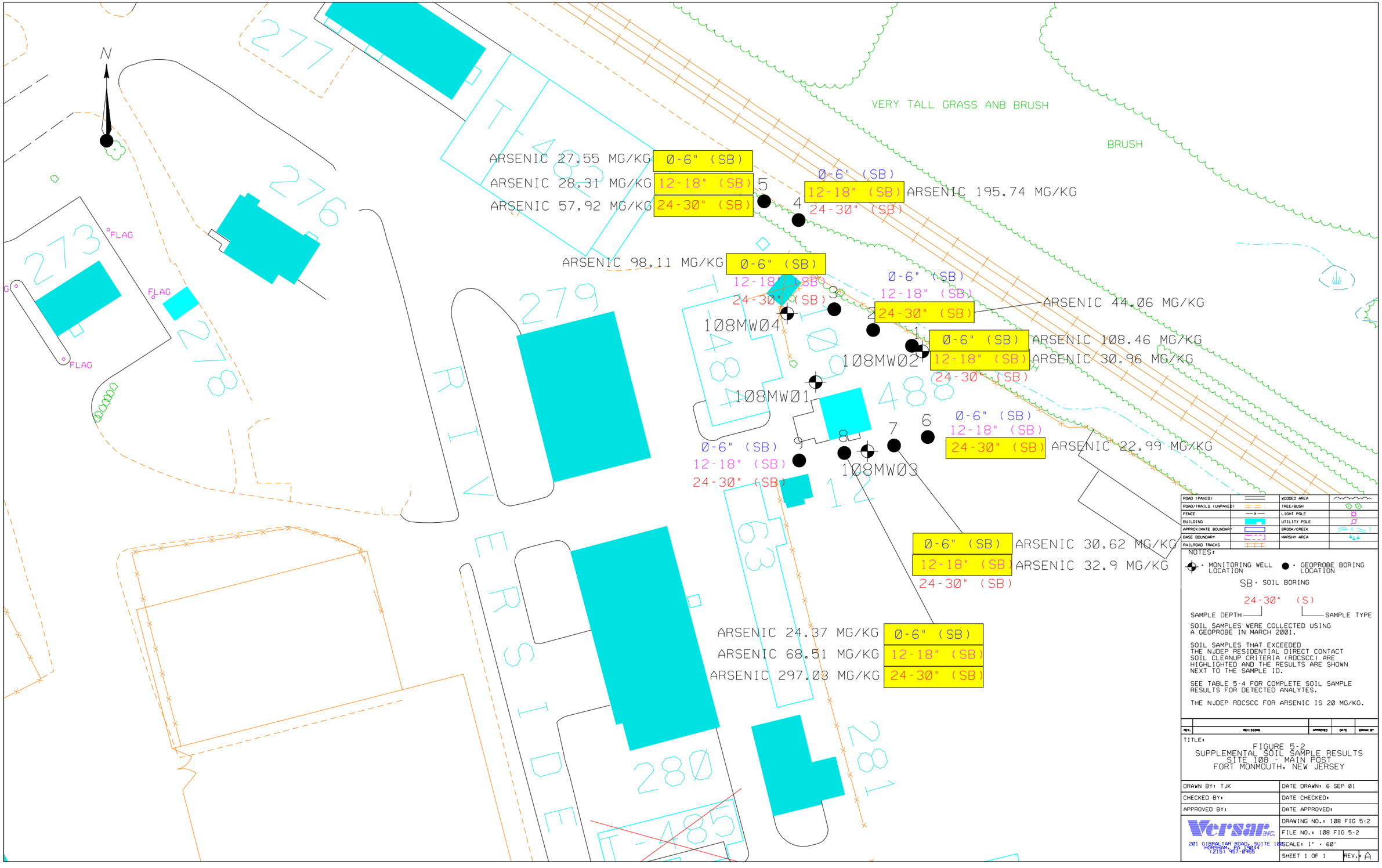
N
VERY TALL GRASS ANB BRUSH
BRUSH
ARSENIC 27.55 MG/KG
ARSENIC 28.31 MG/KG
ARSENIC 57.92 MG/KG
Ø-6" (SB)
12-18" (SB)
24-30" (SB)
5
4
ARSENIC 195.74 MG/KG
ARSENIC 98.11 MG/KG
3
2
1
108MWØ4
108MWØ2
108MWØ1
108MWØ3
ARSENIC 44.06 MG/KG
ARSENIC 108.46 MG/KG
ARSENIC 30.96 MG/KG
ARSENIC 22.99 MG/KG
6
7
8
9
ARSENIC 30.62 MG/KG
ARSENIC 32.9 MG/KG
ARSENIC 24.37 MG/KG
ARSENIC 68.51 MG/KG
ARSENIC 297.03 MG/KG
FLAG
FLAG
FLAG
273
276
277
278
279
280
281
T-485
RIVERSIDE
ROAD (PAVED)
ROAD/TRAILS (UNPAVED)
FENCE
BUILDING
APPROXIMATE BOUNDARY
BASE BOUNDARY
RAILROAD TRACKS
WOODED AREA
TREE/BUSH
LIGHT POLE
UTILITY POLE
BROOK/CREEK
MARSHY AREA
NOTES:
· MONITORING WELL LOCATION
· GEOPROBE BORING LOCATION
SB · SOIL BORING
24-30" (S)
SAMPLE DEPTH
SAMPLE TYPE
SOIL SAMPLES WERE COLLECTED USING A GEOPROBE IN MARCH 2001.
SOIL SAMPLES THAT EXCEEDED THE NJDEP RESIDENTIAL DIRECT CONTACT SOIL CLEANUP CRITERIA (RDCSCC) ARE HIGHLIGHTED AND THE RESULTS ARE SHOWN NEXT TO THE SAMPLE ID.
SEE TABLE 5-4 FOR COMPLETE SOIL SAMPLE RESULTS FOR DETECTED ANALYTES.
THE NJDEP RDCSCC FOR ARSENIC IS 20 MG/KG.
REV.
REVISIONS
APPROVED
DATE
DRAWN BY
TITLE:
FIGURE 5-2
SUPPLEMENTAL SOIL SAMPLE RESULTS
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY
DRAWN BY: TJK
DATE DRAWN: 6 SEP 01
CHECKED BY:
DATE CHECKED:
APPROVED BY:
DATE APPROVED:
DRAWING NO.: 108 FIG 5-2
FILE NO.: 108 FIG 5-2
SCALE: 1" = 60'
SHEET 1 OF 1
REV.:
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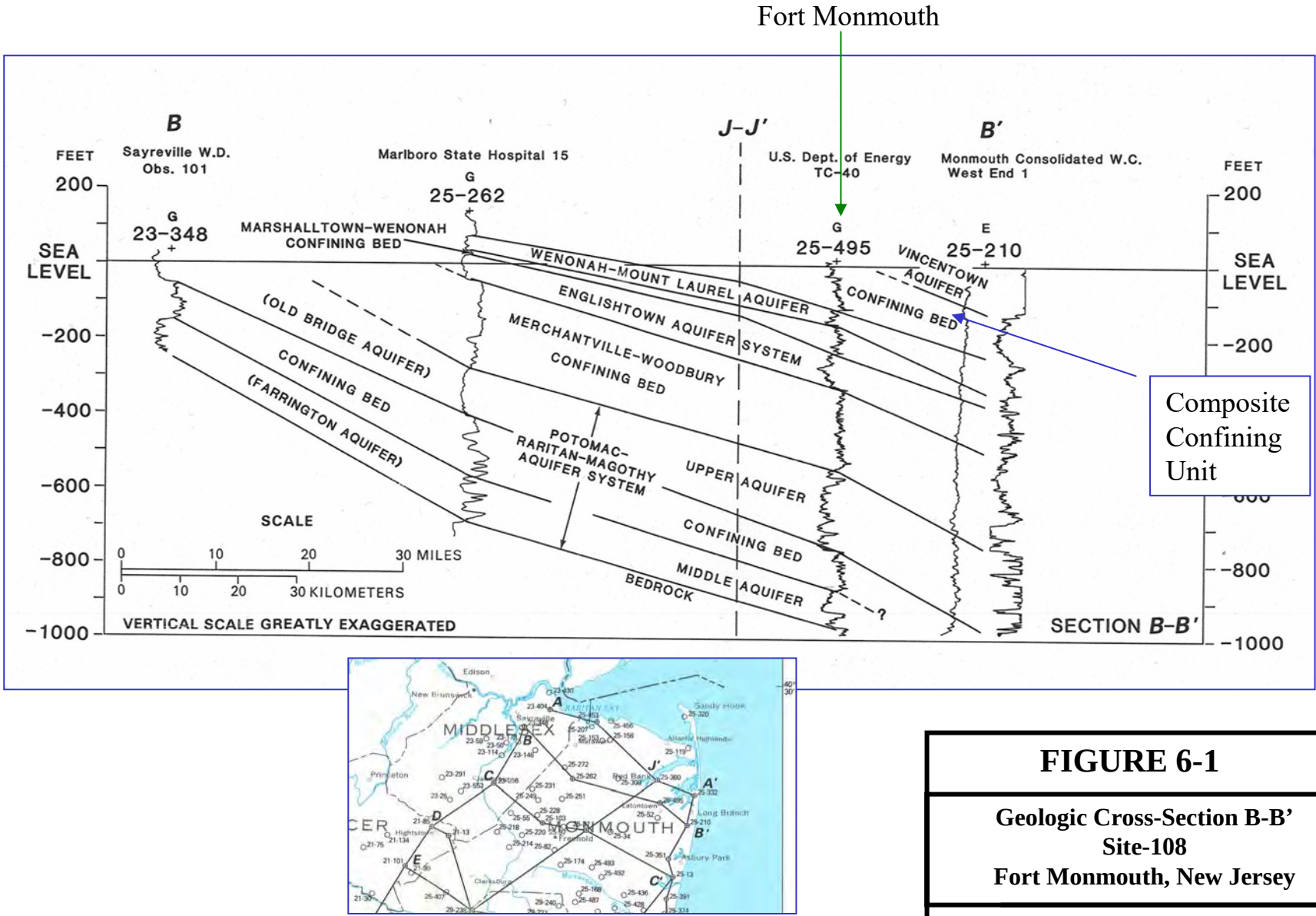
(215) 957-0905



Source: Zapecza, O. 1989. *Hydrogeologic Framework of the New Jersey Coastal Plain.* USGS Professional Paper 1404-B. U.S. Government Printing Office, Washington, DC.

FIGURE 6-1

Geologic Cross-Section B-B'
Site-108
Fort Monmouth, New Jersey

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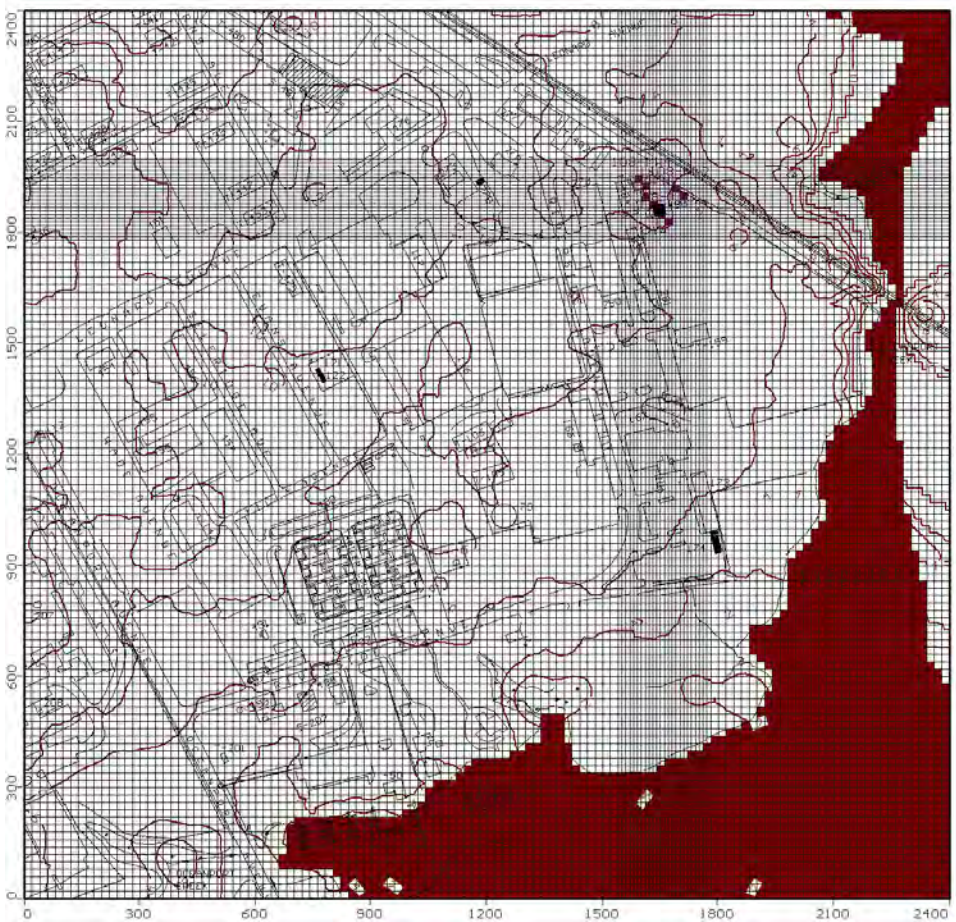

Notes:

1) Grid size is 20’ by 20’ in most of model area, 10’ x 10’ in vicinity of Site 108.
2) Monitoring wells at Site 108 are shown in purple.
3) Topographic contours for the ground surface are shown as brown lines. The contour interval is 2 feet.
3) Oceanport Creek shown in solid brown, represents river boundary with constant head of zero feet (mean sea level).
4) Coordinates shown represent NAD-83 survey feet.

FIGURE 6-2

MODFLOW Boundaries and Grid
Site 108
Fort Monmouth, New Jersey

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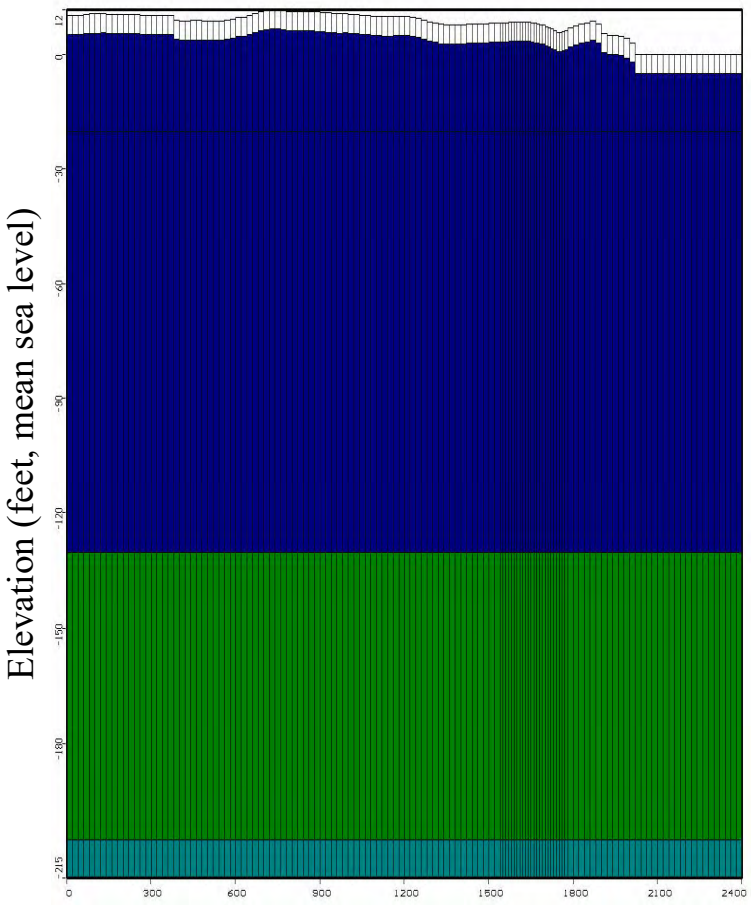

Layer 1: Fill

Thickness = 5 feet

K = 8.9 ft/day

(geometric mean from slug test at Site 108)

Layers 2 and 3: Navesink-Hornerstown Confining Unit

Thickness = 125 feet

K = 0.12 ft/day

Layer 4: Wenonah-Mount Laurel Aquifer

Thickness = 75 feet

K = 15.96 ft/day

Layer 5: Marshaltown-Wenonah Confining Unit

Thickness = 10 feet

K = 0.00018 ft/day

FIGURE 6-3

Cross Section of Model Area
Site 108
Fort Monmouth, New Jersey

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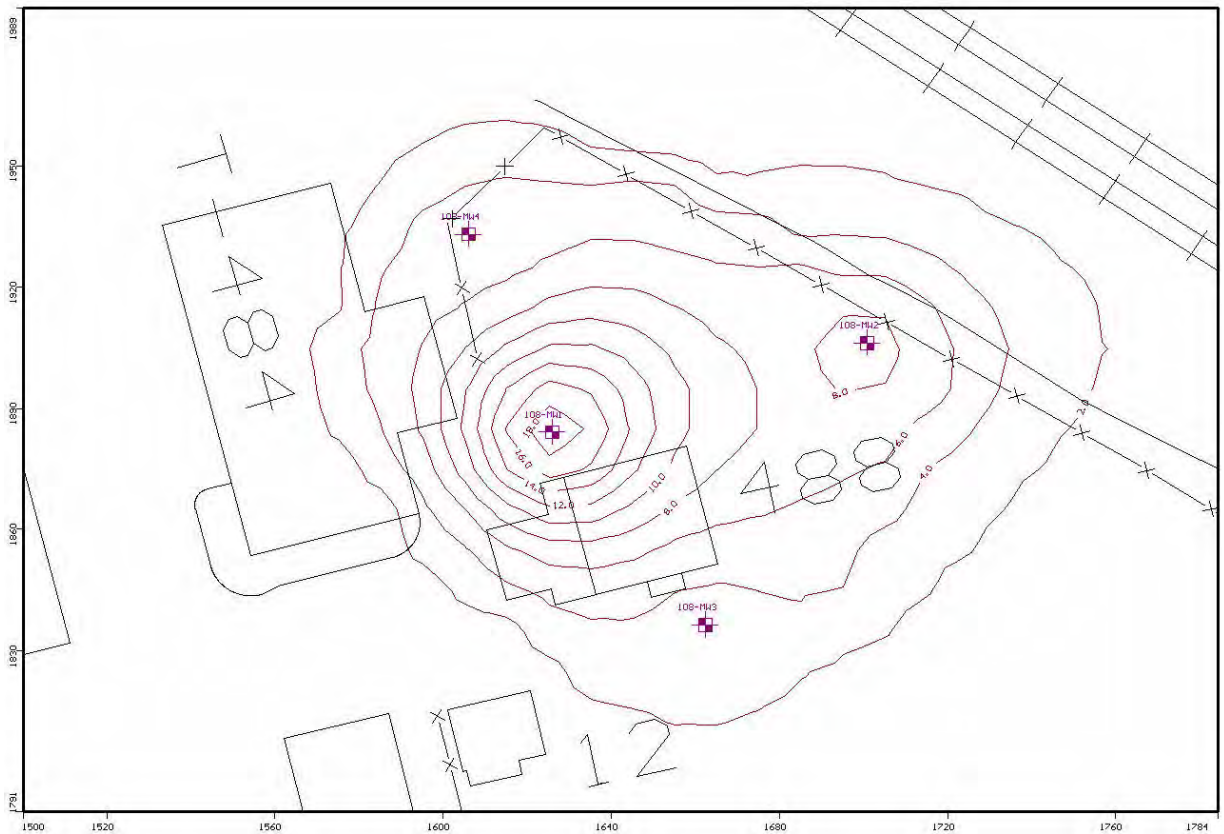

Notes:

1) Isoconcentration lines represent initial concentrations of arsenic in groundwater as used in the MODFLOW simulation. Contour Interval = 2 ug/L.
2) The NJDEP groundwater quality criteria for arsenic is 8 ug/L.
3) Monitoring wells for Site 108 are shown in purple.
4) Initial Concentrations based on averaged concentrations from groundwater sampling program. See Table 6-1 for averaged groundwater sampling results.
5) Coordinates shown represent NAD-83 survey feet.

FIGURE 6-4

Initial Concentration of Arsenic
In MODFLOW Simulation
Site 108
Fort Monmouth, New Jersey

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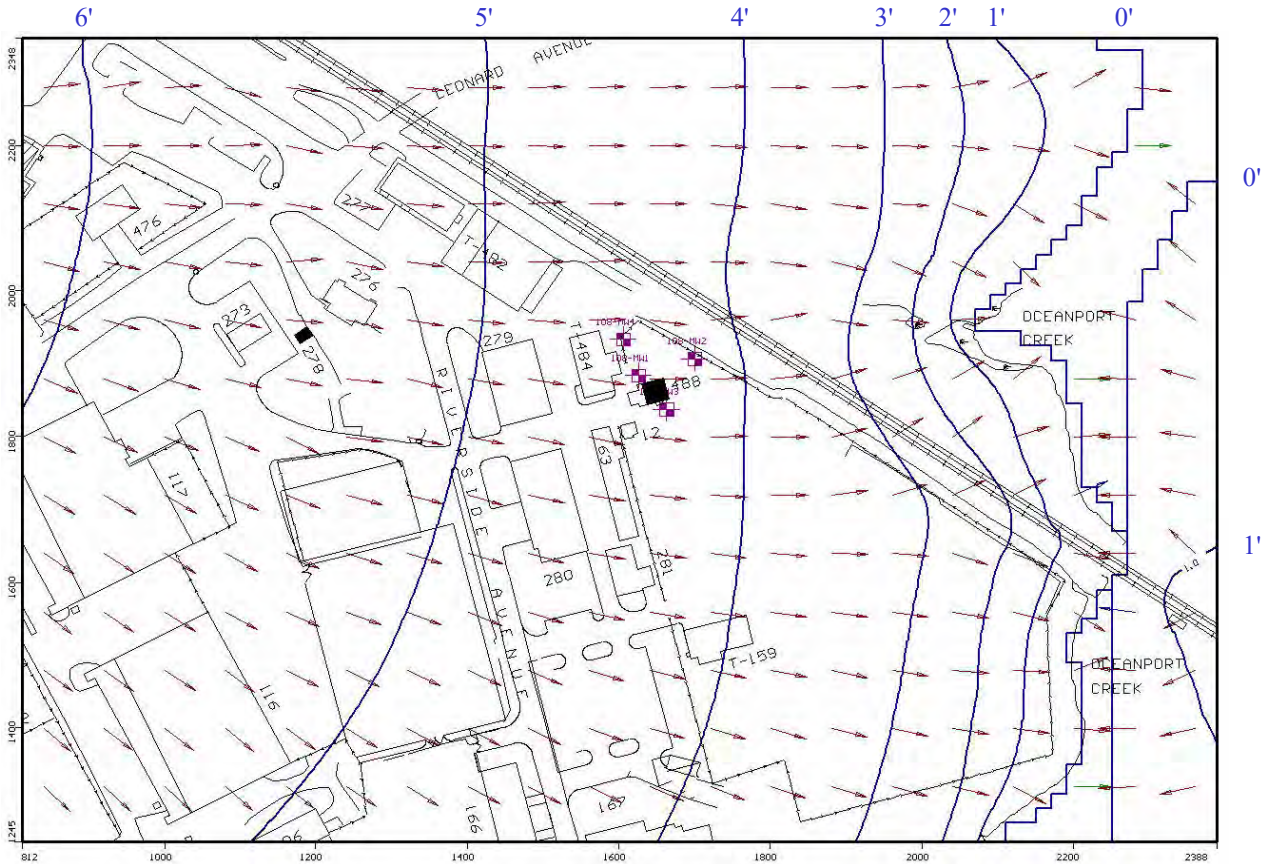

Notes:

1) Arrows indicate groundwater flow direction.
2) Monitoring wells for Site 108 are shown in purple.
3) Contour Lines indicate groundwater elevation contours. Contour Interval = 1 ft.
4) Coordinates shown represent NAD-83 survey feet.
5) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000

FIGURE 6-5

Flow Directions and Groundwater Elevation Contours
Site 108
Fort Monmouth, New Jersey

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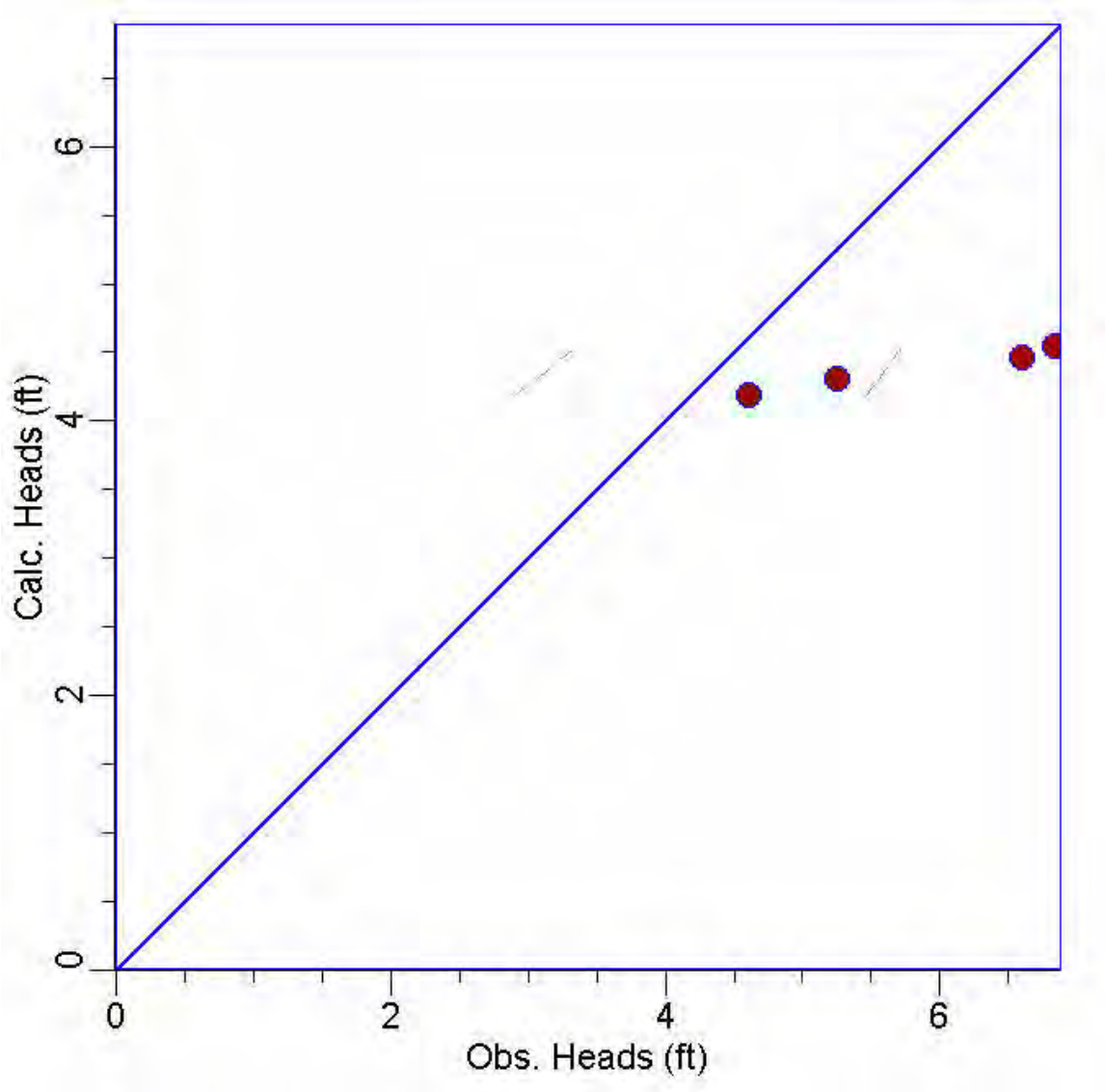

Notes:
1) This graph represents a comparison between heads calculated in the model with heads observed in monitoring wells at Site 108 on February 8, 2001.
2) Modeling Software: *Visual MODFLOW Version 2.7.2*, Waterloo Hydrogeologic, Inc., 2000.

FIGURE 6-6

MODFLOW Calibration:
Calculated Versus Observed Head
Site 108
Fort Monmouth, New Jersey

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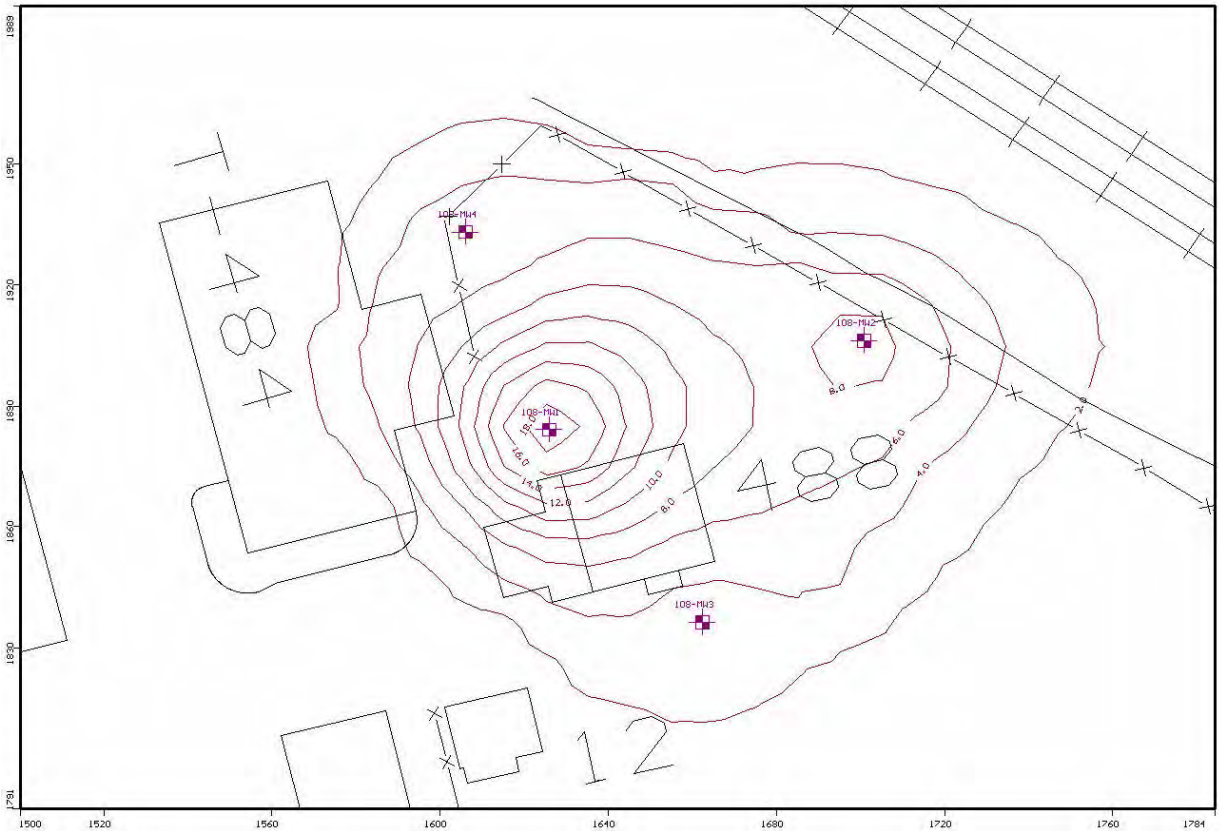

FIGURE 6-7

Predicted Arsenic Concentration
10 Years
Site 108
Fort Monmouth, New Jersey

Notes:
1) Isoconcentration contours represent predicted arsenic concentrations at 10 years. Contour Interval = 2 ug/L.
2) The NJDEP groundwater quality criteria for arsenic is 8 ug/L.
3) Monitoring wells for Site 108 are shown in purple.
4) Coordinates shown represent NAD-83 survey feet.
5) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000

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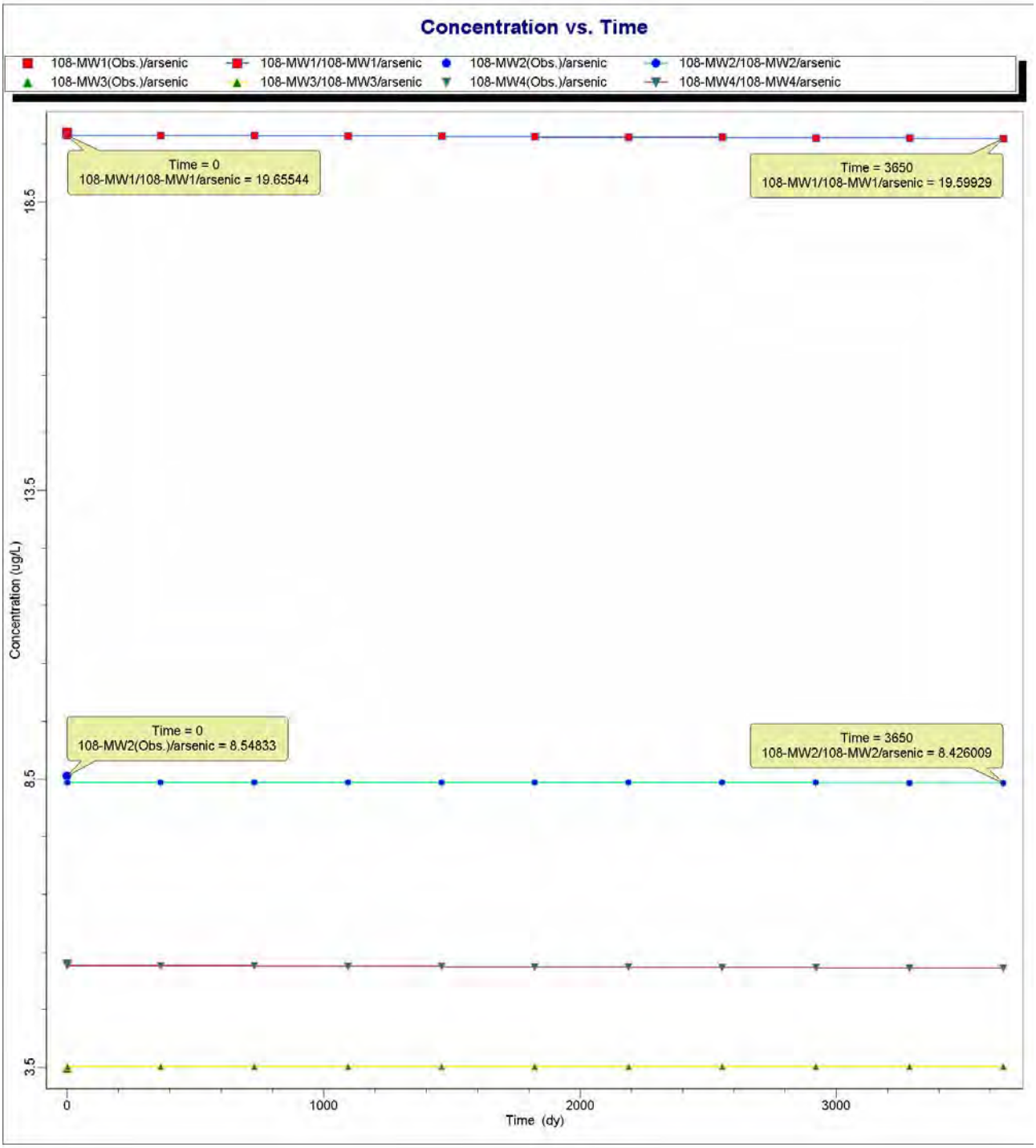

FIGURE 6-8

Predicted Arsenic Concentration Versus Time
Site 108
Fort Monmouth, New Jersey

Notes:
1) NJDEP groundwater criteria for arsenic is 8 ug/L.
2) Time for compliance is estimated from this graph to be greater than 1,000 years.
3) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000.

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N

2902774
2923608

2903369
2904271

2922526
2905084
2922181

2931440
2906958
2907264
2907172

2904519

2919474

2938652
2936864

2900961
2906499

2924557
2919537
2910282
2922236
2911855
2938340

2901400
2919952

DOMESTIC WELL
RUMSON COUNTRY CLUB
NJDEP PERMIT #2904513
PERMIT DATE: 10/16/64
DEPTH: 350 FEET

2902505

2903015

2906460
2938811

2904815

2930322
2906131
2925506
2935504

2915421

108 SITE

2903438
2937878

2931552
2921780

2905009

2904855
2904817

2914157

2915005

2904782
2901016

2906510

2908810

2922549

2914244

1000 500 0 1000
SCALE IN FEET

NOTES:

DOMESTIC/IRRIGATION WELL
WITH PERMIT NUMBER
(LOCATION WITHIN 100 FOOT ACCURACY)

ADDITIONAL INFORMATION IS PROVIDED FOR DOMESTIC OR IRRIGATION WELLS WITHIN 1000 FT OF THE 108 SITE.

CIRCLE PORTRAYS 1000 FOOT DISTANCE FROM SITE.

TITLE:
FIGURE 6-9
DOMESTIC AND IRRIGATION WELLS
SITE 108 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK/PS	DATE DRAWN: 30 AUGUST 01
CHECKED BY:	DATE CHECKED:
APPROVED BY:	DATE APPROVED:
	DRAWING No.: FIG. 6-9
	FILE No.: 108 FIG. 6-9
	SCALE: 1" = 1000'
	SHEET OF REV.: A

Versar INC.
2558 PEARL BUCK ROAD SUITE 1
BRISTOL, PA 19007
(215) 788-7844

Scope of Work for Building 108

Prepared by: Robert Youhas

Date Prepared: 11/01/2010; Revised on 11/16/10, 11/22/10

Background

Site 108 is located in the eastern portion of the Main Post Area of Fort Monmouth, east of Riverside Avenue in the vicinity of buildings 63, 484 and 488. As part of the DPW's underground storage tank (UST) management program, two UST closure reports (May 1994 and February 1996) have been submitted to the New Jersey Department of Environmental Protection (NJDEP) regarding USTs in the vicinity of Site 108. Four monitoring wells (108-MW1, 108-MW2, 108-MW3 and 108-MW4) were installed in September 1993 and August 1995, as part of the UST closures.

According to the *UST Closure and Site Investigation Report* (SIR) for Site 108, NJDEP Facility No. 090010, TMS No. 60, 61, 62, 63 and 64, Fort Monmouth, New Jersey, prepared by Roy F. Weston, Inc. (Weston) for the Fort Monmouth Directorate of Public Works (DPW), dated May 1994, there were five USTs (UST Nos. 60 through 64) located north of building 488, which is north of former Building 108. UST Nos. 60, 61 and 62 were single-walled, steel, 5,000-gallon unleaded gasoline tanks. UST No. 63 was a single-walled, steel, 5,000-gallon diesel fuel tank. UST No. 64 was a single-walled, steel, 5,000-gallon kerosene tank.

In February and November 1990, tightness testing was performed on UST No. 63. Results confirmed that the UST was "tight". There is no documentation of tightness testing for the other four USTs.

In March and April 1993, the five USTs, dispensers, and appurtenant piping were drained, removed, and recycled offsite. In addition to the UST removals, approximately 221 cubic yards of potentially contaminated soil was removed and disposed offsite. UST Nos. 60, 61, and 62 were observed to be in good condition. The condition of UST No. 63 was not documented in the *UST Closure Report* (Weston, 1994). Several corrosion holes of approximately 1/16-inch diameter were observed on UST No. 64. In addition, a sheen was observed on the groundwater surface in the UST No. 64 excavation. On April 12, 1993, based on observations during the excavation of UST No. 64, a discharge was reported to the NJDEP, and case number 93-04-12-29 was assigned. All post-excavation soil sampling results were in compliance with the NJDEP's November 4, 2009 Residential Direct Contact Soil Remediation Standards (RDCSRS), with the exception of the following compounds:

Table 1 Post-Excavation Soil Sample Exceedances for UST No. 64

Compound	MSSRS (mg/kg)	S-3	S-4	S-5	S-6	S-7	S-8	S-11	S-14	S-16	S-17	S-19
Benzo(*a*)anthracene	**0.6**[B]	**2.3**	0.35	**0.78**	**1.2**	ND	0.5J	0.44	**1.0**	0.42J	0.19J	**2.3**
Benzo(*b*)fluoranthene	**0.6**[B]	**1.8**	0.22J	0.10J	0.3	ND	**0.63J**	**0.65**	ND	ND	0.19J	**2.3**
Dibenzo(*a,h*)anthracene	**0.2**[B]	**0.35J**	0.074J	0.10J	**0.3**	ND	ND	0.13J	**0.25J**	ND	ND	ND
Benzo(*a*)pyrene	**0.2**[B]	**1.8**	**0.34J**	**0.57**	**1.1**	ND	ND	**0.4**	**0.87**	**0.27J**	**1.3**	**2.1**
Indeno(1,2,3-cd)pyrene	**0.6**[B]	**1.1**	0.19J	0.28J	**0.68**	ND	ND	0.26J	0.49	ND	0.21J	ND
Benzene	**2.0**[B]	ND	ND	1.0	ND	**4.0**	ND	ND	ND	0.76J	**2.5**	ND

MSSRS = Most Stringent Soil Remediation Standard
[B]Exceeds November 4, 2009 Residential Direct Contact Soil Remediation Standards (RDCSRS)
J = Estimated Concentration
B = Indicates Compound Also Found in Blank
mg/kg = milligrams per kilogram

This is the same as the 1993 data in the other data package

According to the *UST Closure and Site Investigation Report for Former Building 108*, UST No. 090010-7, prepared by Smith Technologies Corporation, dated February 1996, there was one UST (No. 7) located adjacent to former Building 108. UST No. 7 was a steel, 1,000-gallon UST that contained No. 2 fuel oil. On July 14, 1994, UST No. 7 was drained, removed, and disposed offsite. One small hole was observed during the inspection by the subsurface evaluator. In soils surrounding the UST, no evidence of contamination was observed. On July 14, 1994, to evaluate soil conditions following removal of UST No. 7 and associated piping, post-excavation soil samples were collected from eight locations and analyzed for total petroleum hydrocarbons (TPHC). TPHC was detected in five of the eight soil samples at concentrations ranging from 26.2 mg/kg to 192.0 mg/kg, in compliance with the NJDEP soil cleanup criteria of 5,100 mg/kg. Based on visual inspection of UST No. 7 and appurtenant piping, field screening of subsurface soils, and analytical results of collected soil samples, the DPW concluded that no reportable discharge had occurred.

On March 8, 2001, as part of the remedial investigation of Site 108, a Geoprobe investigation was conducted. Soil sampling was conducted based on detections of elevated arsenic concentrations in groundwater monitoring well samples collected at Site 108. A total of twenty-seven soil samples and three duplicate samples were collected from nine distinct Geoprobe borings. The soil samples were collected from each Geoprobe boring at depth intervals of 0 to 6 inches, 12 to 18 inches and 24 to 30 inches below ground surface (bgs). The soil samples were analyzed by the Fort Monmouth Environmental Testing Laboratory (FMETL) for arsenic and lead. Arsenic was detected at concentrations exceeding the RDCSCC of 19 mg/kg in fourteen soil samples collected from eight separate Geoprobe® boring locations. Concentrations ranged from 15.56 mg/kg (24-30 inches) at boring location #9 to 297.03 mg/kg (24-30 inches) at boring location #8. Lead was detected at concentrations below the RDCSCC of 400 mg/kg in twenty-seven soil samples collected from nine separate Geoprobe® boring locations. Concentrations ranged from 1.33 mg/kg (12-18 inches) at boring location #3 to 166 mg/kg (24-30 inches) at boring location #8.

Purpose

To respond to the following comment made by the NJDEP in their June 24, 2008 correspondence letter:

Ground Water - General

a) *The existing monitoring wells cannot adequately monitor potential ground water impacts at Site 108, and thus the remedial investigation of ground water isn't complete. Ground water samples must be collected from beneath former UST #64, the locations of borings S-5 and S-7 [where the Impact to Ground Water Soil Cleanup Criteria (IGWSCC) for benzene was exceeded], and within 10 feet hydraulically downgradient of the former UST piping and dispenser area. NJDEP recommends the use of temporary well points initially. Ground water samples should be analyzed for VO (volatile organic) +10 and base neutrals (BN) +15.*

b) *Based on comment "a" above, NJDEP cannot concur with the conclusion that arsenic is the only ground water contaminant of concern at Site 108.*

Revisit select soil borings that exceeded NJDEP soil remediation standards by collecting additional groundwater and soil samples for volatile organic compound (VOC) and base neutral (BN) analysis. Analysis for arsenic and lead will not be performed as part of this Scope of Work, as soil samples were

collected from Site 108 on October 27, 2010 and analyzed for Target Analyte List (TAL) metals in support of the *Base-Wide Glauconitic Soil Study.*

Scope of Work

Soil

Advance eleven soil borings (108BL-1 through 108BL-11) to the groundwater table. Scan the soil column collected in each acetate sleeve with a photoionzation detector (PID). Collect a single soil sample within six inches of the groundwater table (soil-water interface) from each soil boring. Table #2 assigns a proposed soil boring (BL-1 through BL-11) to a historical soil sample. Submit the following soil samples to Fort Monmouth laboratory for VO+10 analysis only: BL-5. Submit the following soil samples to Fort Monmouth laboratory for BN+15 analysis only: BL-1, BL-2, BL-3, BL-4, BL-6, BL-7, BL-8, BL-9, and BL-11. Submit the following soil sample to Fort Monmouth laboratory for both VO+10 and BN+15 analyses: BL-10. Proposed soil boring 108BL-12 will be a temporary groundwater point only, located hydraulically downgradient of the UST No. 64 excavation.

Table 2 Post-Excavation Soil Sample Exceedances for UST No. 64 with Proposed Soil Borings

Proposed Soil Boring		BL-1	BL-2	BL-3	BL-4	BL-5	BL-6	BL-7	BL-8	BL-9	BL-10	BL-11
Proposed Analysis		BN+15	BN+15	BN+15	BN+15	VO+10	BN+15	BN+15	BN+15	BN+15	VO+10, BN+15	BN+15
Compound	MSSRS (mg/kg)	S-3	S-4	S-5	S-6	S-7	S-8	S-11	S-14	S-16	S-17	S-19
Benzo(*a*)anthracene	0.6[8]	**2.3**	0.35	**0.78**	**1.2**	ND	0.5J	0.44	**1.0**	0.42J	0.19J	**2.3**
Benzo(*b*)fluoranthene	0.6[8]	**1.8**	0.22J	0.10J	0.3	ND	**0.63J**	**0.65**	ND	ND	0.19J	**2.3**
Dibenzo(*a,h*)anthracene	0.2[8]	**0.35J**	0.074J	0.10J	**0.3**	ND	ND	0.13J	**0.25J**	ND	ND	ND
Benzo(*a*)pyrene	0.2[8]	**1.8**	**0.34J**	**0.57**	**1.1**	ND	ND	**0.4**	**0.87**	**0.27J**	**1.3**	**2.1**
Indeno(1,2,3-cd)pyrene	0.6[8]	**1.1**	0.19J	0.28J	**0.68**	ND	ND	0.26J	0.49	ND	0.21J	ND
Benzene	2.0[8]	ND	ND	1.0	ND	**4.0**	ND	ND	ND	0.76J	**2.5**	ND

MSSRS = Most Stringent Soil Remediation Standard

[8]Exceeds November 4, 2009Residential Direct Contact Soil Remediation Standards (RDCSRS)

J = Estimated Concentration

B = Indicates Compound Also Found in Blank

mg/kg = milligrams per kilogram

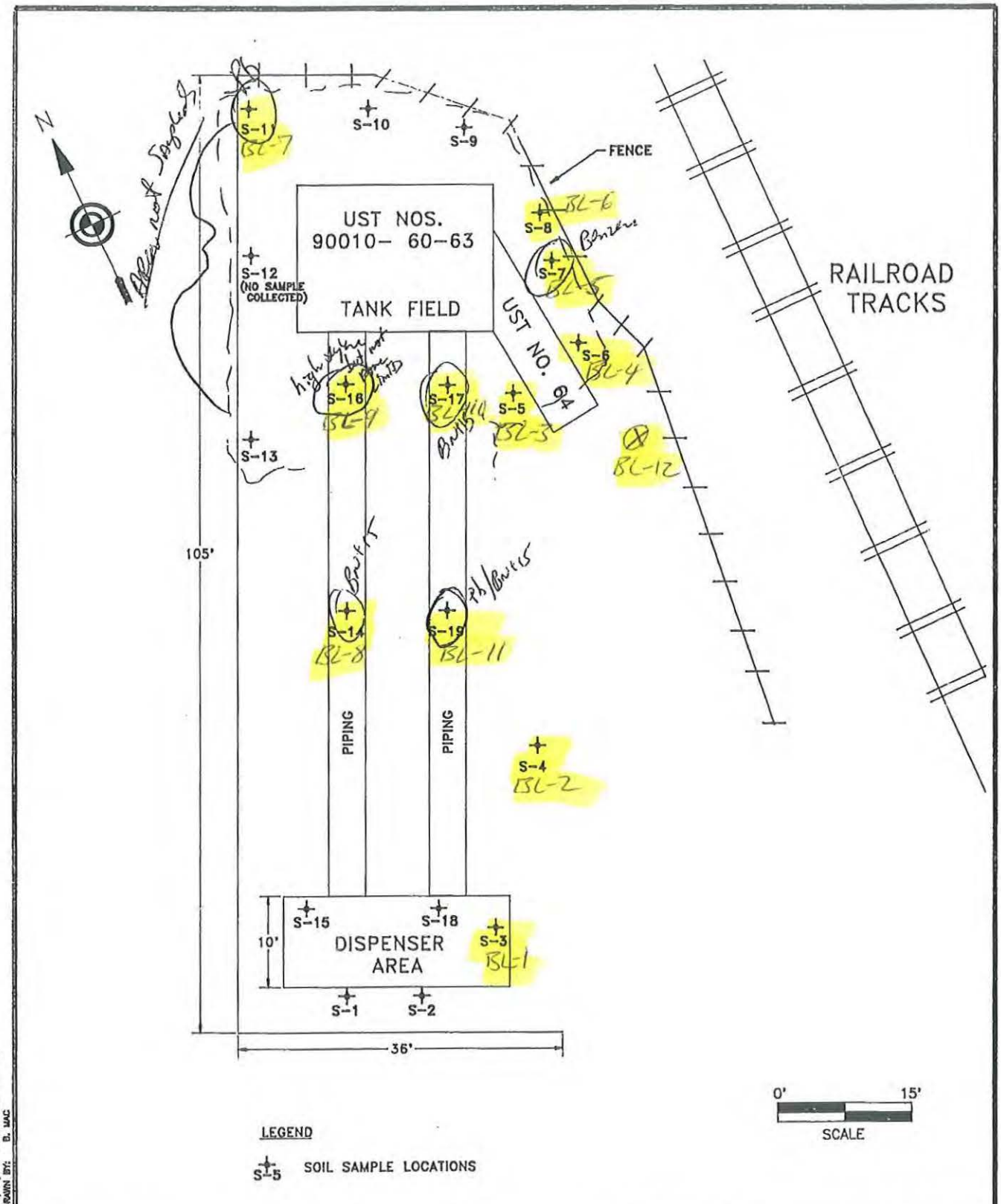
Groundwater

Install poly vinyl chloride (PVC) temporary monitoring points in the boreholes of soil borings 108BL-5, 108BL-7, and 108BL-12. Soil boring 108BL-12 is a temporary well point only – no soil samples are to be collected. Ensure that each temporary well point is screened across the groundwater table. Purge each temporary well point with a peristaltic pump until the purge water is free of suspended sediments. Following purging, collect a groundwater sample using a dedicated bailer. Submit the groundwater samples to the DPW Environmental Laboratory for VO+10 and BN+15 analyses. After the groundwater samples are collected, remove each temporary monitoring point from their respective boreholes and backfill each to grade.

SOPs

Please refer to the following Fort Monmouth Standard Operating Procedures (SOPs): SAM-0204, SAM-0206, and SAM-0207.

Results /Recommendations



REVISION #: 1 DATE: 5/16/94 PLOT NAME: BLD-130
FILE NAME: BLD-108.DWG DRAWN BY: B. MAC

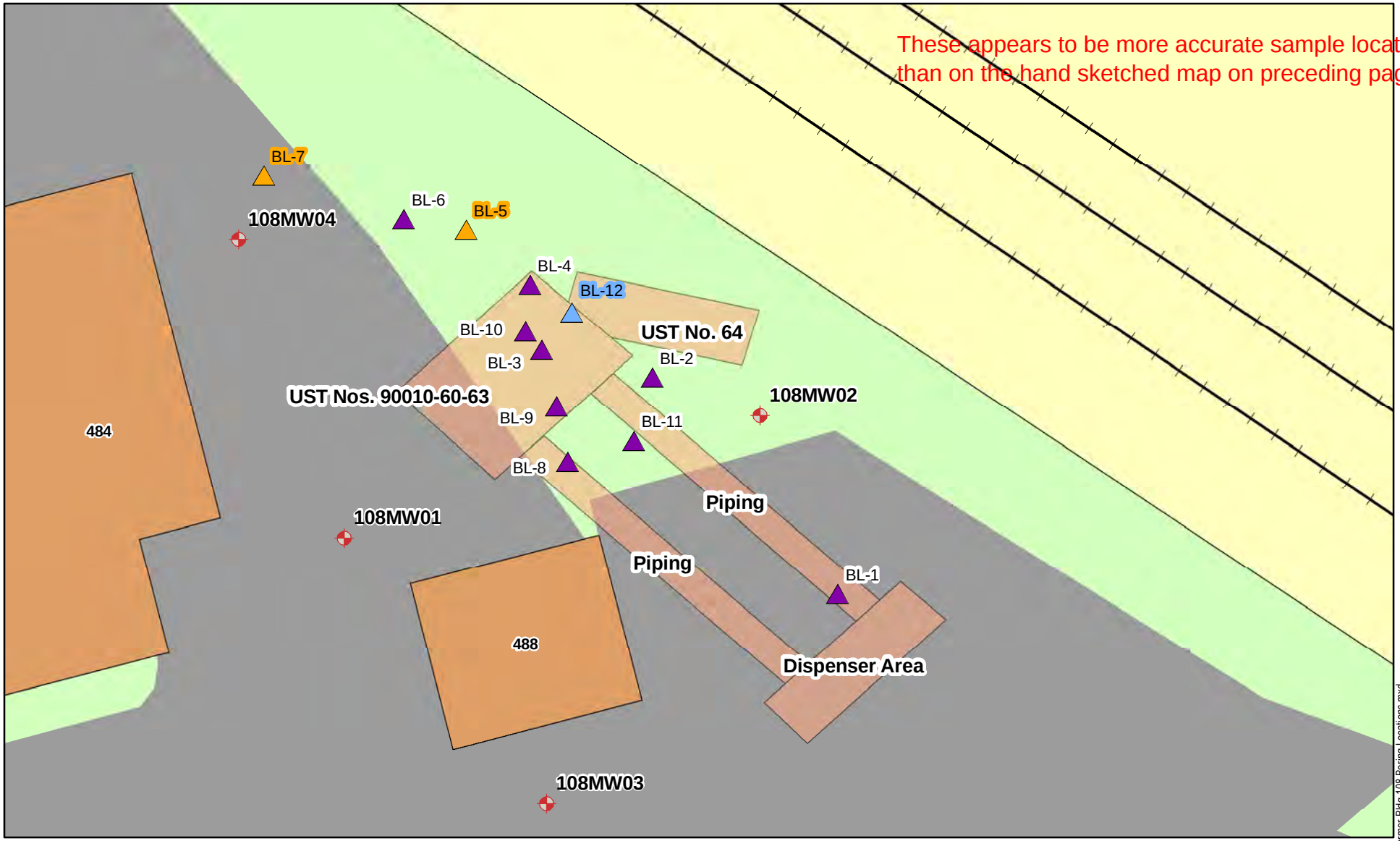
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: UNDERGROUND STORAGE TANK CLOSURE AND SITE INVESTIGATION REPORT BUILDING 108- UST NOS. 60-64
FORT MONMOUTH NEW JERSEY
CLIENT NAME: U.S. ARMY - FORT MONMOUTH DIRECTORATE OF PUBLIC WORKS

POST-EXCAVATION SOIL SAMPLING LOCATIONS

DATE: 5/17/94

FIGURE #: 2-1



Soil Boring Locations
Former Bldg 108; Main Post
Fort Monmouth, New Jersey
FOUO

Legend

- Soil and Groundwater Sampling Locations
- Groundwater Sampling Locations
- Soil Boring Locations
- Monitoring Well
- Former USTs
- (Location of UST's and Dispenser Areas are approximated.)
- Existing Building
- ACTIVE RAILROAD
- Roadway & Parking
- Post Boundaries

0 10 20 40 Feet

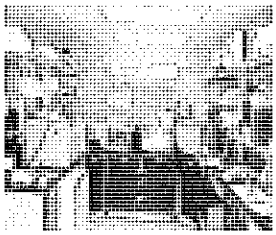
Map Created by:
Fort Monmouth Installation GIO, Environmental Division
Fort Monmouth, New Jersey
Date: February 9, 2011
All drawings must be field verified.
New Jersey State Plane Feet, NAD83

N W E S

February 9, 2011 H:\GIS\GIS Maps\CH\PR11\Former Bldg 108 Boring Locations.mxd

FORT MONMOUTH ENVIRONMENTAL TESTING LABORATORY

DIRECTORATE OF PUBLIC WORKS
PHONE: (732) 532-6224 FAX: (732) 532-6263
WET-CHEM - METALS - ORGANICS - FIELD SAMPLING
CERTIFICATIONS: NJDEP #13461



ANALYTICAL DATA REPORT
Fort Monmouth Environmental Laboratory
ENVIRONMENTAL DIVISION
Fort Monmouth, New Jersey
PROJECT: 11-33178

Building 488

Field Sample Location	Laboratory Sample ID#	Matrix	Date and Time of Collection	Date Received
BL-7 (3.0-3.5')	1055301	Soil	15-Dec-10 09:15	12/15/10
BL-6 (5.5-6.0')	1055302	Soil	15-Dec-10 09:50	12/15/10
BL-4 (3.5-4.0')	1055303	Soil	15-Dec-10 11:00	12/15/10
BL-9 (2.5-3.0')	1055304	Soil	15-Dec-10 11:45	12/15/10
BL-8 (3.0-3.5')	1055305	Soil	15-Dec-10 13:35	12/15/10
BL-11 (2.0-2.5')	1055306	Soil	15-Dec-10 14:00	12/15/10
BL-3 (2.0-2.5')	1055307	Soil	15-Dec-10 14:30	12/15/10
BL-2 (2.5-3.0')	1055308	Soil	15-Dec-10 14:55	12/15/10

ANALYSIS:
FORT MONMOUTH ENVIRONMENTAL LAB.
BN+15

Dean Tardiff/Date: 1/10/11
Laboratory Manager

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E569.D**	Misc Info	**BL-7 3.0-3.5**	Sample Weight	**10.55 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**84.6 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.112**		
Sample Name	**1055301**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.111	0.56	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.188	0.56	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.299	0.56	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.216	0.56	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.187	0.56	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.195	0.56	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.289	0.56	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.217	0.56	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.251	0.56	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.283	0.56	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.212	0.56	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.253	0.56	mg/kg	
78-59-1	Isophorone			not	detected	510	0.269	0.56	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.222	0.56	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.245	0.56	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.271	0.56	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.415	0.56	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.242	0.56	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.291	0.56	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.164	0.56	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.281	0.56	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.344	0.56	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.296	0.56	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.305	0.56	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.292	0.56	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.248	1.12	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.304	0.56	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.357	0.56	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.292	0.56	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.280	0.56	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.317	0.56	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.311	0.56	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.306	0.56	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.304	0.56	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.322	0.56	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.323	0.56	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.336	0.56	mg/kg	
85-01-8	Phenanthrene	15.40	730984	0.56	mg/kg	NLE	0.333	0.56	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.335	0.56	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.320	0.56	mg/kg	
206-44-0	Fluoranthene	17.15	1868345	1.42	mg/kg	2300	0.333	0.56	mg/kg	

Semi-Volatile Analysis Report
Page 2

Data File Name	**E569.D**	Misc Info	**BL-7 3.0-3.5**	Sample Weight	**10.55 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**84.6 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.112**		
Sample Name	**1055301**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.301	1.12	mg/kg	
129-00-0	Pyrene	17.49	1581460	1.05	mg/kg	1700	0.355	0.56	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.295	0.56	mg/kg	
56-55-3	Benzo[a]anthracene	19.22	866836	0.66	mg/kg	0.6	0.334	0.56	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.305	0.56	mg/kg	
218-01-9	Chrysene	19.28	841656	0.67	mg/kg	62	0.315	0.56	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.354	0.56	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.297	0.56	mg/kg	
205-99-2	Benzo[b]fluoranthene	20.96	1010248	0.81	mg/kg	0.6	0.240	0.56	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.288	0.56	mg/kg	
50-32-8	Benzo[a]pyrene	21.61	664766	0.58	mg/kg	0.2	0.258	0.56	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene	24.10	373497	0.35	mg/kg	0.6	0.218	0.56	mg/kg	**J**
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.204	0.56	mg/kg	
191-24-2	Benzo[g,h,i]perylene	24.76	343947	0.38	mg/kg	380000	0.207	0.56	mg/kg	**J**

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Lincar Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-7 3.0-3.5**

Lab Name: FMETL Lab Code 13461

Project: Case No.: Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055301

Sample wt/vol: 10.55 (g/ml) G Lab File ID: E569.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 15.4 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

Number TICs found: 5 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	5.92	11000	J
2.	extraction by-product	6.68	98000	J
3.	extraction by-product	13.78	450	J
4.	extraction by-product	15.59	700	J
5.	unknown PAH	21.51	600	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E572.D**	Misc Info	**BL-6 5.5-6.0**	Sample Weight	**10.07 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**83.4 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.119**		
Sample Name	**1055302**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.118	0.60	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.200	0.60	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.318	0.60	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.230	0.60	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.199	0.60	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.207	0.60	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.307	0.60	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.231	0.60	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.267	0.60	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.301	0.60	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.225	0.60	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.269	0.60	mg/kg	
78-59-1	Isophorone			not	detected	510	0.286	0.60	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.236	0.60	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.261	0.60	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.288	0.60	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.441	0.60	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.257	0.60	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.310	0.60	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.174	0.60	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.299	0.60	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.366	0.60	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.314	0.60	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.324	0.60	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.311	0.60	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.263	1.19	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.323	0.60	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.380	0.60	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.311	0.60	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.298	0.60	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.337	0.60	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.331	0.60	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.325	0.60	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.323	0.60	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.342	0.60	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.343	0.60	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.357	0.60	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.354	0.60	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.356	0.60	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.341	0.60	mg/kg	
206-44-0	Fluoranthene	17.15	832651	0.69	mg/kg	2300	0.354	0.60	mg/kg	

Semi-Volatile Analysis Report
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Data File Name	**E572.D**	Misc Info	**BL-6 5.5-6.0**	Sample Weight	**10.07 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**83.4 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.119**		
Sample Name	**1055302**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.320	1.19	mg/kg	
129-00-0	Pyrene	17.48	861192	0.62	mg/kg	1700	0.377	0.60	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.313	0.60	mg/kg	
56-55-3	Benzo[a]anthracene	19.23	622889	0.52	mg/kg	0.6	0.355	0.60	mg/kg	J
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.324	0.60	mg/kg	
218-01-9	Chrysene	19.29	583117	0.50	mg/kg	62	0.335	0.60	mg/kg	J
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.376	0.60	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.316	0.60	mg/kg	
205-99-2	Benzo[b]fluoranthene	20.98	771963	0.67	mg/kg	0.6	0.255	0.60	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.306	0.60	mg/kg	
50-32-8	Benzo[a]pyrene	21.63	458396	0.43	mg/kg	0.2	0.274	0.60	mg/kg	J
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.232	0.60	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.217	0.60	mg/kg	
191-24-2	Benzo[g,h,i]perylene	24.78	260272	0.31	mg/kg	380000	0.220	0.60	mg/kg	J

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-6 5.5-6.0**

Lab Name: FMETL Lab Code 13461

Project: _____ Case No.: _____ Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055302

Sample wt/vol: 10.07 (g/ml) G Lab File ID: E572.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 16.6 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

Number TICs found: 25 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.68	100000	J
2.	Alkane: Straight-Chain	18.99	1300	J
3.	unknown hydrocarbon	19.62	1100	J
4.	unknown hydrocarbon	19.70	1100	J
5.	unknown PAH	19.83	1500	J
6.	unknown hydrocarbon	19.94	1500	J
7.	unknown hydrocarbon	20.22	930	J
8.	unknown hydrocarbon	20.35	1100	J
9.	unknown hydrocarbon	20.52	910	J
10.	unknown hydrocarbon	20.67	1600	J
11.	unknown hydrocarbon	20.74	1100	J
12.	unknown hydrocarbon	20.85	2100	J
13.	Alkane: Straight-Chain	21.08	1400	J
14.	unknown PAH	21.17	1000	J
15.	unknown hydrocarbon	21.25	1100	J
16.	unknown hydrocarbon	21.32	1500	J
17.	unknown hydrocarbon	21.43	930	J
18.	unknown PAH	21.52	1700	J
19.	unknown hydrocarbon	21.90	970	J
20.	unknown hydrocarbon	22.02	1100	J
21.	Alkane: Straight-Chain	22.58	1700	J
22.	unknown hydrocarbon	22.86	920	J
23.	unknown hydrocarbon	22.98	2000	J
24.	unknown hydrocarbon	23.17	990	J
25.	unknown hydrocarbon	23.64	960	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E573.D**	Misc Info	**BL-4 3.5-4.0**	Sample Weight	**10.44 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**87.0 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.110**		
Sample Name	**1055303**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.109	0.55	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.185	0.55	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.294	0.55	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.212	0.55	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.184	0.55	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.192	0.55	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.284	0.55	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.214	0.55	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.247	0.55	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.279	0.55	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.208	0.55	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.249	0.55	mg/kg	
78-59-1	Isophorone			not	detected	510	0.264	0.55	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.218	0.55	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.241	0.55	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.266	0.55	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.407	0.55	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.238	0.55	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.286	0.55	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.161	0.55	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.276	0.55	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.338	0.55	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.291	0.55	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.299	0.55	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.287	0.55	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.243	1.10	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.298	0.55	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.351	0.55	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.287	0.55	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.275	0.55	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.312	0.55	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.306	0.55	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.301	0.55	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.298	0.55	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.316	0.55	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.317	0.55	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.330	0.55	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.327	0.55	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.329	0.55	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.315	0.55	mg/kg	
206-44-0	Fluoranthene			not	detected	2300	0.327	0.55	mg/kg	

Semi-Volatile Analysis Report
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Data File Name	**E573.D**	Misc Info	**BL-4 3.5-4.0**	Sample Weight	**10.44 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**87.0 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.110**		
Sample Name	**1055303**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.296	1.10	mg/kg	
129-00-0	Pyrene			not	detected	1700	0.349	0.55	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.290	0.55	mg/kg	
56-55-3	Benzo[a]anthracene			not	detected	0.6	0.328	0.55	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.299	0.55	mg/kg	
218-01-9	Chrysene			not	detected	62	0.309	0.55	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.348	0.55	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.292	0.55	mg/kg	
205-99-2	Benzo[b]fluoranthene			not	detected	0.6	0.236	0.55	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.283	0.55	mg/kg	
50-32-8	Benzo[a]pyrene			not	detected	0.2	0.253	0.55	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.215	0.55	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.200	0.55	mg/kg	
191-24-2	Benzo[g,h,i]perylene			not	detected	380000	0.204	0.55	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-4 3.5-4.0**

Lab Name: FMETL Lab Code 13461

Project: Case No.: Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055303

Sample wt/vol: 10.44 (g/ml) G Lab File ID: E573.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 13 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

Number TICs found: 24 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.67	83000	J
2.	unknown hydrocarbon	18.71	1000	J
3.	Alkane: Straight-Chain	18.99	1500	J
4.	unknown hydrocarbon	19.52	960	J
5.	unknown hydrocarbon	19.70	1200	J
6.	unknown hydrocarbon	19.83	1400	J
7.	unknown hydrocarbon	19.94	1000	J
8.	unknown hydrocarbon	20.04	1800	J
9.	unknown hydrocarbon	20.15	990	J
10.	unknown hydrocarbon	20.40	920	J
11.	unknown hydrocarbon	20.54	2000	J
12.	unknown hydrocarbon	20.75	1000	J
13.	unknown hydrocarbon	20.85	1500	J
14.	unknown PAH	20.98	1500	J
15.	unknown hydrocarbon	21.08	2000	J
16.	unknown hydrocarbon	21.31	930	J
17.	unknown hydrocarbon	21.41	1000	J
18.	unknown PAH	21.51	1500	J
19.	unknown hydrocarbon	22.03	1400	J
20.	unknown hydrocarbon	22.37	920	J
21.	Alkane: Straight-Chain	22.58	1200	J
22.	unknown hydrocarbon	22.69	900	J
23.	unknown hydrocarbon	22.98	1600	J
24.	unknown hydrocarbon	23.17	920	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	E574.D	Misc Info	BL-9 2.5-3.0	Sample Weight	10.31 g
Operator	ROBERTS	Dilution factor	1	Percent Solids	84.3 %
Date Acquired	5-Jan-11	Sample Multiplier	0.115		
Sample Name	1055304	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.114	0.58	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.193	0.58	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.307	0.58	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.222	0.58	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.192	0.58	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.200	0.58	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.297	0.58	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.223	0.58	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.258	0.58	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.291	0.58	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.217	0.58	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.260	0.58	mg/kg	
78-59-1	Isophorone			not	detected	510	0.276	0.58	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.228	0.58	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.252	0.58	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.278	0.58	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.426	0.58	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.249	0.58	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.299	0.58	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.168	0.58	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.289	0.58	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.353	0.58	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.304	0.58	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.313	0.58	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.300	0.58	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.254	1.15	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.312	0.58	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.367	0.58	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.300	0.58	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.288	0.58	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.326	0.58	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.320	0.58	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.314	0.58	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.312	0.58	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.330	0.58	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.331	0.58	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.345	0.58	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.342	0.58	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.344	0.58	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.329	0.58	mg/kg	
206-44-0	Fluoranthene			not	detected	2300	0.342	0.58	mg/kg	

Semi-Volatile Analysis Report
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Data File Name	**E574.D**	Misc Info	**BL-9 2.5-3.0**	Sample Weight	**10.31 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**84.3 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.115**		
Sample Name	**1055304**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.310	1.15	mg/kg	
129-00-0	Pyrene			not	detected	1700	0.365	0.58	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.303	0.58	mg/kg	
56-55-3	Benzo[a]anthracene			not	detected	0.6	0.343	0.58	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.313	0.58	mg/kg	
218-01-9	Chrysene			not	detected	62	0.323	0.58	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.364	0.58	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.305	0.58	mg/kg	
205-99-2	Benzo[b]fluoranthene			not	detected	0.6	0.246	0.58	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.296	0.58	mg/kg	
50-32-8	Benzo[a]pyrene			not	detected	0.2	0.265	0.58	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.224	0.58	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.209	0.58	mg/kg	
191-24-2	Benzo[g,h,i]perylene			not	detected	380000	0.213	0.58	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-9 2.5-3.0**

Lab Name: FMETL Lab Code 13461

Project: Case No.: Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055304

Sample wt/vol: 10.31 (g/ml) G Lab File ID: E574.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 15.7 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

Number TICs found: 25 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.67	86000	J
2.	unknown hydrocarbon	19.62	1200	J
3.	Alkane: Branched	19.93	1100	J
4.	unknown hydrocarbon	20.03	900	J
5.	unknown hydrocarbon	20.38	900	J
6.	Alkane: Straight-Chain	20.46	910	J
7.	unknown hydrocarbon	20.61	1200	J
8.	unknown hydrocarbon	20.80	2500	J
9.	unknown PAH	20.97	1000	J
10.	Alkane: Straight-Chain	21.07	1200	J
11.	unknown PAH	21.51	900	J
12.	unknown hydrocarbon	22.18	1100	J
13.	unknown hydrocarbon	22.39	1000	J
14.	Alkane: Straight-Chain	22.58	2200	J
15.	unknown hydrocarbon	22.76	940	J
16.	unknown hydrocarbon	22.86	900	J
17.	unknown hydrocarbon	23.18	1000	J
18.	unknown hydrocarbon	23.56	1100	J
19.	unknown hydrocarbon	23.70	940	J
20.	unknown hydrocarbon	23.92	930	J
21.	Alkane: Straight-Chain	24.22	1300	J
22.	unknown hydrocarbon	24.49	980	J
23.	unknown hydrocarbon	24.65	1200	J
24.	unknown hydrocarbon	25.07	1400	J
25.	unknown hydrocarbon	25.26	1600	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E575.D**	Misc Info	**BL-8 3.0-3.5**	Sample Weight	**10.07 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**88.8 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.112**		
Sample Name	**1055305**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.111	0.56	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.188	0.56	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.299	0.56	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.216	0.56	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.187	0.56	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.195	0.56	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.289	0.56	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.217	0.56	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.250	0.56	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.283	0.56	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.211	0.56	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.253	0.56	mg/kg	
78-59-1	Isophorone			not	detected	510	0.268	0.56	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.221	0.56	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.245	0.56	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.271	0.56	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.414	0.56	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.242	0.56	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.291	0.56	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.163	0.56	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.281	0.56	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.343	0.56	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.295	0.56	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.304	0.56	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.292	0.56	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.247	1.12	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.303	0.56	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.357	0.56	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.292	0.56	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.280	0.56	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.316	0.56	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.311	0.56	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.305	0.56	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.303	0.56	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.321	0.56	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.322	0.56	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.335	0.56	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.332	0.56	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.334	0.56	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.320	0.56	mg/kg	
206-44-0	Fluoranthene			not	detected	2300	0.332	0.56	mg/kg	

Semi-Volatile Analysis Report
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Data File Name	**E575.D**	Misc Info	**BL-8 3.0-3.5**	Sample Weight	**10.07 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**88.8 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.112**		
Sample Name	**1055305**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.301	1.12	mg/kg	
129-00-0	Pyrene			not	detected	1700	0.355	0.56	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.294	0.56	mg/kg	
56-55-3	Benzo[a]anthracene			not	detected	0.6	0.333	0.56	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.304	0.56	mg/kg	
218-01-9	Chrysene			not	detected	62	0.314	0.56	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.353	0.56	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.296	0.56	mg/kg	
205-99-2	Benzo[b]fluoranthene			not	detected	0.6	0.239	0.56	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.287	0.56	mg/kg	
50-32-8	Benzo[a]pyrene			not	detected	0.2	0.257	0.56	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.218	0.56	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.204	0.56	mg/kg	
191-24-2	Benzo[g,h,i]perylene			not	detected	380000	0.207	0.56	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-8 3.0-3.5**

Lab Name: FMETL Lab Code 13461

Project: _____ Case No.: _____ Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055305

Sample wt/vol: 10.07 (g/ml) G Lab File ID: E575.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 11.2 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

Number TICs found: 4 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	5.91	8900	J
2.	extraction by-product	6.68	110000	J
3.	extraction by-product	13.78	780	J
4.	extraction by-product	15.59	1800	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E576.D**	Misc Info	**BL-11 2.0-2.5**	Sample Weight	**10.15 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**91.0 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.108**		
Sample Name	**1055306**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.107	0.54	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.182	0.54	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.289	0.54	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.209	0.54	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.181	0.54	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.188	0.54	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.279	0.54	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.210	0.54	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.243	0.54	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.274	0.54	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.205	0.54	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.245	0.54	mg/kg	
78-59-1	Isophorone			not	detected	510	0.260	0.54	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.214	0.54	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.237	0.54	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.262	0.54	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.401	0.54	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.234	0.54	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.281	0.54	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.158	0.54	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.272	0.54	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.332	0.54	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.286	0.54	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.294	0.54	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.283	0.54	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.239	1.08	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.293	0.54	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.345	0.54	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.283	0.54	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.271	0.54	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.306	0.54	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.301	0.54	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.296	0.54	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.293	0.54	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.311	0.54	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.312	0.54	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.325	0.54	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.322	0.54	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.324	0.54	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.310	0.54	mg/kg	
206-44-0	Fluoranthene			not	detected	2300	0.322	0.54	mg/kg	

Semi-Volatile Analysis Report
Page 2

Data File Name	**E576.D**	Misc Info	**BL-11 2.0-2.5**	Sample Weight	**10.15 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**91.0 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.108**		
Sample Name	**1055306**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (ug/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.291	1.08	mg/kg	
129-00-0	Pyrene			not	detected	1700	0.343	0.54	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.285	0.54	mg/kg	
56-55-3	Benzo[a]anthracene			not	detected	0.6	0.323	0.54	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.294	0.54	mg/kg	
218-01-9	Chrysene			not	detected	62	0.304	0.54	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.342	0.54	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.287	0.54	mg/kg	
205-99-2	Benzo[b]fluoranthene			not	detected	0.6	0.232	0.54	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.278	0.54	mg/kg	
50-32-8	Benzo[a]pyrene			not	detected	0.2	0.249	0.54	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.211	0.54	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.197	0.54	mg/kg	
191-24-2	Benzo[g,h,i]perylene			not	detected	380000	0.200	0.54	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-11 2.0-2.5**

Lab Name: FMETL Lab Code 13461

Project: _____ Case No.: _____ Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055306

Sample wt/vol: 10.15 (g/ml) G Lab File ID: E576.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 9 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

Number TICs found: 2 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	5.91	7100	J
2.	extraction by-product	6.66	76000	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E578.D**	Misc Info	**BL-3 2.0-2.5**	Sample Weight	**10.20 g**
Operator	**ROBERTS**	Dilution factor	**2**	Percent Solids	**87.9 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.223**		
Sample Name	**1055307 2x**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.221	1.12	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.375	1.12	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.596	1.12	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.431	1.12	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.373	1.12	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.388	1.12	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.576	1.12	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.433	1.12	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.500	1.12	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.564	1.12	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.422	1.12	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.504	1.12	mg/kg	
78-59-1	Isophorone			not	detected	510	0.535	1.12	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.442	1.12	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.489	1.12	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.540	1.12	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.825	1.12	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.482	1.12	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.580	1.12	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.326	1.12	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.560	1.12	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.685	1.12	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.589	1.12	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.607	1.12	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.582	1.12	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.493	2.23	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.605	1.12	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.712	1.12	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.582	1.12	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.558	1.12	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.631	1.12	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.620	1.12	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.609	1.12	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.605	1.12	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.640	1.12	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.642	1.12	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.669	1.12	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.663	1.12	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.667	1.12	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.638	1.12	mg/kg	
206-44-0	Fluoranthene			not	detected	2300	0.663	1.12	mg/kg	

Semi-Volatile Analysis Report
Page 2

Data File Name	**E578.D**	Misc Info	**BL-3 2.0-2.5**	Sample Weight	**10.20 g**
Operator	**ROBERTS**	Dilution factor	**2**	Percent Solids	**87.9 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.223**		
Sample Name	**1055307 2x**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.600	2.23	mg/kg	
129-00-0	Pyrene			not	detected	1700	0.707	1.12	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.587	1.12	mg/kg	
56-55-3	Benzo[a]anthracene			not	detected	0.6	0.665	1.12	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.607	1.12	mg/kg	
218-01-9	Chrysene			not	detected	62	0.627	1.12	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.705	1.12	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.591	1.12	mg/kg	
205-99-2	Benzo[b]fluoranthene			not	detected	0.6	0.477	1.12	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.573	1.12	mg/kg	
50-32-8	Benzo[a]pyrene			not	detected	0.2	0.513	1.12	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.435	1.12	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.406	1.12	mg/kg	
191-24-2	Benzo[g,h,i]perylene			not	detected	380000	0.413	1.12	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-3 2.0-2.5**

Lab Name: FMETL Lab Code 13461

Project: Case No.: Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1053307 2x

Sample wt/vol: 10.2 (g/ml) G Lab File ID: E578.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 12.1 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 3 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.63	89000	JD
2.	unknown hydrocarbon	18.99	2100	JD
3.	extraction by-product	19.19	1500	JD

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E577.D**	Misc Info	**BL-2 2.5-3.0**	Sample Weight	**10.24 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**88.3 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.111**		
Sample Name	**1055308**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.109	0.55	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.186	0.55	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.295	0.55	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.213	0.55	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.185	0.55	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.192	0.55	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.285	0.55	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.215	0.55	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.248	0.55	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.280	0.55	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.209	0.55	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.250	0.55	mg/kg	
78-59-1	Isophorone			not	detected	510	0.265	0.55	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.219	0.55	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.242	0.55	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.268	0.55	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.409	0.55	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.239	0.55	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.288	0.55	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.161	0.55	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.278	0.55	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.340	0.55	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.292	0.55	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.301	0.55	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.289	0.55	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.244	1.11	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.300	0.55	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.353	0.55	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.289	0.55	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.276	0.55	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.313	0.55	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.307	0.55	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.302	0.55	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.300	0.55	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.317	0.55	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.319	0.55	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.332	0.55	mg/kg	
85-01-8	Phenanthrene	15.41	1952453	1.53	mg/kg	NLE	0.328	0.55	mg/kg	
120-12-7	Anthracene	15.48	466298	0.36	mg/kg	17000	0.331	0.55	mg/kg	J
84-74-2	Di-n-butylphthalate			not	detected	6100	0.316	0.55	mg/kg	
206-44-0	Fluoranthene	17.16	3851972	2.99	mg/kg	2300	0.328	0.55	mg/kg	

Semi-Volatile Analysis Report
Page 2

Data File Name	**E577.D**	Misc Info	**BL-2 2.5-3.0**	Sample Weight	**10.24 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**88.3 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.111**		
Sample Name	**1055308**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.298	1.11	mg/kg	
129-00-0	Pyrene	17.50	3564592	2.50	mg/kg	1700	0.351	0.55	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.291	0.55	mg/kg	
56-55-3	Benzo[a]anthracene	19.24	1689954	1.36	mg/kg	0.6	0.330	0.55	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.301	0.55	mg/kg	
218-01-9	Chrysene	19.30	1589980	1.34	mg/kg	62	0.311	0.55	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.349	0.55	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.293	0.55	mg/kg	
205-99-2	Benzo[b]fluoranthene	21.00	1752831	1.46	mg/kg	0.6	0.237	0.55	mg/kg	
207-08-9	Benzo[k]fluoranthene	21.03	682338	0.59	mg/kg	6	0.284	0.55	mg/kg	
50-32-8	Benzo[a]pyrene	21.65	1215432	1.10	mg/kg	0.2	0.254	0.55	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene	24.14	663893	0.64	mg/kg	0.6	0.216	0.55	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.201	0.55	mg/kg	
191-24-2	Benzo[g,h,i]perylene	24.81	612869	0.71	mg/kg	380000	0.205	0.55	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Establisbed
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-2 2.5-3.0**

Lab Name: FMETL Lab Code 13461

Project: _____ Case No.: _____ Location: 488 SDG No.: 10553

Matrix: (soil/water) SOIL Lab Sample ID: 1055308

Sample wt/vol: 10.24 (g/ml) G Lab File ID: E577.D

Level: (low/med) LOW Date Received: 12/15/2010

% Moisture: 11.7 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

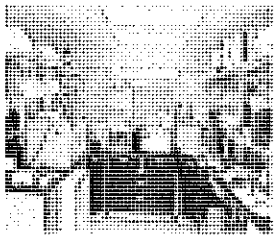
GPC Cleanup: (Y/N) N pH: _____

Number TICs found: 25 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.67	86000	J
2.	unknown PAH	16.15	1800	J
3.	unknown PAH	16.27	2900	J
4.	Alkane: Straight-Chain	16.38	2600	J
5.	unknown	16.48	2000	J
6.	unknown	16.57	2100	J
7.	unknown	16.67	2300	J
8.	unknown	16.76	1700	J
9.	unknown	16.80	2100	J
10.	unknown	16.92	2100	J
11.	unknown PAH	17.97	1700	J
12.	unknown hydrocarbon	18.71	1900	J
13.	unknown hydrocarbon	18.97	3400	J
14.	unknown hydrocarbon	19.59	1900	J
15.	Alkane: Branched	19.71	2000	J
16.	unknown hydrocarbon	20.22	1700	J
17.	unknown hydrocarbon	20.56	2300	J
18.	unknown hydrocarbon	20.70	2000	J
19.	unknown hydrocarbon	20.83	2600	J
20.	Alkane: Branched	21.09	1800	J
21.	unknown PAH	21.54	2400	J
22.	unknown hydrocarbon	22.04	1800	J
23.	Alkane: Straight-Chain	22.60	2500	J
24.	unknown hydrocarbon	22.99	2500	J
25.	unknown hydrocarbon	23.66	1800	J

FORT MONMOUTH ENVIRONMENTAL TESTING LABORATORY

DIRECTORATE OF PUBLIC WORKS
PHONE: (732) 532-6224 FAX: (732) 532-6263
WET-CHEM - METALS - ORGANICS - FIELD SAMPLING
CERTIFICATIONS: NJDEP #13461



ANALYTICAL DATA REPORT
Fort Monmouth Environmental Laboratory
ENVIRONMENTAL DIVISION
Fort Monmouth, New Jersey
PROJECT: 11-33178

Building 488

Field Sample Location	Laboratory Sample ID#	Matrix	Date and Time of Collection	Date Received
Trip Blank	1055701	Aqueous	16-Dec-10 08:15	12/16/10
Trip Blank	1055702	Methanol	16-Dec-10 08:15	12/16/10
BL1 (3.5-4.0)	1055703	Soil	16-Dec-10 09:00	12/16/10
BL10 (2.0-2.5)	1055704	Soil	16-Dec-10 09:30	12/16/10
BL5 (4')	1055705	Soil	16-Dec-10 09:55	12/16/10
Field Blank	1055706	Aqueous	16-Dec-10 10:18	12/16/10
BL5	1055707	Aqueous	16-Dec-10 10:34	12/16/10
BL12	1055708	Aqueous	16-Dec-10 11:11	12/16/10
BL7	1055709	Aqueous	16-Dec-10 15:00	12/16/10

ANALYSIS:
FORT MONMOUTH ENVIRONMENTAL LAB.
VOA+15, BN+15, %SOLIDS

ACCUTEST LABORATORIES
BN+15

Dean Tardiff/Date: 1/11/11
Laboratory Manager

Volatile Analysis Report
U.S. Army, Fort Monmouth Environmental Laboratory
NJDEP Certification #13461

Data File	VA8329.D	Sample Name	1055707
Operator	ROBERTS	Field ID	488 BL5
Date Acquired	21 Dec 2010 8:43 am	Sample Multiplier	1

CAS#	Compound Name	R.T.	Response	Result		Regulatory Level (ug/l)*	MDL	RL	Qualifiers
107028	Acrolein			not	detected	5	3.21 ug/L	5.00 ug/L	
107131	Acrylonitrile			not	detected	2	0.98 ug/L	5.00 ug/L	
75650	tert-Butyl alcohol			not	detected	100	1.64 ug/L	5.00 ug/L	
1634044	Methyl-tert-Butyl ether			not	detected	70	0.11 ug/L	0.50 ug/L	
108203	Di-isopropyl ether			not	detected	20000	0.17 ug/L	0.50 ug/L	
75718	Dichlorodifluoromethane			not	detected	1000	0.17 ug/L	0.50 ug/L	
74-87-3	Chloromethane			not	detected	nle	0.27 ug/L	0.50 ug/L	
75-01-4	Vinyl Chloride			not	detected	1	0.22 ug/L	0.50 ug/L	
74-83-9	Bromomethane			not	detected	10	0.37 ug/L	0.50 ug/L	
75-00-3	Chloroethane			not	detected	nle	0.32 ug/L	0.50 ug/L	
75-69-4	Trichlorofluoromethane			not	detected	2000	0.15 ug/L	0.50 ug/L	
75-35-4	1,1-Dichloroethene			not	detected	1	0.15 ug/L	0.50 ug/L	
67-64-1	Acetone			not	detected	6000	0.32 ug/L	0.50 ug/L	
75-15-0	Carbon Disulfide			not	detected	700	0.12 ug/L	0.50 ug/L	
75-09-2	Methylene Chloride			not	detected	3	0.26 ug/L	0.50 ug/L	
156-60-5	trans-1,2-Dichloroethene			not	detected	100	0.14 ug/L	0.50 ug/L	
75-35-3	1,1-Dichloroethane			not	detected	50	0.12 ug/L	0.50 ug/L	
108-05-4	Vinyl Acetate			not	detected	7000	0.20 ug/L	0.50 ug/L	
78-93-3	2-Butanone			not	detected	300	0.22 ug/L	0.50 ug/L	
156-59-2	cis-1,2-Dichloroethene			not	detected	70	0.12 ug/L	0.50 ug/L	
67-66-3	Chloroform			not	detected	70	0.35 ug/L	0.50 ug/L	
75-55-6	1,1,1-Trichloroethane			not	detected	30	0.12 ug/L	0.50 ug/L	
56-23-5	Carbon Tetrachloride			not	detected	1	0.12 ug/L	0.50 ug/L	
71-43-2	Benzene			not	detected	1	0.12 ug/L	0.50 ug/L	
107-06-2	1,2-Dichloroethane			not	detected	2	0.11 ug/L	0.50 ug/L	
79-01-6	Trichloroethene			not	detected	1	0.11 ug/L	0.50 ug/L	
78-87-5	1,2-Dichloropropane			not	detected	1	0.12 ug/L	0.50 ug/L	
75-27-4	Bromodichloromethane			not	detected	1	0.12 ug/L	0.50 ug/L	
110-75-8	2-Chloroethyl vinyl ether			not	detected	nle	0.24 ug/L	0.50 ug/L	
10061-01-5	cis-1,3-Dichloropropene			not	detected	1**	0.13 ug/L	0.50 ug/L	
108-10-1	4-Methyl-2-Pentanone			not	detected	nle	0.15 ug/L	0.50 ug/L	
108-88-3	Toluene			not	detected	1000	0.12 ug/L	0.50 ug/L	
10061-02-6	trans-1,3-Dichloropropene			not	detected	1**	0.13 ug/L	0.50 ug/L	
79-00-5	1,1,2-Trichloroethane			not	detected	3	0.14 ug/L	0.50 ug/L	
127-18-4	Tetrachloroethene			not	detected	1	0.14 ug/L	0.50 ug/L	
591-78-6	2-Hexanone			not	detected	nle	0.17 ug/L	0.50 ug/L	
126-48-1	Dibromochloromethane			not	detected	1	0.12 ug/L	0.50 ug/L	
108-90-7	Chlorobenzene			not	detected	50	0.12 ug/L	0.50 ug/L	
100-41-4	Ethylbenzene			not	detected	700	0.12 ug/L	0.50 ug/L	
630-20-6	1,1,1,2-tetrachloroethane			not	detected	1	0.13 ug/L	0.50 ug/L	
1330-20-7	m+p-Xylenes			not	detected	nle	0.30 ug/L	1.00 ug/L	
1330-20-7	o-Xylene			not	detected	nle	0.14 ug/L	0.50 ug/L	
100-42-5	Styrene			not	detected	100	0.14 ug/L	0.50 ug/L	
75-25-2	Bromoform			not	detected	4	0.14 ug/L	0.50 ug/L	
79-34-5	1,1,2,2-Tetrachloroethane			not	detected	1	0.14 ug/L	0.50 ug/L	
541-73-1	1,3-Dichlorobenzene			not	detected	600	0.16 ug/L	0.50 ug/L	
106-46-7	1,4-Dichlorobenzene			not	detected	75	0.15 ug/L	0.50 ug/L	
95-50-1	1,2-Dichlorobenzene			not	detected	600	0.13 ug/L	0.50 ug/L	

*Higher of PQLs and Ground Water Quality Criteria as per N.J.A.C. 7:9C

**The regulatory level applies to 1,3-dichloropropene, i.e. the sum of the cis-1,3-dichloropropene and trans-1,3-dichloropropene isomers

Qualifiers

B = Compound found in related blank
E = Value above linear range
D = Value from dilution
PQL = Practical Quantitation Limit
J= Estimated concentration, value falls between R.L. and M.D.L.
MDL = Method Detection Limit
NLE = No Limit Established
R.T. = Retention Time
R.L. = Reporting Limit

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12/21/2010 11:40 AM

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1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

FIELD ID: **BL 5**

Lab Name: FMETL NJDEP# 13461

Project: Case No: Location: 488 SDG No.: 10557

Matrix: (soil/water) WATER Lab Sample ID: 1055707

Sample wt/vol: 5.0 (g/ml) ML Lab File ID: VA8329.D

Level: (low/med) LOW Date Received: 12/16/2010

% Moisture: not dec. Date Analyzed: 12/21/2010

GC Column: RTX-VM ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q

Volatile Analysis Report
U.S. Army, Fort Monmouth Environmental Laboratory
NJDEP Certification #13461

Data File	VA8330.D	Sample Name	1055708
Operator	ROBERTS	Field ID	488 BL12
Date Acquired	21 Dec 2010 9:14 am	Sample Multiplier	1

CAS#	Compound Name	R.T.	Response	Result	Regulatory Level (ug/l)*	MDL	RL	Qualifiers
107028	Acrolein			not detected	5	3.21 ug/L	5.00 ug/L	
107131	Acrylonitrile			not detected	2	0.98 ug/L	5.00 ug/L	
75650	tert-Butyl alcohol			not detected	100	1.64 ug/L	5.00 ug/L	
1634044	Methyl-tert-Butyl ether			not detected	70	0.11 ug/L	0.50 ug/L	
108203	Di-isopropyl ether			not detected	20000	0.17 ug/L	0.50 ug/L	
75718	Dichlorodifluoromethane			not detected	1000	0.17 ug/L	0.50 ug/L	
74-87-3	Chloromethane			not detected	nle	0.27 ug/L	0.50 ug/L	
75-01-4	Vinyl Chloride			not detected	1	0.22 ug/L	0.50 ug/L	
74-83-9	Bromomethane			not detected	10	0.37 ug/L	0.50 ug/L	
75-00-3	Chloroethane			not detected	nle	0.32 ug/L	0.50 ug/L	
75-69-4	Trichlorofluoromethane			not detected	2000	0.15 ug/L	0.50 ug/L	
75-35-4	1,1-Dichloroethene			not detected	1	0.15 ug/L	0.50 ug/L	
67-64-1	Acetone			not detected	6000	0.32 ug/L	0.50 ug/L	
75-15-0	Carbon Disulfide			not detected	700	0.12 ug/L	0.50 ug/L	
75-09-2	Methylene Chloride			not detected	3	0.26 ug/L	0.50 ug/L	
156-60-5	trans-1,2-Dichloroethene			not detected	100	0.14 ug/L	0.50 ug/L	
75-35-3	1,1-Dichloroethane			not detected	50	0.12 ug/L	0.50 ug/L	
108-05-4	Vinyl Acetate			not detected	7000	0.20 ug/L	0.50 ug/L	
78-93-3	2-Butanone			not detected	300	0.22 ug/L	0.50 ug/L	
156-59-2	cis-1,2-Dichloroethene			not detected	70	0.12 ug/L	0.50 ug/L	
67-66-3	Chloroform			not detected	70	0.35 ug/L	0.50 ug/L	
75-55-6	1,1,1-Trichloroethane			not detected	30	0.12 ug/L	0.50 ug/L	
56-23-5	Carbon Tetrachloride			not detected	1	0.12 ug/L	0.50 ug/L	
71-43-2	Benzene			not detected	1	0.12 ug/L	0.50 ug/L	
107-06-2	1,2-Dichloroethane			not detected	2	0.11 ug/L	0.50 ug/L	
79-01-6	Trichloroethene			not detected	1	0.11 ug/L	0.50 ug/L	
78-87-5	1,2-Dichloropropane			not detected	1	0.12 ug/L	0.50 ug/L	
75-27-4	Bromodichloromethane			not detected	1	0.12 ug/L	0.50 ug/L	
110-75-8	2-Chloroethyl vinyl ether			not detected	nle	0.24 ug/L	0.50 ug/L	
10061-01-5	cis-1,3-Dichloropropene			not detected	1**	0.13 ug/L	0.50 ug/L	
108-10-1	4-Methyl-2-Pentanone			not detected	nle	0.15 ug/L	0.50 ug/L	
108-88-3	Toluene			not detected	1000	0.12 ug/L	0.50 ug/L	
10061-02-6	trans-1,3-Dichloropropene			not detected	1**	0.13 ug/L	0.50 ug/L	
79-00-5	1,1,2-Trichloroethane			not detected	3	0.14 ug/L	0.50 ug/L	
127-18-4	Tetrachloroethene			not detected	1	0.14 ug/L	0.50 ug/L	
591-78-6	2-Hexanone			not detected	nle	0.17 ug/L	0.50 ug/L	
126-48-1	Dibromochloromethane			not detected	1	0.12 ug/L	0.50 ug/L	
108-90-7	Chlorobenzene			not detected	50	0.12 ug/L	0.50 ug/L	
100-41-4	Ethylbenzene			not detected	700	0.12 ug/L	0.50 ug/L	
630-20-6	1,1,1,2-tetrachloroethane			not detected	1	0.13 ug/L	0.50 ug/L	
1330-20-7	m+p-Xylenes			not detected	nle	0.30 ug/L	1.00 ug/L	
1330-20-7	o-Xylene			not detected	nle	0.14 ug/L	0.50 ug/L	
100-42-5	Styrene			not detected	100	0.14 ug/L	0.50 ug/L	
75-25-2	Bromoform			not detected	4	0.14 ug/L	0.50 ug/L	
79-34-5	1,1,2,2-Tetrachloroethane			not detected	1	0.14 ug/L	0.50 ug/L	
541-73-1	1,3-Dichlorobenzene			not detected	600	0.16 ug/L	0.50 ug/L	
106-46-7	1,4-Dichlorobenzene			not detected	75	0.15 ug/L	0.50 ug/L	
95-50-1	1,2-Dichlorobenzene			not detected	600	0.13 ug/L	0.50 ug/L	

*Higher of PQLs and Ground Water Quality Criteria as per N.J.A.C. 7:9C

**The regulatory level applies to 1,3-dichloropropene, i.e. the sum of the cis-1,3-dichloropropene and trans-1,3-dichloropropene isomers

Qualifiers

B = Compound found in related blank
E = Value above linear range
D = Value from dilution
PQL = Practical Quantitation Limit
J= Estimated concentration, value falls between R.L. and M.D.L.
MDL = Method Detection Limit
NLE = No Limit Established
R.T. = Retentiou Time
R.L. = Reporting Limit

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VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

FIELD ID: **BL 12**

Lab Name: FMETL NJDEP# 13461

Project: Case No: Location: 488 SDG No.: 10557

Matrix: (soil/water) WATER Lab Sample ID: 1055708

Sample wt/vol: 5.0 (g/ml) ML Lab File ID: VA8330.D

Level: (low/med) LOW Date Received: 12/16/2010

% Moisture: not dec. Date Analyzed: 12/21/2010

GC Column: RTX-VM ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q

Volatile Analysis Report
U.S. Army, Fort Monmouth Environmental Laboratory
NJDEP Certification #13461

Data File	VA8331.D	Sample Name	1055709
Operator	ROBERTS	Field ID	488 BL7
Date Acquired	21 Dec 2010 9:44 am	Sample Multiplier	1

CAS#	Compound Name	R.T.	Response	Result	Regulatory Level (ug/l)*	MDL	RL	Qualifiers
107028	Acrolein			not detected	5	3.21 ug/L	5.00 ug/L	
107131	Acrylonitrile			not detected	2	0.98 ug/L	5.00 ug/L	
75650	tert-Butyl alcohol			not detected	100	1.64 ug/L	5.00 ug/L	
1634044	Methyl-tert-Butyl ether			not detected	70	0.11 ug/L	0.50 ug/L	
108203	Di-isopropyl ether			not detected	20000	0.17 ug/L	0.50 ug/L	
75718	Dichlorodifluoromethane			not detected	1000	0.17 ug/L	0.50 ug/L	
74-87-3	Chloromethane			not detected	nle	0.27 ug/L	0.50 ug/L	
75-01-4	Vinyl Chloride			not detected	1	0.22 ug/L	0.50 ug/L	
74-83-9	Bromomethane			not detected	10	0.37 ug/L	0.50 ug/L	
75-00-3	Chloroethane			not detected	nle	0.32 ug/L	0.50 ug/L	
75-69-4	Trichlorofluoromethane			not detected	2000	0.15 ug/L	0.50 ug/L	
75-35-4	1,1-Dichloroethene			not detected	1	0.15 ug/L	0.50 ug/L	
67-64-1	Acetone			not detected	6000	0.32 ug/L	0.50 ug/L	
75-15-0	Carbon Disulfide			not detected	700	0.12 ug/L	0.50 ug/L	
75-09-2	Methylene Chloride			not detected	3	0.26 ug/L	0.50 ug/L	
156-60-5	trans-1,2-Dichloroethene			not detected	100	0.14 ug/L	0.50 ug/L	
75-35-3	1,1-Dichloroethane			not detected	50	0.12 ug/L	0.50 ug/L	
108-05-4	Vinyl Acetate			not detected	7000	0.20 ug/L	0.50 ug/L	
78-93-3	2-Butanone			not detected	300	0.22 ug/L	0.50 ug/L	
156-59-2	cis-1,2-Dichloroethene			not detected	70	0.12 ug/L	0.50 ug/L	
67-66-3	Chloroform			not detected	70	0.35 ug/L	0.50 ug/L	
75-55-6	1,1,1-Trichloroethane			not detected	30	0.12 ug/L	0.50 ug/L	
56-23-5	Carbon Tetrachloride			not detected	1	0.12 ug/L	0.50 ug/L	
71-43-2	Benzene			not detected	1	0.12 ug/L	0.50 ug/L	
107-06-2	1,2-Dichloroethane			not detected	2	0.11 ug/L	0.50 ug/L	
79-01-6	Trichloroethene			not detected	1	0.11 ug/L	0.50 ug/L	
78-87-5	1,2-Dichloropropane			not detected	1	0.12 ug/L	0.50 ug/L	
75-27-4	Bromodichloromethane			not detected	1	0.12 ug/L	0.50 ug/L	
110-75-8	2-Chloroethyl vinyl ether			not detected	nle	0.24 ug/L	0.50 ug/L	
10061-01-5	cis-1,3-Dichloropropene			not detected	1**	0.13 ug/L	0.50 ug/L	
108-10-1	4-Methyl-2-Pentanone			not detected	nle	0.15 ug/L	0.50 ug/L	
108-88-3	Toluene			not detected	1000	0.12 ug/L	0.50 ug/L	
10061-02-6	trans-1,3-Dichloropropene			not detected	1**	0.13 ug/L	0.50 ug/L	
79-00-5	1,1,2-Trichloroethane			not detected	3	0.14 ug/L	0.50 ug/L	
127-18-4	Tetrachloroethene			not detected	1	0.14 ug/L	0.50 ug/L	
591-78-6	2-Hexanone			not detected	nle	0.17 ug/L	0.50 ug/L	
126-48-1	Dibromochloromethane			not detected	1	0.12 ug/L	0.50 ug/L	
108-90-7	Chlorobenzene			not detected	50	0.12 ug/L	0.50 ug/L	
100-41-4	Ethylbenzene			not detected	700	0.12 ug/L	0.50 ug/L	
630-20-6	1,1,1,2-tetrachloroethane			not detected	1	0.13 ug/L	0.50 ug/L	
1330-20-7	m+p-Xylenes			not detected	nle	0.30 ug/L	1.00 ug/L	
1330-20-7	o-Xylene			not detected	nle	0.14 ug/L	0.50 ug/L	
100-42-5	Styrene			not detected	100	0.14 ug/L	0.50 ug/L	
75-25-2	Bromoform			not detected	4	0.14 ug/L	0.50 ug/L	
79-34-5	1,1,2,2-Tetrachloroethane			not detected	1	0.14 ug/L	0.50 ug/L	
541-73-1	1,3-Dichlorobenzene			not detected	600	0.16 ug/L	0.50 ug/L	
106-46-7	1,4-Dichlorobenzene			not detected	75	0.15 ug/L	0.50 ug/L	
95-50-1	1,2-Dichlorobenzene			not detected	600	0.13 ug/L	0.50 ug/L	

*Higher of PQLs and Ground Water Quality Criteria as per N.J.A.C. 7:9C

**The regulatory level applies to 1,3-dichloropropene, i.e. the sum of the cis-1,3-dichloropropene and trans-1,3-dichloropropene isomers

Qualifiers

B = Compound found in related blank
E = Value above linear range
D = Value from dilution
PQL = Practical Quantitation Limit
J= Estimated concentration, value falls between R.L. and M.D.L.
MDL = Method Detection Limit
NLE = No Limit Established
R.T. = Retention Time
R.L. = Reporting Limit

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

FIELD ID: **BL 7**

Lab Name: FMETL NJDEP# 13461

Project: Case No: Location: 488 SDG No.: 10557

Matrix: (soil/water) WATER Lab Sample ID: 1055709

Sample wt/vol: 5.0 (g/ml) ML Lab File ID: VA8331.D

Level: (low/med) LOW Date Received: 12/16/2010

% Moisture: not dec. Date Analyzed: 12/21/2010

GC Column: RTX-VM ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q

Raw Data: F94239.D

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.07 488 BL 5		
Lab Sample ID:	JA64433-2	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	F94239.D	1	01/03/11	NAP	12/20/10	OP47364	EF4402
Run #2							

	Initial Volume	Final Volume
Run #1	1000 ml	1.0 ml
Run #2		

BN TCL42 List

CAS No.	Compound	Result	RL	MDL	Units	Q
98-86-2	Acetophenone	ND	2.0	0.40	ug/l	
1912-24-9	Atrazine	ND	5.0	0.39	ug/l	
100-52-7	Benzaldehyde	ND	5.0	0.40	ug/l	
101-55-3	4-Bromophenyl phenyl ether	ND	2.0	0.35	ug/l	
85-68-7	Butyl benzyl phthalate	ND	2.0	0.25	ug/l	
92-52-4	1,1'-Biphenyl	ND	1.0	0.42	ug/l	
91-58-7	2-Chloronaphthalene	ND	2.0	0.42	ug/l	
106-47-8	4-Chloroaniline	ND	5.0	0.25	ug/l	
86-74-8	Carbazole	ND	1.0	0.17	ug/l	
105-60-2	Caprolactam	ND	2.0	0.20	ug/l	
111-91-1	bis(2-Chloroethoxy)methane	ND	2.0	0.25	ug/l	
111-44-4	bis(2-Chloroethyl)ether	ND	2.0	0.31	ug/l	
108-60-1	bis(2-Chloroisopropyl)ether	ND	2.0	0.39	ug/l	
7005-72-3	4-Chlorophenyl phenyl ether	ND	2.0	0.35	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	2.0	0.22	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	2.0	0.33	ug/l	
91-94-1	3,3'-Dichlorobenzidine	ND	5.0	0.30	ug/l	
132-64-9	Dibenzofuran	ND	5.0	0.30	ug/l	
84-74-2	Di-n-butyl phthalate	ND	2.0	0.19	ug/l	
117-84-0	Di-n-octyl phthalate	ND	2.0	0.40	ug/l	
84-66-2	Diethyl phthalate	ND	2.0	0.17	ug/l	
131-11-3	Dimethyl phthalate	ND	2.0	0.23	ug/l	
117-81-7	bis(2-Ethylhexyl)phthalate	ND	2.0	0.33	ug/l	
87-68-3	Hexachlorobutadiene	ND	1.0	0.13	ug/l	
77-47-4	Hexachlorocyclopentadiene	ND	20	0.24	ug/l	
67-72-1	Hexachloroethane	ND	2.0	0.21	ug/l	
78-59-1	Isophorone	ND	2.0	0.25	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.0	0.66	ug/l	
88-74-4	2-Nitroaniline	ND	5.0	0.24	ug/l	
99-09-2	3-Nitroaniline	ND	5.0	0.29	ug/l	
100-01-6	4-Nitroaniline	ND	5.0	0.18	ug/l	
98-95-3	Nitrobenzene	ND	2.0	0.25	ug/l	

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	10557.07 488 BL 5		
Lab Sample ID:	JA64433-2	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

BN TCL42 List

CAS No.	Compound	Result	RL	MDL	Units	Q
621-64-7	N-Nitroso-di-n-propylamine	ND	2.0	0.44	ug/l	
86-30-6	N-Nitrosodiphenylamine	ND	5.0	0.22	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	87%		25-112%
321-60-8	2-Fluorobiphenyl	83%		31-106%
1718-51-0	Terphenyl-d14	64%		14-122%

CAS No.	Tentatively Identified Compounds	R.T.	Est. Conc.	Units	Q
	Internal standard added for SIM test	4.09	4.8	ug/l	J
	Internal standard added for SIM test	7.82	4.2	ug/l	J
	Total TIC, Semi-Volatile		0	ug/l	

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Raw Data: 3M23079.D

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.07 488 BL 5		
Lab Sample ID:	JA64433-2	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C BY SIM SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3M23079.D	1	12/23/10	KLS	12/20/10	OP47364A	E3M1001
Run #2							

	Initial Volume	Final Volume
Run #1	1000 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	0.10	0.011	ug/l	
208-96-8	Acenaphthylene	ND	0.10	0.011	ug/l	
120-12-7	Anthracene	ND	0.10	0.0084	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.10	0.0098	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.10	0.016	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.10	0.0095	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.10	0.010	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.10	0.013	ug/l	
218-01-9	Chrysene	ND	0.10	0.011	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.10	0.019	ug/l	
206-44-0	Fluoranthene	ND	0.10	0.0081	ug/l	
86-73-7	Fluorene	ND	0.10	0.0090	ug/l	
118-74-1	Hexachlorobenzene	ND	0.020	0.010	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.10	0.016	ug/l	
91-20-3	Naphthalene	ND	0.10	0.012	ug/l	
85-01-8	Phenanthrene	ND	0.10	0.0094	ug/l	
129-00-0	Pyrene	ND	0.10	0.012	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	93%		18-119%
321-60-8	2-Fluorobiphenyl	78%		18-104%
1718-51-0	Terphenyl-d14	60%		13-109%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Raw Data: F94240.D

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.08 488 BL 12		
Lab Sample ID:	JA64433-3	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	F94240.D	1	01/03/11	NAP	12/20/10	OP47364	EF4402
Run #2							

	Initial Volume	Final Volume
Run #1	1000 ml	1.0 ml
Run #2		

BN TCL42 List

CAS No.	Compound	Result	RL	MDL	Units	Q
98-86-2	Acetophenone	ND	2.0	0.40	ng/l	
1912-24-9	Atrazine	ND	5.0	0.39	ug/l	
100-52-7	Benzaldehyde	ND	5.0	0.40	ug/l	
101-55-3	4-Bromophenyl phenyl ether	ND	2.0	0.35	ug/l	
85-68-7	Butyl benzyl phthalate	ND	2.0	0.25	ug/l	
92-52-4	1,1'-Biphenyl	ND	1.0	0.42	ug/l	
91-58-7	2-Chloronaphthalene	ND	2.0	0.42	ug/l	
106-47-8	4-Chloroaniline	ND	5.0	0.25	ug/l	
86-74-8	Carbazole	ND	1.0	0.17	ug/l	
105-60-2	Caprolactam	ND	2.0	0.20	ug/l	
111-91-1	bis(2-Chloroethoxy)methane	ND	2.0	0.25	ug/l	
111-44-4	bis(2-Chloroethyl)ether	ND	2.0	0.31	ug/l	
108-60-1	bis(2-Chloroisopropyl)ether	ND	2.0	0.39	ug/l	
7005-72-3	4-Chlorophenyl phenyl ether	ND	2.0	0.35	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	2.0	0.22	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	2.0	0.33	ug/l	
91-94-1	3,3'-Dichlorobenzidine	ND	5.0	0.30	ug/l	
132-64-9	Dibenzofuran	ND	5.0	0.30	ug/l	
84-74-2	Di-n-butyl phthalate	ND	2.0	0.19	ug/l	
117-84-0	Di-n-octyl phthalate	ND	2.0	0.40	ug/l	
84-66-2	Diethyl phthalate	ND	2.0	0.17	ug/l	
131-11-3	Dimethyl phthalate	ND	2.0	0.23	ug/l	
117-81-7	bis(2-Ethylhexyl)phthalate	ND	2.0	0.33	ug/l	
87-68-3	Hexachlorobutadiene	ND	1.0	0.13	ug/l	
77-47-4	Hexachlorocyclopentadiene	ND	20	0.24	ug/l	
67-72-1	Hexachloroethane	ND	2.0	0.21	ug/l	
78-59-1	Isophorone	ND	2.0	0.25	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.0	0.66	ug/l	
88-74-4	2-Nitroaniline	ND	5.0	0.24	ug/l	
99-09-2	3-Nitroaniline	ND	5.0	0.29	ug/l	
100-01-6	4-Nitroaniline	ND	5.0	0.18	ug/l	
98-95-3	Nitrobenzene	ND	2.0	0.25	ng/l	

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.08 488 BL 12		
Lab Sample ID:	JA64433-3	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

BN TCL42 List

CAS No.	Compound	Result	RL	MDL	Units	Q
621-64-7	N-Nitroso-di-n-propylamine	ND	2.0	0.44	ug/l	
86-30-6	N-Nitrosodiphenylamine	ND	5.0	0.22	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	82%		25-112%
321-60-8	2-Fluorobiphenyl	82%		31-106%
1718-51-0	Terphenyl-d14	55%		14-122%

CAS No.	Tentatively Identified Compounds	R.T.	Est. Conc.	Units	Q
	Internal standard added for SIM test	4.09	4.2	ug/l	J
	Internal standard added for SIM test	7.82	4	ug/l	J
	Total TIC, Semi-Volatile		0	ug/l	

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Raw Data: 3M23054.D

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.08 488 BL 12		
Lab Sample ID:	JA64433-3	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C BY SIM SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3M23054.D	1	12/21/10	KLS	12/20/10	OP47364A	E3M1000
Run #2							

	Initial Volume	Final Volume
Run #1	1000 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	0.10	0.011	ug/l	
208-96-8	Acenaphthylene	ND	0.10	0.011	ug/l	
120-12-7	Anthracene	ND	0.10	0.0084	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.10	0.0098	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.10	0.016	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.10	0.0095	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.10	0.010	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.10	0.013	ug/l	
218-01-9	Chrysene	ND	0.10	0.011	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.10	0.019	ug/l	
206-44-0	Fluoranthene	ND	0.10	0.0081	ug/l	
86-73-7	Fluorene	ND	0.10	0.0090	ug/l	
118-74-1	Hexachlorobenzene	ND	0.020	0.010	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.10	0.016	ug/l	
91-20-3	Naphthalene	ND	0.10	0.012	ug/l	
85-01-8	Phenanthrene	ND	0.10	0.0094	ug/l	
129-00-0	Pyrene	ND	0.10	0.012	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	88%		18-119%
321-60-8	2-Fluorobiphenyl	80%		18-104%
1718-51-0	Terphenyl-d14	49%		13-109%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.09 488 BL 7		
Lab Sample ID:	JA64433-4	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	F94241.D	1	01/03/11	NAP	12/20/10	OP47364	EF4402
Run #2							

	Initial Volume	Final Volume
Run #1	1000 ml	1.0 ml
Run #2		

BN TCL42 List

CAS No.	Compound	Result	RL	MDL	Units	Q
98-86-2	Acetophenone	ND	2.0	0.40	ug/l	
19I2-24-9	Atrazine	ND	5.0	0.39	ug/l	
100-52-7	Benzaldehyde	ND	5.0	0.40	ug/l	
101-55-3	4-Bromophenyl phenyl ether	ND	2.0	0.35	ug/l	
85-68-7	Butyl benzyl phthalate	ND	2.0	0.25	ug/l	
92-52-4	1,1'-Biphenyl	ND	1.0	0.42	ug/l	
91-58-7	2-Chloronaphthalene	ND	2.0	0.42	ug/l	
106-47-8	4-Chloroaniline	ND	5.0	0.25	ug/l	
86-74-8	Carbazole	ND	1.0	0.17	ug/l	
105-60-2	Caprolactam	ND	2.0	0.20	ug/l	
111-91-1	bis(2-Chloroethoxy)methane	ND	2.0	0.25	ug/l	
111-44-4	bis(2-Chloroethyl)ether	ND	2.0	0.31	ug/l	
108-60-1	bis(2-Chloroisopropyl)ether	ND	2.0	0.39	ug/l	
7005-72-3	4-Chlorophenyl phenyl ether	ND	2.0	0.35	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	2.0	0.22	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	2.0	0.33	ug/l	
91-94-1	3,3'-Dichlorobenzidine	ND	5.0	0.30	ug/l	
132-64-9	Dibenzofuran	ND	5.0	0.30	ug/l	
84-74-2	Di-n-butyl phthalate	ND	2.0	0.19	ug/l	
117-84-0	Di-n-octyl phthalate	ND	2.0	0.40	ug/l	
84-66-2	Diethyl phthalate	ND	2.0	0.17	ug/l	
131-11-3	Dimethyl phthalate	ND	2.0	0.23	ug/l	
117-81-7	bis(2-Ethylhexyl)phthalate	ND	2.0	0.33	ug/l	
87-68-3	Hexachlorobutadiene	ND	1.0	0.13	ug/l	
77-47-4	Hexachlorocyclopentadiene	ND	20	0.24	ug/l	
67-72-1	Hexachloroethane	ND	2.0	0.21	ug/l	
78-59-1	Isophorone	ND	2.0	0.25	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.0	0.66	ug/l	
88-74-4	2-Nitroaniline	ND	5.0	0.24	ug/l	
99-09-2	3-Nitroaniline	ND	5.0	0.29	ug/l	
100-01-6	4-Nitroaniline	ND	5.0	0.18	ug/l	
98-95-3	Nitrobenzene	ND	2.0	0.25	ug/l	

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.09 488 BL 7		
Lab Sample ID:	JA64433-4	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

BN TCL42 List

CAS No.	Compound	Result	RL	MDL	Units	Q
621-64-7	N-Nitroso-di-n-propylamine	ND	2.0	0.44	ug/l	
86-30-6	N-Nitrosodiphenylamine	ND	5.0	0.22	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	84%		25-112%
321-60-8	2-Fluorobiphenyl	84%		31-106%
1718-51-0	Terphenyl-d14	63%		14-122%

CAS No.	Tentatively Identified Compounds	R.T.	Est. Conc.	Units	Q
	Internal standard added for SIM test	4.09	4	ug/l	J
	Total TIC, Semi-Volatile		0	ug/l	

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Raw Data: 3M23055.D

Accutest Laboratories

Report of Analysis

Client Sample ID:	10557.09 488 BL 7		
Lab Sample ID:	JA64433-4	Date Sampled:	12/16/10
Matrix:	AQ - Ground Water	Date Received:	12/17/10
Method:	SW846 8270C BY SIM SW846 3510C	Percent Solids:	n/a
Project:	Building 488 Event		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3M23055.D	1	12/21/10	KLS	12/20/10	OP47364A	E3M1000
Run #2							

	Initial Volume	Final Volume
Run #1	1000 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	0.10	0.011	ug/l	
208-96-8	Acenaphthylene	ND	0.10	0.011	ug/l	
120-12-7	Anthracene	ND	0.10	0.0084	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.10	0.0098	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.10	0.016	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.10	0.0095	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.10	0.010	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.10	0.013	ug/l	
218-01-9	Chrysene	ND	0.10	0.011	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.10	0.019	ug/l	
206-44-0	Fluoranthene	ND	0.10	0.0081	ug/l	
86-73-7	Fluorene	ND	0.10	0.0090	ug/l	
118-74-1	Hexachlorobenzene	ND	0.020	0.010	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.10	0.016	ug/l	
91-20-3	Naphthalene	ND	0.10	0.012	ug/l	
85-01-8	Phenanthrene	ND	0.10	0.0094	ug/l	
129-00-0	Pyrene	ND	0.10	0.012	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	91%		18-119%
321-60-8	2-Fluorobiphenyl	82%		18-104%
1718-51-0	Terphenyl-d14	60%		13-109%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SEMI-VOLATILE ORGANICS

(SOIL)

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	**E580.D**	Misc Info	**BL 1 3.5-4.0**	Sample Weight	**10.47 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**82.4 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.116**		
Sample Name	**1055703**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.115	0.58	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.195	0.58	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.309	0.58	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.224	0.58	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.194	0.58	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.202	0.58	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.299	0.58	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.225	0.58	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.260	0.58	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.293	0.58	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.219	0.58	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.262	0.58	mg/kg	
78-59-1	Isophorone			not	detected	510	0.278	0.58	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.230	0.58	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.254	0.58	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.281	0.58	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.429	0.58	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.250	0.58	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.301	0.58	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.169	0.58	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.291	0.58	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.356	0.58	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.306	0.58	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.315	0.58	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.303	0.58	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.256	1.16	mg/kg	
83-32-9	Acenaphthene	13.25	406149	0.41	mg/kg	3400	0.314	0.58	mg/kg	J
132-64-9	Dibenzofuran			not	detected	NLE	0.370	0.58	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.303	0.58	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.290	0.58	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.328	0.58	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.322	0.58	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.316	0.58	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.314	0.58	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.333	0.58	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.334	0.58	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.348	0.58	mg/kg	
85-01-8	Phenanthrene	15.40	600457	0.46	mg/kg	NLE	0.344	0.58	mg/kg	J
120-12-7	Anthracene			not	detected	17000	0.347	0.58	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.332	0.58	mg/kg	
206-44-0	Fluoranthene	17.16	1196526	0.92	mg/kg	2300	0.344	0.58	mg/kg	

Semi-Volatile Analysis Report
Page 2

Data File Name	**E580.D**	Misc Info	**BL 1 3.5-4.0**	Sample Weight	**10.47 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**82.4 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.116**		
Sample Name	**1055703**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.312	1.16	mg/kg	
129-00-0	Pyrene	17.49	1094933	0.79	mg/kg	1700	0.367	0.58	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.305	0.58	mg/kg	
56-55-3	Benzo[a]anthracene	19.24	606297	0.50	mg/kg	0.6	0.345	0.58	mg/kg	J
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.315	0.58	mg/kg	
218-01-9	Chrysene	19.29	569595	0.49	mg/kg	62	0.326	0.58	mg/kg	J
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.366	0.58	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.307	0.58	mg/kg	
205-99-2	Benzo[b]fluoranthene	20.98	719582	0.64	mg/kg	0.6	0.248	0.58	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.298	0.58	mg/kg	
50-32-8	Benzo[a]pyrene	21.65	453873	0.44	mg/kg	0.2	0.267	0.58	mg/kg	J
193-39-5	Indeno[1,2,3-cd]pyrene	24.14	230549	0.24	mg/kg	0.6	0.226	0.58	mg/kg	J
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.211	0.58	mg/kg	
191-24-2	Benzo[g,h,i]perylene	24.81	224255	0.28	mg/kg	380000	0.214	0.58	mg/kg	J

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-1 3.5-4.0**

Lab Name: FMETL Lab Code 13461

Project: _____ Case No.: _____ Location: 488 SDG No.: 10557

Matrix: (soil/water) SOIL Lab Sample ID: 1055703

Sample wt/vol: 10.47 (g/ml) G Lab File ID: E580.D

Level: (low/med) LOW Date Received: 12/16/2010

% Moisture: 17.6 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

Number TICs found: 25 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.66	66000	J
2.	unknown	16.11	1100	J
3.	unknown	16.17	910	J
4.	unknown	16.28	1600	J
5.	unknown	16.38	1100	J
6.	unknown	16.64	1200	J
7.	unknown	16.93	1500	J
8.	unknown	18.71	1100	J
9.	unknown PAH	18.88	980	J
10.	Alkane: Straight-Chain	18.99	1000	J
11.	Alkane: Straight-Chain	19.45	910	J
12.	Alkane: Straight-Chain	19.94	1500	J
13.	unknown	20.04	1100	J
14.	unknown	20.41	1100	J
15.	unknown	20.70	880	J
16.	unknown	20.85	1500	J
17.	Alkane: Straight-Chain	21.08	1400	J
18.	unknown	21.23	1100	J
19.	unknown	21.34	880	J
20.	unknown PAH	21.53	1300	J
21.	Alkane: Straight-Chain	22.59	1800	J
22.	unknown hydrocarbon	22.78	870	J
23.	unknown hydrocarbon	22.99	1700	J
24.	unknown hydrocarbon	23.36	1200	J
25.	unknown hydrocarbon	23.65	1400	J

Semi-Volatile Analysis Report

U.S. Army, Fort Monmouth Environmental Laboratory

NJDEP Certification #13461

Data File Name	E579.D	Misc Info	BL 10 2.0-2.5	Sample Weight	10.18 g
Operator	ROBERTS	Dilution factor	1	Percent Solids	88.2 %
Date Acquired	5-Jan-11	Sample Multiplier	0.111		
Sample Name	1055704	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100])*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*	MDL	RL		Qualifiers
110-86-1	pyridine			not	detected	NLE	0.110	0.56	mg/kg	
62-75-9	N-nitroso-dimethylamine			not	detected	0.7	0.187	0.56	mg/kg	
62-53-3	Aniline			not	detected	NLE	0.297	0.56	mg/kg	
111-44-4	bis-2-chloroethyl ether			not	detected	0.4	0.215	0.56	mg/kg	
541-73-1	1,3-dichlorobenzene			not	detected	5300	0.186	0.56	mg/kg	
106-46-7	1,4-dichlorobenzene			not	detected	5	0.194	0.56	mg/kg	
100-51-6	Benzyl alcohol			not	detected	NLE	0.287	0.56	mg/kg	
95-50-1	1,2-dichlorobenzene			not	detected	5300	0.216	0.56	mg/kg	
39638-32-9	bis(2-chloroisopropyl)ether			not	detected	23	0.249	0.56	mg/kg	
621-64-7	N-nitroso-di-n-propylamine			not	detected	0.2	0.282	0.56	mg/kg	
67-72-1	Hexachloroethane			not	detected	35	0.210	0.56	mg/kg	
98-95-3	Nitrobenzene			not	detected	31	0.252	0.56	mg/kg	
78-59-1	Isophorone			not	detected	510	0.267	0.56	mg/kg	
111-91-1	bis(2-chloroethoxy)methane			not	detected	NLE	0.221	0.56	mg/kg	
120-82-1	1,2,4-trichlorobenzene			not	detected	73	0.244	0.56	mg/kg	
91-20-3	Naphthalene			not	detected	6	0.270	0.56	mg/kg	
106-47-8	4-chloroaniline			not	detected	9	0.412	0.56	mg/kg	
87-68-3	Hexachlorobutadiene			not	detected	6	0.241	0.56	mg/kg	
91-57-6	2-methylnaphthalene			not	detected	230	0.290	0.56	mg/kg	
77-47-4	Hexachlorocyclopentadiene			not	detected	45	0.163	0.56	mg/kg	
91-58-7	2-chloronaphthalene			not	detected	NLE	0.280	0.56	mg/kg	
88-74-4	2-nitroaniline			not	detected	39	0.342	0.56	mg/kg	
131-11-3	Dimethylphthalate			not	detected	NLE	0.294	0.56	mg/kg	
208-96-8	Acenaphthylene			not	detected	NLE	0.303	0.56	mg/kg	
606-20-2	2,6-dinitrotoluene			not	detected	0.7	0.291	0.56	mg/kg	
99-09-2	3-nitroaniline			not	detected	NLE	0.246	1.11	mg/kg	
83-32-9	Acenaphthene			not	detected	3400	0.302	0.56	mg/kg	
132-64-9	Dibenzofuran			not	detected	NLE	0.355	0.56	mg/kg	
121-14-2	2,4-dinitrotoluene			not	detected	0.7	0.291	0.56	mg/kg	
84-66-2	Diethylphthalate			not	detected	49000	0.278	0.56	mg/kg	
86-73-7	Fluorene			not	detected	2300	0.315	0.56	mg/kg	
7005-72-3	4-chlorophenyl-phenylether			not	detected	NLE	0.310	0.56	mg/kg	
100-01-6	4-nitroaniline			not	detected	NLE	0.304	0.56	mg/kg	
86-30-6	N-nitrosodiphenylamine			not	detected	99	0.302	0.56	mg/kg	
103-33-3	Azobenzene			not	detected	NLE	0.320	0.56	mg/kg	
101-55-3	4-bromophenyl-phenylether			not	detected	NLE	0.321	0.56	mg/kg	
118-74-1	Hexachlorobenzene			not	detected	0.3	0.334	0.56	mg/kg	
85-01-8	Phenanthrene			not	detected	NLE	0.331	0.56	mg/kg	
120-12-7	Anthracene			not	detected	17000	0.333	0.56	mg/kg	
84-74-2	Di-n-butylphthalate			not	detected	6100	0.319	0.56	mg/kg	
206-44-0	Fluoranthene			not	detected	2300	0.331	0.56	mg/kg	

Semi-Volatile Analysis Report
Page 2

Data File Name	**E579.D**	Misc Info	**BL 10 2.0-2.5**	Sample Weight	**10.18 g**
Operator	**ROBERTS**	Dilution factor	**1**	Percent Solids	**88.2 %**
Date Acquired	**5-Jan-11**	Sample Multiplier	**0.111**		
Sample Name	**1055704**	*Sample multiplier = (0.001*Dilution factor)/([sample weight(kg)]*[percent solids/100],*			
		Multiplied by 0.001 to convert ug/kg to mg/kg.			

CAS#	Name	R.T.	Response	Result		Regulatory Level (mg/kg)*		RL		Qualifiers
92-87-5	Benzidine			not	detected	0.7	0.300	1.11	mg/kg	
129-00-0	Pyrene			not	detected	1700	0.353	0.56	mg/kg	
85-68-7	Butylbenzylphthalate			not	detected	1200	0.293	0.56	mg/kg	
56-55-3	Benzo[a]anthracene			not	detected	0.6	0.332	0.56	mg/kg	
91-94-1	3,3'-dichlorobenzidine			not	detected	1	0.303	0.56	mg/kg	
218-01-9	Chrysene			not	detected	62	0.313	0.56	mg/kg	
117-81-7	bis(2-ethylhexyl)phthalate			not	detected	35	0.352	0.56	mg/kg	
117-84-0	Di-n-octylphthalate			not	detected	2400	0.295	0.56	mg/kg	
205-99-2	Benzo[b]fluoranthene			not	detected	0.6	0.238	0.56	mg/kg	
207-08-9	Benzo[k]fluoranthene			not	detected	6	0.286	0.56	mg/kg	
50-32-8	Benzo[a]pyrene			not	detected	0.2	0.256	0.56	mg/kg	
193-39-5	Indeno[1,2,3-cd]pyrene			not	detected	0.6	0.217	0.56	mg/kg	
53-70-3	Dibenz[a,h]anthracene			not	detected	0.2	0.203	0.56	mg/kg	
191-24-2	Benzo[g,h,i]perylene			not	detected	380000	0.206	0.56	mg/kg	

* Higher of PQL's and Interim Criteria as per NJAC 7:9-6.9(c).

Qualifiers

E= Value Exceeds Linear Range
D= Value from dilution
B= Compound in Related Blank
MDL= Method Detection Limit
NLE= No Limit Established
R.T.=Retention Time
RL= Reporting Limit. The values between the MDL and RL are considered estimated.
J= Estimated concentration, value lies between RL and MDL

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Field Id: **BL-10 2.0-2.5**

Lab Name: FMETL Lab Code 13461

Project: _____ Case No.: _____ Location: 488 SDG No.: 10557

Matrix: (soil/water) SOIL Lab Sample ID: 1055704

Sample wt/vol: 10.18 (g/ml) G Lab File ID: E579.D

Level: (low/med) LOW Date Received: 12/16/2010

% Moisture: 11.8 decanted: (Y/N) N Date Extracted: 12/20/2010

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/5/2011

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

Number TICs found: 8 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	extraction by-product	6.65	62000	J
2.	Alkane: Branched	18.99	750	J
3.	extraction by-product	19.19	980	J
4.	Alkane: Straight-Chain	19.93	860	J
5.	unknown PAH	20.98	780	J
6.	Alkane: Straight-Chain	21.07	840	J
7.	unknown PAH	21.52	770	J
8.	Alkane: Straight-Chain	22.58	1200	J

APPENDIX H: FTMM-57 Building 108 UST Gasoline Release

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1.0 WATER LEVEL MEASUREMENTS AND WELL ASSESSMENT

Monitoring wells located within FTMM-57 were gauged on October 2, 2015. Monitoring well locations as well as other site features are provided in **Figure 1**. Details regarding the water level measurements are provided in **Table 1**. Groundwater elevations in monitoring wells ranged from 3.61 (108MW03) to 8.76 (108MW01) feet above mean sea level (amsl). The inferred shallow groundwater flow direction is generally to the southeast towards Oceanport Creek, as shown in **Figure 2**.

During the groundwater gauging, the physical condition of FTMM-57 monitoring wells were assessed. The site monitoring wells were found to be in good condition.

2.0 GROUNDWATER SAMPLING

A groundwater sample was collected from one monitoring well (108MW04) located at FTMM-57 as part of the annual (fourth quarter) 2015 groundwater sampling event. FTMM-57 is sampled on an annual basis. The groundwater sampling program included measuring the depth to groundwater in monitoring wells prior to sampling and collection of groundwater samples using low-flow purging and sampling (LFPS). The groundwater sample was collected from well 108MW04 on November 20, 2015 and analyzed for lead via USEPA Method SW6010C.

The samples were collected in accordance with the New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual (FSPM) and the Sampling Analysis Plan (SAP). Field blanks, duplicates, matrix spike, matrix spike duplicate and quality assurance (QA) split samples were collected for every 5% of samples collected per parameter, per matrix, in accordance with the Quality Assurance Project Plan (QAPP).

The completed LFPS field sheets can be found in **Attachment A**.

3.0 HISTORICAL GROUNDWATER SAMPLING RESULTS

The historical quarterly groundwater sampling events conducted at FTMM-57 consisted solely of metals analysis. During the historical events, several metals including aluminum, arsenic, beryllium, chromium, iron, lead, manganese, mercury and sodium were detected in exceedance of the NJDEP Ground Water Quality Standard (GWQS). However, sodium, manganese, mercury and lead were the only metals to exceed their individual background concentration established in the 1995 Weston Report. Sodium and manganese are attributed to background conditions that typically contribute to elevated metal concentrations in groundwater, such as the glauconitic soils that underlie the site. Lead was found in exceedance of its background concentration (Weston, 1995) in site monitoring well 108MW04 during the February and August 2011 groundwater monitoring events. Lead is potentially associated with historical site operations.

Mercury exceeded its NJDEP GWQS and background concentration (Weston, 1995) in November 2010. Prior to and since this exceedance, mercury has not been detected in excess of its NJDEP GWQS. The November 2010 mercury exceedance is anomalous. Historical groundwater analytical results are presented in **Table 2**.

Aluminum, arsenic, iron, manganese and sodium were detected above their respective NJDEP GWQS. Of these metals, only manganese and sodium were the detected at concentrations greater than their background concentrations (Weston, 1995). However, manganese and sodium are found naturally in the glauconitic soil underlying the Site and are considered background conditions and not associated with historical site uses. No volatile organic compounds (VOCs) or pesticides were detected above their NJDEP GWQS.

During the August 2013 Baseline Sampling Event, four monitoring wells were sampled for VOCs plus tentatively identified VOCs, pesticides and metals. No VOCs or pesticides were detected above the NJDEP GWQS. Metals detected above the NJDEP GWQS at the four wells were attributed to site background conditions. Groundwater analytical detections from samples collected during the August 2013 sampling event are presented in **Table 3**.

The Final August 2013 Baseline Groundwater Sampling Report was accepted by the NJDEP in their February 5, 2015 letter. Based on this approval, three out of the four groundwater monitoring wells were removed from the long-term monitoring (LTM) program including: 108MW01, 108MW02 and 108MW03; and VOCs, pesticides and metals analysis were discontinued with the exception of lead.

Lead was not detected at monitoring well 108MW04 during the annual (fourth quarter) 2014 sampling event. Based on the collective data, the Annual (Fourth Quarter) 2014 Groundwater Sampling Report recommended that one additional sampling round at 108MW04 for lead be conducted to confirm the absence of lead above the NJDEP GWQS, and to support the termination of long-term monitoring at FTMM-57. This recommendation was accepted by the NJDEP in their January 26, 2016 letter.

4.0 ANNUAL (FOURTH QUARTER) 2015 GROUNDWATER RESULTS

The lead concentration detected in the groundwater sample from 108MW04 was non-detect above the method detection limit of 2.5 µg/L which is below the NJDEP GWQS of 5 µg/L during the annual (fourth quarter) 2015 sampling event.

5.0 FINDINGS AND RECOMMENDATIONS

Historically, well 108MW04 contained lead concentrations (ranging from non-detect to 101 µg/L) above the NJDEP GWQS of 5 µg/L and its background concentration (Weston, 1995), however, lead was not detected above the method detection limit during the August 2013, 2014 and 2015 sampling events in this well. A review of historical groundwater sampling results is presented in **Table 4**, which also provides the matrix used to determine the status of the wells relative to future groundwater sampling and analyses. Based on the collective groundwater sampling results, it is recommended that groundwater sampling at FTMM-57 be discontinued and a no further action determination will be requested for groundwater at this site.

TABLES

Table 1
Groundwater Gauging Data and Elevations (October 2, 2015) and LFPS Sampling Summary
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

Site/Well ID	Installation Date	Well Permit #	Y Coord. (North)	X Coord. (East)	Depth (ft. bgs)	Casing Length (ft)	Screen Length (ft)	TOC Elevation (ft)	Gauge Time	PID Reading (ppm)	Gauged Depth to Water (ft. TOC)	Gauged Depth to Bottom (ft. TOC)	Calculated Groundwater Elevation (ft)	Well Sampled this Event
Shallow Monitoring Wells														
108MW01	6/13/1993	29-29739	541684.19	623725.94	13.0	3.0	10.0	10.76	14:58	0.0	2.00	9.60	8.76	
108MW02	6/14/1993	29-29740	541706.21	623800.79	13.0	3.0	10.0	9.80	14:42	0.0	5.45	14.20	4.35	
108MW03	6/13/1993	29-29741	541636.38	623762.37	13.0	3.0	10.0	7.07	14:30	0.0	3.46	10.51	3.61	
108MW04	8/16/1995	29-33762	541737.89	623706.93	12.0	2.0	10.0	8.40	14:50	0.0	1.08	12.00	7.32	11/20/2015

Notes:
1) The synoptic round of water levels in the wells was collected on October 2, 2015.
2) Information on well permit number, X and Y coordinates, depth, screen length, screen interval and TOC elevation were provided by FTMM in a table in June 2013.
3) ft = feet
4) DTW = depth to water (measured from the top of well casing)
5) DTB = depth to bottom of well (measured from the top of well casing)
6) bgs = below ground surface
7) ppm = parts per million (of VOCs)
8) TOC = Top of Casing
9) Elevation = feet above mean sea level
10) N/A = information not available
11) LFPS = Low-Flow Purging and Sampling

Table 2
Historical Groundwater Analytical Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

				108MW01																											
Round No.	**NJDEP GWQS**	**USEPA MCL**	**Weston 1995 Background (Main Post)**	44		44 Dup		45		45 Dup		46		46 Dup		47		47 Dup		48		48 Dup		49		49 Dup		50	
Date Collected				8/3/2007		8/3/2007		12/3/2007		12/3/2007		3/6/2008		3/6/2008		4/30/2008		4/30/2008		8/6/2008		8/6/2008		10/15/2008		10/15/2008		2/17/2009	
ANALYTE / Lab ID				70293.03		70293.02		70502.03		70502.02		80070.03		80070.02		80144.03		80144.02		80282.03		80282.02		80370.03		80370.02		90057.03	
Metals (µg/L)																															
Antimony	6	6	20.7	**0.955**	ER	ND		ND		ND		ND		ND		**3.13**	ER	**1.57**	ER	**1.69**	ER	ND		ND		ND		**11.4**	
Arsenic	3	10	89.3	**10.1**		**7.67**		ND		ND		**4.32**		ND		**3.82**	ER	ND		**4.5**	ER	**5.03**		**7.7**		**6.93**		**11.7**	
Barium	6,000	2,000	699	**41.8**		**40.8**		**22.3**		**21.7**		**29.6**		**29**		**29.7**		**3.13**	ER	**46.8**		**47.6**		**62.5**		**56.1**		**41.8**	
Beryllium	1	4	2.1	ND		ND		ND		ND		ND		ND		**0.237**	ER	**0.282**	ER	ND		ND		**0.41**	ER	**0.379**	ER	ND	
Cadmium	4	5	9.5	ND		ND		ND		**0.321**	ER	**0.229**	ER	**0.235**	ER	**0.409**	ER	**0.345**	ER	**0.37**	ER	**0.447**	ER	**0.644**	ER	**0.581**	ER	ND	
Chromium	70	100	191	**0.917**	ER	**0.259**	ER	**1.29**	ER	**1.19**	ER	**1.47**	ER	**1.13**	ER	**5.39**		**1.42**	ER	**0.962**	ER	**0.96**	ER	**15.8**		**6.62**		**1.07**	ER
Copper	1,300	1,300 *	65.6	**3.49**	ER	**2.77**	ER	**1.58**	ER	**1.93**	ER	**9.84**	ER	**9.91**		**2.82**	ER	**4.49**	ER	**1.49**	ER	**2.35**	ER	**13.3**		**9.61**		**7.85**	
Lead	5	15	22.7	ND		ND		**0.955**	ER	**1.47**	ER	**4.85**	ER	**4.25**	ER	**5.43**		**10.9**		**2.45**	ER	**4.41**	ER	**30.8**		**20.9**		**16.1**	
Mercury	2	2	0.26	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Nickel	100	NLE	187	ND		**0.336**	ER	ND		ND		**6.12**		**6.71**		**2.74**	ER	**1.97**	ER	**0.931**	ER	**0.993**	ER	**2.12**	ER	**1.18**	ER	ND	
Selenium	40	50	29.6	**9.86**	ER	**10.3**		ND		**5.03**	ER	ND		ND		**10.2**		**8.67**	ER	**11.5**		**11.2**		**5.63**	ER	**4.33**	ER	**113**	
Thallium	2	2	5.5	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

Notes:

Detections are bolded

Shaded cells = concentrations exceed the NJDEP GWQS

NJDEP Ground Water Quality Criteria as per N.J.A.C. 7:9-6 (July 27, 2007)

USEPA MCL = U.S. Environmental Protection Agency Maximum Contaminant Level (2012)

* Value is the USEPA Action Level.

J - Estimated concentration exceeds the MDL and is less than the RL

NLE = No limit established

ND - Not detected

NR - Not reported

ER = Estimated result

LF = Low-flow sampling method used to collect sample

DUP = field duplicate sample

Table 2
Historical Groundwater Analytical Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

				108MW01																							
Round No.			**Weston 1995**	51		52		53		LF3		LF4		LF4 Dup		LF5		LF6	LF7	LF8	LF9	44		45		46	
Date Collected	**NJDEP GWQS**	**USEPA MCL**	**Background (Main Post)**	6/30/2009		8/28/2009		11/6/2009		2/19/2010		5/10/2010		5/10/2010		8/19/2010		11/22/2010	2/18/2011	5/3/2011	8/19/2011	8/3/2007		12/3/2007		3/6/2008	
ANALYTE / Lab ID				90270.03		90362.03		90439.03		10062.03		10180.03		10180.02		10352.03		1050204	1106006	1118802	1135006	70293.04		70502.04		80070.04	
Metals (µg/L)																											
Antimony	6	6	20.7	**6.94**	ER	**7.06**	ER	**6.34**	ER	ND		**12.1**		**10.7**		**8.82**	ER	< 4.7	< 6	< 6	< 6	ND		ND		ND	
Arsenic	3	10	89.3	**28.2**		**32.1**		**10.32**		**2.33**	ER	**2.61**	ER	**2.91**	ER	**3.16**	ER	**1.19**	< 3	< 3	**15.6**	**6.33**		ND		**5.52**	
Barium	6,000	2,000	699	**34.5**		**43.7**		**44.7**		**14.3**		**23.7**		**23.9**		**46.2**		**36**	< 200	< 200	< 200	**42.3**		**26.4**		**38.5**	
Beryllium	1	4	2.1	ND		**0.06**	ER	**0.108**	ER	ND		ND		ND		ND		< 0.4	< 1	< 1	< 1	ND		ND		ND	
Cadmium	4	5	9.5	ND		ND		ND		ND		ND		ND		ND		< 0.4	< 3	< 3	< 3	**0.484**	ER	ND		**0.406**	ER
Chromium	70	100	191	ND		ND		**5.77**		**2.88**	ER	**1.8**	ER	**1.75**	ER	ND		< 0.6	< 10	< 10	< 10	**1.12**	ER	**1.15**	ER	**1.14**	ER
Copper	1,300	1,300 *	65.6	**5.68**		**6.23**		**7.58**		**3.11**	ER	**1.95**	ER	**1.85**	ER	**3.95**	ER	**0.986**	< 10	**13.1**	< 10	**9.9**		**6.92**		**19.5**	
Lead	5	15	22.7	**2.9**	ER	**10.4**		**26**		ND		ND		ND		**6.91**		< 2.1	< 3	**3.3**	< 3	**2.05**	ER	**3.07**	ER	**6.73**	
Mercury	2	2	0.26	ND		ND		ND		ND		**0.12**	ER	**0.12**	ER	ND		**3.97**	< 0.2	< 0.2	< 0.2	ND		ND		ND	
Nickel	100	NLE	187	**2.78**	ER	**1.01**	ER	**2.32**	ER	**0.779**	ER	**1.02**	ER	**1.27**	ER	**1.21**	ER	**1.49**	< 10	< 10	< 10	**1.84**	ER	ND		**7.11**	
Selenium	40	50	29.6	**40.8**		**77.9**		**13.6**	ER	**45**		NR		NR		**103**		**3.97**	< 10	< 10	< 10	**7.23**	ER	ND		ND	
Thallium	2	2	5.5	ND		ND		ND		ND		ND		ND		ND		< 0.53	< 2	< 2	< 2	ND		ND		ND	

Notes:

Detections are bolded

Shaded cells = concentrations exceed the NJDEP GWQS

NJDEP Ground Water Quality Criteria as per N.J.A.C. 7:9-6 (July 27, 2007)

USEPA MCL = U.S. Environmental Protection Agency Maximum Contaminant Level (2012)

* Value is the USEPA Action Level.

J - Estimated concentration exceeds the MDL and is less than the RL

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LF = Low-flow sampling method used to collect sample

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Table 2
Historical Groundwater Analytical Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

				108MW02																												108MW03	
Round No.			**Weston 1995**	47		48		49		50		51		52		53		LF3		LF4		LF5		LF6		LF7	LF8	LF9				44	
Date Collected	**NJDEP GWQS**	**USEPA MCL**	**Background**	4/30/2008		8/6/2008		10/15/2008		2/17/2009		6/30/2009		8/28/2009		11/6/2009		2/19/2010		5/7/2010		8/19/2010		11/19/2010		2/18/2011	5/3/2011	8/19/2011				8/3/2007	
ANALYTE / Lab ID			**(Main Post)**	80144.04		80282.04		80370.04		90057.04		90270.04		90362.04		90439.04		10062.04		10178.04		10352.02		1050104		1106004	1118803	1135004				70293.05	
Metals (µg/L)																																	
Antimony	6	6	20.7	ND		ND		**1.65**	ER	**18.2**		**4.62**	ER	**5.71**	ER	ND		**6.48**	ER	**6.32**	ER	**9.33**	ER	**6.54**		< 6	< 6	< 6				ND	
Arsenic	3	10	89.3	ND		**13.8**		**19.6**		**81.2**		**25.1**		**58.2**		**6.42**		**9.18**		**2.64**	ER	**6.68**		**4.24**		< 3	**15.9**	**12.3**				**10.6**	
Barium	6,000	2,000	699	**39.5**		**53**		**74.3**		**40.1**		**55.1**		**94.1**		**67.8**		**50.2**		**47.3**		**62.1**		**74**		< 200	< 200	< 200				**24.7**	
Beryllium	1	4	2.1	**0.133**	ER	ND		**0.236**	ER	ND		ND		**0.337**	ER	ND		**0.11**	ER	ND		ND		< 0.4		< 1	< 1	< 1				ND	
Cadmium	4	5	9.5	**0.331**	ER	**1.57**	ER	**0.46**	ER	ND		ND		**2.25**		ND		**0.505**	ER	ND		**1.33**	ER	**0.888**		< 3	< 3	< 3				**0.226**	ER
Chromium	70	100	191	**0.969**	ER	**1.9**	ER	**14.3**		**3.28**	ER	**6.1**		**5.34**		ND		**16.2**		**2.61**	ER	ND		< 0.6		**15.4**	**22.7**	**12.2**				**0.758**	ER
Copper	1,300	1,300 *	65.6	**7.75**		**3.5**	ER	**18.1**		**9.93**		**11.7**		**2.72**	ER	**3.25**	ER	**9.64**		**4.26**	ER	**7.72**		**1.7**		**12.5**	**31.9**	**12.5**				**11.3**	
Lead	5	15	22.7	**2.54**	ER	**5.59**		**7.42**		**12.6**		**6.2**		**16**		**2.82**	ER	**7.6**		ND		**5**		< 2.1		**5.6**	**14.5**	**4.5**				ND	
Mercury	2	2	0.26	ND		ND		ND		ND		ND		ND		ND		ND		**0.14**	ER	ND		< 0.254		< 0.2	< 0.2	< 0.2				ND	
Nickel	100	NLE	187	**2.54**	ER	**2.55**	ER	**2.51**	ER	ND		**4.56**	ER	**4.69**	ER	**1.66**	ER	**2.89**	ER	**1.58**	ER	**4.45**	ER	**2.8**		< 10	< 10	< 10				ND	
Selenium	40	50	29.6	**6.63**	ER	**4.6**	ER	ND		**85.1**		35.5		**116**		**9.21**	ER	**55**		NR		**94.8**		< 1.36		< 10	< 10	< 10				**5.3**	ER
Thallium	2	2	5.5	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		< 0.53		< 2	< 2	< 2				ND	

Notes:

Detections are bolded

Shaded cells = concentrations exceed the NJDEP GWQS

NJDEP Ground Water Quality Criteria as per N.J.A.C. 7:9-6 (July 27, 2007)

USEPA MCL = U.S. Environmental Protection Agency Maximum Contaminant Level (2012)

* Value is the USEPA Action Level.

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Table 2
Historical Groundwater Analytical Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

				108MW03																															
Round No.	**NJDEP GWQS**	**USEPA MCL**	**Weston 1995 Background (Main Post)**	45		46		47		48		49		50		51		52		53		LF3		LF4		LF5		LF6	LF6 Dup	LF7
Date Collected				12/3/2007		3/6/2008		4/30/2008		8/6/2008		10/15/2008		2/17/2009		6/30/2009		8/28/2009		11/6/2009		2/19/2010		5/7/2010		8/19/2010		11/22/2010	11/22/2010	2/18/2011
ANALYTE / Lab ID				70502.05		80070.05		80144.05		80282.05		80370.05		90057.05		90270.05		90362.05		90439.05		10062.05		10178.05		10352.04		1050203	1050202	1106005
Metals (µg/L)																																			
Antimony	6	6	20.7	ND		**0.804**	ER	ND		ND		ND		**19.5**		**8.73**	ER	ND		ND		**8.66**	ER	**7.64**	ER	**7.97**	ER	< 4.7	< 4.7	< 6
Arsenic	3	10	89.3	**3.13**	ER	**5.86**		**2.47**	ER	**6.6**		**13.8**		**124**		**35.7**		**37.7**		**6.54**		**2.31**	ER	**4.13**	ER	**9.1**		**2.83**	**2.59**	< 3
Barium	6,000	2,000	699	**13.9**		**31.8**		**14.7**		**16**		**35.7**		**36.5**		**105**		**41.3**		**27.6**		**32.7**		**33.4**		**27.4**		**14.8**	**14.7**	< 200
Beryllium	1	4	2.1	ND		ND		**0.111**	ER	ND		**0.411**	ER	ND		ND		ND		ND		ND		ND		ND		< 0.4	< 0.4	< 1
Cadmium	4	5	9.5	**0.394**	ER	**1.33**	ER	**0.607**	ER	**0.627**	ER	**1.97**	ER	**0.565**	ER	**0.541**	ER	ND		ND		ND		ND		ND		< 0.4	< 0.4	< 3
Chromium	70	100	191	**0.877**	ER	**1.96**	ER	**1.32**	ER	**2.52**	ER	**26.8**		**0.583**	ER	ND		ND		ND		ND		ND		ND		**2.73**	**1.47**	< 10
Copper	1,300	1,300 *	65.6	**18.7**		**29.5**		**19.4**		**5.32**		**60.3**		**9.81**		**8.49**		**2.22**	ER	ND		**4.27**	ER	**2.55**	ER	**4.7**	ER	**5.31**	**2.98**	< 10
Lead	5	15	22.7	**2.69**	ER	**1.19**	ER	**5.26**		**1.39**	ER	**12.5**		**4.98**	ER	**1.61**	ER	**2.43**	ER	ND		ND		ND		ND		< 2.1	< 2.1	< 3
Mercury	2	2	0.26	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		**0.14**	ER	ND		< 0.254	< 0.254	< 0.2
Nickel	100	NLE	187	ND		**6.37**		**2.55**	ER	**0.631**	ER	**5.43**		ND		**2.48**	ER	**0.617**	ER	**1.95**	ER	**1.12**	ER	**1.27**	ER	**1.23**	ER	**0.789**	**1.17**	< 10
Selenium	40	50	29.6	**3.68**	ER	ND		**3.92**	ER	**4**	ER	**3.38**	ER	**107**		**46.4**		**73.1**		ND		**55.2**		NR		**70.4**		**1.67**	< 1.36	< 10
Thallium	2	2	5.5	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		< 0.53	< 0.53	< 2

Notes:

Detections are bolded

Shaded cells = concentrations exceed the NJDEP GWQS

NJDEP Ground Water Quality Criteria as per N.J.A.C. 7:9-6 (July 27, 2007)

USEPA MCL = U.S. Environmental Protection Agency Maximum Contaminant Level (2012)

* Value is the USEPA Action Level.

J - Estimated concentration exceeds the MDL and is less than the RL

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Table 2
Historical Groundwater Analytical Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

				108MW03		108MW04																									
Round No.			**Weston 1995**	LF8	LF9	45		46		47		48		49		50		51		51 Dup		52		52 Dup		53		53 Dup		54	
Date Collected	**NJDEP GWQS**	**USEPA MCL**	**Background (Main Post)**	5/11/2011	8/19/2011	8/3/2007		12/3/2007		3/6/2008		4/30/2008		8/6/2008		10/15/2008		2/17/2009		2/17/2009		6/30/2009		6/30/2009		8/28/2009		8/28/2009		11/6/2009	
ANALYTE / Lab ID				1120401	1135005	70293.06		70502.06		80070.06		80144.06		80282.06		80370.06		90057.06		90057.02		90270.06		90270.02		90362.06		90362.02		90439.06	
Metals (µg/L)																															
Antimony	6	6	20.7	< 6	< 6	ND		ND		ND		ND		ND		ND		**7.85**	ER	**14**		**1.35**	ER	**7.37**		**7.58**	ER	**7.4**	ER	ND	
Arsenic	3	10	89.3	**4.9**	**3.3**	**6.59**		**4.17**	ER	**4.54**	ER	**9.53**		**4.92**	ER	**3.23**	ER	**52.9**		**72.9**		**19.2**		**22.6**		**31.9**		**36.1**		**9.73**	
Barium	6,000	2,000	699	< 200	< 200	**36.5**		**9.99**		**7.68**		**8.87**		**9.76**		**18**		**14.6**		**13.8**		**33.1**		**36.9**		**40.8**		**44.8**		**10.8**	
Beryllium	1	4	2.1	< 1	< 1	ND		ND		ND		**0.147**	ER	ND		**0.281**	ER	ND		ND		**0.418**	ER	**0.669**	ER	ND		ND		ND	
Cadmium	4	5	9.5	< 3	< 3	ND		ND		ND		ND		**0.323**	ER	**0.352**	ER	ND		**0.695**	ER	**0.63**	ER	**0.377**	ER	ND		ND		ND	
Chromium	70	100	191	< 10	< 10	ND		**1.81**	ER	**1.2**	ER	**0.613**	ER	**1.91**	ER	**9.47**		**1.57**	ER	**2.76**	ER	**30.4**		**72.5**		**6.02**		**5.85**		**3.41**	ER
Copper	1,300	1,300 *	65.6	< 10	< 10	**30.4**		**29.8**		**18.3**		**5.25**		**7.9**		**25.3**		**18.5**		**11.7**		81.8		**59.4**		**19.1**		**11.9**		**11.7**	
Lead	5	15	22.7	< 3	**4.7**	ND		**6.49**		ND		ND		ND		**5.38**		**9.74**		**1.71**	ER	**25.1**		**22.7**		**5.26**		**4.04**	ER	**3.55**	ER
Mercury	2	2	0.26	< 0.2	< 0.2	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Nickel	100	NLE	187	< 10	< 10	**0.665**	ER	ND		**5.78**		**1.58**	ER	**0.824**	ER	**1.32**	ER	ND		**1.96**	ER	**5.16**		**5.58**		**0.42**	ER	**0.572**	ER	**1.37**	ER
Selenium	40	50	29.6	< 10	< 10	**9.78**	ER	**3.9**	ER	ND		**3.12**	ER	**3.68**	ER	**6.99**	ER	**71.8**		**43.4**		**17**		**10.4**		**89.2**		**81.4**		**8.1**	ER
Thallium	2	2	5.5	< 2	< 2	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

Notes:
Detections are bolded
Shaded cells = concentrations exceed the NJDEP GWQS
NJDEP Ground Water Quality Criteria as per N.J.A.C. 7:9-6 (July 27, 2007)
USEPA MCL = U.S. Environmental Protection Agency Maximum Contaminant Level (2012)
* Value is the USEPA Action Level.
J - Estimated concentration exceeds the MDL and is less than the RL
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Table 2
Historical Groundwater Analytical Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

				108MW04																		
Round No.	**NJDEP GWQS**	**USEPA MCL**	**Weston 1995 Background (Main Post)**	54 Dup		LF3		LF3 Dup		LF4		LF4 Dup		LF5		LF6	LF6 Dup	LF7	LF7 Dup	LF8	LF9	LF9 Dup
Date Collected				11/6/2009		2/19/2010		2/19/2010		5/7/2010		5/7/2010		8/19/2010		11/19/2010	11/19/2010	2/18/2011	2/18/2011	5/3/2011	8/19/2011	8/19/2011
ANALYTE / Lab ID				90439.02		10062.06		10062.02		10178.03		10178.02		10352.01		1050103	1050102	1106003	1106002	1118801	1135003	1135002
Metals (µg/L)																						
Antimony	6	6	20.7	ND		ND		ND		ND		**6.414**	ER	**7.91**	ER	< 4.7	< 4.7	< 6	< 6	< 6	< 6	< 6
Arsenic	3	10	89.3	**8.69**		**7.23**		**6.5**		**5.02**		**5.19**		**1.79**	ER	**1.91**	**1.95**	**17.7**	**9.4**	**4.3**	**34**	**21.8**
Barium	6,000	2,000	699	**11.2**		**5.72**		**6.03**		**14.8**		**17.4**		**29**		**26.3**	**25.5**	< 200	< 200	< 200	< 200	< 200
Beryllium	1	4	2.1	ND		ND		ND		ND		**0.07**	ER	ND		< 0.4	< 0.4	< 1	< 1	< 1	**1.1**	< 1
Cadmium	4	5	9.5	ND		ND		ND		ND		ND		ND		< 0.4	< 0.4	< 3	< 3	< 3	< 3	< 3
Chromium	70	100	191	**8.51**		**3.35**	ER	**3.92**	ER	**7.14**		**10.7**		ND		**1.28**	**0.641**	**62.1**	**28.2**	**21.4**	**131**	**92.6**
Copper	1,300	1,300 *	65.6	**8.03**		**7.5**		**7.22**		**8.56**		**10.6**		**5.26**		**1.99**	**1.53**	170	70.7	**14.2**	207	122
Lead	5	15	22.7	**2.98**	ER	ND		ND		**3.72**	ER	**4.7**	ER	ND		< 2.1	< 2.1	**76.4**	**48.5**	**4**	**101**	**60.5**
Mercury	2	2	0.26	ND		ND		ND		**0.12**	ER	**0.14**	ER	ND		< 0.254	< 0.254	< 0.2	< 0.2	< 0.2	0.36	**0.23**
Nickel	100	NLE	187	**1.58**	ER	**0.89**	ER	**0.796**	ER	**1.65**	ER	**2.46**	ER	**1.05**	ER	**1.11**	< 0.70	**15.6**	< 10	< 10	**23**	**17.4**
Selenium	40	50	29.6	**9.61**	ER	**24.5**		**13.5**		NR		NR		**73.5**		**2.65**	**2.38**	< 10	< 10	< 10	**14**	**10.1**
Thallium	2	2	5.5	ND		ND		ND		ND		ND		ND		< 0.53	< 0.53	< 2	< 2	< 2	< 2	< 2

Notes:
Detections are bolded
Shaded cells = concentrations exceed the NJDEP GWQS
NJDEP Ground Water Quality Criteria as per N.J.A.C. 7:9-6 (July 27, 2007)
USEPA MCL = U.S. Environmental Protection Agency Maximum Contaminant Level (2012)
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Table 3
Groundwater Analytical Results - 2013, 2014, 2015
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

Loc ID	NJDEP GWQS	2015-06 USEPA MCL	108MW01	108MW02	108MW03	108MW04		
Sample ID			FTMM-57-GW-108MW01	FTMM-57-GW-108MW02	FTMM-57-GW-108MW03	FTMM-57-GW-108MW04	FTMM-57-GW-108MW04-8.25	FTMM-57-GW-108MW04-7.5
Sample Date			8/19/2013	8/19/2013	8/19/2013	8/19/2013	10/2/2014	11/20/2015
QA/QC			SA	SA	SA	SA	SA	SA
Sample Method			LFPS	LFPS	LFPS	LFPS	LFPS	LFPS
Filtered			Total	Total	Total	Total	Total	Total
Volatile Organic Compounds (µg/l)								
1,1,1,2-Tetrachloroethane	1	NLE	< 1	< 1	< 1	< 1	NA	NA
1,1,1-Trichloroethane	30	200	< 1	< 1	< 1	< 1	NA	NA
1,1,2,2-Tetrachloroethane	1	NLE	< 1	< 1	< 1	< 1	NA	NA
1,1,2-Trichloroethane	3	5	< 1	< 1	< 1	< 1	NA	NA
1,1-Dichloroethane	50	NLE	< 1	< 1	< 1	< 1	NA	NA
1,1-Dichloroethene	1	7	< 1	< 1	< 1	< 1	NA	NA
1,1-Dichloropropene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
1,2,3-Trichlorobenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
1,2,3-Trichloropropane	0.03	NLE	< 1	< 1	< 1	< 1	NA	NA
1,2,4-Trichlorobenzene	9	70	< 1	< 1	< 1	< 1	NA	NA
1,2,4-Trimethylbenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
1,2-Dibromo-3-chloropropane	0.02	0.2	< 1	< 1	< 1	< 1	NA	NA
1,2-Dibromoethane	0.03	0.05	< 1	< 1	< 1	< 1	NA	NA
1,2-Dichlorobenzene	600	600	< 1	< 1	< 1	< 1	NA	NA
1,2-Dichloroethane	2	5	< 1	< 1	< 1	< 1	NA	NA
1,2-Dichloropropane	1	5	< 1	< 1	< 1	< 1	NA	NA
1,3,5-Trimethylbenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
1,3-Dichlorobenzene	600	NLE	< 1	< 1	< 1	< 1	NA	NA
1,3-Dichloropropane	100	NLE	< 1	< 1	< 1	< 1	NA	NA
1,4-Dichlorobenzene	75	75	< 1	< 1	< 1	< 1	NA	NA
2,2-Dichloropropane	100	NLE	< 1	< 1	< 1	< 1	NA	NA
2-Chlorotoluene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Acetone	6,000	NLE	< 5	**2.9 J**	< 5	**1.4 J**	NA	NA
Benzene	1	5	< 1	< 1	< 1	< 1	NA	NA
Bromobenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Bromochloromethane	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Bromodichloromethane	1	80	< 1	< 1	< 1	< 1	NA	NA
Bromoform	4	80	< 1	< 1	< 1	< 1	NA	NA
Carbon tetrachloride	1	5	< 1	< 1	< 1	< 1	NA	NA
Chlorobenzene	50	100	< 1	< 1	< 1	< 1	NA	NA
Chlorodibromomethane	1	80	< 1	< 1	< 1	< 1	NA	NA
Chloroethane	5	NLE	< 1	< 1	< 1	< 1	NA	NA
Chloroform	70	80	< 1	< 1	< 1	< 1	NA	NA
Cis-1,2-Dichloroethene	70	70	< 1	< 1	< 1	< 1	NA	NA
Cis-1,3-Dichloropropene	1	NLE	< 1	< 1	< 1	< 1	NA	NA
Cymene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Dichlorodifluoromethane	1,000	NLE	< 1	< 1	< 1	< 1	NA	NA
Ethyl benzene	700	700	< 1	< 1	< 1	< 1	NA	NA
Hexachlorobutadiene	1	NLE	< 1	< 1	< 1	< 1	NA	NA
Isopropylbenzene	700	NLE	< 1	< 1	< 1	< 1	NA	NA
Meta/Para Xylene	1,000	NLE	< 2	< 2	< 2	< 2	NA	NA
Methyl bromide	10	NLE	< 1	< 1	< 1	< 1	NA	NA
Methyl butyl ketone	300	NLE	< 5	< 5	< 5	< 5	NA	NA
Methyl chloride	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Methyl ethyl ketone	300	NLE	< 1	< 1	< 1	< 1	NA	NA
Methyl isobutyl ketone	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Methyl Tertbutyl Ether	70	NLE	< 1	< 1	< 1	< 1	NA	NA
Methylene chloride	3	5	< 1	< 1	< 1	< 1	NA	NA
Naphthalene	300	NLE	< 1	< 1	< 1	< 1	NA	NA
n-Butylbenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Ortho Xylene	1,000	NLE	< 1	< 1	< 1	< 1	NA	NA
p-Chlorotoluene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Propylbenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
sec-Butylbenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Styrene	100	100	< 1	< 1	< 1	< 1	NA	NA
tert-Butylbenzene	100	NLE	< 1	< 1	< 1	< 1	NA	NA
Tetrachloroethene	1	5	< 1	< 1	< 1	< 1	NA	NA
Toluene	600	1,000	< 1	< 1	< 1	< 1	NA	NA
Total TIC, Volatile	500	NLE	ND	ND	ND	ND	NA	NA
Total Xylenes	1,000	10,000	< 3	< 3	< 3	< 3	NA	NA
Trans-1,2-Dichloroethene	100	100	< 1	< 1	< 1	< 1	NA	NA
Trans-1,3-Dichloropropene	1	NLE	< 1	< 1	< 1	< 1	NA	NA
Trichloroethene	1	5	< 1	< 1	< 1	< 1	NA	NA

Table 3
Groundwater Analytical Results - 2013, 2014, 2015
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

Loc ID	NJDEP GWQS	2015-06 USEPA MCL	108MW01	108MW02	108MW03	108MW04		
Sample ID			FTMM-57-GW-108MW01	FTMM-57-GW-108MW02	FTMM-57-GW-108MW03	FTMM-57-GW-108MW04	FTMM-57-GW-108MW04-8.25	FTMM-57-GW-108MW04-7.5
Sample Date			8/19/2013	8/19/2013	8/19/2013	8/19/2013	10/2/2014	11/20/2015
QA/QC			SA	SA	SA	SA	SA	SA
Sample Method			LFPS	LFPS	LFPS	LFPS	LFPS	LFPS
Filtered			Total	Total	Total	Total	Total	Total
Trichlorofluoromethane	2,000	NLE	< 1	< 1	< 1	< 1	NA	NA
Vinyl chloride	1	2	< 1	< 1	< 1	< 1	NA	NA
Pesticides (µg/l)								
4,4'-DDD	0.1	NLE	< 0.039	< 0.039	< 0.039	< 0.039	NA	NA
4,4'-DDE	0.1	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
4,4'-DDT	0.1	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Aldrin	0.04	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Alpha-BHC	0.02	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Alpha-Chlordane	0.5	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Beta-BHC	0.04	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Delta-BHC	100	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Dieldrin	0.03	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Endosulfan I	40	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Endosulfan II	40	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Endosulfan sulfate	40	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Endrin	2	2	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Endrin aldehyde	100	2	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Endrin ketone	100	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Gamma-BHC/Lindane	0.03	0.2	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
gamma-Chlordane	NLE	NLE	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Heptachlor	0.05	0.4	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Heptachlor epoxide	0.2	0.2	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Methoxychlor	40	40	< 0.025	< 0.025	< 0.025	< 0.025	NA	NA
Toxaphene	2	3	< 0.5	< 0.5	< 0.5	< 0.5	NA	NA
Inorganics (µg/l)								
Aluminum	200	NLE	**606**	**94.8 J**	**169**	**33.6 J**	NA	NA
Antimony	6	6	**4.4 J**	< 4	**2.5 J**	< 4	NA	NA
Arsenic	3	10	< 5	**9 J**	**5.4 J**	< 5	NA	**2 J**
Barium	6,000	2,000	**38.3**	**43.1**	**22.6**	**23**	NA	NA
Beryllium	1	4	< 0.3	< 0.3	< 0.3	< 0.3	NA	NA
Cadmium	4	5	< 0.4	< 0.4	< 0.4	< 0.4	NA	< 2.5
Calcium	NLE	NLE	**67,500**	**37,700**	**31,700**	**51,200**	NA	NA
Chromium	70	100	**5.3**	**3.9**	**2**	**1.8**	NA	NA
Cobalt	100	NLE	< 1	**1.2 J**	< 1	< 1	NA	NA
Copper	1,300	1,300	**8.4 J**	**2.9 J**	**5 J**	**3.4 J**	NA	NA
Iron	300	NLE	**3,230**	**14,700**	**1,820**	**98.8 J**	NA	NA
Lead	5	15	**2.5 J**	< 2	< 2	< 2	< 2.5	< 2.5
Magnesium	NLE	NLE	**5,190**	**8,290**	**3,670**	**4,370**	NA	NA
Manganese	50	NLE	**19.8**	**363**	**52.3**	**1.5 J**	NA	NA
Mercury	2	2	< 0.08	< 0.08	< 0.08	< 0.08	NA	NA
Nickel	100	NLE	< 5	**3.5 J**	< 5	< 5	NA	NA
Potassium	NLE	NLE	**8,520**	**2,970**	**6,100**	**4,540**	NA	NA
Selenium	40	50	**6.4 J**	**3.6 J**	**4 J**	**4.4 J**	NA	NA
Silver	40	NLE	**0.893 J**	**0.545 J**	**0.773 J**	**0.601 J**	NA	NA
Sodium	50,000	NLE	**64,700**	**102,000**	**81,800**	**6,930**	NA	NA
Thallium	2	2	< 10	< 10	< 10	< 10	NA	NA
Vanadium	NLE	NLE	**6.4**	**12.3**	**11.2**	**2.3 J**	NA	NA
Zinc	2,000	NLE	**86.2**	**3 J**	**30.5**	**19 J**	NA	NA

Table 3
Groundwater Analytical Results - 2013, 2014, 2015
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

Footnote:

1) All historical data collected prior to 2013 are reported as provided by others.

2) Number of Analyses is the number of detected and non-detected results excluding rejected results. Sample duplicate pairs have not been averaged.

3) NLE = no limit established.

4) ND = not detected in any background sample, no background concentration available.

5) Chemical result qualifiers are assigned by the laboratory and is typically evaluated and modified (if necessary) by during data validation.

[blank] = detect, i.e. detected chemical result value.
B = Compound detected in the sample and its associated blank sample.
R = Rejected, data validation rejected the results.
U = non-detect, i.e. not detected equal to or above this value.
U-DL = Elevated sample detection limit due to difficult sample matrix.
U-ND = Analyte not detected in sample, but no detection or reporting limit provided.
J = estimated (detect or non-detect) value.
E (or ER) = Estimated result.
D = Results from dilution of sample.
J-DL = Elevated sample detection limit due to difficult sample matrix.
JN = Tentatively identified compound, estimated concentration.

6) Chemical results greater than or equal to the action level (depending on criteria) are highlighted based on the Criteria that are present.

- Cell Shade values represent a result that is above the NJ Ground Water Quality Criteria ####

NJDEP Interim Specific GWQC values are presented for the NJ GWQS where there is not a Specific Ground Water Quality Criteria. A full list of compounds is available at (http://www.nj.gov/dep/wms/bwqsa/gwqs_interim_criteria_table.htm).

NJDEP Interim Generic GWQC values are presented for the NJ GWQS where there is not a XXXXX or a NJDEP Interim Specific GWQC. Available at (http://www.nj.gov/dep/wms/bwqsa/gwqs_interim_criteria_table.htm).

- Bold Outline represent a result that is above the USEPA 2014-05 MCL. ###

- Cell Style values represent a result that is above the Weston 1995 Background (Main Post). ###

n/a = all concentrations were less than the detection limit, therefore, no location of maximum value identified.

Dash (-) = only background concentrations for metals are being used as comparison criteria.

7) Criteria action level source document and web address.

- The NJ Ground Water Quality Criteria refers to the NJDEP Groundwater Quality Standards - Adopted July 22, 2010
  http://www.state.nj.us/dep/wms/bwqsa/docs/njac79C.pdf
- The 2014-05 USEPA MCL refers to the USEPA's Region 9 Regional Screening Levels (HQ=1.0) - 5/31/2014 (Last revised)
  http://www.epa.gov/region9/superfund/prg/
- The Weston 1995 Background (Main Post) refers to the FTMM reports.
  NA

8) Wells sampled in the most recent fourth quarter sampling event are highlighted in yellow. Sample ID

Table 4
Review of Historical Groundwater Sampling Results
Site FTMM-57 Building 108 UST Gasoline Release
Annual (Fourth Quarter) 2015 Groundwater Sampling Report
Fort Monmouth, New Jersey

Site Name/ Well ID	Interpretation of Historical and 2015 Results [1]			2015 Evaluation				Retain Analyte/Well (Yes or No)	Rationale
	Chem Class / Analyte	Does it Exceed NJDEP GWQS (Yes or No) (If Yes, identify compound)	Do Metals Exceed FTMM Background Concentration (Yes or No) (If Yes, identify Metal)	Seasonal Effect?[2] (Y/N)	Anomaly? (Y/N)	Exceedance part of overall trend? (Y/N)	Well needed for sentinel purposes? (Y/N)		
FTMM-57, B108									
108MW04	Pb	No	No	No	No	N/A	No	No	Pb not detected in 2015, 2014 or 2013 sampling events. Discontinue sampling.

Notes

1. Has any of the analyte compounds exceeded the NJDEP GWQS in the 2015 data and the 4 previous quarterly data rounds or 2 previous annual rounds?
   a. If yes then keep analyte in LTM list
   b. If no then remove this analyte from LTM list
   c. a and b above may be occasionally superceded on a case-by-case basis, depending on site conditions.
2. Has any of the analyte compounds exceeded the NJDEP GWQS seasonally (winter spring vs. summer fall)?
3. N/A - Not applicable
4. Per the 2/5/15 NJDEP approval letter of the Final 2013 Baseline Groundwater Report, groundwater monitoring wells 108MW01, 108MW02 and 108MW03; were removed from the long- term monitoring sampling program and VOCs, pesticides and metals analysis were discontinued in 2014 with the exception of lead.

FIGURES

LEGEND:

- Shallow Monitoring Well
- Former Building 108
- Municipal Boundary
- Installation Boundary
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Surface Water Feature

N

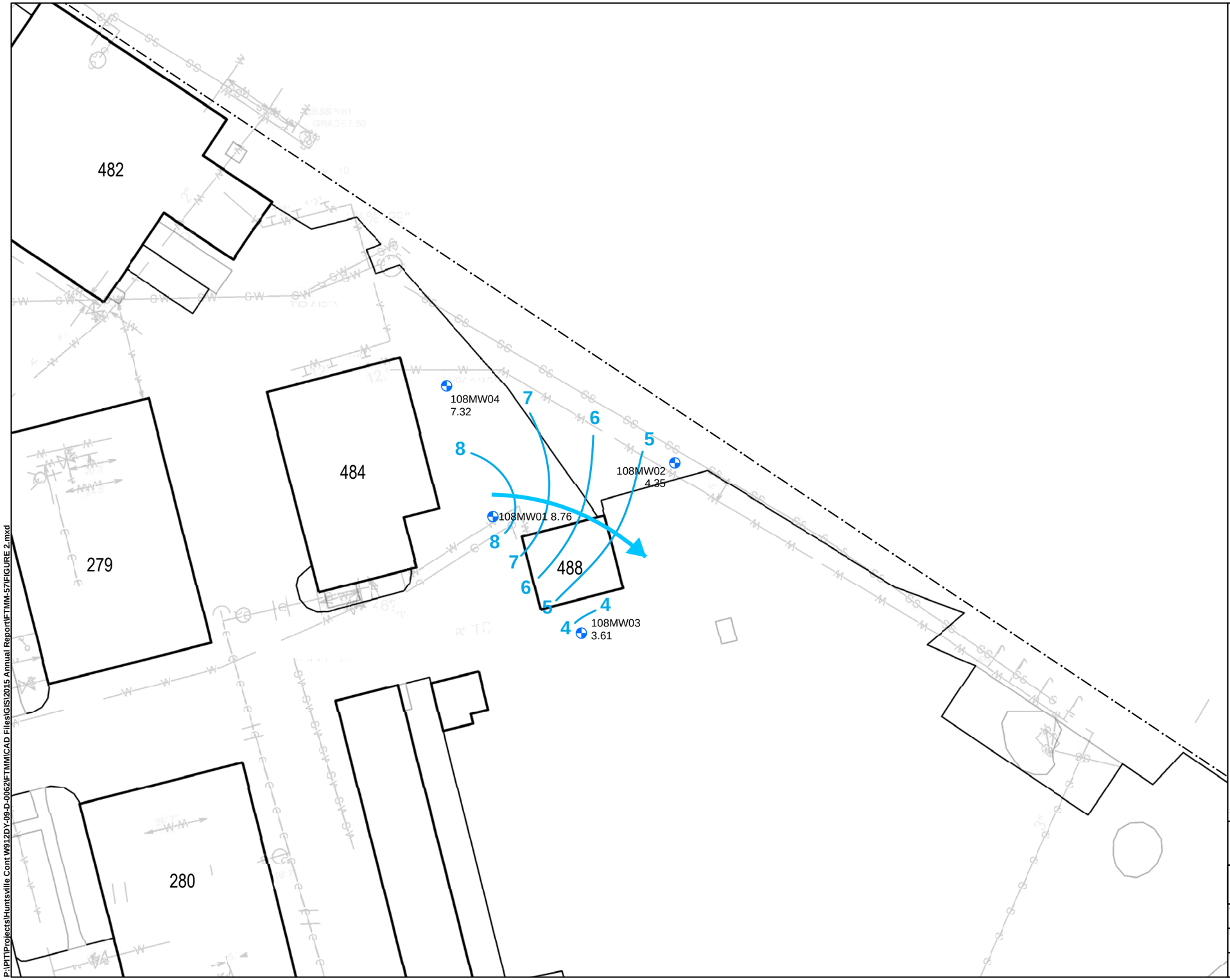
1 inch = 100 feet

0 50 100 200 Feet

Source: FTMM Supplied CAD

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey
LAYOUT OF FTMM-57 BUILDING 108 UST GASOLINE RELEASE	
CREATED BY: RR	REVIEWED BY: ME
DATE: OCT. 2015	FIGURE NUMBER: FIGURE 1
PROJECT NUMBER: 748810-01000	FILE: FIGURE 1.mxd

P:\PIT\Projects\Huntsville Cont W912DY-09-D-0062\FTMM\CAD Files\GIS\2014 Annual Report\FTMM-57\FIGURE 1.mxd



LEGEND:

- Shallow Monitoring Well
- Former Building 108
- Installation Boundary
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Surface Water Feature
- Groundwater Elevation Contour
- Inferred Groundwater Flow Direction

N

1 inch = 40 feet

0 20 40 80 Feet

Source: FTMM Supplied CAD

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey

FTMM-57 SHALLOW GROUNDWATER CONTOURS - OCTOBER 2, 2015

CREATED BY: RR	REVIEWED BY: ME
DATE: MAR. 2016	FIGURE NUMBER: FIGURE 2
PROJECT NUMBER: 748810-01000	FILE: FIGURE 2.mxd

P:\PIT\Projects\Huntsville Cont W912DY-09-D-0062\FTMM\CAD Files\GIS\2015 Annual Report\FTMM-57\FIGURE 2.mxd

ATTACHMENTS

Attachment A LFPS Field Sheets

LOW FLOW GROUND WATER SAMPLING - DATA SHEET

SHEET 1 OF 1

PROJECT SITE/LOCATION: FTMM-57 | CONSULTING FIRM: PARSONS
DATE: 11/20/15 | FIELD PERSONNEL: A. DiIonno
WEATHER: 60°F, Sunny

MONITOR WELL #: 108MW04 | WELL DEPTH: 12.0' feet | PUMP INTAKE DEPTH: 7.5 ft to TOC
WELL PERMIT #: 29-33762 | WELL DIAMETER: 4 inches | SCREENED/OPEN INTERVAL: 2-12 ft to TOC

PID/FID READINGS:
BACKGROUND: 0.0 ppm
BENEATH OUTER CAP: 0.0 ppm
BENEATH INNER CAP: 0.0 ppm

GAUGING/PUMPING INFORMATION:
INITIAL DEPTH TO WATER (BEFORE PUMP INSTALLATION): 3.09 ft to TOC
DEPTH TO PRODUCT: N/A ft to TOC ; PRODUCT THICKNESS: N/A ft
MAKE/MODEL OF PUMP:

WATER QUALITY METER INFORMATION:
INSTRUMENT MAKE/MODEL: YSI 6920
SERIAL #: 01M0724AC
TEMP. CORRECTION VALUE: -0.11°C

Time	PURGING	SAMPLING	pH (units) READING	pH (units) CHANGE	SPECIFIC CONDUCTIVITY (mS/cm) READING	SPECIFIC CONDUCTIVITY (mS/cm) CHANGE	REDOX POTENTIAL (mV) READING	REDOX POTENTIAL (mV) CHANGE	DISSOLVED OXYGEN (mg/L) READING	DISSOLVED OXYGEN (mg/L) CHANGE	TURBIDITY (NTU) READING	TURBIDITY (NTU) CHANGE	TEMPERATURE (degrees C) READING	TEMPERATURE (degrees C) CHANGE	PUMPING RATE (ml/min)	DEPTH TO WATER (ft below TOC)
1543	X		7.11		0.153		121.2		9.89		19.2		16.78		300	3.07
1548	X		7.06		0.135		120.8		8.95		13.4		16.93		300	3.18
1553	X		6.97		0.133		116.5		8.78		13.2		16.97		300	3.19
1558	X		6.99		0.135		112.0		8.75		12.3		16.88		300	3.22
1603	X		6.95		0.142		114.9		8.79		10.3		16.80		300	3.24
1608	X		6.91		0.148		116.8		8.77		10.6		16.79		300	3.25
1613	X	X	6.87		0.149		120.1		8.74		10.8		16.72		300	3.26

SAMPLING INFORMATION:
Sample ID: FTMM-57-GW-108MW04-7.5
Sample Time: 1613
Comments: —

QA/QC INFORMATION:
Duplicate Collected?: NO
MS/MSD Collected?: NO
Filtering?:

ADDITIONAL OBSERVATIONS/COMMENTS:
Clarity: Clear
Odor: None
Other: —

*INDICATOR PARAMETERS HAVE STABILIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
pH: ± 0.1 units ; Spec. Conductivity: ± 3% ; ORP: ± 10mV ; D.O.: ± 10% ; Turbidity: ± 10% (or <1 NTU) ; Temperature: ± 3%. ; Water Level Change: < 0.3 ft

ANALYST NAME & SIGNATURE: Alex DiIonno Alex DiIonno | DATE: 11/20/15
REVIEWER NAME & SIGNATURE: | DATE:

APPENDIX D
2017 Soil Boring Logs

PARSONS Page 1 of 1

Soil Boring Log

CLIENT: USACE
PROJECT NAME: FTMM - ECP
PROJECT LOCATION: FTMM Parcel
PROJECT NUMBER: 748810-

GROUNDWATER OBSERVATIONS
WATER LEVEL: 2.5' (108 MW-04)
DATE: 11-13-17
TIME: 0900
MEAS. FROM: TOC

INSPECTOR: TOM HORN
DRILLER: ECDI WELLS REEVE
WEATHER: OVERCAST 55°F
CONTRACTOR: East Coast Drilling, Inc. (ECDI)
RIG TYPE: Geoprobe(R) ~~7822DT~~ 6610 DT
DATE/TIME START: 11-13-17 / 1250
DATE/TIME FINISH: 11-13-17 / 1400
WEIGHT OF HAMMER: N/A
DROP OF HAMMER: N/A
TYPE OF HAMMER: N/A

BORING/WELL ID: FTMM-57-SB-01
LOCATION DESCRIPTION: GRASSY AREA
LOCATION PLAN: Oceanport, New Jersey

DEPTH (feet)	SAMPLE I.D.	BLOWS per 6"	ADV/ REC.	PID (ppm)	FIELD IDENTIFICATION OF MATERIAL	STRATA	COMMENTS
0			36/60	0.0	MOIST REDDISH-BROWN VF-F SAND, TR M GRAVEL, TR GRASS ROOTS		
				0.0	MOIST YELLOW TAN BROWN MOD LOOSE VF-F SAND SOME C GRAVEL		
1				0.0	MOIST V DENSE BROWN-BLACK SILTY SAND AND ANGULAR GRAVEL		
				0.0			
2				0.0	MOIST OLIVE GRAY BROWN V STIFF SILTY SAND, TR CLAY		
*	FTMM-57-SB-01-2.5-3			0.0			1430
3					NO RECOVERY		
4							
5			48/60	0.0	WET LOOSE DARK TAN-BROWN VF-F SAND		
				0.0	WET VERY SOFT GREEN-GRAY SANDY SILT, TR CLAY, SLIGHT ORGANIC ODOR		
* 6	FTMM-57-SB-01-6-6.5			0.0			1435
				0.0			
7				0.0	WET VERY STIFF GREEN-GRAY ~~SILTY~~ SANDY SILT, TR CLAY.		
				0.0	WET GREENISH-TAN MOD SOFT CLAYEY SILT, TR VF SAND.		
* 8	FTMM-57-SB-01-8-8.5			0.0			1450
				1.0			
9					NO RECOVERY		
10					END OF BORING		

Remarks:

Sample Types	Consistency vs. Blowcount / Foot				
S -- Split-Spoon	Granular (Sand & Gravel)		Fine Grained (Silt & Clay)		and - 35-50%
U -- Undisturbed Tube	V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some - 20-35%
C -- Rock Core	Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little - 10-20%
A -- Auger Cuttings	M. Dense: 10-30		M. Stiff: 4-8	Hard: > 30	trace - <10%
					moisture, density, color, gradation

PARSONS

Soil Boring Log

CLIENT: USACE
PROJECT NAME: FTMM - ECP
PROJECT LOCATION: FTMM Parcel
PROJECT NUMBER: 748810-

GROUNDWATER OBSERVATIONS
WATER LEVEL: 2.5 (108 MW04)
DATE: 11-13-17
TIME: 0900
MEAS. FROM: TOIC

INSPECTOR: TOM HORN
DRILLER: ECDI WELLS REEVE
WEATHER: OVERCAST, 55°F
CONTRACTOR: East Coast Drilling, Inc. (ECDI)
RIG TYPE: Geoprobe(R) ~~7822DT~~ 6610 DT
DATE/TIME START: 11-13-17 / 1330
DATE/TIME FINISH: 11-13-17 / 1345
WEIGHT OF HAMMER: N/A
DROP OF HAMMER: N/A
TYPE OF HAMMER: N/A

BORING/WELL ID: FTMM-57-SB-02
LOCATION DESCRIPTION: GRASSY AREAS
LOCATION PLAN: Oceanport, New Jersey

DEPTH (feet)	SAMPLE I.D.	BLOWS per 6"	ADV/ REC.	PID (ppm)	FIELD IDENTIFICATION OF MATERIAL	STRATA	COMMENTS
0			40/60	0.0	MOIST DK REDDISH BROWN MOD DENSE SILTY SAND W/ GRASS ROOTS		
				0.0	~~DRY~~ MOIST, DK BROWN-YELLOW BROWN		
1				0.0	MOD DENSE SAND		
				0.0	WET ORANGE-YELLOW-BROWN		
* 2	FTMM-57-SB-02-2-2.5			0.0	MOD DENSE SAND		1515
				0.0	↓		
3				0.0			
					NO RECOVERY		
4							
5			40/60	0.0	WET ORANGE-YELLOW-BROWN		
				0.0	MOD LOOSE SAND		
6				0.0	↓		
				0.0	WET GRAY-BROWN SOFT		
* 7	FTMM-57-SB-02-7-7.5			0.0	SANDY SILT, TR. CLAY		1525
				1.0	↓		
* 8	FTMM-57-SB-02-8-8.5			0.0			1530
					NO RECOVERY		
9							
10					END OF BORING		

Remarks:

Sample Types	Consistency vs. Blowcount / Foot				
S – Split-Spoon	Granular (Sand & Gravel)		Fine Grained (Silt & Clay)		and - 35-50%
U – Undisturbed Tube	V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some - 20-35%
C – Rock Core	Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little - 10-20%
A – Auger Cuttings	M. Dense: 10-30		M. Stiff: 4-8	Hard: > 30	trace - <10%
					moisture, density, color, gradation

APPENDIX E

Laboratory Analytical Reports

(included electronically on the CD of this report)

ALS Environmental

34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

November 29, 2017

Ms.Cris Grill
Parsons - Boston MA
100 High St.
4th Floor
Boston, MA 02110

Certificate of Analysis

Project Name:	**Ft. Monmouth Soils**	Workorder:	**2276585**
Purchase Order:		Workorder ID:	**PQF-098|FTMM-57**

Dear Ms.Cris Grill:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, November 14, 2017.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mrs. Vanessa N Badman (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Kent Friesen , Mr. Julien Chambert , Ms. Lorraine Weber

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

ALS Environmental

34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

SAMPLE SUMMARY

Workorder: 2276585 PQF-098|FTMM-57

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2276585001	FTMM-57-SB-01-2.5-3	Solid	11/13/2017 14:30	11/14/2017 20:00	Collected by Client
2276585002	FTMM-57-SB-02-2.5-3	Solid	11/13/2017 15:15	11/14/2017 20:00	Collected by Client
2276585003	FTMM-57-SB-01-6-6.5	Solid	11/13/2017 14:35	11/14/2017 20:00	Collected by Client
2276585004	FTMM-57-SB-01-8-8.5	Solid	11/13/2017 14:50	11/14/2017 20:00	Collected by Client
2276585005	FTMM-57-SB-02-7-7.5	Solid	11/13/2017 15:25	11/14/2017 20:00	Collected by Client
2276585006	FTMM-57-SB-102-7-7.5	Solid	11/13/2017 15:30	11/14/2017 20:00	Collected by Client
2276585007	FTMM-57-SB-02-8-8.5	Solid	11/13/2017 15:30	11/14/2017 20:00	Collected by Client

ALS Environmental

34 Dogwood Lane ▪ Middletown, PA 17057 ▪ Phone: 717-944-5541 ▪ Fax: 717-944-1430 ▪ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

SAMPLE SUMMARY

Workorder: 2276585 PQF-098|FTMM-57

Notes

-- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
-- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
-- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
-- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
-- The Chain of Custody document is included as part of this report.
-- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
-- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
-- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
-- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585001** Date Collected: 11/13/2017 14:30 Matrix: Solid

Sample ID: **FTMM-57-SB-01-2.5-3** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.11		mg/kg	0.0090	0.0045	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Benzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Bromobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Bromochloromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Bromodichloromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Bromoform	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Bromomethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
2-Butanone	0.0093		mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
tert-Butyl Alcohol	0.0034J	J	mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
n-Butylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
tert-Butylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
sec-Butylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Carbon Tetrachloride	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Chlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Chlorodibromomethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Chloroethane	0.0022U	U	mg/kg	0.0045	0.0022	0.00099	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Chloroform	0.00051J	J	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Chloromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
o-Chlorotoluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
p-Chlorotoluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2-Dibromo-3-chloropropane	0.0022U	U	mg/kg	0.0045	0.0022	0.0013	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2-Dibromoethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2-Dichlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,3-Dichlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,4-Dichlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Dichlorodifluoromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1-Dichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2-Dichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1-Dichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
cis-1,2-Dichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
trans-1,2-Dichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,3-Dichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
2,2-Dichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2-Dichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1-Dichloropropene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
cis-1,3-Dichloropropene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585001** Date Collected: 11/13/2017 14:30 Matrix: Solid

Sample ID: **FTMM-57-SB-01-2.5-3** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
trans-1,3-Dichloropropene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Ethylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Hexachlorobutadiene	0.00090U	U	mg/kg	0.0045	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
2-Hexanone	0.0045U	U	mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Isopropylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
p-Isopropyltoluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Methyl t-Butyl Ether	0.00060J	J	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0045U	U	mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Methylene Chloride	0.00090U	U	mg/kg	0.0018	0.00090	0.00054	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Naphthalene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
n-Propylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Styrene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1,1,2-Tetrachloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1,2,2-Tetrachloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Tetrachloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Toluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2,3-Trichlorobenzene	0.00090U	U	mg/kg	0.0045	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2,4-Trichlorobenzene	0.00090U	U	mg/kg	0.0045	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1,1-Trichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,1,2-Trichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Trichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Trichlorofluoromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2,3-Trichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,2,4-Trimethylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
1,3,5-Trimethylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Vinyl Chloride	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
o-Xylene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
mp-Xylene	0.0018U	U	mg/kg	0.0036	0.0018	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	97.6		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
4-Bromofluorobenzene (S)	104		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Dibromofluoromethane (S)	107		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D
Toluene-d8 (S)	110		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 17:07	TMP	D

LIBRARY SEARCH - VOLATILES

No TIC's Detected	.				Lib Search VOC			11/21/17 17:07	CPK	F

SEMIVOLATILES

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ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585001** Date Collected: 11/13/2017 14:30 Matrix: Solid

Sample ID: **FTMM-57-SB-01-2.5-3** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Acenaphthene	0.077U	U	mg/kg	0.11	0.077	0.0069	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Acenaphthylene	0.077U	U	mg/kg	0.11	0.077	0.0080	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Anthracene	0.077U	U	mg/kg	0.11	0.077	0.0092	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Benzo(a)anthracene	0.029J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Benzo(a)pyrene	0.033J	J	mg/kg	0.11	0.077	0.0046	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Benzo(b)fluoranthene	0.039J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Benzo(g,h,i)perylene	0.031J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Benzo(k)fluoranthene	0.018J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Chrysene	0.027J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Dibenzo(a,h)anthracene	0.013J	J	mg/kg	0.11	0.077	0.0069	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Fluoranthene	0.057J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Fluorene	0.077U	U	mg/kg	0.11	0.077	0.0069	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Indeno(1,2,3-cd)pyrene	0.077U	U	mg/kg	0.11	0.077	0.0080	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
2-Methylnaphthalene	0.077U	U	mg/kg	0.31	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Naphthalene	0.077U	U	mg/kg	0.11	0.077	0.0069	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Phenanthrene	0.027J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Pyrene	0.053J	J	mg/kg	0.11	0.077	0.0057	SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	81.3		%	39 - 132			SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
2-Fluorobiphenyl (S)	66.1		%	44 - 115			SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
2-Fluorophenol (S)	70.8		%	35 - 115			SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Nitrobenzene-d5 (S)	68.4		%	37 - 122			SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Phenol-d5 (S)	69.4		%	33 - 122			SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
Terphenyl-d14 (S)	80.6		%	54 - 127			SW846 8270D	11/27/17	VLM	11/27/17 16:39	GEC	A
WET CHEMISTRY												
Moisture	15.8		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	84.2		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	5.9		mg/kg	2.3	1.5	0.78	SW846 6010C	11/28/17	DAG	11/28/17 14:39	SRT	A1

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585002** Date Collected: 11/13/2017 15:15 Matrix: Solid

Sample ID: **FTMM-57-SB-02-2.5-3** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.012		mg/kg	0.0092	0.0046	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Benzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Bromobenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Bromochloromethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Bromodichloromethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Bromoform	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Bromomethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
2-Butanone	0.0046U	U	mg/kg	0.0092	0.0046	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
tert-Butyl Alcohol	0.0032J	J	mg/kg	0.0092	0.0046	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
n-Butylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
tert-Butylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
sec-Butylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Carbon Tetrachloride	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Chlorobenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Chlorodibromomethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Chloroethane	0.0023U	U	mg/kg	0.0046	0.0023	0.0010	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Chloroform	0.00069J	J	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Chloromethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
o-Chlorotoluene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
p-Chlorotoluene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2-Dibromo-3-chloropropane	0.0023U	U	mg/kg	0.0046	0.0023	0.0014	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2-Dibromoethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2-Dichlorobenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,3-Dichlorobenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,4-Dichlorobenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Dichlorodifluoromethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1-Dichloroethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2-Dichloroethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1-Dichloroethene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
cis-1,2-Dichloroethene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
trans-1,2-Dichloroethene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,3-Dichloropropane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
2,2-Dichloropropane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2-Dichloropropane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1-Dichloropropene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
cis-1,3-Dichloropropene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585002** Date Collected: 11/13/2017 15:15 Matrix: Solid

Sample ID: **FTMM-57-SB-02-2.5-3** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
trans-1,3-Dichloropropene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Ethylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Hexachlorobutadiene	0.00092U	U	mg/kg	0.0046	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
2-Hexanone	0.0046U	U	mg/kg	0.0092	0.0046	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Isopropylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
p-Isopropyltoluene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Methyl t-Butyl Ether	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0046U	U	mg/kg	0.0092	0.0046	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Methylene Chloride	0.00092U	U	mg/kg	0.0018	0.00092	0.00055	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Naphthalene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
n-Propylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Styrene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1,1,2-Tetrachloroethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1,2,2-Tetrachloroethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Tetrachloroethene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Toluene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2,3-Trichlorobenzene	0.00092U	U	mg/kg	0.0046	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2,4-Trichlorobenzene	0.00092U	U	mg/kg	0.0046	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1,1-Trichloroethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,1,2-Trichloroethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Trichloroethene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Trichlorofluoromethane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2,3-Trichloropropane	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,2,4-Trimethylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
1,3,5-Trimethylbenzene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Vinyl Chloride	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
o-Xylene	0.00092U	U	mg/kg	0.0018	0.00092	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
mp-Xylene	0.0018U	U	mg/kg	0.0037	0.0018	0.00046	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	98.5		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
4-Bromofluorobenzene (S)	106		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Dibromofluoromethane (S)	108		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D
Toluene-d8 (S)	109		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 17:30	TMP	D

LIBRARY SEARCH - VOLATILES

No TIC's Detected	.				Lib Search VOC			11/21/17 17:30	CPK	F

SEMIVOLATILES

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585002** Date Collected: 11/13/2017 15:15 Matrix: Solid

Sample ID: **FTMM-57-SB-02-2.5-3** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Acenaphthene	0.073U	U	mg/kg	0.11	0.073	0.0065	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Acenaphthylene	0.073U	U	mg/kg	0.11	0.073	0.0076	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Anthracene	0.073U	U	mg/kg	0.11	0.073	0.0087	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Benzo(a)anthracene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Benzo(a)pyrene	0.073U	U	mg/kg	0.11	0.073	0.0044	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Benzo(b)fluoranthene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Benzo(g,h,i)perylene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Benzo(k)fluoranthene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Chrysene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Dibenzo(a,h)anthracene	0.073U	U	mg/kg	0.11	0.073	0.0065	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Fluoranthene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Fluorene	0.073U	U	mg/kg	0.11	0.073	0.0065	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Indeno(1,2,3-cd)pyrene	0.073U	U	mg/kg	0.11	0.073	0.0076	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
2-Methylnaphthalene	0.073U	U	mg/kg	0.29	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Naphthalene	0.073U	U	mg/kg	0.11	0.073	0.0065	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Phenanthrene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Pyrene	0.073U	U	mg/kg	0.11	0.073	0.0054	SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	85.2		%	39 - 132			SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
2-Fluorobiphenyl (S)	72.9		%	44 - 115			SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
2-Fluorophenol (S)	80.2		%	35 - 115			SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Nitrobenzene-d5 (S)	76		%	37 - 122			SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Phenol-d5 (S)	78.9		%	33 - 122			SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
Terphenyl-d14 (S)	87.3		%	54 - 127			SW846 8270D	11/27/17	VLM	11/27/17 17:06	GEC	A
WET CHEMISTRY												
Moisture	12.3		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	87.7		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	3.9		mg/kg	0.71	0.47	0.24	SW846 6010C	11/28/17	DAG	11/28/17 14:46	SRT	A1

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585003** Date Collected: 11/13/2017 14:35 Matrix: Solid

Sample ID: **FTMM-57-SB-01-6-6.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.11		mg/kg	0.0099	0.0050	0.0032	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Benzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Bromobenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Bromochloromethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Bromodichloromethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Bromoform	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Bromomethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
2-Butanone	0.0079J	J	mg/kg	0.0099	0.0050	0.0025	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
tert-Butyl Alcohol	0.012		mg/kg	0.0099	0.0050	0.0025	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
n-Butylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
tert-Butylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
sec-Butylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Carbon Tetrachloride	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Chlorobenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Chlorodibromomethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Chloroethane	0.0025U	U	mg/kg	0.0050	0.0025	0.0011	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Chloroform	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Chloromethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
o-Chlorotoluene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
p-Chlorotoluene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2-Dibromo-3-chloropropane	0.0025U	U	mg/kg	0.0050	0.0025	0.0015	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2-Dibromoethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2-Dichlorobenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,3-Dichlorobenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,4-Dichlorobenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Dichlorodifluoromethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1-Dichloroethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2-Dichloroethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1-Dichloroethene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
cis-1,2-Dichloroethene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
trans-1,2-Dichloroethene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,3-Dichloropropane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
2,2-Dichloropropane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2-Dichloropropane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1-Dichloropropene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
cis-1,3-Dichloropropene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D

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NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585003** Date Collected: 11/13/2017 14:35 Matrix: Solid

Sample ID: **FTMM-57-SB-01-6-6.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
trans-1,3-Dichloropropene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Ethylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Hexachlorobutadiene	0.00099U	U	mg/kg	0.0050	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
2-Hexanone	0.0050U	U	mg/kg	0.0099	0.0050	0.0025	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Isopropylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
p-Isopropyltoluene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Methyl t-Butyl Ether	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0050U	U	mg/kg	0.0099	0.0050	0.0025	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Methylene Chloride	0.00099U	U	mg/kg	0.0020	0.00099	0.00059	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Naphthalene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
n-Propylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Styrene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1,1,2-Tetrachloroethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1,2,2-Tetrachloroethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Tetrachloroethene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Toluene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2,3-Trichlorobenzene	0.00099U	U	mg/kg	0.0050	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2,4-Trichlorobenzene	0.00099U	U	mg/kg	0.0050	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1,1-Trichloroethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,1,2-Trichloroethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Trichloroethene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Trichlorofluoromethane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2,3-Trichloropropane	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,2,4-Trimethylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
1,3,5-Trimethylbenzene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Vinyl Chloride	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
o-Xylene	0.00099U	U	mg/kg	0.0020	0.00099	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
mp-Xylene	0.0020U	U	mg/kg	0.0040	0.0020	0.00050	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	98.4		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
4-Bromofluorobenzene (S)	106		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Dibromofluoromethane (S)	109		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D
Toluene-d8 (S)	110		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 17:53	TMP	D

LIBRARY SEARCH - VOLATILES

No TIC's Detected	.				Lib Search VOC			11/21/17 17:53	CPK	F

SEMIVOLATILES

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585003** Date Collected: 11/13/2017 14:35 Matrix: Solid

Sample ID: **FTMM-57-SB-01-6-6.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Acenaphthene	0.078U	U	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Acenaphthylene	0.078U	U	mg/kg	0.12	0.078	0.0081	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Anthracene	0.078U	U	mg/kg	0.12	0.078	0.0093	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Benzo(a)anthracene	0.078U	U	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Benzo(a)pyrene	0.078U	U	mg/kg	0.12	0.078	0.0047	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Benzo(b)fluoranthene	0.078U	U	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Benzo(g,h,i)perylene	0.078U	U	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Benzo(k)fluoranthene	0.078U	U	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Chrysene	0.078U	U	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Dibenzo(a,h)anthracene	0.078U	U	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Fluoranthene	0.078U	U	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Fluorene	0.078U	U	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Indeno(1,2,3-cd)pyrene	0.078U	U	mg/kg	0.12	0.078	0.0081	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
2-Methylnaphthalene	0.078U	U	mg/kg	0.31	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Naphthalene	0.078U	U	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Phenanthrene	0.014J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Pyrene	0.015J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	83.7		%	39 - 132			SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
2-Fluorobiphenyl (S)	71.2		%	44 - 115			SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
2-Fluorophenol (S)	77.3		%	35 - 115			SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Nitrobenzene-d5 (S)	73.7		%	37 - 122			SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Phenol-d5 (S)	73.9		%	33 - 122			SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
Terphenyl-d14 (S)	83.7		%	54 - 127			SW846 8270D	11/27/17	VLM	11/27/17 17:32	GEC	A
WET CHEMISTRY												
Moisture	17.4		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	82.6		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	4.6		mg/kg	2.4	1.6	0.81	SW846 6010C	11/28/17	DAG	11/28/17 14:50	SRT	A1

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585004** Date Collected: 11/13/2017 14:50 Matrix: Solid

Sample ID: **FTMM-57-SB-01-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.12		mg/kg	0.011	0.0057	0.0037	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Benzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Bromobenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Bromochloromethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Bromodichloromethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Bromoform	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Bromomethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
2-Butanone	0.0071J	J	mg/kg	0.011	0.0057	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
tert-Butyl Alcohol	0.011J	J	mg/kg	0.011	0.0057	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
n-Butylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
tert-Butylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
sec-Butylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Carbon Tetrachloride	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Chlorobenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Chlorodibromomethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Chloroethane	0.0029U	U	mg/kg	0.0057	0.0029	0.0013	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Chloroform	0.0010J	J	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Chloromethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
o-Chlorotoluene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
p-Chlorotoluene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2-Dibromo-3-chloropropane	0.0029U	U	mg/kg	0.0057	0.0029	0.0017	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2-Dibromoethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2-Dichlorobenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,3-Dichlorobenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,4-Dichlorobenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Dichlorodifluoromethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1-Dichloroethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2-Dichloroethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1-Dichloroethene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
cis-1,2-Dichloroethene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
trans-1,2-Dichloroethene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,3-Dichloropropane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
2,2-Dichloropropane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2-Dichloropropane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1-Dichloropropene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
cis-1,3-Dichloropropene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585004** Date Collected: 11/13/2017 14:50 Matrix: Solid

Sample ID: **FTMM-57-SB-01-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
trans-1,3-Dichloropropene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Ethylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Hexachlorobutadiene	0.0011U	U	mg/kg	0.0057	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
2-Hexanone	0.0057U	U	mg/kg	0.011	0.0057	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Isopropylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
p-Isopropyltoluene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Methyl t-Butyl Ether	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0057U	U	mg/kg	0.011	0.0057	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Methylene Chloride	0.0011U	U	mg/kg	0.0023	0.0011	0.00069	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Naphthalene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
n-Propylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Styrene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1,1,2-Tetrachloroethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1,2,2-Tetrachloroethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Tetrachloroethene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Toluene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2,3-Trichlorobenzene	0.0011U	U	mg/kg	0.0057	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2,4-Trichlorobenzene	0.0011U	U	mg/kg	0.0057	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1,1-Trichloroethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,1,2-Trichloroethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Trichloroethene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Trichlorofluoromethane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2,3-Trichloropropane	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,2,4-Trimethylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
1,3,5-Trimethylbenzene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Vinyl Chloride	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
o-Xylene	0.0011U	U	mg/kg	0.0023	0.0011	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
mp-Xylene	0.0023U	U	mg/kg	0.0046	0.0023	0.00057	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	96.6		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
4-Bromofluorobenzene (S)	108		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Dibromofluoromethane (S)	109		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D
Toluene-d8 (S)	110		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 18:17	TMP	D

LIBRARY SEARCH - VOLATILES

No TIC's Detected	.				Lib Search VOC			11/21/17 18:17	CPK	F

SEMIVOLATILES

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585004** Date Collected: 11/13/2017 14:50 Matrix: Solid

Sample ID: **FTMM-57-SB-01-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Acenaphthene	0.083U	U	mg/kg	0.12	0.083	0.0074	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Acenaphthylene	0.083U	U	mg/kg	0.12	0.083	0.0086	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Anthracene	0.083U	U	mg/kg	0.12	0.083	0.0099	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Benzo(a)anthracene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Benzo(a)pyrene	0.083U	U	mg/kg	0.12	0.083	0.0049	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Benzo(b)fluoranthene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Benzo(g,h,i)perylene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Benzo(k)fluoranthene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Chrysene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Dibenzo(a,h)anthracene	0.083U	U	mg/kg	0.12	0.083	0.0074	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Fluoranthene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Fluorene	0.083U	U	mg/kg	0.12	0.083	0.0074	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Indeno(1,2,3-cd)pyrene	0.083U	U	mg/kg	0.12	0.083	0.0086	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
2-Methylnaphthalene	0.083U	U	mg/kg	0.33	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Naphthalene	0.083U	U	mg/kg	0.12	0.083	0.0074	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Phenanthrene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Pyrene	0.083U	U	mg/kg	0.12	0.083	0.0062	SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	74.2		%	39 - 132			SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
2-Fluorobiphenyl (S)	58.9		%	44 - 115			SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
2-Fluorophenol (S)	75		%	35 - 115			SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Nitrobenzene-d5 (S)	67.4		%	37 - 122			SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Phenol-d5 (S)	75		%	33 - 122			SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
Terphenyl-d14 (S)	69.8		%	54 - 127			SW846 8270D	11/27/17	VLM	11/27/17 17:59	GEC	A
WET CHEMISTRY												
Moisture	23.0		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	77.0		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	5.4		mg/kg	2.6	1.7	0.87	SW846 6010C	11/28/17	DAG	11/28/17 14:54	SRT	A1

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585005** Date Collected: 11/13/2017 15:25 Matrix: Solid

Sample ID: **FTMM-57-SB-02-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.064	4,5,6	mg/kg	0.0091	0.0045	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Benzene	0.00091U	U,28	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Bromobenzene	0.00091U	U,62,63	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Bromochloromethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Bromodichloromethane	0.00091U	U,32	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Bromoform	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Bromomethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
2-Butanone	0.0088J	J,16,17	mg/kg	0.0091	0.0045	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
tert-Butyl Alcohol	0.0045U	U,8,9	mg/kg	0.0091	0.0045	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
n-Butylbenzene	0.00091U	U,86,87	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
tert-Butylbenzene	0.00091U	U,72,73	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
sec-Butylbenzene	0.00091U	U,76,77	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Carbon Tetrachloride	0.00091U	U,26,27	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Chlorobenzene	0.00091U	U,46,47,48	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Chlorodibromomethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Chloroethane	0.0023U	U	mg/kg	0.0045	0.0023	0.0010	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Chloroform	0.00091U	U,19	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Chloromethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
o-Chlorotoluene	0.00091U	U,66,67	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
p-Chlorotoluene	0.00091U	U,68,69	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2-Dibromo-3-chloropropane	0.0023U	U,88,89	mg/kg	0.0045	0.0023	0.0014	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2-Dibromoethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2-Dichlorobenzene	0.00091U	U,84,85	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,3-Dichlorobenzene	0.00091U	U,78,79	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,4-Dichlorobenzene	0.00091U	U,80,81	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585005** Date Collected: 11/13/2017 15:25 Matrix: Solid

Sample ID: **FTMM-57-SB-02-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Dichlorodifluoromethane	0.00091U	U,1	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1-Dichloroethane	0.00091U	U,1 4,15	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2-Dichloroethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1-Dichloroethene	0.00091U	U,7	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
cis-1,2-Dichloroethene	0.00091U	U,1 8	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
trans-1,2-Dichloroethene	0.00091U	U,1 2,13	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,3-Dichloropropane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
2,2-Dichloropropane	0.00091U	U,2 0,21	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2-Dichloropropane	0.00091U	U,2 9	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1-Dichloropropene	0.00091U	U,2 4,25	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
cis-1,3-Dichloropropene	0.00091U	U,3 3,34	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
trans-1,3-Dichloropropene	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Ethylbenzene	0.00091U	U,4 9,50 ,51	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Hexachlorobutadiene	0.00091U	U,9 2,93	mg/kg	0.0045	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
2-Hexanone	0.0045U	U,4 0,41	mg/kg	0.0091	0.0045	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Isopropylbenzene	0.00091U	U,6 0,61	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
p-Isopropyltoluene	0.00091U	U,8 2,83	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Methyl t-Butyl Ether	0.00056J	J	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0045U	U,3 5,36	mg/kg	0.0091	0.0045	0.0023	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Methylene Chloride	0.00091U	U,1 0,11	mg/kg	0.0018	0.00091	0.00054	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Naphthalene	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
n-Propylbenzene	0.00091U	U,6 4,65	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Styrene	0.00091U	U,5 5,56	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1,1,2-Tetrachloroethane	0.00091U	U,4 4,45	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1,2,2-Tetrachloroethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Tetrachloroethene	0.00091U	U,4 2,43	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585005** Date Collected: 11/13/2017 15:25 Matrix: Solid

Sample ID: **FTMM-57-SB-02-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Toluene	0.00091U	U,37,38,39	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2,3-Trichlorobenzene	0.00091U	U,94,95	mg/kg	0.0045	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2,4-Trichlorobenzene	0.00091U	U,90,91	mg/kg	0.0045	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1,1-Trichloroethane	0.00091U	U,22,23	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,1,2-Trichloroethane	0.00091U	U	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Trichloroethene	0.00091U	U,30,31	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Trichlorofluoromethane	0.00091U	U,3	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2,3-Trichloropropane	0.00091U	U,59	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,2,4-Trimethylbenzene	0.00091U	U,74,75	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
1,3,5-Trimethylbenzene	0.00091U	U,70,71	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Vinyl Chloride	0.00091U	U,2	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
o-Xylene	0.00091U	U,57,58	mg/kg	0.0018	0.00091	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
mp-Xylene	0.0018U	U,52,53,54	mg/kg	0.0036	0.0018	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	94.7		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
4-Bromofluorobenzene (S)	107		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Dibromofluoromethane (S)	108		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Toluene-d8 (S)	109		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Library Search - Volatiles										
Butane, 2,3-dimethyl-	21.1	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Pentane, 2,4-dimethyl-	8.7	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Hexane, 2,2-dimethyl-	53.5	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Pentane, 2,3,4-trimethyl-	10.5	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
Pentane, 2,3,3-trimethyl-	47.6	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 18:40	TMP	D
SEMIVOLATILES										
Acenaphthene	0.078U	U	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Acenaphthylene	0.078U	U	mg/kg	0.12	0.078	0.0082	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Anthracene	0.020J	J	mg/kg	0.12	0.078	0.0094	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Benzo(a)anthracene	0.065J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585005** Date Collected: 11/13/2017 15:25 Matrix: Solid

Sample ID: **FTMM-57-SB-02-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Benzo(a)pyrene	0.046J	J	mg/kg	0.12	0.078	0.0047	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Benzo(b)fluoranthene	0.084J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Benzo(g,h,i)perylene	0.032J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Benzo(k)fluoranthene	0.022J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Chrysene	0.036J	J	mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Dibenzo(a,h)anthracene	0.016J	J	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Fluoranthene	0.19		mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Fluorene	0.013J	J	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Indeno(1,2,3-cd)pyrene	0.023J	J	mg/kg	0.12	0.078	0.0082	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
2-Methylnaphthalene	0.083J	J	mg/kg	0.32	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Naphthalene	0.046J	J	mg/kg	0.12	0.078	0.0070	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Phenanthrene	0.12		mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Pyrene	0.17		mg/kg	0.12	0.078	0.0058	SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	86.2		%	39 - 132			SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
2-Fluorobiphenyl (S)	76.3		%	44 - 115			SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
2-Fluorophenol (S)	82.8		%	35 - 115			SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Nitrobenzene-d5 (S)	78.2		%	37 - 122			SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Phenol-d5 (S)	81.7		%	33 - 122			SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
Terphenyl-d14 (S)	81.2		%	54 - 127			SW846 8270D	11/27/17	VLM	11/28/17 16:17	GEC	A
WET CHEMISTRY												
Moisture	16.1		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	83.9		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	3.7		mg/kg	2.3	1.5	0.76	SW846 6010C	11/28/17	DAG	11/28/17 14:57	SRT	A1

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585006** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-102-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.072		mg/kg	0.0090	0.0045	0.0029	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Benzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Bromobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Bromochloromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Bromodichloromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Bromoform	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Bromomethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
2-Butanone	0.013		mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
tert-Butyl Alcohol	0.0045U	U	mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
n-Butylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
tert-Butylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
sec-Butylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Carbon Tetrachloride	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Chlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Chlorodibromomethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Chloroethane	0.0022U	U	mg/kg	0.0045	0.0022	0.00098	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Chloroform	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Chloromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
o-Chlorotoluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
p-Chlorotoluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2-Dibromo-3-chloropropane	0.0022U	U	mg/kg	0.0045	0.0022	0.0013	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2-Dibromoethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2-Dichlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,3-Dichlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,4-Dichlorobenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Dichlorodifluoromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1-Dichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2-Dichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1-Dichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
cis-1,2-Dichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
trans-1,2-Dichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,3-Dichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
2,2-Dichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2-Dichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1-Dichloropropene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
cis-1,3-Dichloropropene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585006** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-102-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
trans-1,3-Dichloropropene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Ethylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Hexachlorobutadiene	0.00090U	U	mg/kg	0.0045	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
2-Hexanone	0.0045U	U	mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Isopropylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
p-Isopropyltoluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Methyl t-Butyl Ether	0.00067J	J	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0045U	U	mg/kg	0.0090	0.0045	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Methylene Chloride	0.00090U	U	mg/kg	0.0018	0.00090	0.00054	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Naphthalene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
n-Propylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Styrene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1,1,2-Tetrachloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1,2,2-Tetrachloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Tetrachloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Toluene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2,3-Trichlorobenzene	0.00090U	U	mg/kg	0.0045	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2,4-Trichlorobenzene	0.00090U	U	mg/kg	0.0045	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1,1-Trichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,1,2-Trichloroethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Trichloroethene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Trichlorofluoromethane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2,3-Trichloropropane	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,2,4-Trimethylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
1,3,5-Trimethylbenzene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Vinyl Chloride	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
o-Xylene	0.00090U	U	mg/kg	0.0018	0.00090	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
mp-Xylene	0.0018U	U	mg/kg	0.0036	0.0018	0.00045	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	94.6		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
4-Bromofluorobenzene (S)	106		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Dibromofluoromethane (S)	106		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Toluene-d8 (S)	110		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Library Search - Volatiles										
Butane, 2-methyl-	31.0	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Butane, 2,2-dimethyl-	22.0	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Butane, 2,3-dimethyl-	80.8	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585006** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-102-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Pentane, 2,4-dimethyl-	15.5	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Cyclopentane, methyl-	40.9	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Butane, 2,2,3-trimethyl-	6.3	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Pentane, 3,3-dimethyl-	9.1	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Butane, 2,2,3,3-tetramethyl	71.2	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Pentane, 2,3,4-trimethyl-	13.0	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
Pentane, 2,3,3-trimethyl-	33.9	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:04	TMP	D
SEMIVOLATILES												
Acenaphthene	0.074U	U	mg/kg	0.11	0.074	0.0067	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Acenaphthylene	0.074U	U	mg/kg	0.11	0.074	0.0078	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Anthracene	0.074U	U	mg/kg	0.11	0.074	0.0089	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Benzo(a)anthracene	0.057J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Benzo(a)pyrene	0.020J	J	mg/kg	0.11	0.074	0.0044	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Benzo(b)fluoranthene	0.059J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Benzo(g,h,i)perylene	0.034J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Benzo(k)fluoranthene	0.031J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Chrysene	0.056J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Dibenzo(a,h)anthracene	0.074U	U	mg/kg	0.11	0.074	0.0067	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Fluoranthene	0.10J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Fluorene	0.074U	U	mg/kg	0.11	0.074	0.0067	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Indeno(1,2,3-cd)pyrene	0.036J	J	mg/kg	0.11	0.074	0.0078	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
2-Methylnaphthalene	0.051J	J	mg/kg	0.30	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Naphthalene	0.042J	J	mg/kg	0.11	0.074	0.0067	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Phenanthrene	0.052J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Pyrene	0.11J	J	mg/kg	0.11	0.074	0.0056	SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	76.5		%	39 - 132			SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
2-Fluorobiphenyl (S)	58.5		%	44 - 115			SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
2-Fluorophenol (S)	72		%	35 - 115			SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Nitrobenzene-d5 (S)	64.8		%	37 - 122			SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Phenol-d5 (S)	69.3		%	33 - 122			SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
Terphenyl-d14 (S)	72.7		%	54 - 127			SW846 8270D	11/27/17	VLM	11/28/17 17:37	GEC	A
WET CHEMISTRY												
Moisture	14.1		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	85.9		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	5.6		mg/kg	2.0	1.4	0.68	SW846 6010C	11/28/17	DAG	11/28/17 15:01	SRT	A1

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585006** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-102-7-7.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared By	Analyzed	By	*Cntr*

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585007** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-02-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
VOLATILE ORGANICS												
Acetone	0.075		mg/kg	0.0087	0.0043	0.0028	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Benzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Bromobenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Bromochloromethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Bromodichloromethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Bromoform	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Bromomethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
2-Butanone	0.0043U	U	mg/kg	0.0087	0.0043	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
tert-Butyl Alcohol	0.0085J	J	mg/kg	0.0087	0.0043	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
n-Butylbenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
tert-Butylbenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
sec-Butylbenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Carbon Tetrachloride	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Chlorobenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Chlorodibromomethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Chloroethane	0.0022U	U	mg/kg	0.0043	0.0022	0.00095	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Chloroform	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Chloromethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
o-Chlorotoluene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
p-Chlorotoluene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2-Dibromo-3-chloropropane	0.0022U	U	mg/kg	0.0043	0.0022	0.0013	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2-Dibromoethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2-Dichlorobenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,3-Dichlorobenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,4-Dichlorobenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Dichlorodifluoromethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1-Dichloroethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2-Dichloroethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1-Dichloroethene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
cis-1,2-Dichloroethene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
trans-1,2-Dichloroethene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,3-Dichloropropane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
2,2-Dichloropropane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2-Dichloropropane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1-Dichloropropene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
cis-1,3-Dichloropropene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585007** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-02-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
trans-1,3-Dichloropropene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Ethylbenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Hexachlorobutadiene	0.00087U	U	mg/kg	0.0043	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
2-Hexanone	0.0043U	U	mg/kg	0.0087	0.0043	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Isopropylbenzene	0.0045		mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
p-Isopropyltoluene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Methyl t-Butyl Ether	0.0028		mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
4-Methyl-2-Pentanone(MIBK)	0.0043U	U	mg/kg	0.0087	0.0043	0.0022	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Methylene Chloride	0.00087U	U	mg/kg	0.0017	0.00087	0.00052	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Naphthalene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
n-Propylbenzene	0.00047J	J	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Styrene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1,1,2-Tetrachloroethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1,2,2-Tetrachloroethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Tetrachloroethene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Toluene	0.00059J	J	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2,3-Trichlorobenzene	0.00087U	U	mg/kg	0.0043	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2,4-Trichlorobenzene	0.00087U	U	mg/kg	0.0043	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1,1-Trichloroethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,1,2-Trichloroethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Trichloroethene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Trichlorofluoromethane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2,3-Trichloropropane	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,2,4-Trimethylbenzene	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,3,5-Trimethylbenzene	0.00046J	J	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Vinyl Chloride	0.00087U	U	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
o-Xylene	0.0016J	J	mg/kg	0.0017	0.00087	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
mp-Xylene	0.00085J	J	mg/kg	0.0035	0.0017	0.00043	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D

Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*	*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
1,2-Dichloroethane-d4 (S)	96.4		%	71 - 136	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
4-Bromofluorobenzene (S)	105		%	79 - 119	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Dibromofluoromethane (S)	96.1		%	78 - 119	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Toluene-d8 (S)	110		%	85 - 116	SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Library Search - Volatiles										
Butane, 2-methyl-	40.5	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Pentane, 2-methyl-	51.0	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Cyclopentane	51.7	J N	ug/kg		SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D

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ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585007** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-02-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared	By	Analyzed	By	Cntr
Cyclopentane, methyl-	157	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
1,3-Pentadiene, 3-methyl-,	8.1	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Cyclohexane	116	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
2H-Pyran-2,6(3H)-dione, dih	9.4	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Cyclobutane, ethenyl-	31.3	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Cyclopentene, 1,5-dimethyl-	11.2	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
Cyclohexene, 1-methyl-	8.2	J N	ug/kg				SW846 8260C	11/13/17	PDK	11/21/17 19:27	TMP	D
SEMIVOLATILES												
Acenaphthene	0.076U	U	mg/kg	0.11	0.076	0.0068	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Acenaphthylene	0.076U	U	mg/kg	0.11	0.076	0.0079	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Anthracene	0.076U	U	mg/kg	0.11	0.076	0.0090	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Benzo(a)anthracene	0.020J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Benzo(a)pyrene	0.029J	J	mg/kg	0.11	0.076	0.0045	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Benzo(b)fluoranthene	0.042J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Benzo(g,h,i)perylene	0.020J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Benzo(k)fluoranthene	0.017J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Chrysene	0.017J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Dibenzo(a,h)anthracene	0.076U	U	mg/kg	0.11	0.076	0.0068	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Fluoranthene	0.064J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Fluorene	0.076U	U	mg/kg	0.11	0.076	0.0068	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Indeno(1,2,3-cd)pyrene	0.076U	U	mg/kg	0.11	0.076	0.0079	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
2-Methylnaphthalene	0.035J	J	mg/kg	0.31	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Naphthalene	0.033J	J	mg/kg	0.11	0.076	0.0068	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Phenanthrene	0.033J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Pyrene	0.068J	J	mg/kg	0.11	0.076	0.0057	SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Surrogate Recoveries	*Results*	*Flag*	*Units*	*Limits*			*Method*	*Prepared*	*By*	*Analyzed*	*By*	*Cntr*
2,4,6-Tribromophenol (S)	85.1		%	39 - 132			SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
2-Fluorobiphenyl (S)	72.8		%	44 - 115			SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
2-Fluorophenol (S)	77.7		%	35 - 115			SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Nitrobenzene-d5 (S)	71.2		%	37 - 122			SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Phenol-d5 (S)	74.5		%	33 - 122			SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
Terphenyl-d14 (S)	86.5		%	54 - 127			SW846 8270D	11/27/17	VLM	11/28/17 18:04	GEC	A
WET CHEMISTRY												
Moisture	15.5		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
Total Solids	84.5		%	0.1	0.1	0.01	S2540G-11			11/19/17 19:41	MLM	A
METALS												
Arsenic, Total	4.4		mg/kg	2.2	1.5	0.73	SW846 6010C	11/28/17	DAG	11/28/17 15:23	SRT	A1

ALS Environmental

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NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

Lab ID: **2276585007** Date Collected: 11/13/2017 15:30 Matrix: Solid

Sample ID: **FTMM-57-SB-02-8-8.5** Date Received: 11/14/2017 20:00

Parameters	Results	Flag	Units	LOQ	LOD	DL	Method	Prepared By	Analyzed	By	*Cntr*

Vanessa N. Badman

Mrs. Vanessa N Badman
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2276585005	1	FTMM-57-SB-02-7-7.5	SW846 8260C	Dichlorodifluoromethane
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Dichlorodifluoromethane. The RPD was reported as 33.8 and the upper control limit is 30.				
2276585005	2	FTMM-57-SB-02-7-7.5	SW846 8260C	Vinyl Chloride
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Vinyl Chloride. The RPD was reported as 31.9 and the upper control limit is 30.				
2276585005	3	FTMM-57-SB-02-7-7.5	SW846 8260C	Trichlorofluoromethane
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Trichlorofluoromethane. The RPD was reported as 30.8 and the upper control limit is 30.				
2276585005	4	FTMM-57-SB-02-7-7.5	SW846 8260C	Acetone
The QC sample type MS for method SW846 8260C was outside the control limits for the analyte Acetone. The % Recovery was reported as 196 and the control limits were 36 to 164.				
2276585005	5	FTMM-57-SB-02-7-7.5	SW846 8260C	Acetone
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Acetone. The RPD was reported as 46.1 and the upper control limit is 30.				
2276585005	6	FTMM-57-SB-02-7-7.5	SW846 8260C	Acetone
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Acetone. The % Recovery was reported as 359 and the control limits were 36 to 164.				
2276585005	7	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1-Dichloroethene
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1-Dichloroethene. The % Recovery was reported as 60.9 and the control limits were 70 to 131.				
2276585005	8	FTMM-57-SB-02-7-7.5	SW846 8260C	tert-Butyl Alcohol
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte tert-Butyl Alcohol. The RPD was reported as 52.3 and the upper control limit is 30.				
2276585005	9	FTMM-57-SB-02-7-7.5	SW846 8260C	tert-Butyl Alcohol
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte tert-Butyl Alcohol. The % Recovery was reported as 198 and the control limits were 68 to 133.				
2276585005	10	FTMM-57-SB-02-7-7.5	SW846 8260C	Methylene Chloride
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Methylene Chloride. The RPD was reported as 37.5 and the upper control limit is 30.				
2276585005	11	FTMM-57-SB-02-7-7.5	SW846 8260C	Methylene Chloride
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Methylene Chloride. The % Recovery was reported as 58.3 and the control limits were 70 to 128.				
2276585005	12	FTMM-57-SB-02-7-7.5	SW846 8260C	trans-1,2-Dichloroethene
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte trans-1,2-Dichloroethene. The % Recovery was reported as 56.5 and the control limits were 74 to 125.				
2276585005	13	FTMM-57-SB-02-7-7.5	SW846 8260C	trans-1,2-Dichloroethene
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte trans-1,2-Dichloroethene. The RPD was reported as 35.7 and the upper control limit is 30.				
2276585005	14	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1-Dichloroethane
The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1-Dichloroethane. The RPD was reported as 31.8 and the upper control limit is 30.				

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

2276585005	15	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1-Dichloroethane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1-Dichloroethane. The % Recovery was reported as 62.6 and the control limits were 76 to 125.

2276585005	16	FTMM-57-SB-02-7-7.5	SW846 8260C	2-Butanone

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 2-Butanone. The RPD was reported as 38.3 and the upper control limit is 30.

2276585005	17	FTMM-57-SB-02-7-7.5	SW846 8260C	2-Butanone

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 2-Butanone. The % Recovery was reported as 223 and the control limits were 51 to 148.

2276585005	18	FTMM-57-SB-02-7-7.5	SW846 8260C	cis-1,2-Dichloroethene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte cis-1,2-Dichloroethene. The % Recovery was reported as 62.3 and the control limits were 77 to 123.

2276585005	19	FTMM-57-SB-02-7-7.5	SW846 8260C	Chloroform

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Chloroform. The % Recovery was reported as 64.2 and the control limits were 78 to 123.

2276585005	20	FTMM-57-SB-02-7-7.5	SW846 8260C	2,2-Dichloropropane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 2,2-Dichloropropane. The % Recovery was reported as 53.8 and the control limits were 67 to 133.

2276585005	21	FTMM-57-SB-02-7-7.5	SW846 8260C	2,2-Dichloropropane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 2,2-Dichloropropane. The RPD was reported as 41.9 and the upper control limit is 30.

2276585005	22	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1,1-Trichloroethane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1,1-Trichloroethane. The % Recovery was reported as 53.7 and the control limits were 73 to 130.

2276585005	23	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1,1-Trichloroethane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1,1-Trichloroethane. The RPD was reported as 41.3 and the upper control limit is 30.

2276585005	24	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1-Dichloropropene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1-Dichloropropene. The % Recovery was reported as 49.6 and the control limits were 76 to 125.

2276585005	25	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1-Dichloropropene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1-Dichloropropene. The RPD was reported as 47.8 and the upper control limit is 30.

2276585005	26	FTMM-57-SB-02-7-7.5	SW846 8260C	Carbon Tetrachloride

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Carbon Tetrachloride. The % Recovery was reported as 45.4 and the control limits were 70 to 135.

2276585005	27	FTMM-57-SB-02-7-7.5	SW846 8260C	Carbon Tetrachloride

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Carbon Tetrachloride. The RPD was reported as 57.1 and the upper control limit is 30.

2276585005	28	FTMM-57-SB-02-7-7.5	SW846 8260C	Benzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Benzene. The % Recovery was reported as 60.2 and the control limits were 77 to 121.

2276585005	29	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2-Dichloropropane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2-Dichloropropane. The % Recovery was reported as 68.6 and the control limits were 76 to 123.

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2276585005	30	FTMM-57-SB-02-7-7.5	SW846 8260C	Trichloroethene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Trichloroethene. The RPD was reported as 33 and the upper control limit is 30.

2276585005	31	FTMM-57-SB-02-7-7.5	SW846 8260C	Trichloroethene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Trichloroethene. The % Recovery was reported as 58.1 and the control limits were 77 to 123.

2276585005	32	FTMM-57-SB-02-7-7.5	SW846 8260C	Bromodichloromethane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Bromodichloromethane. The % Recovery was reported as 71 and the control limits were 75 to 127.

2276585005	33	FTMM-57-SB-02-7-7.5	SW846 8260C	cis-1,3-Dichloropropene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte cis-1,3-Dichloropropene. The % Recovery was reported as 60.5 and the control limits were 74 to 126.

2276585005	34	FTMM-57-SB-02-7-7.5	SW846 8260C	cis-1,3-Dichloropropene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte cis-1,3-Dichloropropene. The RPD was reported as 30.8 and the upper control limit is 30.

2276585005	35	FTMM-57-SB-02-7-7.5	SW846 8260C	4-Methyl-2-Pentanone(MIBK)

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 4-Methyl-2-Pentanone(MIBK). The % Recovery was reported as 182 and the control limits were 65 to 135.

2276585005	36	FTMM-57-SB-02-7-7.5	SW846 8260C	4-Methyl-2-Pentanone(MIBK)

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 4-Methyl-2-Pentanone(MIBK). The RPD was reported as 32.2 and the upper control limit is 30.

2276585005	37	FTMM-57-SB-02-7-7.5	SW846 8260C	Toluene

The QC sample type MS for method SW846 8260C was outside the control limits for the analyte Toluene. The % Recovery was reported as 74.3 and the control limits were 77 to 121.

2276585005	38	FTMM-57-SB-02-7-7.5	SW846 8260C	Toluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Toluene. The % Recovery was reported as 52.1 and the control limits were 77 to 121.

2276585005	39	FTMM-57-SB-02-7-7.5	SW846 8260C	Toluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Toluene. The RPD was reported as 35.6 and the upper control limit is 30.

2276585005	40	FTMM-57-SB-02-7-7.5	SW846 8260C	2-Hexanone

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 2-Hexanone. The % Recovery was reported as 190 and the control limits were 53 to 145.

2276585005	41	FTMM-57-SB-02-7-7.5	SW846 8260C	2-Hexanone

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 2-Hexanone. The RPD was reported as 35 and the upper control limit is 30.

2276585005	42	FTMM-57-SB-02-7-7.5	SW846 8260C	Tetrachloroethene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Tetrachloroethene. The % Recovery was reported as 49.6 and the control limits were 73 to 128.

2276585005	43	FTMM-57-SB-02-7-7.5	SW846 8260C	Tetrachloroethene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Tetrachloroethene. The RPD was reported as 40.6 and the upper control limit is 30.

2276585005	44	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1,1,2-Tetrachloroethane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1,1,2-Tetrachloroethane. The % Recovery was reported as 54.6 and the control limits were 78 to 125.

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2276585005	45	FTMM-57-SB-02-7-7.5	SW846 8260C	1,1,1,2-Tetrachloroethane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,1,1,2-Tetrachloroethane. The RPD was reported as 39.7 and the upper control limit is 30.

2276585005	46	FTMM-57-SB-02-7-7.5	SW846 8260C	Chlorobenzene

The QC sample type MS for method SW846 8260C was outside the control limits for the analyte Chlorobenzene. The % Recovery was reported as 76.6 and the control limits were 79 to 120.

2276585005	47	FTMM-57-SB-02-7-7.5	SW846 8260C	Chlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Chlorobenzene. The % Recovery was reported as 53.2 and the control limits were 79 to 120.

2276585005	48	FTMM-57-SB-02-7-7.5	SW846 8260C	Chlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Chlorobenzene. The RPD was reported as 36.4 and the upper control limit is 30.

2276585005	49	FTMM-57-SB-02-7-7.5	SW846 8260C	Ethylbenzene

The QC sample type MS for method SW846 8260C was outside the control limits for the analyte Ethylbenzene. The % Recovery was reported as 75.7 and the control limits were 76 to 122.

2276585005	50	FTMM-57-SB-02-7-7.5	SW846 8260C	Ethylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Ethylbenzene. The % Recovery was reported as 46.9 and the control limits were 76 to 122.

2276585005	51	FTMM-57-SB-02-7-7.5	SW846 8260C	Ethylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Ethylbenzene. The RPD was reported as 47.5 and the upper control limit is 30.

2276585005	52	FTMM-57-SB-02-7-7.5	SW846 8260C	mp-Xylene

The QC sample type MS for method SW846 8260C was outside the control limits for the analyte mp-Xylene. The % Recovery was reported as 76.7 and the control limits were 77 to 124.

2276585005	53	FTMM-57-SB-02-7-7.5	SW846 8260C	mp-Xylene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte mp-Xylene. The % Recovery was reported as 44.9 and the control limits were 77 to 124.

2276585005	54	FTMM-57-SB-02-7-7.5	SW846 8260C	mp-Xylene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte mp-Xylene. The RPD was reported as 52.7 and the upper control limit is 30.

2276585005	55	FTMM-57-SB-02-7-7.5	SW846 8260C	Styrene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Styrene. The % Recovery was reported as 49 and the control limits were 76 to 124.

2276585005	56	FTMM-57-SB-02-7-7.5	SW846 8260C	Styrene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Styrene. The RPD was reported as 47.5 and the upper control limit is 30.

2276585005	57	FTMM-57-SB-02-7-7.5	SW846 8260C	o-Xylene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte o-Xylene. The % Recovery was reported as 47.8 and the control limits were 77 to 123.

2276585005	58	FTMM-57-SB-02-7-7.5	SW846 8260C	o-Xylene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte o-Xylene. The RPD was reported as 48.7 and the upper control limit is 30.

2276585005	59	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,3-Trichloropropane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,3-Trichloropropane. The % Recovery was reported as 126 and the control limits were 73 to 125.

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2276585005	60	FTMM-57-SB-02-7-7.5	SW846 8260C	Isopropylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Isopropylbenzene. The % Recovery was reported as 41.9 and the control limits were 68 to 134.

2276585005	61	FTMM-57-SB-02-7-7.5	SW846 8260C	Isopropylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Isopropylbenzene. The RPD was reported as 61 and the upper control limit is 30.

2276585005	62	FTMM-57-SB-02-7-7.5	SW846 8260C	Bromobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Bromobenzene. The % Recovery was reported as 57 and the control limits were 78 to 121.

2276585005	63	FTMM-57-SB-02-7-7.5	SW846 8260C	Bromobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Bromobenzene. The RPD was reported as 35.3 and the upper control limit is 30.

2276585005	64	FTMM-57-SB-02-7-7.5	SW846 8260C	n-Propylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte n-Propylbenzene. The % Recovery was reported as 40.5 and the control limits were 73 to 125.

2276585005	65	FTMM-57-SB-02-7-7.5	SW846 8260C	n-Propylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte n-Propylbenzene. The RPD was reported as 64.3 and the upper control limit is 30.

2276585005	66	FTMM-57-SB-02-7-7.5	SW846 8260C	o-Chlorotoluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte o-Chlorotoluene. The % Recovery was reported as 44.9 and the control limits were 75 to 122.

2276585005	67	FTMM-57-SB-02-7-7.5	SW846 8260C	o-Chlorotoluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte o-Chlorotoluene. The RPD was reported as 52.7 and the upper control limit is 30.

2276585005	68	FTMM-57-SB-02-7-7.5	SW846 8260C	p-Chlorotoluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte p-Chlorotoluene. The % Recovery was reported as 43.8 and the control limits were 72 to 124.

2276585005	69	FTMM-57-SB-02-7-7.5	SW846 8260C	p-Chlorotoluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte p-Chlorotoluene. The RPD was reported as 55.6 and the upper control limit is 30.

2276585005	70	FTMM-57-SB-02-7-7.5	SW846 8260C	1,3,5-Trimethylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,3,5-Trimethylbenzene. The % Recovery was reported as 42.2 and the control limits were 73 to 124.

2276585005	71	FTMM-57-SB-02-7-7.5	SW846 8260C	1,3,5-Trimethylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,3,5-Trimethylbenzene. The RPD was reported as 63.7 and the upper control limit is 30.

2276585005	72	FTMM-57-SB-02-7-7.5	SW846 8260C	tert-Butylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte tert-Butylbenzene. The % Recovery was reported as 38.5 and the control limits were 73 to 125.

2276585005	73	FTMM-57-SB-02-7-7.5	SW846 8260C	tert-Butylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte tert-Butylbenzene. The RPD was reported as 71.3 and the upper control limit is 30.

2276585005	74	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,4-Trimethylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,4-Trimethylbenzene. The % Recovery was reported as 42.9 and the control limits were 75 to 123.

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2276585005	75	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,4-Trimethylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,4-Trimethylbenzene. The RPD was reported as 61.3 and the upper control limit is 30.

2276585005	76	FTMM-57-SB-02-7-7.5	SW846 8260C	sec-Butylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte sec-Butylbenzene. The % Recovery was reported as 36.8 and the control limits were 73 to 126.

2276585005	77	FTMM-57-SB-02-7-7.5	SW846 8260C	sec-Butylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte sec-Butylbenzene. The RPD was reported as 76 and the upper control limit is 30.

2276585005	78	FTMM-57-SB-02-7-7.5	SW846 8260C	1,3-Dichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,3-Dichlorobenzene. The % Recovery was reported as 48.7 and the control limits were 77 to 121.

2276585005	79	FTMM-57-SB-02-7-7.5	SW846 8260C	1,3-Dichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,3-Dichlorobenzene. The RPD was reported as 46.5 and the upper control limit is 30.

2276585005	80	FTMM-57-SB-02-7-7.5	SW846 8260C	1,4-Dichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,4-Dichlorobenzene. The % Recovery was reported as 49.8 and the control limits were 75 to 120.

2276585005	81	FTMM-57-SB-02-7-7.5	SW846 8260C	1,4-Dichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,4-Dichlorobenzene. The RPD was reported as 45.7 and the upper control limit is 30.

2276585005	82	FTMM-57-SB-02-7-7.5	SW846 8260C	p-Isopropyltoluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte p-Isopropyltoluene. The % Recovery was reported as 38.2 and the control limits were 73 to 127.

2276585005	83	FTMM-57-SB-02-7-7.5	SW846 8260C	p-Isopropyltoluene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte p-Isopropyltoluene. The RPD was reported as 73.2 and the upper control limit is 30.

2276585005	84	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2-Dichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2-Dichlorobenzene. The % Recovery was reported as 56.9 and the control limits were 78 to 121.

2276585005	85	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2-Dichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2-Dichlorobenzene. The RPD was reported as 37.4 and the upper control limit is 30.

2276585005	86	FTMM-57-SB-02-7-7.5	SW846 8260C	n-Butylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte n-Butylbenzene. The % Recovery was reported as 42.7 and the control limits were 70 to 128.

2276585005	87	FTMM-57-SB-02-7-7.5	SW846 8260C	n-Butylbenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte n-Butylbenzene. The RPD was reported as 65.2 and the upper control limit is 30.

2276585005	88	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2-Dibromo-3-chloropropane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2-Dibromo-3-chloropropane. The % Recovery was reported as 183 and the control limits were 61 to 132.

2276585005	89	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2-Dibromo-3-chloropropane

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2-Dibromo-3-chloropropane. The RPD was reported as 38.8 and the upper control limit is 30.

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34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2276585 PQF-098|FTMM-57

2276585005	90	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,4-Trichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,4-Trichlorobenzene. The RPD was reported as 55 and the upper control limit is 30.

2276585005	91	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,4-Trichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,4-Trichlorobenzene. The % Recovery was reported as 51.5 and the control limits were 67 to 129.

2276585005	92	FTMM-57-SB-02-7-7.5	SW846 8260C	Hexachlorobutadiene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Hexachlorobutadiene. The RPD was reported as 73.4 and the upper control limit is 30.

2276585005	93	FTMM-57-SB-02-7-7.5	SW846 8260C	Hexachlorobutadiene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte Hexachlorobutadiene. The % Recovery was reported as 45 and the control limits were 61 to 135.

2276585005	94	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,3-Trichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,3-Trichlorobenzene. The RPD was reported as 39 and the upper control limit is 30.

2276585005	95	FTMM-57-SB-02-7-7.5	SW846 8260C	1,2,3-Trichlorobenzene

The QC sample type MSD for method SW846 8260C was outside the control limits for the analyte 1,2,3-Trichlorobenzene. The % Recovery was reported as 59.9 and the control limits were 66 to 130.

6585

ALS Environmental
34 Dogwood Lane
Middletown, PA 07057
(717) 944-5541

CHAIN OF C… REQUEST FO…

ALL SHADED AREAS MUST BE C…
SAMPLER. INSTRUCTIONS ON THE BACK.

2276585

COC #: M5701 11132017 | 1 of 1
ALS Quote #:

Client Name: Parsons Federal
Address: 100 High St. 4th Floor
Boston, MA 02110
Contact: Lorraine Weber
Phone#: 315-552-9745
Project Name/#: FTMM-57
Bill To: Parsons Federal

TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: Approved?
Email? [X] -Y lorraine.weber@parsons.com
Fax? [ ] -Y No.:

	Container Type	terracore	AN								
	Container Size	5 gm	4 oz								
	Preservative	--	4c								

ANALYSES/METHOD REQUESTED

	Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	VOC (8260C)+ 15 TICs (soil)	2-methylnaphthalene & naphthalene + PAHs-(8270D), Arsenic (6010D)								AUTHORIZED TO RUN
						Enter Number of Containers Per Sample or Field Results Below.									
1	FTMM-57-SB-01 - 2.5-3	11/13/17	1430	G	SO	3	1								X
2	FTMM-57-SB-02 - 2.5-3		1515	G	SO	3	1								X
3	FTMM-57-SB-01-6-6.5		1435	G	SO	3	1								
4	FTMM-57-SB-01-8-8.5		1450	G	SO	3	1								
5	FTMM-57-SB-02-7-7.5		1525	G	SO	3	1								
6	FTMM-57-SB-02-7.7.5-MS		1535	G	SO	3	1								
7	FTMM-57-SB-02-7.7.5-MSD		1525	G	SO	3	1								
8	FTMM-57-SB02-7-7.5		1530	G	SO	3	1								
9	FTMM-57-SB-02-8-8.5		1530	G	SO	3	1								
10	~~DUP-FTMM-57-SB-11302017~~	11/13/17	1450	G	W	3	(2L)								

* Each set has 1-2oz SO jar-on ice

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2°C Therm ID: 402
No. of Coolers: _____

	Y	N	Initial
Custody Seals Present?			
(If present) Seals Intact?			
Received on Ice?			
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

Sample/COC Comments

ALS Field Services: _Pickup _Labor
_Composite Sampling _Rental Equipment
_Other:

Project Comments: 748810
MDL Must Meet NJDEP Soil Cleanup Criteria and/or Groundwater Quality Standards

LOGGED BY(signature): DATE 11/13/17 TIME 1700
REVIEWED BY(signature): DATE 11-13-17 TIME 1800

Data Deliverables: [ ] Standard [X] CLP-like [ ] USACE
Special Processing: USACE [ ] Navy [ ]
State Samples Collected In: [ ] NY [X] NJ [ ] PA [ ] NC

Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type- ERPIMS

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	Frank Accorsi PARSONS	11-14-17	1010	2	[signature] ALS	11/14	1010
3	[signature] ALS	11/14/17		4		11-14	1740
5		11-14-17	2000	6	[signature]	11/14	2000
7				8			
9				10			

* G=Grab; C=Composite **Matrix - Al=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 USA

DATA VALIDATION REPORT FOR FTMM-57

BUILDING 108

FORT MONMOUTH, OCEANPORT, MONMOUTH COUNTY, NEW JERSEY

BRAC 05 Facility
Contract W912DY-09-D-0062
Task Order: 0012, Project No. 369857

Submitted To:

U.S. Army Engineering and Support Center
Huntsville, Alabama

and

U.S. Army Corps of Engineers, New York District

Prepared By:

PARSONS
401 Diamond Dr. NW, Huntsville, AL 35806

Revision No. 0
March 2018

TABLE OF CONTENTS

LIST OF ATTACHMENTS

SECTION 1
DATA USABILITY SUMMARY

Soil samples were collected from the FTMM-57 Building 108 site in Oceanport, New Jersey on November 13, 2017. Analytical results from these samples were validated and reviewed by Parsons for usability with respect to the following requirements:

- 2013 FTMM Sampling and Analysis Plan (SAP); and
- Department of Defense (DoD) Quality Systems Manual (QSM)

The analytical laboratory for this project was ALS Environmental (ALS) in Middletown, Pennsylvania. This laboratory is certified to conduct project analyses through the New Jersey Department of Environmental Protection (NJDEP) and DoD Environmental Laboratory Approval Program (ELAP).

1.1 SAMPLING AND CHAIN-OF-CUSTODY

The samples were collected, properly preserved, shipped under a COC record, and received at ALS within one day of sampling. All samples were received intact and in good condition at the laboratory.

1.2 LABORATORY DATA PACKAGES

The laboratory data package turnaround time, defined as the time from sample receipt by the laboratory to receipt of the analytical data packages by Parsons, was 35-55 days for the samples.

The laboratory data packages received from ALS were paginated, complete, and overall were of good quality. Comments on specific quality control (QC) and other requirements are discussed in detail in Section 2.

1.3 LABORATORY ANALYTICAL METHODS

The soil samples were collected from the site and analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and arsenic. Summaries of issues concerning these laboratory analyses are presented in Subsections 1.3.1 through 1.3.3. The data qualifications resulting from the data validation review and statements on the laboratory analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) are discussed for each analytical method in Section 2. The laboratory data were reviewed and may be qualified with the following validation flags:

"U" - not detected at the value given,

"UJ" - estimated and not detected at the value given,

"J" - estimated at the value given,

"J+" - estimated biased high at the value given,

"J-" - estimated biased low at the value given,

"B" - compound detected in the sample at a concentration less than or equal to 5 times (10 times for common lab contaminants) the blank,

"N" - presumptive evidence at the value given, and

"R" - unusable value.

The validated laboratory data were tabulated and are presented in Attachment A.

1.3.1 Volatile Organic Analysis

Soil samples were analyzed for VOCs + tentatively identified compounds (TICs) using the USEPA SW-846 8260C analytical method. Certain reported results for these samples were qualified as estimated based upon laboratory control sample recoveries and matrix spike/matrix spike duplicate (MS/MSD) recoveries. The reported VOC analytical results were 100% complete (i.e., usable) for the project data. PARCCS requirements were met.

1.3.2 PAH Organic Analysis

Soil samples were analyzed for PAHs using the USEPA SW-846 8270D analytical method. The reported results for these samples did not require qualification resulting from data validation. The reported PAH analytical results were considered 100% complete (i.e., usable) for the project data. PARCCS requirements were met.

1.3.3 Metals Analysis

Soil samples collected from the site were analyzed for arsenic using the USEPA SW-846 6020A analytical method. The reported results for these samples did not require qualification resulting from data validation. The reported metals results were considered 100% complete (i.e., usable) for the data presented by ALS. PARCCS requirements were met.

SECTION 2
DATA VALIDATION REPORT

2.1 SOIL SAMPLES

Data review has been completed for data packages generated by ALS containing soil samples collected from the site. These samples were contained within sample delivery groups (SDGs) PQF098 and PQF099. All of these samples were properly preserved, shipped under a COC record, and received intact by the analytical laboratory. The validated laboratory data were tabulated and are presented in Attachment A.

Data validation was performed for all samples in accordance with the project SAP and DoD QSM. This data validation and usability report is presented by analysis type.

2.1.1 Volatiles + TICs

The following items were reviewed for compliancy in the volatile analysis:

- Custody documentation
- Holding times
- Surrogate recoveries
- Matrix spike/matrix spike duplicate (MS/MSD) precision and accuracy
- Laboratory control sample (LCS) recoveries
- Laboratory method blank and equipment blank contamination
- GC/MS instrument performance
- Initial and continuing calibrations
- Internal standard area counts and retention times
- Field duplicate precision
- Sample result verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols with the exception of MS/MSD precision and accuracy, LCS recoveries, and blank contamination as discussed below.

<u>MS/MSD Precision and Accuracy</u>

All MS/MSD precision (relative percent difference; RPD) and accuracy (percent recovery; %R) measurements were considered acceptable and within QC limits for designated spiked project samples with the exception of the MS/MSD accuracy results for acetone (196%R/359%R; QC limit 36-164%R), chlorobenzene (76.6%R/53.2%R; QC limit 79-120%R), ethylbenzene (75.7%R/46.9%R; QC limit 76-122%R), toluene (74.3%R/52.1%R; QC limit 77-121%R), and m,p-xylene (76.7%R/44.9%R; QC limit 77-124%R) during the spiked analyses of sample FTMM-57-SB-02-7-7.5. Therefore, results for those compounds where MS/MSD accuracy results fell below the QC limit were considered estimated with positive results qualified “J” and nondetected results qualified “UJ” for the affected parent sample. Positive results where MS/MSD accuracy

results exceeded the QC limit were considered estimated and qualified "J" for the affected parent sample.

LCS Recoveries

All LCS recoveries were considered acceptable and within QC limits with the exception of the high LCS recoveries for hexachlorobutadiene (134%R; QC limit 80-120%R) and methylene chloride (156%R; QC limit 80-120%R) and the low LCS recovery for 2-hexanone (73.6%R; QC limit 80-120%R) associated with the soil samples. Validation qualification was not required for hexachlorobutadiene and methylene chloride since these compounds were not detected in the associated samples. However, 2-hexanone results which were nondetects were considered estimated and qualified "UJ" for the samples.

Blank Contamination

The laboratory method blank associated with the soil samples contained chloroform and naphthalene greater than ½ LOQ at concentrations of 0.54 and 0.68 mg/kg, respectively. Validation qualification of the project samples was not required.

Usability

All volatile soil sample results were considered usable following data validation.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, comparability, and sensitivity. The volatile soil sample data presented by ALS were 100% complete (i.e., usable). The validated volatile laboratory data are tabulated and presented in Attachment A.

2.1.2 PAHs

The following items were reviewed for compliancy in the PAH analysis:

- Custody documentation
- Holding times
- Surrogate recoveries
- Matrix spike/matrix spike duplicate (MS/MSD) precision and accuracy
- Laboratory control sample (LCS) recoveries
- Laboratory method blank and equipment blank contamination
- Initial calibrations
- Verification calibrations
- Internal standard recoveries
- Field duplicate precision
- Sample result verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols with the exception of blank contamination as discussed below.

Blank Contamination

The QC equipment blank FTMM-57-EB-11132017 associated with the project samples contained 2-methylnaphthalene greater than ½ LOQ at a concentration of 1.1 µg/L. Validation qualification of the project samples was not required.

Usability

All PAH sample results for the soil samples were considered usable following data validation.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, comparability, and sensitivity. The PAH data presented by ALS were 100% complete with all data considered usable and valid. The validated data are tabulated and presented in Attachment A.

2.1.3 Arsenic

The following items were reviewed for compliancy in the arsenic analysis:

- Custody documentation
- Holding times
- Initial and continuing calibration verifications
- Initial and continuing calibration blank, and laboratory preparation blank contamination
- Matrix spike/matrix spike duplicate (MS/MSD) recoveries
- Laboratory duplicate precision
- Laboratory control sample (LCS) recoveries
- Serial dilutions
- Interference check sample recoveries
- Field duplicate precision
- Sample result verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols.

Usability

All arsenic results for the soil samples were considered usable following data validation.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, comparability, and sensitivity. The arsenic data for the soil samples presented by ALS were 100% complete (i.e., usable). The validated laboratory data are tabulated and presented in Attachment A.

ATTACHMENT A
VALIDATED LABORATORY DATA

Validated Laboratory Data
FTMM - 57 BLDG 108
November 2017 Sampling

Loc ID	NJ Residential Direct Contact SRS	FTMM57-SB-01		
Sample ID		FTMM-57-SB-01-2.5-3	FTMM-57-SB-01-6-6.5	FTMM-57-SB-01-8-8.5
Sample Date		11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)				
1,1,1,2-Tetrachloroethane		< 0.0009	< 0.001	< 0.0011
1,1,1-Trichloroethane	160000	< 0.0009	< 0.001	< 0.0011
1,1,2,2-Tetrachloroethane	1	< 0.0009	< 0.001	< 0.0011
1,1,2-Trichloroethane	2	< 0.0009	< 0.001	< 0.0011
1,1-Dichloroethane	8	< 0.0009	< 0.001	< 0.0011
1,1-Dichloroethene	11	< 0.0009	< 0.001	< 0.0011
1,1-Dichloropropene		< 0.0009	< 0.001	< 0.0011
1,2,3-Trichlorobenzene		< 0.0009	< 0.001	< 0.0011
1,2,3-Trichloropropane		< 0.0009	< 0.001	< 0.0011
1,2,4-Trichlorobenzene	73	< 0.0009	< 0.001	< 0.0011
1,2,4-Trimethylbenzene		< 0.0009	< 0.001	< 0.0011
1,2-Dibromo-3-chloropropane	0.08	< 0.0022	< 0.0025	< 0.0029
1,2-Dibromoethane	0.008	< 0.0009	< 0.001	< 0.0011
1,2-Dichlorobenzene	5300	< 0.0009	< 0.001	< 0.0011
1,2-Dichloroethane	0.9	< 0.0009	< 0.001	< 0.0011
1,2-Dichloropropane	2	< 0.0009	< 0.001	< 0.0011
1,3,5-Trimethylbenzene		< 0.0009	< 0.001	< 0.0011
1,3-Dichlorobenzene	5300	< 0.0009	< 0.001	< 0.0011
1,3-Dichloropropane		< 0.0009	< 0.001	< 0.0011
1,4-Dichlorobenzene	5	< 0.0009	< 0.001	< 0.0011
2,2-Dichloropropane		< 0.0009	< 0.001	< 0.0011
2-Chlorotoluene		< 0.0009	< 0.001	< 0.0011
Acetone	70000	**0.11**	**0.11**	**0.12**
Benzene	2	< 0.0009	< 0.001	< 0.0011
Bromobenzene		< 0.0009	< 0.001	< 0.0011
Bromochloromethane		< 0.0009	< 0.001	< 0.0011
Bromodichloromethane	1	< 0.0009	< 0.001	< 0.0011
Bromoform	81	< 0.0009	< 0.001	< 0.0011
Carbon tetrachloride	2	< 0.0009	< 0.001	< 0.0011
Chlorobenzene	510	< 0.0009	< 0.001	< 0.0011
Chlorodibromomethane	3	< 0.0009	< 0.001	< 0.0011
Chloroethane	220	< 0.0022	< 0.0025	< 0.0029
Chloroform	0.6	**0.0005 J**	< 0.001	**0.001 J**
Cis-1,2-Dichloroethene	230	< 0.0009	< 0.001	< 0.0011
Cis-1,3-Dichloropropene		< 0.0009	< 0.001	< 0.0011
Cymene		< 0.0009	< 0.001	< 0.0011
Dichlorodifluoromethane	490	< 0.0009	< 0.001	< 0.0011
Ethyl benzene	7800	< 0.0009	< 0.001	< 0.0011
Hexachlorobutadiene	6	< 0.0009	< 0.001	< 0.0011
Isopropylbenzene		< 0.0009	< 0.001	< 0.0011
Meta/Para Xylene		< 0.0018	< 0.002	< 0.0023
Methyl bromide	25	< 0.0009	< 0.001	< 0.0011
Methyl butyl ketone		< 0.0045 UJ	< 0.005 UJ	< 0.0057 UJ

Validated Laboratory Data
FTMM - 57 BLDG 108
November 2017 Sampling

Loc ID	NJ Residential Direct Contact SRS	FTMM57-SB-01		
Sample ID		FTMM-57-SB-01-2.5-3	FTMM-57-SB-01-6-6.5	FTMM-57-SB-01-8-8.5
Sample Date		11/13/2017	11/13/2017	11/13/2017
Methyl chloride	4	< 0.0009	< 0.001	< 0.0011
Methyl ethyl ketone	3100	**0.0093**	**0.0079 J**	**0.0071 J**
Methyl isobutyl ketone		< 0.0045	< 0.005	< 0.0057
Methyl Tertbutyl Ether	110	**0.0006 J**	< 0.001	< 0.0011
Methylene chloride	46	< 0.0009	< 0.001	< 0.0011
Naphthalene	6	< 0.0009	< 0.001	< 0.0011
n-Butylbenzene		< 0.0009	< 0.001	< 0.0011
Ortho Xylene		< 0.0009	< 0.001	< 0.0011
p-Chlorotoluene		< 0.0009	< 0.001	< 0.0011
Propylbenzene		< 0.0009	< 0.001	< 0.0011
sec-Butylbenzene		< 0.0009	< 0.001	< 0.0011
Styrene	90	< 0.0009	< 0.001	< 0.0011
Tert Butyl Alcohol	1400	**0.0034 J**	**0.012**	**0.011 J**
tert-Butylbenzene		< 0.0009	< 0.001	< 0.0011
Tetrachloroethene	43	< 0.0009	< 0.001	< 0.0011
Toluene	6300	< 0.0009	< 0.001	< 0.0011
Trans-1,2-Dichloroethene	300	< 0.0009	< 0.001	< 0.0011
Trans-1,3-Dichloropropene		< 0.0009	< 0.001	< 0.0011
Trichloroethene	3	< 0.0009	< 0.001	< 0.0011
Trichlorofluoromethane	23000	< 0.0009	< 0.001	< 0.0011
Vinyl chloride	0.7	< 0.0009	< 0.001	< 0.0011
TIC VOCs (µg/kg)				
1,5-DIMETHYLCYCLOPENTENE		NA	NA	NA
1-METHYL-1-CYCLOHEXENE		NA	NA	NA
2,2,3,3-TETRAMETHYL BUTANE		NA	NA	NA
2,2,3-TRIMETHYLBUTANE		NA	NA	NA
2,2-DIMETHYL HEXANE		NA	NA	NA
2,2-DIMETHYLBUTANE		NA	NA	NA
2,3,3-TRIMETHYLPENTANE		NA	NA	NA
2,3,4-Trimethylpentane		NA	NA	NA
2,3-Dimethylbutane		NA	NA	NA
2,4-Dimethylpentane		NA	NA	NA
26DIODIHPYR		NA	NA	NA
2-Methylbutane		NA	NA	NA
2-Methylpentane		NA	NA	NA
33DIPENT		NA	NA	NA
3-METHYL-1,3-PENTADIENE		NA	NA	NA
Cyclohexane		NA	NA	NA
CYCLOPENTANE		NA	NA	NA
ETHENCYC		NA	NA	NA
METHCYC		NA	NA	NA
Semivolatile Organic Compounds (mg/kg)				
2-Methylnaphthalene	230	< 0.077	< 0.078	< 0.083
Acenaphthene	3400	< 0.077	< 0.078	< 0.083
Acenaphthylene		< 0.077	< 0.078	< 0.083
Anthracene	17000	< 0.077	< 0.078	< 0.083
Benzo(a)anthracene	5	**0.029 J**	< 0.078	< 0.083
Benzo(a)pyrene	0.5	**0.033 J**	< 0.078	< 0.083

Validated Laboratory Data
FTMM - 57 BLDG 108
November 2017 Sampling

Loc ID	NJ Residential Direct Contact SRS	FTMM57-SB-01		
Sample ID		FTMM-57-SB-01-2.5-3	FTMM-57-SB-01-6-6.5	FTMM-57-SB-01-8-8.5
Sample Date		11/13/2017	11/13/2017	11/13/2017
Benzo(b)fluoranthene	5	**0.039 J**	< 0.078	< 0.083
Benzo(ghi)perylene	380000	**0.031 J**	< 0.078	< 0.083
Benzo(k)fluoranthene	45	**0.018 J**	< 0.078	< 0.083
Chrysene	450	**0.027 J**	< 0.078	< 0.083
Dibenz(a,h)anthracene	0.5	**0.013 J**	< 0.078	< 0.083
Fluoranthene	2300	**0.057 J**	< 0.078	< 0.083
Fluorene	2300	< 0.077	< 0.078	< 0.083
Indeno(1,2,3-cd)pyrene	5	< 0.077	< 0.078	< 0.083
Naphthalene	6	< 0.077	< 0.078	< 0.083
Phenanthrene		**0.027 J**	**0.014 J**	< 0.083
Pyrene	1700	**0.053 J**	**0.015 J**	< 0.083
Inorganics (mg/kg)				
Arsenic	19	**5.9**	**4.6**	**5.4**
Wet Chemistry - Moisture				
Moisture (percent)		**15.8**	**17.4**	**23**
Percent Solids (percent)		**84.2**	**82.6**	**77**

Validated Laboratory Data
FTMM - 57 BLDG 108
November 2017 Sampling

Loc ID	NJ Residential Direct Contact SRS	FTMM57-SB-02			
Sample ID		FTMM-57-SB-02-2.5-3	FTMM-57-SB-02-7-7.5	FTMM-57-SB-102-7-7.5	FTMM-57-SB-02-8-8.5
Sample Date		11/13/2017	11/13/2017	11/13/2017	11/13/2017
Volatile Organic Compounds (mg/kg)					
1,1,1,2-Tetrachloroethane		< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,1-Trichloroethane	160000	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,2,2-Tetrachloroethane	1	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1,2-Trichloroethane	2	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloroethane	8	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloroethene	11	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,1-Dichloropropene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,3-Trichlorobenzene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,3-Trichloropropane		< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,4-Trichlorobenzene	73	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2,4-Trimethylbenzene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dibromo-3-chloropropane	0.08	< 0.0023	< 0.0023	< 0.0022	< 0.0022
1,2-Dibromoethane	0.008	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichlorobenzene	5300	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichloroethane	0.9	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,2-Dichloropropane	2	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,3,5-Trimethylbenzene		< 0.0009	< 0.0009	< 0.0009	**0.0005 J**
1,3-Dichlorobenzene	5300	< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,3-Dichloropropane		< 0.0009	< 0.0009	< 0.0009	< 0.0009
1,4-Dichlorobenzene	5	< 0.0009	< 0.0009	< 0.0009	< 0.0009
2,2-Dichloropropane		< 0.0009	< 0.0009	< 0.0009	< 0.0009
2-Chlorotoluene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Acetone	70000	**0.012**	**0.064 J**	**0.072**	**0.075**
Benzene	2	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromobenzene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromochloromethane		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromodichloromethane	1	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Bromoform	81	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Carbon tetrachloride	2	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Chlorobenzene	510	< 0.0009	< 0.0009 UJ	< 0.0009	< 0.0009
Chlorodibromomethane	3	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Chloroethane	220	< 0.0023	< 0.0023	< 0.0022	< 0.0022
Chloroform	0.6	**0.0007 J**	< 0.0009	< 0.0009	< 0.0009
Cis-1,2-Dichloroethene	230	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cis-1,3-Dichloropropene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cymene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Dichlorodifluoromethane	490	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Ethyl benzene	7800	< 0.0009	< 0.0009 UJ	< 0.0009	< 0.0009
Hexachlorobutadiene	6	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Isopropylbenzene		< 0.0009	< 0.0009	< 0.0009	**0.0045**
Meta/Para Xylene		< 0.0018	< 0.0018 UJ	< 0.0018	**0.0008 J**
Methyl bromide	25	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Methyl butyl ketone		< 0.0046 UJ	< 0.0045 UJ	< 0.0045 UJ	< 0.0043 UJ

Validated Laboratory Data
FTMM - 57 BLDG 108
November 2017 Sampling

Loc ID	NJ Residential Direct Contact SRS	FTMM57-SB-02			
Sample ID		FTMM-57-SB-02-2.5-3	FTMM-57-SB-02-7-7.5	FTMM-57-SB-102-7-7.5	FTMM-57-SB-02-8-8.5
Sample Date		11/13/2017	11/13/2017	11/13/2017	11/13/2017
Methyl chloride	4	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Methyl ethyl ketone	3100	< 0.0046	**0.0088 J**	**0.013**	< 0.0043
Methyl isobutyl ketone		< 0.0046	< 0.0045	< 0.0045	< 0.0043
Methyl Tertbutyl Ether	110	< 0.0009	**0.0006 J**	**0.0007 J**	**0.0028**
Methylene chloride	46	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Naphthalene	6	< 0.0009	< 0.0009	< 0.0009	< 0.0009
n-Butylbenzene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Ortho Xylene		< 0.0009	< 0.0009	< 0.0009	**0.0016 J**
p-Chlorotoluene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Propylbenzene		< 0.0009	< 0.0009	< 0.0009	**0.0005 J**
sec-Butylbenzene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Styrene	90	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Tert Butyl Alcohol	1400	**0.0032 J**	< 0.0045	< 0.0045	**0.0085 J**
tert-Butylbenzene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Tetrachloroethene	43	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Toluene	6300	< 0.0009	< 0.0009 UJ	< 0.0009	**0.0006 J**
Trans-1,2-Dichloroethene	300	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trans-1,3-Dichloropropene		< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trichloroethene	3	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Trichlorofluoromethane	23000	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Vinyl chloride	0.7	< 0.0009	< 0.0009	< 0.0009	< 0.0009
TIC VOCs (µg/kg)					
1,5-DIMETHYLCYCLOPENTENE		NA	NA	NA	**11.2 JN**
1-METHYL-1-CYCLOHEXENE		NA	NA	NA	**8.2 JN**
2,2,3,3-TETRAMETHYL BUTANE		NA	NA	**71.2 JN**	NA
2,2,3-TRIMETHYLBUTANE		NA	NA	**6.3 JN**	NA
2,2-DIMETHYL HEXANE		NA	**53.5 JN**	NA	NA
2,2-DIMETHYLBUTANE		NA	NA	**22 JN**	NA
2,3,3-TRIMETHYLPENTANE		NA	**47.6 JN**	**33.9 JN**	NA
2,3,4-Trimethylpentane		NA	**10.5 JN**	**13 JN**	NA
2,3-Dimethylbutane		NA	**21.1 JN**	**80.8 JN**	NA
2,4-Dimethylpentane		NA	**8.7 JN**	**15.5 JN**	NA
26DIODIHPYR		NA	NA	NA	**9.4 JN**
2-Methylbutane		NA	NA	**31 JN**	**40.5 JN**
2-Methylpentane		NA	NA	NA	**51 JN**
33DIPENT		NA	NA	**9.1 JN**	NA
3-METHYL-1,3-PENTADIENE		NA	NA	NA	**8.1 JN**
Cyclohexane		NA	NA	NA	**116 JN**
CYCLOPENTANE		NA	NA	NA	**51.7 JN**
ETHENCYC		NA	NA	NA	**31.3 JN**
METHCYC		NA	NA	**40.9 JN**	**157 JN**
Semivolatile Organic Compounds (mg/kg)					
2-Methylnaphthalene	230	< 0.073	**0.083 J**	**0.051 J**	**0.035 J**
Acenaphthene	3400	< 0.073	< 0.078	< 0.074	< 0.076
Acenaphthylene		< 0.073	< 0.078	< 0.074	< 0.076
Anthracene	17000	< 0.073	**0.02 J**	< 0.074	< 0.076
Benzo(a)anthracene	5	< 0.073	**0.065 J**	**0.057 J**	**0.02 J**
Benzo(a)pyrene	0.5	< 0.073	**0.046 J**	**0.02 J**	**0.029 J**

Validated Laboratory Data
FTMM - 57 BLDG 108
November 2017 Sampling

Loc ID	NJ Residential Direct Contact SRS	FTMM57-SB-02			
Sample ID		FTMM-57-SB-02-2.5-3	FTMM-57-SB-02-7-7.5	FTMM-57-SB-102-7-7.5	FTMM-57-SB-02-8-8.5
Sample Date		11/13/2017	11/13/2017	11/13/2017	11/13/2017
Benzo(b)fluoranthene	5	< 0.073	**0.084 J**	**0.059 J**	**0.042 J**
Benzo(ghi)perylene	380000	< 0.073	**0.032 J**	**0.034 J**	**0.02 J**
Benzo(k)fluoranthene	45	< 0.073	**0.022 J**	**0.031 J**	**0.017 J**
Chrysene	450	< 0.073	**0.036 J**	**0.056 J**	**0.017 J**
Dibenz(a,h)anthracene	0.5	< 0.073	**0.016 J**	< 0.074	< 0.076
Fluoranthene	2300	< 0.073	**0.19**	**0.1 J**	**0.064 J**
Fluorene	2300	< 0.073	**0.013 J**	< 0.074	< 0.076
Indeno(1,2,3-cd)pyrene	5	< 0.073	**0.023 J**	**0.036 J**	< 0.076
Naphthalene	6	< 0.073	**0.046 J**	**0.042 J**	**0.033 J**
Phenanthrene		< 0.073	**0.12**	**0.052 J**	**0.033 J**
Pyrene	1700	< 0.073	**0.17**	**0.11 J**	**0.068 J**
Inorganics (mg/kg)					
Arsenic	19	**3.9**	**3.7**	**5.6**	**4.4**
Wet Chemistry - Moisture					
Moisture (percent)		**12.3**	**16.1**	**14.1**	**15.5**
Percent Solids (percent)		**87.7**	**83.9**	**85.9**	**84.5**

APPENDIX F

Human Health Risk Assessment

HUMAN HEALTH RISK ASSESSMENT
FORT MONMOUTH
FTMM-57

November 2, 2018

Contract Number W912DY-09-D-0062, Task Order 0012

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ATTACHMENTS

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ACRONYMS AND ABBREVIATIONS

µg	microgram
ADAF	Age Dependent Adjustment Factor
atm	atmosphere
ATSDR	Agency for Toxic Substances and Disease Registry
BaP	benzo(a)pyrene
bgs	below ground surface
C_a	contaminant concentration in air
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	constituent of potential concern
C_{sat}	chemical-specific soil saturation
CSM	conceptual site model
DAD	dermal absorbed dose
EC(air)	exposure concentration in air
EPC	exposure point concentration
ELCR	excess lifetime cancer risk
ft	feet
FTMM	Fort Monmouth
FS	Feasibility Study
g	gram
GIABS	gastrointestinal absorption factors
HEAST	Health Effects Assessment Tables
Hg	mercury
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
IUR	inhalation unit risk
kg	kilogram
LOAEL	lowest observed adverse effect level
m^3	cubic meters
mg	miligram
mm	milimeter
MOA	mode of action
MP	Main Post
MRL	Minimal Risk Level
NCP	National Contingency Plan
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NOAEL	no observed adverse effect level
OAF	oral absorption factors
OEHHA	Office of Environmental Health Hazard Assessment
PAH	polycyclic aromatic hydrocarbon
PEF	particulate emission factor

ACRONYMS AND ABBREVIATIONS (*continued*)

PPRTV	Provisional Peer Reviewed Toxicity Value
Q/C	Site-Specific Dispersion Model
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RfD_d	dermal reference dose
RfD_o	oral reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
RPF	relative potency factor
RSL	Regional Screening Levels
s	second
SF	slope factor
SF_d	dermal slope factor
SF_o	oral slope factor
THQ	target hazard quotient
TR	target risk
TRSR	Technical Requirements for Site Remediation
UCL	upper confidence limit
USEPA	United Stattes Environmental Protection Agency
UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
VF	volatilization factor

SECTION 1
INTRODUCTION

1.1 Overall Introduction

This risk assessment is part of the Summary Remedial Investigation (RI) Report for Fort Monmouth (FTMM)-57 at Fort Monmouth, New Jersey. Specific activities that are being performed under this project include:

1. Performance of RIs and Feasibility Studies (FS), and preparation of RI/FS reports to achieve acceptance of Decision Documents in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300 and to the extent possible to meet the substantive remedial requirements of New Jersey Administrative Code (N.J.A.C.) 7:26E Technical Requirements for Site Remediation (TRSR); and
2. Support for the closure of environmental sites to facilitate the efficient transfer of real property to other parties.

This risk assessment was conducted according to the Final Human Health Risk Assessment Work Plan for RI/FS at Fort Monmouth Army Installation, Non-Landfill Sites (Parsons, 2015).

Section 1 of this risk assessment is a brief introduction including a description of the site and the data evaluation for the human health risk assessment. Section 2 describes the human health risk assessment (HHRA) and Section 3 presents the references used in the preparation of this document. Tables and figures referenced in this report follow Section 3.

1.2 Site Description

FTMM-57 is located on the eastern edge of the Main Post near existing Buildings 484 and 488 (Summary RI Report Figure 1). FTMM-57 has also been designated as Site 108 based on proximity to the former Building T-108 Motor Pool Office, which was demolished between 1994 and 2004. Real property records indicate that four gasoline tanks and one kerosene tank with associated pump islands were installed at this location in 1952, and refer to this same area as the Building 109 motor pool gasoline and kerosene service station. Gasoline tanks and pump islands were present at this location as early as 1941 based on historical drawings.

Concrete and asphalt pavement covers most of the parcel and a relatively small portion of the parcel (less than 30 percent) consists of unpaved grass or shrub areas. The site is currently unoccupied. Future land use is open space.

The soil at FTMM-57 consists primarily of sand with some silt to approximately six feet below ground surface (bgs). In some borings, deeper soils below six feet bgs consist of olive green sandy clays, indicating glauconitic materials. The depth to groundwater at FTMM-57 ranged from approximately 3.6 to 8.8 feet bgs during the most recent groundwater monitoring event in October 2015. Groundwater is expected to flow southeast towards a ditch that discharges into Oceanport Creek (Summary RI Report Figure 3).

1.3 Data Evaluation

FTMM-57 has previously been sampled by others as well as by Parsons in 2013, 2014, 2015, 2016, and 2017. The available sampling data are summarized in the Summary RI Report. Sample data associated with FTMM-57 include soil and groundwater samples. Soil samples were collected in areas where it was expected that soil contamination could be present. Groundwater samples were collected from monitoring wells within FTMM-57.

Chemical results with final validation qualifiers of any letter other than "U," "UJ," or "R" were considered detected and suitable for use in risk assessment; therefore "J," "ER", and "D" qualified data results were used in the risk assessment (United States Environmental Protection Agency [USEPA], 1989). "B" and "JB" qualified data results were included in the risk assessment data set, as recommended by USEPA, but will be considered not detected (USEPA, 1989).

1.3.1 Selection of Constituents of Potential Concern

Constituents of potential concern (COPCs) in soil were identified by comparing the maximum detected concentration of each analyte to the USEPA residential Regional Screening Levels (RSL) (Target Risk [TR] = $1x10^{-6}$ and Target Hazard Quotient [THQ] = 0.1) (USEPA, 2017a). The THQ of 0.1 was used during screening and selection of COPCs to account for cumulative effects of non-carcinogenic chemicals. The results of the COPC identification process are presented in the Summary RI Report. For the purposes of the risk assessment (i.e., because different receptors may be exposed to different soil intervals), COPCs in soil were identified for surface soil (0 to 2 feet bgs) and for combined surface and subsurface soil (0 to 15 feet bgs).

It should be noted that only residential screening values were used in determining COPCs for this risk assessment, although a number of evaluated site receptors (e.g., onsite worker, construction worker) do not conform to a conventional residential site use pattern. Developing one COPC list for all receptors based on residential screening values is very conservative; it ensures that every site chemical that could possibly contribute to risk or hazard is considered.

COPCs in groundwater were identified by comparing the maximum detected concentrations of each analyte in samples collected from permanent wells between August 2010 and November 2015 to the USEPA tapwater RSL (TR = $1x10^{-6}$ and THQ = 0.1) (USEPA, 2017a). Analytes that are detected at concentrations greater than USEPA tapwater RSLs are considered COPCs unless they are determined to be associated with non-site-related contamination (i.e., contamination introduced at the laboratory or during field sampling, or emanating from an upgradient source unrelated to the site). Detected analytes that exceed the tapwater RSL are then assessed more holistically to determine whether exceedances are representative of site-related contamination, or are due to other factors such as turbidity or upgradient sources. The process used, and the results of the COPC identification process, are presented in the Summary RI Report.

Elevated turbidity can result in concentrations of metals in groundwater that are higher than that found in better quality groundwater resources. Metals exceeding screening levels were exempted from being identified as COPCs as a result of this holistic assessment if any of the following conditions were met:

- There are only a small number of exceedances during the most recent sampling events such that the exceedances were anomalous outliers and not representative of the vast majority of the data;
- The exceedances occur early in the time period encompassed by the most recent sampling events, and concentrations in subsequent samples are below the screening value;
- The exceedances only occur in an upgradient monitoring well; and/or

- The metal is classified as an essential human nutrient (i.e., calcium, iron, magnesium, potassium, and sodium).

The screening levels referenced are June 2017 USEPA RSLs.

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SECTION 2
HUMAN HEALTH RISK ASSESSMENT

2.1 Risk Assessment Process

The HHRA provides an evaluation of the potential risks to human health posed by chemicals detected in surface soil, combined surface and subsurface soil, and groundwater associated with FTMM-57 at the Former Fort Monmouth. As presented in USEPA guidance documents, the HHRA is a four-step evaluation process which includes:

- Data evaluation and identification of COPC;
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

Each of these steps is discussed in detail in the following subsections.

2.2 Identification of Constituents of Potential Concern

2.2.1 Selection of Constituents of Potential Concern

Concentrations of detected chemicals were compared to screening levels to identify COPCs. COPCs were selected by comparing the maximum concentration of each detected analyte in soil and groundwater samples to selected screening levels. Generally, those analytes that are present at concentrations greater than screening levels were retained as COPCs for further evaluation; chemicals detected at concentrations below these screening levels were not considered COPCs. The screening process is presented in Section 1.3 above and in Section 4 of the Summary RI Report .

2.2.2 Constituents of Potential Concern Results

Surface Soil (0 to 2 feet bgs): As shown on Table 5 of the Summary RI Report, benzene, ethylbenzene, *meta/para*-xylene, ortho-xylene, benzo(a)anthracene, benzo(a)pyrene (BaP), benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, and arsenic are identified as COPCs in soil. Of these COPCs, benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are considered mutagens by the USEPA (USEPA, 2017a).

Combined Surface and Subsurface Soil (0 to 15 feet bgs): As shown on Table 5 of the Summary RI Report, benzene, ethylbenzene, *meta/para*-xylene, ortho-xylene, benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, and arsenic are identified as COPCs in soil. Of these COPCs, benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are considered mutagens by the USEPA (USEPA, 2017a).

Groundwater: As shown on Table 7 of the Summary RI Report, antimony, arsenic, cobalt, manganese, and vanadium are COPCs in groundwater. None of these are considered mutagens by the USEPA (USEPA, 2017a).

Vapor Intrusion: As described above, five COPCs were identified in groundwater. Only volatile COPCs are evaluated for vapor intrusion. Volatile compounds are operationally defined as those COPCs with a Henry's Law constant greater than or equal to 1×10^{-5} atmosphere-cubic meters ($atm\text{-}m^3$) per mole or a vapor pressure greater than or equal to 1 millimeter of mercury (mm Hg) (USEPA, 2017b). There are no volatile COPCs in groundwater.

2.3 Exposure Assessment

The exposure assessment consists of three main elements:

1. Evaluation of exposure pathways and identification of receptors;
2. Estimation of exposure point concentrations (EPCs); and
3. Estimation of human intake.

The RA evaluates the reasonable maximum exposure (RME), as defined by USEPA (1993a). The RME is designed to be a measure of "high-end" exposure. USEPA (2004a) describes the selection of exposure parameters to support the RME as follows:

> In comparison with the average exposure, the "high end" exposure estimate is defined as the highest exposure that is reasonably expected to occur at a site but that is still within the range of possible exposures, referred to as the RME (USEPA, 1989). According to the Guidance on Risk Characterization for Risk Managers and Risk Assessors (USEPA, 1992), risk assessors should approach the estimation of the RME by identifying the most sensitive exposure parameters. The sensitivity of a parameter generally refers to its impact on the exposure estimates, which correlates with the degree of variability of the parameter values. Parameters with a high degree of variability in the distribution of parameter values are likely to have a greater impact on the range of risk estimates than those with low variability. For one or a few of the sensitive parameters, the maximum or near-maximum values should be used, with central tendency or average values used for all other parameters. The high-end estimates are based, in some cases, on statistically based criteria (95th or 90th percentiles), and in others, on best professional judgment. In general, exposure duration, exposure frequency, and contact rate are likely to be the most sensitive parameters in an exposure assessment (USEPA, 1989).

2.3.1 Conceptual Site Model

2.3.1.1 Evaluation of Exposure Pathways and Identification of Receptors

A conceptual site model (CSM) is used to qualitatively define the type of potential exposures to contaminants at or migrating from a site (i.e., to systematically evaluate the effect of chemicals in relevant media on potential receptors). The CSM describes onsite release points, affected physical media, types of contaminant transport and fate mechanisms that may be involved at the site, each group of potentially exposed populations or receptors, and how each receptor group may contact site-related contamination. The CSM is used to summarize existing site characterization data, including assumptions about land, groundwater and surface water use, and to complete a qualitative exposure pathway assessment. A CSM diagram has been developed for FTMM-57 and is presented in **Figure F.2.1**.

2.3.1.2 Evaluation of Exposure Pathways and Identification of Receptors

An exposure pathway evaluation describes how a receptor could be exposed to COPCs at, or migrating from, a site. A potentially complete exposure pathway consists of four necessary elements:

- A source and mechanism of chemical release;
- An environmental transport medium;
- A point of potential contact with a receptor; and
- A feasible route of exposure at the exposure point.

The potentially complete exposure pathways and receptors at FTMM-57 are identified in this section. The site-specific CSM (**Figure F.2.1**) identifies the exposure pathways and receptors that are present at

specific sites. Consistent with Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989), current and future land-use scenarios were considered for the site.

The surface water and sediment exposure pathways are incomplete for all human receptors because there is no surface water or sediment present within FTMM-57. The ingestion of biota pathways are incomplete for all human receptors because there is no source of biota for human ingestion.

Volatile compounds in groundwater may migrate upwards and be discharged to ambient (i.e., outdoor) air where receptors at the site may be exposed to them via inhalation. Additionally, inhalation of vapors migrating from groundwater to indoor air is evaluated. Volatile compounds are operationally defined as those COPCs with a Henry's Law constant greater than or equal to 1 x 10^{-5} atm-m^3 per mole or a vapor pressure greater than or equal to 1 mm Hg (USEPA, 2017b). These pathways are incomplete because there are no volatile COPCs in groundwater.

The site-specific CSM for potential human exposures is depicted in **Figure F.2.1**, and is formulated according to applicable guidance, with the use of professional judgment and site-specific information on land use, water use, contaminant sources, release mechanisms, routes of migration, potential exposure points, potential routes of exposure, and potential receptor groups associated with the site. In accordance with the site-specific CSM, risk was quantitatively or qualitatively evaluated for the following potential human exposure scenarios:

- **Current/Future receptors under the unlimited use and unrestricted exposure (UU/UE) scenario**: There is currently no residential use at FTMM-57, and the site zoning does not include residential use. However, in order to provide a complete evaluation of the site in the risk assessment, FTMM-57 has been evaluated for UU/UE, in the absence of institutional controls, including any restrictions on the use of groundwater. Evaluation of the UU/UE scenario allows risk management decisions to be made regarding restrictions on future use of the property. To quantify exposure and risk under the UU/UE scenario (hereafter UU/UE receptors), the most conservative exposures are those that are consistent with a residential exposure scenario (i.e., an exposure scenario that considers long-term exposure of both children and adults to potentially contaminated environmental media). For UU/UE receptors the HHRA evaluates exposure over a 6-year span as a child and a 20-year span as an adult.
    - Potential exposure of UU/UE receptors to COPCs in surface soil (0 to 2 feet bgs) and combined surface and subsurface soil (0 to 15 feet bgs) by incidental ingestion, dermal contact, and inhalation of ambient dust and vapors in ambient air is evaluated.
    - Although groundwater at the site currently is not used as a potable water source and it is anticipated that groundwater use will be restricted following property transfer, groundwater as a potable water source for UU/UE receptors is evaluated. Although alternative potable water supplies (i.e., municipal water supplies) are currently used at the site, and will continue to be used at the site, New Jersey Department of Environmental Protection (NJDEP) considers all groundwater as a potential potable water supply. Therefore, potential exposure of current and future UU/UE receptors to potable groundwater by ingestion, dermal contact, and inhalation of volatiles emitted from potable uses of groundwater is evaluated. Evaluation of these pathways allows for a determination regarding the need for future groundwater restrictions.
- **Current/Future Outdoor Workers (e.g., landscaping personnel, maintenance workers)**: This scenario represents those workers that are present within the area. Outdoor workers are

expected to perform any necessary maintenance or landscaping activities resulting in long-term exposure to potentially contaminated media (e.g., exposure duration 25 years), several days of the week (e.g., exposure frequency 225 days/year).

  - Potential exposure of outdoor workers to COPCs in surface soil (0 to 2 feet bgs) by incidental ingestion, dermal contact, and inhalation of ambient dust and vapors in ambient air is evaluated. Outdoor workers are not expected to encounter soil greater than 2 feet bgs, therefore, exposure to subsurface soil is not evaluated for outdoor workers at FTMM-57.
  - Groundwater at the site is currently not used as a potable water source and current/future outdoor workers are not expected to be exposed to groundwater during routine activities; therefore, exposure to groundwater is an incomplete pathway and will not be evaluated for outdoor workers.

- **Current / Future Recreational Users:** This scenario represents adolescent and adult receptors that may use only those sites designated for passive open space for recreational purposes.
  - Potential exposure of current/future recreational users to COPCs in surface soil (0 to 2 feet bgs) by incidental ingestion, dermal contact, and inhalation of ambient dust and vapors in ambient air, in part as an adolescent (aged 6-<16 years) and in part as an adult, is evaluated. Recreational users are not expected to encounter subsurface soil (2 to 15 feet bgs). Therefore, exposure to subsurface soil is an incomplete pathway.
  - Groundwater at the site is currently not used as a potable water source and current/future recreational users are not expected to be exposed to groundwater during recreational visits; therefore, exposure to groundwater is an incomplete pathway.
- **Current/Future Utility Workers:** This scenario is expected to represent utility workers that would typically be involved in a single short-term excavation project at a given location, such as would be expected to be associated with repair or installation of utility lines. It is not expected that the same crew would return to the same location to conduct additional repair, installation, or maintenance of underground utility lines.
  - Potential exposure of utility workers to combined surface and subsurface soil (0 to 15 feet bgs) through incidental ingestion, dermal contact, and inhalation of ambient dust and vapors in ambient air is evaluated.
  - The depth to groundwater in the FTMM-57 area is approximately four to nine feet bgs. Utility workers may be exposed to contaminants present in groundwater through incidental ingestion, dermal contact, and inhalation of volatile contaminants. Exposure of utility workers exposed to COPCs through incidental ingestion and dermal contact is quantitatively evaluated. Volatile compounds in soil gas and/or groundwater may migrate upwards and be discharged to ambient (i.e., outdoor) air where utility workers at the site may be exposed to them via inhalation. While utility workers may be exposed to volatile compounds present in groundwater during excavation activities, there is no validated model available to quantify exposure to volatiles in a trench. Therefore, this exposure pathway is qualitatively evaluated.

The exposure scenarios selected for evaluation are anticipated to account for the range of reasonably anticipated exposures under current and future conditions at the site. The scenarios selected are sufficiently conservative to adequately address other less common scenarios for soil and groundwater.

A summary of the relevant receptors and exposure scenarios is provided in **Table F.2.1**.

The exposure assumptions used for estimating chemical intake are presented in **Table F.2.2** for soil and **Table F.2.3** for groundwater.

2.3.1.3 Exposure Area

An exposure area is the area over which sampling data are aggregated for estimation of risk. The size and location of the exposure area is commensurate with the assumed activity patterns of each specific receptor. Exposure areas for different receptors may overlap, that is, the UU/UE receptors would be expected to be exposed to an area of less than a half acre in size, while outdoor workers would be expected to be exposed to a larger area. The exposure areas are defined considering the results of the source area investigation (e.g., the center point of the most contaminated areas) and activity patterns of the potential receptors being evaluated. Locations of the highest detected concentrations within FTMM-57 have been evaluated spatially to determine best placement of exposure area boundaries for the HHRA, to ensure that the highest detected concentrations are evaluated in the HHRA.

Figure F.2.2 shows the soil exposure area for FTMM-57. The exposure area is the area at the site with the highest concentrations of COPCs that would be most likely to pose an unacceptable risk to potential receptors. For groundwater, exposure is expected to be limited to a single sample location, as exposure to groundwater would be expected to occur at a single point, either through installation of a well, or excavation by a utility worker. Each groundwater well location is considered a separate exposure point, because it is assumed each well is an individual potential source of drinking water.

2.3.2 Estimation of Exposure Point Concentrations

EPCs are the concentrations of chemicals in a given medium to which a receptor may be exposed at a specific location known as the "exposure point." EPCs are estimated using a combination of available analytical data and fate and transport modeling data to represent the RME that is expected to occur at the site. Initial EPCs for soil are the maximum detected concentration of each analyte. If an unacceptable cumulative risk or hazard index is calculated, 95% upper confidence limits (UCL) are calculated for those COPCs contributing significantly to the risk/hazard (i.e., greater than 25% of the cumulative risk/hazard) and the risk is estimated using the 95% UCL on the mean as the EPC for those analytes. If there was an insufficient sample size to calculate a 95% UCL, the maximum detected concentration was kept as the EPC.

The groundwater evaluation was conducted both sitewide, as well as for individual wells. The EPCs for the sitewide groundwater evaluation are the maximum detected concentration, regardless of the well it was detected in, from samples collected from August 2010 through November 2015. For evaluation of the individual wells, the EPCs are the maximum detected concentration from each well from samples collected from August 2010 through November 2015. During the individual well calculation, if an unacceptable cumulative risk or hazard index is calculated, 95% UCL are calculated for those COPCs contributing significantly to the risk/hazard (i.e., greater than 25% of the cumulative risk/hazard) and the risk is estimated using the 95% UCL on the mean as the EPC for those analytes. If there was an insufficient sample size to calculate a 95% UCL, the maximum detected concentration was kept as the EPC.

The data tables present results for all samples, including primary and duplicate samples and are included in the Summary RI Report. The “best value” sample result of all primary and duplicate results were used to determine the EPC. If both values represent detected concentrations, then the highest detected concentration (i.e., the most conservative) was considered the “best value” for use in the risk assessment. If one value represents a detected concentration and one value is qualified as not detected, then the

detected value was considered the best value and was retained in the risk assessment. If both values are qualified as not detected, the highest reported U flagged value was retained.

Polycyclic aromatic hydrocarbons (PAH) found in environmental samples are almost always present in complex mixtures. Therefore, a consideration of the risks associated with exposure to the entire suite of carcinogenic PAHs was considered. BaP is the most researched carcinogenic PAH, and the carcinogenicity of other PAHs is determined relative to BaP. A Relative Potency Factor (RPF) approach was used to calculate a BaP-equivalent concentration (USEPA, 1993b). A BaP-equivalent concentration was calculated for the carcinogenic PAHs by multiplying the individual results for the carcinogenic PAH by the RPF for each sample, and summing the values. The RPFs for each carcinogenic PAH are shown in **Table F.2.4**. BaP-equivalent concentrations were calculated for surface soil and combined surface and subsurface soil. The maximum calculated BaP-equivalent concentration for each soil profile was selected for use as the EPC.

EPCs for risk estimation were calculated for each receptor type as follows:

- Initial EPCs for soil were the maximum detected concentration of each analyte. If an unacceptable cumulative risk or hazard index was calculated, 95% UCL were calculated for those COPCs contributing significantly to the risk/hazard (i.e., greater than 25% of the cumulative risk/hazard) and the risk is estimated using the 95% UCL on the mean as the EPC for those analytes. If there was an insufficient sample size to calculate a 95% UCL, the maximum detected concentration was used as the EPC. Soil EPCs for the combined surface and subsurface soil exposure scenario for the UU/UE and utility worker were calculated by aggregating analytical data collected from the exposure area for combined surface and subsurface soil (0-≤15 feet bgs). Surface soil EPCs for all receptor scenarios were estimated from the analytical data collected from the exposure area for surface soil (0-≤2 feet bgs). Soil EPCs are shown in **Tables F.2.5 and F.2.6.**
- In accordance with the approved final risk assessment work plan (Parsons, 2015), the groundwater EPCs were the maximum detected result of each analyte from the samples collected from the eight sampling events conducted from the time period of August 2010 through November 2017 from all wells. In addition, the risk for each well was estimated using the maximum detected concentration from each well. If an unacceptable cumulative risk or hazard index was calculated, 95% UCL were calculated for those COPCs contributing significantly to the risk/hazard (i.e., greater than 25% of the cumulative risk/hazard) and the risk is estimated using the 95% UCL on the mean as the EPC for those analytes. Groundwater EPCs for all wells combined and for individual wells are shown in **Table F.2.7.**

2.3.3 Estimation of Human Intake

Human intake, expressed as milligrams of chemical per kilogram of body weight per day (mg/kg-day), is obtained by multiplying the EPC by exposure factors specific to an exposure scenario. The resultant intake is compared to a carcinogenic slope factor or noncarcinogenic reference dose to derive the carcinogenic risks and noncarcinogenic hazards associated with potential exposures from the site.

The following general equation (USEPA, 1989) is used to quantify the intake of COPCs by potential receptors:

$$Intake = \frac{(C)(CR)\ (EF)(ED)}{(BW)(AT)}$$

Where: C = Chemical concentration in medium (mg/kg)
CR = Contact rate (amount/unit time)

EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days), for noncarcinogens, equal to ED x 365 days/year; for carcinogens, equal to 70 year assumed lifespan x 365 days/year)

In accordance with USEPA guidance (1989), human intake for carcinogens is calculated differently from those for noncarcinogens. For carcinogens, human intake is averaged over an assumed lifetime of 70 years, because cancer is considered to be a non-threshold phenomenon, and multiple individual chemical exposures which could result in the development of cancer are accrued over a lifetime. The probability of developing cancer is believed to be proportional to the duration and intensity of exposure. That is to say, the probability of developing cancer is proportional to the dose of chemical absorbed into the body, the frequency of exposure, and the duration of exposure.

For cancer assessments that require evaluation of multiple age groups simultaneously, such as UU/UE receptors and recreational users, age-adjusted factors are used to account for the periods of an individual's life spent as a child or adolescent and as an adult. For UU/UE receptors, inputs consistent with residential exposure were used to calculate intakes for carcinogens, and it is assumed that exposure would occur in part as a child (aged 0-<6 years) and the remainder as an adult (the subsequent 20 years). For recreational users, it is assumed that exposure would occur in part as an adolescent (aged 6-<16 years) and in part as an adult (aged 16-<30 years). The age-adjusted factor ($Factor_{adj}$) encompasses the contact rate, exposure duration, and body weight in all cancer assessments for which a portion of the exposure would be expected to occur as a child or adolescent (subscripted "adl") and a portion as an adult, as these are the exposure parameters that are expected to differ between children, adolescents, and adults. This factor is calculated as follows:

$$Factor_{adj} = \left[\frac{(ED_{adl\ or\ child})\ (CR_{adl\ or\ child})}{(BW_{adl\ or\ child})}\right] + \left[\frac{(ED_{adult})\ (CR_{adult})}{(BW_{adult})}\right]$$

Where:
$ED_{adl\ or\ child}$ = Adolescent or child exposure duration (years)
$CR_{adl\ or\ child}$ = Adolescent or child contact rate (amount/unit time)
ED_{adult} = Total exposure duration of both adult and child (years)
CR_{adult} = Adult contact rate (amount/unit time)
$BW_{adl\ or\ child}$ = Adolescent or child body weight (kg)
BW_{adult} = Adult body weight (kg)

Outdoor workers and utility workers are included only as adult receptors. Therefore, an age-adjusted factor is not used for these receptors to estimate carcinogenic intake.

For noncarcinogens, the intake is averaged only over the duration of exposure. This reflects the assumption that noncarcinogenic effects have a toxicity threshold. Adverse health effects could result if the toxicity threshold were exceeded for a period of time corresponding to the exposure duration. Conversely, intake of a chemical below the toxicity threshold for a period of time corresponding to the exposure duration would not be expected to result in adverse health effects in the receptor. Therefore, intake is calculated separately for different age groups for noncarcinogens.

Appropriate exposure factors were used to calculate pathway-specific intake factors for all complete pathways at the site. When appropriate, site-specific information was used to develop reasonable yet conservative exposure factors. When neither site-specific information nor default values were available,

best professional judgment was used to select appropriate exposure parameters. The equations for calculating both carcinogenic and noncarcinogenic intake of non-mutagenic COPCs are provided in the following subsections. The calculation of human intake of mutagenic COPCs is discussed below in Subsection 2.3.3.3

2.3.3.1 Intake Equations for Soil

Soil Ingestion

The following equations (USEPA, 1989) will be used to calculate the intake (expressed as mg/kg-day) associated with the incidental ingestion of COPCs in soil. The exposure parameter values, definition and units, and source of the value for the inputs as described in the equations below are shown for each receptor in **Table F.2.2**.

Intakes from incidental ingestion of noncarcinogenic COPCs in soil, as applicable, were calculated for the UU/UE receptors (adult and child separately), outdoor workers, utility workers, and recreational users (adult and adolescent separately) as:

$$Ingestion = \frac{(C_S)\ (IRS)\ (EF)\ (ED)\ (CF_S)(FI)}{(AT)\ (BW)}$$

Where:
- C_S = Contaminant concentration in soil (mg/kg)
- IRS = Ingestion rate soil (mg/day) - for adult, adolescent, or child receptors, as applicable
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years) - for adult, adolescent, or child receptors, as applicable
- CF_S = Conversion factor for soil (1E-06 kg/mg)
- FI = Fraction soil ingested from source (unitless)
- AT = Averaging time (days) - for noncarcinogens, equal to ED x 365 days/year
- BW = Body weight (kg) - for adult, adolescent, or child receptors, as applicable

For scenarios that require evaluation of multiple age groups simultaneously, such as for UU/UE receptors and recreational users, the carcinogenic age-adjusted intake from incidental ingestion is calculated as:

$$Ingestion_{age-adj} = \frac{(C_s)\ \left(IFS_{adj}\right)\ (EF)\ (CF_s)\ (FI)}{(AT)}$$

Where:

$$IFS_{adj} = \left(\frac{(ED_{adl\ or\ child})(IRS_{adl\ or\ child})}{(BW_{adl\ or\ child})}\right) + \left(\frac{(ED_{adult})(IRS_{adult})}{(BW_{adult})}\right)$$

Where:
- C_s = Contaminant concentration in soil (mg/kg)
- IFS_{adj} = Age-adjusted soil ingestion factor (mg-year/kg-day)
- IRS_{adult} = Ingestion rate soil (mg /day) - adult
- IRS_{adl} = Ingestion rate soil (mg /day) - adolescent

IRS_{child} = Ingestion rate soil (mg /day) - child
EF = Exposure frequency (days/year)
ED_{adult} = Exposure duration (years) - adult
ED_{adl} = Exposure duration (years) - adolescent
ED_{child} = Exposure duration (years) - child
CF_s = Conversion factor for soil (1E-06 kg/mg)
FI = Fraction soil ingested from source (unitless)
AT = Averaging time (days) - for carcinogens, equal to70-year lifetime x 365 days/year
BW_{adult} = Body weight (kg) - adult
BW_{adl} = Body weight (kg) - adolescent
BW_{child} = Body weight (kg) - child

Dermal Contact with Soil

The following equations (USEPA, 2004a) were used to calculate the dermal absorbed dose (DAD) (expressed as mg/kg-day) from dermal contact with COPCs in soil. The exposure parameter values, definition and units, and source of the value for the inputs as described in the equations below are shown for each receptor in **Table F.2.2**.

Intakes from dermal contact of noncarcinogenic COPCs in soil, as applicable, were calculated for UU/UE receptors (adult and child separately), outdoor workers, utility workers, and recreational users (adult and adolescent separately) as:

$$DAD = \frac{(DA_{event})\ (EF)\ (ED)\ (EV)\ (SA)}{(AT)\ (BW)}$$

Where the absorbed does per event (DA_{event}), in milligrams per square centimeter per event (mg/cm^2-event), will be estimated as follows (USEPA, 2004a):

$$DA_{event} = (C_s)\ (CF_s)\ (AF)\ (ABS_d)$$

Where: DA_{event} = Absorbed dose per event (mg/cm^2-event) – for adult, adolescent, or child receptors, as applicable
EF = Exposure frequency (days/year)
ED = Exposure duration (years) – for adult, adolescent, or child receptors, as applicable
EV = Event frequency (events/day)
SA = Exposed skin surface area available for contact (cm^2) – for adult, adolescent, or child receptors, as applicable
AT = Averaging time (days) - for noncarcinogens, equal to ED x 365 days/year
BW = Body weight (kg) – for adult, adolescent, or child receptors, as applicable
Cs = Contaminant concentration in soil (mg/kg)
CFs = Conversion factor for soil (1E-06 kg/mg)
AF = Adherence factor of soil to skin (mg/cm^2) – for adult, adolescent, or child receptors, as applicable
ABS_d = Dermal absorption fraction (unitless)

For scenarios that require evaluation of multiple age groups simultaneously, such as UU/UE receptors and recreational users, the carcinogenic age-adjusted intake from dermal contact will be calculated as:

$$DAD_{age-adj} = \frac{(C_s)\left(SFS_{adj}\right)(ABS_d)(EF)(EV)(CF_s)}{(AT)}$$

Where:

$$SFS_{adj} = \left(\frac{(ED_{adl\ or\ child})(AF_{adl\ or\ child})(SA_{adl\ or\ child})}{(BW_{adl\ or\ child})}\right) + \left(\frac{(ED_{adult})(AF_{adult})(SA_{adult})}{(BW_{adult})}\right)$$

Where:

Cs	=	Contaminant concentration in soil (mg/kg)
SFS_{adj}	=	Age-adjusted dermal exposure factor (mg-year/kg-day)
ABS_d	=	Dermal absorption fraction (unitless)
EF	=	Exposure frequency (days/year)
EV	=	Event frequency (events/day)
CFs	=	Conversion factor for soil (1E-06 kg/mg)
AT	=	Averaging time (days) - for carcinogens, equal to 70-year lifetime x 365 days/year
ED_{adult}	=	Exposure duration (years) - adult
ED_{adl}	=	Exposure duration (years) - adolescent
ED_{child}	=	Exposure duration (years) - child
AF_{adult}	=	Adherence factor of soil to skin (mg/cm^2) - adult
AF_{adl}	=	Adherence factor of soil to skin (mg/cm^2) - adolescent
AF_{child}	=	Adherence factor of soil to skin (mg/cm^2) - child
SA_{adult}	=	Exposed skin surface area available for contact (cm^2) – adult
SA_{adl}	=	Exposed skin surface area available for contact (cm^2) - adolescent
SA_{child}	=	Exposed skin surface area available for contact (cm^2) - child
BW_{adult}	=	Body weight (kg) - adult
BW_{adl}	=	Body weight (kg) - adolescent
BW_{child}	=	Body weight (kg) - child

Inhalation of Particulates and Vapors from Soil

The following equations (USEPA, 2009) were used to calculate the exposure concentration in air (EC[air]) (expressed as micrograms per cubic meter [$\mu g/m^3$]) associated with the inhalation of COPCs in soil. The exposure parameter values, definition and units, and source of the value for the inputs as described in the equations below are shown for each receptor in **Table F.2.2**.

The EC(air) from soil particulates or vapors emitted from soil into ambient air were calculated for UU/UE receptors (adult and child separately for noncarcinogenic COPCs), utility workers, outdoor workers, and recreational users (adult and adolescent separately for noncarcinogenic COPCs).

The EC(air) of soil particulates and vapors emitted from soil are calculated for noncarcinogenic and carcinogenic compounds as:

$$EC(air) = \frac{(C_a)(ET)(EF)(ED)}{(AT)}$$

For exposure scenarios where a receptor would be exposed to both ambient dust and vapors in air, the contaminant concentration in air (C_a), expressed in µ/m^3, is estimated using the following equation derived from USEPA RSL User's Guide (2017c):

$$C_a = (C_s)\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF} + \frac{1}{VF}\right)$$

Where:
- C_a = Contamination concentration in air (µg/m^3)
- ET = Exposure time (hours/day)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years); calculated as 6 years as child plus 20 years as adult (UU/UE exposure receptors) and 10 years as adolescent plus 14 years as adult (recreational user)
- AT = Averaging time (days) - for noncarcinogens, equal to ED x 365 days/year; for carcinogens, equal to 70-year lifetime x 365 days/year
- C_S = Chemical concentration in soil (mg/kg)
- PEF = Particulate emission factor (m^3/kg)
- VF = Chemical-specific volatilization factor (m^3/kg)

For COPCs that are not volatile, there is no VF. Thus, there is no contribution to the EC(air) from volatilization, and the EC(air) is based solely on resuspension of soil particulates such as at FTMM-57. For exposure scenarios where a receptor would be exposed to ambient dust, but not vapors (e.g., inorganic compounds) in air, the contaminant concentration in air (C_a), expressed in µg/m^3, was estimated using the following equation derived from USEPA RSL User's Guide (2017c):

$$C_a = (C_s)\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)$$

Where:
- C_a = Contamination concentration in air (µg/m^3)
- C_S = Chemical concentration in soil (mg/kg)
- PEF = Particulate emission factor (m^3/kg)

The air concentrations of COPCs were modeled to determine the inhalation exposure concentration. The particulate emission factor (PEF) relates the concentration of COPCs in soil with the concentration of dust particles in the air. This PEF relates to dust generated from open sources, which is termed "fugitive" because it is not discharged into the atmosphere in a confined flow stream. The volatilization factor (VF) is used to define the relationship between the concentration of the COPCs in soil and the flux of the volatilized COPCs to air. Dispersion models are used to determine the dispersion of COPCs in the atmosphere, reduced to a single site-specific dispersion model (Q/C) term which represents the inverse of the mean concentration at the center of the square source (expressed in gram per square meter per second [g/m^2-s] per kg/m^3), based on regional climatic zones, source area, and nearest city. For FTMM, the Q/C value is based on Zone VIII, Philadelphia, Pennsylvania, and a 0.5 acre source area. The default exposure parameter values for the inputs as described in the PEF and VF equations below are shown in **Table F.2.8**.

The PEF, in m^3/kg, is estimated using the following equation (USEPA, 2002; 2017c) see **Table F.2.9**:

$$PEF = \left({}^{Q}/_{C}\right)\left(\frac{3{,}600\ {}^{seconds}/_{hour}}{(0.036)\ (1-V)\left(\left({}^{U_m}/_{U_t}\right)^3\right)\ [F(x)]}\right)$$

Where:
- Q/C = Inverse of mean concentration at center of square source area (g/m^2-s per kg/m^3)
- V = Fraction of vegetative cover (unitless)
- U_m = Mean annual wind speed (meter[s] per second [m/s])
- U_t = Equivalent threshold value of wind speed at 7 m (m/s)
- F(x) = Function dependent on U_m/U_t derived using Cowherd et al. (1985) (unitless)

The VF is estimated using the following equation (USEPA, 2002, 2017c) see **Table F.2.10**.

$$VF = \frac{\left({}^{Q}/_{C}\right)\left(\left((3.14)\ (D_A)\ (T)\right)^{1/2}\right)\left(10^{-4}\ {}^{m^2}/_{cm^2}\right)}{\left((2)\ (\rho_b)\ (D_A)\right)}$$

Where:

$$D_A = \frac{\left[\left(\theta_a^{10/3}\right)\ (D_i)\ (H') + \left(\theta_w^{10/3}\right)\ (D_w)\right]/n^2}{\left((\rho_b)\ (K_d)\right) + \ \theta_w + \ \left((\theta_a)\ (H')\right)}$$

Where:
- VF = Chemical-specific volatilization factor (m^3/kg)
- Q/C = Inverse of mean concentration at center of square source area (g/m^2-s per kg/m^3)
- D_A = Apparent diffusivity (cm^2/s)
- T = Exposure interval(s)
- ρ_b = Dry soil bulk density (g/cm^3)
- θ_a = Air-filled soil porosity (L_{air}/L_{soil}) = n- θ_w
- D_i = Diffusivity in air (cm^2/s)
- H' = Henry's law constant (unitless)
- θ_w = Water-filled soil porosity (L_{water}/L_{soil})
- D_w = Diffusivity in water (cm^2/s)
- n = Total soil porosity (L_{pore}/L_{soil}), calculated as 1-(ρ_b / ρ_s)
- K_d = Soil-water partition coefficient (cm^3/g) (calculated as K_{OC} X f_{OC})
- K_{OC} = Soil organic carbon-water partition coefficient (cm^3/g)
- f_{OC} = Organic carbon content of soil (g/g)
- ρ_s = Soil particle density (g/cm^3)

In addition, soil saturation must be considered when calculating the VF (USEPA, 1996). Soil saturation corresponds to the COPC concentration in soil at which the adsorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil pore air have been reached. Above this concentration, the COPC in soil may be present in free phase. Chemical-specific soil saturation (C_{sat}) concentrations must be compared with the concentration of each volatile soil COPC because a basic principle of the VF calculation is not applicable when free-phase contaminants are present. Therefore, the VF is applicable only if the soil COPC concentration is equal to or less than the soil saturation concentration. Soil saturation concentrations (**Table F.2.11**) were obtained from the USEPA RSL Chemical-specific Parameter Tables (2017d).

If the soil COPC concentration is greater than the soil saturation concentration, the following equation is used to calculate the contaminant concentration in air, C_a ($\mu g/m^3$):

$$C_a = \left[(C_S) \left(\frac{1{,}000\mu g}{mg}\right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat}) \left(\frac{1{,}000\mu g}{mg}\right) \left(\frac{1}{VF}\right)\right]$$

The soil saturation concentration is not calculated for chemicals that are solid at room temperature (e.g., naphthalene). If the soil COPC concentration is less than or equal to the soil saturation concentration, or if the volatile is solid at room temperature, C_a would be calculated the same as for a receptor exposed to both ambient dust and vapors in air.

Where:
- C_S = Chemical concentration in soil (mg/kg)
- C_{sat} = Soil saturation concentration (mg/kg)
- PEF = Particulate emission factor (m^3/kg)
- VF = Chemical-specific volatilization factor (m^3/kg)

2.3.3.2 Intake Equations for Water

Ingestion of Groundwater

The following equations (USEPA, 1989) will be used to calculate the intake (expressed as mg/kg-day) associated with the ingestion of carcinogenic and noncarcinogenic contaminants in water for the utility worker exposed to groundwater in a trench and for UU/UE receptors exposed to potable groundwater. The evaluation of UU/UE receptors will include conservative inputs consistent with a resident using groundwater as a potable water source. The exposure parameter values, definition and units, and source of the value for the inputs as described in the equations below are shown for each receptor in **Table F.2.3.**

Intakes from ingestion of noncarcinogenic COPCs in groundwater are calculated as:

$$Ingestion = \frac{(C_W)\ (IRW)\ (EF)\ (ED)}{(AT)\ (BW)}$$

Where:
- C_W = Contaminant concentration in water (mg/L)
- IRW = Ingestion rate water (L/day) - adult and child receptors, as applicable
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years) - adult and child receptors, as applicable
- AT = Averaging time (days) - for noncarcinogens, equal to ED x 365 days/year

BW = Body weight (kg) - adult and child receptors, as applicable

For scenarios that require evaluation of multiple age groups simultaneously, such as UU/UE receptors, the carcinogenic age-adjusted intake from ingestion is calculated as:

$$Ingestion_{age-adj} = \frac{(C_w)\left(IFW_{adj}\right)(EF)}{(AT)}$$

Where:

$$IFW_{adj} = \left(\frac{(ED_{child})\,(IRW_{child})}{(BW_{child})}\right) + \left(\frac{(ED_{adult})\,(IRW_{adult})}{(BW_{adult})}\right)$$

Where:
C_W = Contaminant concentration in water (mg/L)
IRW_{adult} = Ingestion rate water (L/day) – adult
IRW_{child} = Ingestion rate water (L/day) – child
IFW_{adj} = Age-adjusted water ingestion factor [(L-year)/(kg-day)]
EF = Exposure frequency (days/year)
ED_{adult} = Exposure duration (years) - adult
ED_{child} = Exposure duration (years) - child
AT = Averaging time (days) - for carcinogens, equal to 70-year lifetime x 365 days/year
BW_{adult} = Body weight (kg) – adult
BW_{child} = Body weight (kg) – child

Dermal Contact with Groundwater

The following equations (USEPA, 2004a) were used to calculate the DAD (expressed as mg/kg per day) associated with the dermal contact of COPCs in groundwater. The exposure parameter values, definition and units, and source of the value for the inputs as described in the equations below are shown for each receptor in **Table F.2.3** and for each COPC in **Table F.2.12**.

The DAD of noncarcinogenic COPCs is calculated for UU/UE receptors (adults and children, separately) and utility workers:

$$DAD = \frac{(DA_{event})\,(EF)\,(ED)\,(EV)\,(SA)}{(AT)\,(BW)}$$

Where:
DA_{event} = Absorbed dose per event (mg/cm^2-event)
EF = Exposure frequency (days/year)
EV = Event frequency (events/day)
ED = Exposure duration (years) – adult or child, as applicable
SA = Exposed skin surface area available for contact (cm^2) – adult or child, as applicable
AT = Averaging time (days) - for noncarcinogens, equal to ED x 365 days/year
BW = Body weight (kg) – adult or child, as applicable

For scenarios that require evaluation of multiple age groups simultaneously, such as the UU/UE scenario, the carcinogenic age-adjusted DAD is calculated as:

$$DAD_{age-adj} = \frac{(DA_{event})\ (EV)\ (EF)\ (SFW_{adj})}{AT}$$

Where:

$$SFW_{adj} = \left[\frac{(ED_{child})\ (SA_{child})}{(BW_{child})}\right] + \left[\frac{(ED_{adult})\ (SA_{adult})}{(BW_{adult})}\right]$$

Where the DA_{event} for organic compounds, in mg/cm^2-event, is estimated as follows (USEPA, 2004a):

$If\ t_{event} \leq t^*, then$

$$DA_{event} = (2)\ (FA)\ (K_p)\ (C_w)\sqrt{\frac{((6)\ (\tau_{event})\ (t_{event}))}{\pi}}$$

$If\ t_{event} > t^*, then$

$$DA_{event} = (FA)\ (K_p)\ (C_w)\left[\left(\frac{t_{event}}{(1+B)}\right) + ((2)\ (\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

And where the DA_{event} for inorganic compounds, in mg/cm^2-event, is estimated as follows (USEPA, 2004a):

$$DA_{event} = (K_p)\ (C_w)\ (t_{event})$$

Where:

	DA_{event}	=	Absorbed dose per event (mg/cm^2-event)
	EV	=	Event frequency (events/day)
	EF	=	Exposure frequency (days/year)
	SFW_{adj}	=	Age-adjusted dermal exposure factor (mg-year/kg-day)
	AT	=	Averaging time (days) - for carcinogens, equal to 70-year lifetime x 365 days/year
	ED_{adult}	=	Exposure duration (years) - adult
	ED_{child}	=	Exposure duration (years) - child
	SA_{adult}	=	Skin surface area available for contact (cm^2) - adult
	SA_{child}	=	Skin surface area available for contact (cm^2) - child
	BW_{adult}	=	Body weight (kg) - adult
	BW_{child}	=	Body weight (kg) - child
	FA	=	Fraction absorbed (dimensionless)
	K_p	=	Dermal permeability coefficient of compound in water (cm/hour [hr])
	C_w	=	Chemical concentration in water (mg/cm^3)
	τ_{event}	=	Lag time per event (hr/event)

t_{event} = Event duration (hr/event)
t* = Time to reach steady-state (hr) (calculated as 2.4 τ_{event})
B = Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless)

2.3.3.3 Calculation of Intake for Mutagenic COPCs

If a chemical has been determined to cause cancer by a mutagenic mode of action (MOA), USEPA has noted that it is possible that exposures to that chemical in early life may result in higher lifetime cancer risks than an adult exposure of comparable duration (USEPA, 2007). Therefore, if chemical-specific data on susceptibility from early life exposures are available and have been used to develop cancer slope factors (SFs) or inhalation unit risks (IURs) that specifically address any potential for differential potency in early life stages, the derived SFs/IURs were used in lieu of Age Dependent Adjustment Factors (ADAFs) (discussed below). For example, the Integrated Risk Information System (IRIS) assessment of vinyl chloride provides two sets of SFs/IURs, one that accounts for exposure occurring during early life and one that accounts for exposure occurring later in life.

In assessing the risk for which a mutagenic MOA has been identified by USEPA, default ADAFs were applied for those chemical lacking chemical-specific data on susceptibility from early life exposures. The *Supplemental Guidance for Assessing Cancer Susceptibility from Early Life Exposure to Carcinogens* (USEPA, 2005a) recommends the following default ADAFs:

- 10-fold adjustment for exposures during the first two years of life
- 3-fold adjustment for exposures from ages 2 to <16 years of age
- No adjustment for exposures after turning 16 years of age

These ADAFs are used to prorate the toxicity factors for the respective age ranges, to account for more or less sensitivity during that life stage. For example, there is assumed by default to be 10-fold greater sensitivity over the first two years of life than for an equivalent level of exposure after turning 16 years of age. Consideration of early life stage exposure was limited to the UU/UE receptor and recreational user scenarios. Because the adolescent recreational user is 6 to <16 years of age, only the three-fold adjustment is used in the calculations for intake of mutagenic COPCs.

Table F.2.9 identifies mutagens present in soil and groundwater. The following mutagenic COPCs were identified:

- Surface Soil: benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, collectively evaluated as a BaP-equivalent.
- Combined Surface and Subsurface Soil: benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, collectively evaluated as a BaP-equivalent.
- Groundwater: None

Carcinogenic PAHs were evaluated using the cancer slope factor for BaP, the most thoroughly studied of the carcinogenic PAHs. The evaluation is conducted using a BaP-equivalent concentration that considers an aggregate concentration of seven carcinogenic PAHs as described in Subsection 2.3.2.

For BaP, the following equations were used:

Incidental Ingestion of Soil. The following equation (USEPA, 1989; 2005a) is used to calculate the intake in mg/kg-day for mutagenic COPCs :

For UU/UE receptors:

$$Intake = \frac{C_s \times \left(\begin{array}{c} \frac{(ED_{0-2} \times IRS_c) \times 10}{BW_c} + \frac{(ED_{2-6} \times IRS_c) \times 3}{BW_c} + \\ \frac{(ED_{6-16} \times IRS_a) \times 3}{BW_a} + \frac{(ED_{16-30} \times IRS_a) \times 1}{BW_a} \end{array} \right) \times EF \times 10^{-6} kg/mg}{AT}$$

And for recreational users:

$$Intake = \frac{C_s \times \left(\frac{(ED_{6-16} \times IRS_{adl}) \times 3}{BW_{adl}} + \frac{(ED_{16-30} \times IRS_a) \times 1}{BW_a} \right) \times EF \times 10^{-6} kg/mg}{AT}$$

where:

C_s = chemical concentration in soil (mg/kg)
$ED_{0\text{-}2}$ = exposure duration, 0 to 2 years of age (years)
$ED_{2\text{-}6}$ = exposure duration, 2 to 6 years of age (years)
$ED_{6\text{-}16}$ = exposure duration, 6 to 16 years of age (years)
$ED_{16\text{-}30}$ = exposure duration, 16 to 30 years of age (years)
IRS_c = child soil ingestion rate (mg/day)
IRS_{adl} = adolescent soil ingestion rate (mg/day)
IRS_a = adult soil ingestion rate (mg/day)
BW_c = child body weight (kg)
BW_{adl} = adolescent body weight (kg)
BW_a = adult body weight (kg)
EF = exposure frequency (days/year)
AT = averaging time (days)

Dermal Contact with Soil. The following equations (USEPA, 2004a; 2005a) are used to calculate the intake from dermal contact with mutagenic COPCs in soil:

For UU/UE receptors:

$$DAD = \frac{C_s \times \left(\begin{array}{c} \frac{(ED_{0-2} \times AF_c \times SA_c) \times 10}{BW_c} + \frac{(ED_{2-6} \times AF_c \times SA_c) \times 3}{BW_c} + \\ \frac{(ED_{6-16} \times AF_a \times SA_a) \times 3}{BW_a} + \frac{(ED_{16-30} \times AF_a \times SA_a) \times 1}{BW_a} \end{array} \right) \times ABS \times EF \times 10^{-6} kg/mg}{AT}$$

And for recreational users:

$$DAD = \frac{C_s \times \left(\frac{(ED_{6-16} \times AF_{adl} \times SA_{adl}) \times 3}{BW_{adl}} + \frac{(ED_{16-30} \times AF_a \times SA_a) \times 1}{BW_a} \right) \times ABS \times EF \times 10^{-6} kg/mg}{AT}$$

where:

DAD = dermally absorbed dose (mg/kg-day)
C_s = chemical concentration in soil (mg/kg)

$ED_{0\text{-}2}$ = exposure duration, 0 to 2 years of age (years)
$ED_{2\text{-}6}$ = exposure duration, 2 to 6 years of age (years)
$ED_{6\text{-}16}$ = exposure duration, 6 to 16 years of age (years)
$ED_{16\text{-}30}$ = exposure duration, 16 to 30 years of age (years)
AF_c = child soil-to-skin adherence factor (mg/cm^2-day)
AF_{adl} = adolescent soil-to-skin adherence factor (mg/cm^2-day)
AF_a = adult soil-to-skin adherence factor (mg/cm^2-day)
SA_c = child exposed skin surface area (cm^2)
SA_{adl} = adolescent exposed skin surface area (cm^2)
SA_a = adult exposed skin surface area (cm^2)
BW_c = child body weight (kg)
BW_{adl} = adolescent body weight (kg)
BW_a = adult body weight (kg)
ABS = absorption fraction (unitless)
EF = exposure frequency (days/year)

Inhalation of Fugitive Dusts or Vapors. The following equations (USEPA, 2005a; 2009) are used to calculate the exposure concentrations of other mutagenic COPCs associated with inhalation of fugitive dust or vapor emissions from soil for UU/UE receptors:

$$EC(air) = \frac{C_a \times ET \times EF \times [(ED_{0-2} \times 10) + (ED_{2-6} \times 3) + (ED_{6-16} \times 3) + (ED_{16-30} \times 1)]}{AT}$$

where:

$$C_a = \mathrm{C_s} \times 1{,}000 \mu g/mg \times \left[\frac{1}{\mathrm{VF}} + \frac{1}{\mathrm{PEF}}\right]$$

where:

EC(air) = exposure concentration, air ($\mu g/m^3$)
C_a = contaminant concentration in air ($\mu g/m^3$)
C_s = COPC concentration in soil (mg/kg)
ET = exposure time as a fraction of the day spent at the site (unitless)
EF = exposure frequency (days/year)
$ED_{0\text{-}2}$ = exposure duration, 0 to 2 years of age (years)
$ED_{2\text{-}6}$ = exposure duration, 2 to 6 years of age (years)
$ED_{6\text{-}16}$ = exposure duration, 6 to 16 years of age (years)
$ED_{16\text{-}30}$ = exposure duration, 16 to 30 years of age (years)
AT = averaging time (days)
VF = chemical-specific volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)

The exposure assumptions used to estimate exposures as listed in the equations above are presented in **Tables F.2.2 and F.2.3**.

2.4 Toxicity Assessment

The most recently available toxicity data were used to calculate carcinogenic risk and noncarcinogenic hazard. The toxicity criteria (SF, IUR, reference doses [RfD]), and reference concentrations [RfC]) were selected using the hierarchy below, in accordance with USEPA guidance (USEPA, 2017c):

1. USEPA Integrated Risk Information System (IRIS) on-line database (USEPA, 2017e)
2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) (USEPA, 2017f)
3. Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRL) (ATSDR, 2017)
4. California Office of Environmental Health Hazard Assessment's (OEHHA) Toxicity Criteria Database (OEHHA, 2017)
5. USEPA's PPRTV screening toxicity values in appendices to certain PPRTV assessments (USEPA, 2017f)
6. USEPA's Health Effects Assessment Tables (HEAST) (USEPA, 1997)

Because this hierarchy is consistent with USEPA guidance and the hierarchy USEPA uses to calculate RSLs, the RSL tables (USEPA, 2017a) are used to select the toxicity criteria for this risk assessment (**Table F.2.9**).

USEPA has not developed toxicity values specific to the dermal absorption pathway. However, dermal toxicity values have been derived from the oral toxicity values as described in USEPA's most recent dermal risk assessment guidance (USEPA, 2004a).

Toxicity values provided by USEPA reflect administered-dose values, that is, they represent concentrations that will be protective following ingestion or inhalation. The dermal route of exposure, however, evaluates the toxicity of concentrations of chemicals in the blood (absorbed). Therefore, the absorbed-dose concentrations identified for dermal exposure must be compared to absorbed-dose toxicity values. The absorbed-dose toxicity values are derived by applying oral absorption factors (OAFs) to administered-dose toxicity values. The OAFs used in the human health RA will be obtained from the USEPA RSL tables (USEPA, 2017a), where they are referred to as GIABS (gastrointestinal absorption factors).

Toxicity values for *meta*-xylene were used to evaluate the *meta/para*-xylene results, as the use of the *meta*-xylene toxicity factors will provide a more conservative risk estimate.

2.5 Risk Characterization

The final step in the risk assessment process is risk characterization. The purpose of the risk characterization step is to 1) review the results from the exposure and toxicity assessments; 2) quantitatively estimate the potential for carcinogenic (i.e., risk) and noncarcinogenic (i.e., hazard) effects; and 3) assess and discuss uncertainties associated with each of the aforementioned steps. To characterize potential noncarcinogenic effects, estimated exposure concentrations of COPCs were compared with their respective toxicity values. To characterize potential carcinogenic effects, the incremental probability of an individual developing cancer over a lifetime was calculated from estimated exposure concentrations and chemical-specific dose/response information (i.e., carcinogenic toxicity factors).

For each COPC having available toxicity values, a carcinogenic risk (for carcinogens) and hazard quotient (HQ) estimate (for noncarcinogens) was calculated as described below. Each COPC was included in the cumulative risk calculations. The carcinogenic and noncarcinogenic results and risk summaries by pathway and receptor for current and future receptors exposed to site media are presented.

2.5.1 Noncancer Hazard Estimation

Potential health hazards associated with exposure to noncarcinogenic compounds were evaluated by calculating a HQ. The potential HQ is calculated as the ratio of the intake (via ingestion) or DAD (via dermal contact) to the oral reference dose (RfD_o) or dermal reference dose (RfD_d), respectively, as follows (USEPA, 1989):

$$HQ = Intake / RfD_o \quad (30)$$

$$HQ = DAD / RfD_d \quad (31)$$

where:

HQ = Noncancer hazard quotient (unitless)
Intake = Chronic daily ingestion averaged over the exposure duration (mg/kg-day)
RfD_o = Oral reference dose (mg/kg-day)
DAD = Dermally absorbed dose (mg/kg-day)
RfD_d = Dermal reference dose (mg/kg-day)

For noncancer effects by inhalation exposure, the following equation is used (USEPA, 2009):

$$HQ_{inh} = \frac{EC\ (air)}{(RfC\ x\ 1{,}000\ \frac{\mu g}{mg})} \quad (32)$$

where:

HQ_{inh} = Noncancer hazard quotient from inhalation (unitless)
EC (air) = Exposure concentration in air ($\mu g/m^3$)
RfC = Noncancer reference concentration (mg/m^3)

The noncarcinogenic HQ assumes that there is a level of exposure (i.e., a threshold represented by the RfD or RfC) below which it is unlikely for even sensitive populations to experience adverse health effects (USEPA, 1989). If the EPC exceeds this threshold, there may be concern for potential noncarcinogenic effects. In other words, if the estimated daily intake for any single COPC is greater than its RfD or RfC, the HQ will exceed 1. An HQ that exceeds 1 indicates that there is a potential for adverse health effects associated with exposure to that COPC.

The supporting calculations are provided on the hazard calculation spreadsheets provided at the end of this report.

2.5.2 Cancer Risk Estimation

Individual cancer risk is calculated as the product of exposure (intake for ingestion and DAD for dermal contact) to a constituent (in mg/kg-day) and the SF (SF_o for ingestion and SF_d for dermal contact) for that constituent (in $mg/kg\text{-}day)^{-1}$, as follows (USEPA, 1989):

$$Risk = Intake\ x\ SF_o$$

$$Risk = DAD\ x\ SF_d$$

where:

Risk = Excess lifetime cancer risk (unitless probability)
Intake = Chronic daily ingestion averaged over a lifetime (mg/kg-day)
SF_o = Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
DAD = Dermally absorbed dose (mg/kg-day)
SF_d = Dermal cancer slope factor $(mg/kg\text{-}day)^{-1}$

Inhalation risk is calculated by multiplying the exposure concentration by the IUR. Inhalation risk is estimated by using the following formula (USEPA, 2009):

$$Risk_{inh} = EC(air) \times IUR$$

where:

$Risk_{inh}$ = Excess lifetime cancer risk from inhalation (unitless probability)
EC(air) = Exposure concentration in air $(\mu g/m^3)$
IUR = Inhalation unit risk $(\mu g/m^3)^{-1}$

The risks from the inhalation of volatiles emitted to indoor air from groundwater via vapor intrusion were estimated using the spreadsheets provided by USEPA (2004b).

Each SF is accompanied by a weight-of-evidence classification, which considers the available data for a chemical in order to evaluate the likelihood that the chemical is a potential human carcinogen. The evidence is characterized separately for studies in humans and studies in laboratory animals as sufficient, limited, inadequate, no data, or evidence of noncarcinogenicity. For the purposes of this evaluation, the potential for unacceptable human health risk is identified when the multi-constituent aggregate risk for the direct-contact pathways exceeds an excess lifetime cancer risk (ELCR) of 1×10^{-4}. The supporting calculations are provided on the risk calculation spreadsheets provided at the end of this report.

2.5.3 Cumulative Risk and Hazard Index Estimation

Each COPC was included in the cumulative risk and hazard index (HI) calculations.

A HI is calculated to assess the potential for noncarcinogenic effects posed by more than one constituent. The HI approach assumes that simultaneous sub-threshold exposures to several constituents across all media and pathways of exposure could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the sub-threshold exposures to the acceptable exposure (the RfD or RfC). The HI is equal to the sum of the HQs, and is calculated as follows (USEPA, 1989):

$$HI = \sum HQ_i$$

where: HI = Hazard index (unitless)
HQ_i = Hazard quotient for the i^{th} constituent (unitless)

For the purposes of this evaluation, the potential for unacceptable human health risk is identified when the multi-constituent aggregate risk for the direct-contact pathways exceeds a noncancer HI of 1 (USEPA, 1989).

The following equation is used to calculate the cumulative noncarcinogenic hazard across multiple exposure pathways (USEPA, 1989):

$$Cumulative\ HI = HI_T(inhalation) + HI_T(dermal) + HI_T(ingestion)$$

Cancer risk from exposure to multiple carcinogens and multiple pathways is assumed to be additive, based on the *Guidelines for Carcinogen Risk Assessment* (USEPA, 2005b). The following equation will be used to calculate the total risk from exposure to multiple substances (USEPA, 1989):

$$Risk_T = \sum Risk_i$$

where: $Risk_T$ = Total Risk for multiple constituents per exposure pathway (unitless)
$Risk_i$ = Risk for the i^{th} constituent (unitless)

The following equation is used to calculate the cumulative carcinogenic risk across multiple exposure pathways (USEPA, 1989):

$$Cumulative\ Cancer\ Risk = Risk_T(inhalation) + Risk_T(dermal) + Risk_T(ingestion)$$

2.5.4 Risk Characterization Results

The primary objective of this HHRA was to quantitatively characterize the human health risk associated with current and reasonably expected future exposure to contaminated media at FTMM-57. As discussed in Section 2.3.1, all potentially complete exposure scenarios and pathways were either directly or indirectly evaluated. In the latter case, exposures of relatively lesser magnitude were addressed through the evaluation of more protective exposure scenarios (e.g., the ingestion of groundwater as a source of drinking water is protective of incidental ingestion). The exposure pathways were outlined in Section 2.3.1 and were also shown on the CSM diagram (**Figure F.2.1**). Site-specific carcinogenic risks and noncarcinogenic hazards were estimated for receptors, exposure pathways, and COPCs per the methods described previously in this report. The results of the risk characterization are presented in this section.

2.5.4.1 Surface Soil Risk Characterization

To determine the risk/hazard associated with exposure to contaminants in surface soil at FTMM-57, surface soil samples (0 to 2 feet bgs) were evaluated. As described in the Summary RI Report, the following COPCs were identified in surface soil: benzene, ethylbenzene, *meta/para*-xylene, ortho-xylene, 2-methylnaphthalene, benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, and arsenic. Since benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were identified as COPCs, all seven carcinogenic PAHs were retained for consideration in the risk assessment. The EPC for the BaP-equivalent is described in Subsection 2.3.2 of this report and the EPC for the BaP-equivalent calculation is shown in **Table F.2.4**. Because BaP is the most studied of the carcinogenic PAHs, the BaP-equivalent was evaluated using the SF associated with BaP. The pathway specific, receptor specific, and cumulative risks/hazards are summarized in **Tables F.2.13** through **F.2.34**.

2.5.4.1.1 Carcinogenic Risk

UU/UE Receptors

The cumulative carcinogenic risk for UU/UE receptors is estimated to be 2×10^{-4} **Table F.2.19**, which is greater than the carcinogenic cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in soil. The risk estimate includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors.

Utility Workers

The cumulative carcinogenic risk for future utility workers is estimated to be 2×10^{-6} (**Table F.2.23**), which is less than the carcinogenic cumulative risk goal of 1×10^{-4}. The risk estimate includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during construction and excavation activities.

Outdoor Workers

The cumulative carcinogenic risk for outdoor workers is estimated to be 9×10^{-5} (**Table F.2.27**), which is less than the carcinogenic cumulative risk goal of 1×10^{-4}. The risk estimate includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during maintenance or landscaping activities.

Recreational Users

The cumulative carcinogenic risk for recreational users is estimated to be 2×10^{-5} (**Table F.2.34**), which is less than the carcinogenic cumulative risk goal of 1×10^{-4}. The risk estimate includes evaluation of exposure to contaminants in surface soil via ingestion, dermal contact, and inhalation of particulates and vapors during recreational activities.

2.5.4.1.2 Noncarcinogenic Hazard

UU/UE Receptors

The HIs for both child and adult UU/UE receptors are as follows: child (4) and adult (0.4) (**Table F.2.19**), The HI for the child is greater than 1 and the HI for adults is less than 1. Arsenic is the only significant contributor to the cumulative hazard estimate. Since the total HI for the child was greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with separate target organs would still result in an unacceptable hazard due to exposure to arsenic in soil. The HI includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors.

Utility Workers

The HI for utility workers (0.2) is less than 1 (**Table F.2.23**). The HI includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during construction and excavation activities.

Outdoor Workers

The HI for outdoor workers (0.6) is less than 1 (**Table F.2.27**). The HI includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during maintenance or landscaping activities.

Recreational Users

The HI for both adolescent (0.2) and adult (0.07) recreational users is less than 1 (**Table F.2.34**). The HI includes evaluation of exposure to contaminants in surface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during recreational activities.

2.5.4.2 Combined Surface and Subsurface Soil Risk Characterization

To determine the risk/hazard associated with exposure to contaminants in combined surface and subsurface soil at FTMM-57, surface and subsurface soil samples (0 to 15 feet bgs) were evaluated. As described in the Summary RI Report, the following COPCs were identified in the combined surface and

subsurface soil: benzene, ethylbenzene, *meta/para*-xylene, ortho-xylene, 2-methylnaphthalene, benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, and arsenic. Since benzo(a)anthracene, BaP, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were identified as COPCs, all seven carcinogenic PAHs were retained for consideration in the risk assessment. The EPC for the BaP-equivalent is described in Subsection 2.3.2 of this report and the EPC for the BaP-equivalent calculation is shown in **Table F.2.4**. Because BaP is the most studied of the carcinogenic PAHs, the BaP-equivalent was evaluated using the SF associated with BaP. The pathway specific, receptor specific, and cumulative risks/hazards are summarized in **Tables F.2.35** through **F.2.45**.

2.5.4.2.1 Carcinogenic Risk

UU/UE Receptors

The cumulative carcinogenic risk for UU/UE receptors for is estimated to be 2×10^{-4}, **Table F.2.41**, which is greater than the carcinogenic cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in soil. The risk includes evaluation of exposure to contaminants in combined surface and subsurface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors, as the UU/UE receptor is expected to be exposed to surface soil as well as subsurface soil that has been brought to the surface as a result of excavation activities.

Utility Workers

The cumulative carcinogenic risk for utility workers is estimated to be 2×10^{-6} (**Table F.2.45**), which is less than the carcinogenic cumulative risk goal of 1×10^{-4}. The risk includes evaluation of exposure to contaminants in combined surface and subsurface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during construction and excavation activities.

2.5.4.2.2 Noncarcinogenic Hazard

UU/UE Receptors

The HIs for both child and adult UU/UE receptors are as follows: child (3) and adult (0.4) (**Table F.2.41**), The HI for the child is greater than 1 in and the HI for adults is less than 1. Arsenic is the only significant contributor to te cumulative hazard estimate. Since the total HI for the child was greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with separate target organs would still result in an unacceptable hazard due to esposure to arsenic in soil. The HIs include evaluation of exposure to contaminants in combined surface and subsurface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors, as the UU/UE receptor is expected to be exposed to surface soil as well as subsurface soil that has been brought to the surface as a result of excavation activities.

Utility Workers

The HI for utility workers (0.4) is less than 1 (**Table F.2.45**). The HI includes evaluation of hazards associated with exposure to contaminants in combined surface and subsurface soil via incidental ingestion, dermal contact, and inhalation of particulates and vapors during construction and excavation activities.

2.5.4.3 Groundwater Risk Characterization

To determine the risk/hazard associated with exposure to contaminants in groundwater at FTMM-57, groundwater samples collected from the eight sampling events conducted from August 2010 to November 2015 were evaluated. As described in the Summary RI Report, the following COPCs were identified in

groundwater: antimony, arsenic, cobalt, manganese, and vanadium. In accordance with the approved risk assessment work plan (Parsons, 2015), risks were first calculated using the maximum detected concentration from any well within the exposure area from samples included in the risk assessment data set to show the upper end of risk at the site. Since exposure to groundwater is likely to occur at a specific point, a more realistic EPC would be reflected by samples collected from an individual well. Therefore, the calculated risks for groundwater were also evaluated for each individual well. (**Table F.2.52** through **F.2.63)**

The pathway specific and cumulative risks/hazards from groundwater based on the maximum detected concentration from all wells within the exposure area for the samples collected from the August 2010 to November 2015 sampling events are summarized in **Tables F.2.46** through **F.2.51**.

2.5.4.3.1 Carcinogenic Risk

UU/UE Receptor

The cumulative carcinogenic risk for UU/UE receptors exposed to groundwater is estimated to be 7×10^{-4}, **Table F.2.48**, which is greater than the carcinogenic cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in groundwater. The risk includes evaluation of exposure to contaminants in groundwater via incidental ingestion and dermal contact.

Evaluation of the risk for each individual well (presented in **Tables F.2.52** through **F.2.63**) demonstrates that three wells exceed the carcinogenic cumulative risk goal of 1×10^{-4}: 108MW01 (2×10^{-4}), 108MW02 (3×10^{-4}), 108MW04 (7×10^{-4}).

However, it should be noted that the maximum detected concentration of arsenic in groundwater (34 µg/L) observed in any well in the last 8 rounds of groundwater sampling is approximately one-third of the background value (89 µg/L, Weston, 1995). Therefore, the risks/hazards to UU/UE receptors exposed to groundwater are entirely attributable to naturally occurring concentrations of arsenic.

Utility Worker

The cumulative carcinogenic risk for UU/UE receptors is estimated to be 2×10^{-8} , **Table F.2.51**, which is less than the carcinogenic cumulative risk goal of 1×10^{-4}. The hazard estimate includes evaluation of exposure to contaminants in shallow groundwater encountered during construction and excavation activities via incidental ingestion and dermal contact.

2.5.4.3.2 Noncarcinogenic Hazard

UU/UE Receptor

The cumulative noncarcinogenic HI for UU/UE receptors using the maximum detected concentration of each COPC, regardless of the well it was detected in, is estimated to be 8 for the child receptor (HI_{child}) and 5 for the adult receptor (HI_{adult}) (**Table F.2.48**). The main contributor to these hazard estimates is ingestion of arsenic ($HI_{child} = 6$ and $HI_{adult} = 3$).

Evaluation of the hazard for each individual well (presented in **Tables F.2.52** through **F.2.63**) demonstrates that all wells exceed the noncarcinogenic hazard goal of 1 for child receptors and three for adult receptors. HIs include: 108MW01 ($HI_{child} = 3$, and $HI_{adult} = 2$), 108MW02 ($HI_{child} = 5$, and $HI_{adult} = 3$), 108MW03 ($HI_{child} = 2$, and $HI_{adult} = 1$), and 108MW04 ($HI_{child} = 7$, and $HI_{adult} = 4$).

Since the total HIs are greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with

separate target organs would still result in an unacceptable hazard due to exposure to arsenic in groundwater.

However, it should be noted that the maximum detected concentration of arsenic in groundwater (34 µg/L) observed in any well in the last 8 rounds of groundwater sampling is approximately one-third of the background value (89 µg/L, Weston, 1995). Therefore, the risks/hazards to UU/UE receptors exposed to groundwater are entirely attributable to naturally occurring concentrations of arsenic.

Utility Worker

The HI for utility workers (0.01) is less than 1 (**Table F.2.51**). The hazard estimate includes evaluation of exposure to contaminants in shallow groundwater encountered during construction and excavation activities via incidental ingestion and dermal contact.

2.5.5 Risk Assessment Uncertainties

All human health risk assessments involve use of assumptions, professional judgments, and imperfect data to varying degrees, which result in uncertainty in the final estimates of risk. Risk assessment in general is often based on conservative assumptions and scenarios. Uncertainty can be introduced into a health risk assessment at every step of the process outlined in this document. Uncertainties are present in a risk assessment because it requires integration of the following:

- Release of constituents into the environment, and the areal and vertical distribution of these materials in soil and groundwater;
- Fate and transport of constituents in a variety of different and variable environments by processes that are often poorly understood or too complex to quantify accurately;
- Potential for adverse health effects in humans based on extrapolations from animal studies; and
- Probability of adverse effects in a human population that is highly variable with respect to genetics, age, activity level, and lifestyle.

This section qualitatively describes the inherent and site-specific uncertainties of the assessments process.

2.5.5.1 Uncertainty in Data Collection and Evaluation

The analysis of uncertainties focuses on determining whether the available data are representative of contaminant concentrations and site conditions, and whether features of sampling, analyses, or statistical treatment of the data result in an over- or underestimation of potential risk.

The use of the maximum detected concentration introduces uncertainty into the risk assessment, since the use of one analytical result likely does not accurately represent the concentration of the constituent that a receptor would be exposed throughout the exposure duration. In cases where the analyte is infrequently detected, the use of the maximum concentration will likely overestimate the actual EPC, resulting in an overestimate of the risk. In cases with few total samples, the use of the maximum detected concentration can either over- or underestimate the EPC depending on the distribution of the actual concentrations in the medium of concern.

Initial EPCs are the maximum detected concentration of each analyte. If an unacceptable cumulative risk or hazard index is calculated, 95% UCL are calculated for those COPCs contributing significantly to the risk/hazard (i.e., greater than 25% of the cumulative risk/hazard) and the risk is estimated using the 95% UCL on the mean as the EPC for those analytes. If there was an insufficient sample size to calculate a 95% UCL, the maximum detected concentration was kept as the EPC. USEPA has researched how to determine the appropriate method for calculating a 95%UCL based on the data distribution, data set size, skewness, and percentage of non-detect observations. USEPA's ProUCL version 5.1 will calculate UCLs for datasets with small sample sizes. In some cases the samples sizes were small, and not all UCLs

calculated or suggested by ProUCL are appropriate for use in the risk calculations. Parametric and non-parametric methods (i.e., Chebyshev (Mean, Sd), KM (Percentile Bootstrap), KM (Chebyshev), Adjusted Gamma KM, and Approximate Gamma KM,) were used to determine the 95% UCL for the analytes with six or more samples. For analytes with six samples or less or if ProUCL generated a warning with regards to unreliable statistics, the maximum detected concentration was used as the exposure point concentration. The ProUCL output included in **Attachment F.1** states, "Suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL." ProUCL generates UCLs using all available methods for each data set, regardless of the appropriateness of the method. The results listed under "Suggested UCLs to Use" are the results recommended by ProUCL based on data size, data distribution, and skewness of the data set, as well as the results of simulation studies. Where more than one result was listed in the ProUCL output in "Suggested UCLs to Use", the most conservative (highest) of the recommended "Suggested UCLs to Use" was selected for use as the EPC. This is a default selection made without regard to scientific validity. The use of the most conservative UCL may overestimate the EPC and, therefore, the risk. In addition, the 95% UCL for each EPC includes data over time, and may overestimate the risk if the concentration of constituents in soil is naturally attenuating. The 95% UCL for each well may underestimate risk if the number of detected concentrations is less than six.

Chemicals that were never detected in any samples were eliminated from the risk assessment. It is possible that some chemicals that were eliminated from consideration in the risk assessment may have actually been present in samples at concentrations lower than the sample quantitation limit. If chemicals that were eliminated from the risk assessment were actually present in the environmental medium, the cumulative risk could be underestimated. Detection limits greater than human health screening criteria have the potential to underestimate the risk associated with exposure to COPCs. However, the sampling plan attempted to reduce this uncertainty through the use of a consistent analytical approach as well as a biased sampling approach. Since samples were collected from areas most likely to be contaminated based on the understanding of past site activities, it is unlikely that chemicals were present at health-significant levels and not detected in at least one sample.

Similarly, chemicals that were detected at concentrations less than the selected screening criteria were eliminated from the risk assessment. It is possible that some of these chemicals may have been present at greater concentrations in areas that were not sampled, thus underestimating the potential exposure concentrations. However, the sampling plan attempted to reduce this uncertainty through the use of a consistent analytical approach as well as a biased sampling approach. Since samples were collected from areas identified in the conceptual site model as areas most likely to be contaminated based on the understanding of past site activities, it is unlikely that any chemicals were present at health-significant levels and not detected.

It should be noted that only residential screening values were used in determining COPCs for this risk assessment, although a number of site receptors evaluated (e.g., onsite worker, construction worker) do not conform to a conventional residential site use pattern. Developing one COPC list for all receptors based on residential screening values is very conservative; it ensures that every site chemical that could possibly contribute to risk or hazard is considered.

Steady-state conditions (i.e., the observed concentrations remain the same in the environmental media for the foreseeable future) were assumed for evaluation of potential future exposures. The assumption of steady-state conditions may tend to overestimate long-term exposure and health risk because contaminant concentrations may decline over time due to natural dissipation processes (e.g., biological and chemical degradation) or dilution through transport processes. In some cases, depending on the contaminant and or the release mechanisms involved, steady-state assumptions could potentially underestimate risk (e.g.,

breakdown products that are more toxic than the parent compound or a continuous source contributing to contamination in another medium).

Additionally, using the maximum concentrations detected at each well in the risk calculations assumes that those concentrations remain the same throughout the exposure time of the receptor. However, based on other sampling events from the same wells, those maximun concentrations are not consistently present over time as the risk calculations assume, which results in an overestimated risk.

2.5.5.2 Uncertainty in Exposure Assessment

The risk assessment estimates are conditional on actual and potential exposure pathways identified at the site. If exposure does not occur, no risks are present. Furthermore, the risk assessment process does not factor in the probability of exposure occurring.

Current land uses and characterization of the site's current physical setting provided the basis for predicting future land use at and in the vicinity of the site. The assumption of steady-state conditions was also used in predicting future contaminant concentrations. As discussed in Section 2.5.7.1, this assumption would tend to overestimate potential future exposure levels because concentrations of chemicals may decline with time.

There is also some concern as to how well an exposure scenario approximates the actual conditions that a receptor may be exposed to at a given site. Potential human exposures could deviate from those used in the risk assessment through differences in exposure frequency, contact rates, exposure durations, body weight, and life span. Each of these factors has a degree of uncertainty associated with it that could over- or underestimate risk.

Evaluation of risk for the UU/UE receptor includes calculation of the risk to children. Other sensitive subpopulations such as elderly people, pregnant or nursing women, and people with chronic illnesses were not specifically evaluated in this risk assessment. These subpopulations may be more sensitive to certain chemical exposures. However, USEPA generally considers sensitive subpopulations when developing toxicity factors. Whenever possible, exposure assumptions were made to protect sensitive subpopulations (e.g., the mutagenic mode of action evaluation). Additionally, there are no day care or school facilities, healthcare facilities, nursing homes, retirement communities, or residential areas with children onsite currently.

2.5.5.3 Uncertainty in Toxicity Assessment

Some uncertainty is also inherent in the toxicity values used in the risk assessment. Carcinogenic SFs and route-specific values were derived only for compounds that have been shown to cause an increased incidence of tumors in either human or animal studies. This dose-response curve is then assumed to be linear at low doses (e.g., those found in situations of environmental contamination) and is used to predict tumor incidence at low exposure levels. When an animal study is used, the final SF is adjusted to account for extrapolation of animal data to humans. If the studies used to derive the SF were conducted for less than the life span of the test organism, the final SF had also been adjusted to reflect risk associated with lifetime exposure.

The SF is generally an upper 95th percentile confidence limit of the probability of a response based on experimental animal data in the multistage model. This means that the site-specific chemical risk is not likely to exceed the risk estimate derived through the model and is likely to be less than the predicted risk.

The chronic RfD for a compound is based on studies where either human or animal populations were exposed to a given compound by a given route of exposure for a major portion of the life span (as a USEPA guideline, seven years to a lifetime; USEPA, 1989). RfDs are derived by determining dose-specific effect levels from available quantitative studies and applying uncertainty factors to the most

appropriate effect level to determine an RfD for humans. Uncertainty factors are generally applied as multiples of 10 to represent specific areas of uncertainty in the data. Typically, an uncertainty factor of 100 to 1,000 is used in the professional judgment of uncertainties. General uncertainties in the derivation of RfDs may be associated with factors such as (1) variations in the general population (to protect sensitive receptors), (2) extrapolation of animal data to humans, (3) use of a subchronic study versus a chronic study to determine the no-observed-adverse-effect level (NOAEL), or (4) use of a lowest-observed-adverse-effect level (LOAEL) versus a NOAEL. Both the uncertainty and modifying factors are conservative in nature and tend to overestimate risk.

Although the most current toxicity values assigned by USEPA are used in the risk assessment, these values may not be available for all compounds. The toxicity classification of a chemical may be under review or not available. If data are lacking, the chemical may not be accounted for in the estimates of potential risk. The use of a surrogate may either over or underestimate the risk associated with exposure to this chemical, as the toxicity between the compound and its surrogate may vary.

2.5.5.4 Uncertainty in Estimating Chemical Risk

The expression of the potential risk associated with contaminants detected at the site is a result of the combined steps of data evaluation, exposure assessment, and toxicity assessment. This combination can magnify the uncertainties present in these steps of the risk assessment process.

The groundwater onsite is not currently used as a drinking water resource. There are no current residents onsite. The estimate for non-carcinogenic hazards to child and adult UU/UE receptors exceed the noncarcinogenic cumulative hazard goal of 1. Therefore, there may be an unacceptable hazard to human health if unfiltered groundwater was to be used in the future as a drinking water resource.

In assessing the risk for which a mutagenic MOA has been identified by USEPA, default ADAFs were applied for those chemical lacking chemical-specific data on susceptibility from early life exposures. The *Supplemental Guidance for Assessing Cancer Susceptibility from Early Life Exposure to Carcinogens* (USEPA, 2005a) recommends the following default ADAFs:

- 10-fold adjustment for exposures during the first two years of life
- 3-fold adjustment for exposures from ages 2 to <16 years of age
- No adjustment for exposures after turning 16 years of age

These ADAFs are used to prorate the toxicity factors for the respective age ranges, to account for more or less sensitivity during that life stage. For example, there is assumed by default to be 10-fold greater sensitivity over the first two years of life than for an equivalent level of exposure after turning 16 years of age.

Other COPCs could theoretically function under a mutagenic MOA, and not be identified as such by USEPA. In these situations, the risk associated with early life exposures may be underestimated.

Additional uncertainties are incorporated into the risk assessment when exposures to several substances are summed. Exposure to multiple chemicals may result in interactions between the chemicals in ways that may not be predictable. The assumption is that exposure to multiple chemicals is additive, that is, the carcinogenic risk or hazard quotient for each chemical is simply added together to estimate the cumulative risk or hazard. However, in reality some constituents may produce a synergistic effect, where the risk associated with exposure to these chemicals is actually greater than the sum of the carcinogenic risk or HQs. In such a case, the risk assessment will underestimate the risk. In other cases, some chemicals may interact antagonistically, such that the risk associated with exposure to these chemicals is less than the sum of the carcinogenic risk or HQs. In these cases, the risk assessment will overestimate the risk associated with exposure to these chemicals.

The hazard estimates associated with the groundwater were based on the maximum detected concentrations. As discussed in Section 2.3, although a receptor could be exposed to the maximum detected concentration at any one time, it is unlikely a receptor will be exposed to the maximum detected concentration over the entirety of the exposure duration. Therefore, the hazard to a UU/UE receptor is likely overestimated.

2.6 Conclusions

This HHRA was conducted to evaluate the potential for human health impacts as a result of potential exposures to chemicals in soil and groundwater at FTMM-57 at the former Fort Monmouth.

The cumulative carcinogenic risks and noncarcinogenic hazards estimated for the receptors at the site are as follows (**Tables F.2.64 and F.2.65**):

- UU/UE receptors exposed to surface soil, combined surface and subsurface soil, outdoor air, and potable groundwater: The cumulative carcinogenic risk in surface soil is 2×10^{-4} which is greater than the cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in soil. The cumulative carcinogenic risk in combined surface and subsurface soil is 2×10^{-4} which is greater than the cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in soil.

  The cumulative noncarcinogenic HI for surface soil is estimated to be 4 for the child receptor (HI_{child}) and 0.4 for the adult receptor (HI_{adult}) which is greater than 1 for the child receptor and less than one for the adult receptor. Arsenic is the only significant contributor to the cumulative hazard estimate. The cumulative noncarcinogenic HI for combined surface and subsurface soil is estimated to be 3 for the child receptor (HI_{child}) and 0.4 for the adult receptor (HI_{adult}) which is greater than 1 for the child receptor and less than one for the adult receptor. Arsenic is the only significant contributor to the cumulative hazard estimate. Since the total HI for the child was greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with separate target organs would still result in an unacceptable hazard due to exposure to arsenic in soil.

  The cumulative carcinogenic risk for UU/UE receptors exposed to groundwater was estimated to be 7×10^{-4} which is greater than the cumulative risk goal of 1×10^{-4}. This risk is wholly attributable to exposure to arsenic in groundwater. The cumulative noncarcinogenic HI for UU/UE receptors exposed to groundwater is estimated to be 8 for the child receptor (HI_{child}) and 5 for the adult receptor (HI_{adult}). The main contributor to these hazard estimates is ingestion of arsenic ($HI_{child} = 6$ and $HI_{adult} = 3$).

  Evaluation of the hazard associated with exposure to groundwater in each individual well (presented in **Tables F.2.52** through **F.2.63**) demonstrates that all the hazard estimates for all wells exceed the noncarcinogenic hazard goal of 1 for child receptors, while three wells exceed the hazard goal for adult receptors. HIs are 108MW01 ($HI_{child} = 3$, and $HI_{adult} = 2$), 108MW02 ($HI_{child} = 5$, and $HI_{adult} = 3$), 108MW03 ($HI_{child} = 2$, and $HI_{adult} = 1$), and 108MW04 ($HI_{child} = 7$, and $HI_{adult} = 4$).

  Since the total HIs are greater than 1, target organs were considered (USEPA, 1989). However, since arsenic is the only COPC with an HQ greater than 1, evaluating non-carcinogenic hazards associated with separate target organs would still result in an unacceptable hazard due to exposure to arsenic in groundwater.

However, it should be noted that the maximum detected concentration of arsenic in groundwater (34 µg/L) observed in any well in the last 8 rounds of groundwater sampling is approximately one-third of the background value (89 µg/L, Weston, 1995). Therefore, the risks/hazards to UU/UE receptors exposed to groundwater are entirely attributable to naturally occurring concentrations of arsenic.

- Utility workers exposed to surface soil, combined surface and subsurface soil, and groundwater: The cumulative carcinogenic risk for utility worker exposure to surface soil (2×10^{-6}), combined surface and subsurface soil (2×10^{-6}), and groundwater (2×10^{-8}) are less than the cumulative risk goal of 1×10^{-4}. The HI for utility workers is less than 1 for exposure to surface soil (HI=0.2), combined surface and subsurface soil (HI=0.4), and groundwater (HI = 0.01).
- Outdoor workers exposed to surface soil: The cumulative carcinogenic risk for outdoor worker exposure to surface soil (9×10^{-5})is less than the cumulative risk goal of 1×10^{-4}. The HI for outdoor workers is less than 1 for exposure to surface soil (HI=0.6).
- Recreational users exposed to surface soil: The cumulative carcinogenic risk for recreational users exposure to surface soil (2×10^{-5}) is less than the cumulative risk goal of 1×10^{-4}. The recreational user HI_{adl} for exposure to surface soil is 0.2 and the HI_{adult} is 0.07, which are less than 1.

Uncertainties may result in overestimated risks/hazards. Most notably, onsite groundwater is not currently used as a potable drinking water source so the risk/hazard estimates herein may be overestimated. The estimated risks/hazards associated with potable groundwater would apply only if a well was installed for potable water. The maximum concentrations used from one sample are not are not representative of true site conditions, especially over time, and the hazard is overestimated. The maximum detected concentration of arsenic in groundwater (34 µg/L) observed in any well in the last 8 rounds of groundwater sampling is approximately one-third of the background value (89 µg/L, Weston, 1995). Therefore, the risks/hazards to UU/UE receptors exposed to groundwater are entirely attributable to naturally occurring concentrations of arsenic.

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SECTION 3
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TABLES

Table F.2.1
SUMMARY OF RECEPTORS AND EXPOSURE SCENARIOS
FTMM-57
Fort Monmouth, New Jersey

Media	Unrestricted Use/ Unrestricted Exposure	Outdoor Worker (Current/Future)	Utility Worker (Current/Future)	Recreational Adolescent (Current/Future)	Recreational Adult (Current/Future)
Surface Soil	Quantified	Quantified	Quantified	Quantified	Quantified
Frequency of Exposure	Full time	Full time	One month project	Visit once a week	Visit once a week
Duration of Exposure	Long-Term	Long-Term	One project	Years from ages 6-<16	Adult Exposure
Subsurface Soil	Quantified	No Exposure	Quantified	No Exposure	No Exposure
Frequency of Exposure	Full time	Full time	One month project	Visit once a week	Visit once a week
Duration of Exposure	Long-Term	Long-Term	One project	Years from ages 6-<16	Adult Exposure
Groundwater	Quantified	No Exposure	Quantified	No Exposure	No Exposure
Days/Year	Full time	Full time	One month project	Visit once a week	Visit once a week
Years	Long-Term	Long-Term	One project	Years from ages 6-<16	Adult Exposure
Outdoor Air	Quantified	Quantified	Quantified	Quantified	Quantified
Frequency of Exposure	Full time	Full time	One month project	Visit once a week	Visit once a week
Duration of Exposure	Long-Term	Long-Term	One project	Years from ages 6-<16	Adult Exposure
Indoor Air	No exposure	No Exposure	No Exposure	No Exposure	No Exposure
Frequency of Exposure	Full time	Full time	One month project	Visit once a week	Visit once a week
Duration of Exposure	Long-Term	Long-Term	One project	Years from ages 6-<16	Adult Exposure

Table F.2.2 Soil Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptor	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rationale	Recreational User	Sources	Rationale
THQ	Target Hazard Quotient	unitless	1	USEPA, 2017c	USEPA RSL Users Guide, Table 1	1	USEPA, 2017c	USEPA RSL Users Guide, Table 1	1	USEPA, 2017c	USEPA RSL Users Guide, Table 1	1	USEPA, 2017c	USEPA RSL Users Guide, Table 1
AT_{nc}	Averaging Time – noncarcinogens	days	7,300 (adult) 2,190 (child)	USEPA, 1989	Exhibit 6-9; Period over which exposure is averaged; ED expressed in days (20 years adult x 365 days or 6 years child x 365 days)	9,125	USEPA, 1989	Exhibit 6-9; Period over which exposure is averaged; ED expressed in days (25 years x 365 days)	365	USEPA, 2014	Source references USEPA, 1989, page 6-23; ED expressed in days (1 year x 365 days)	5,110 (adult) 3,650 (adl)	USEPA, 1989	Exhibit 6-9; Period over which exposure is averaged; ED expressed in days (14 years adult x 365 days or 10 years adl x 365 days)
AT_c	Averaging Time – carcinogens	days	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)
ED	Exposure Duration	years	20 (adult) 6 (child	USEPA, 2014	Adult: ED_r (26 years) – ED_{child} (6 years) where ED_r is derived from USEPA, 2011 Table 16-108; 90th percentile for current residence time. Child: Source references USEPA, 1991a, Pages 6 and 15	25	USEPA, 2014	Source references USEPA, 1991a, Page 15; RME scenario for industrial worker	1	USEPA, 2002	Exhibit 5-1; USEPA, default value for construction workers	14 (adult) 10 (adl)	Professional judgment	Adult: Represents the number of years returning to the same location as an adult, assumes 16 to <30 years of age Adl: Represents the number of years returning to the same location as an adolescent; assumes 6 to <16 years of age

Table F.2.2 (Continued) Soil Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptor	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rationale	Recreational User	Sources	Rationale
BW	Body Weight	kg	80 (adult) 15 (child)	USEPA, 2014	Adult: Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 to 78 Child: Source references USEPA, 2011, Table 8-1; weighted average of mean body weights (birth to <6 years	80	USEPA, 2014	Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 – 78	80	USEPA, 2014	Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 – 78	80 (adult) 44 (adl)	Adult: USEPA, 2014 Adl: USEPA, 2011	Adult: Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 to 78 years of age Adl: Table 8-3, mean of body weights for 6 to <11 and 11 to <16 years
EF	Exposure Frequency	days/year	350	USEPA, 2014	Source references USEPA, 1991 (pg. 15); Resident RME scenario	225	USEPA, 2014	Source references USEPA, 1991, page 15, outdoor worker RME scenario	30	Professional judgment	Assumes project of one month duration	50	Professional judgment	Assumes recreational user on site once per week every week of the year, except for 2 weeks vacation
IRS	Soil Ingestion Rate	mg/day	100 (adult) 200 (child)	USEPA, 2014	Adult: Source references USEPA, 1991a (pp. 6 and 15); for resident Child: Source references U.S. EPA 2011 (Table 5-1 "upper-bound values" accounting for both soil and dust ingestion	100	USEPA, 2014	Source references USEPA, 1991, page 15, same as adult resident	330	USEPA, 2017c	Source references USEPA, 2002, Exhibit 5-1, USEPA recommended value for construction worker	50 (adult) 100 (adl)	USEPA, 2011	Adult: Table 5-1, General Population Central Tendency, Adult soil and dust ingestion Adl: Table 5-1, General Population Central Tendency, soil and dust ingestion for 6 to <21 years of age
EV	Event Frequency	events/day	1	USEPA, 2004a	Exhibit 3-5, residential RME scenario	1	USEPA, 2004a	Exhibit 3-5, industrial RME scenario	1	USEPA, 2004a	Exhibit 3-5, industrial RME scenario	1	Professional judgment	Recreational users are expected to be onsite one event per day

Table F.2.2 (Continued) Soil Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptor	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rationale	Recreational User	Sources	Rationale
FI	Fraction Ingested	unitless	1	USEPA, 1989, page 6-39	Assumes that all of contaminated soil contacted is from the site	1	USEPA, 1989, page 6-39	Assumes that all of contaminated soil contacted is from the site	1	USEPA, 1989, page 6-39	Assumes that all of contaminated soil contacted is from the site	1	USEPA, 1989, page 6-39	Assumes that all of contaminated soil contacted is from the site
CF_s	Conversion Factor-soil	kg/mg	1E-06	USEPA, 1989	Exhibit 6-14	1E-06	USEPA, 1989	Exhibit 6-14	1E-06	USEPA, 1989	Exhibit 6-14	1E-06	USEPA, 1989	Exhibit 6-14
GIABS	Gastrointestinal Absorption Factor (also, OAF = Oral Absorption Factor)	unitless	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed in gastrointestinal tract	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed in gastrointestinal tract	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed in gastrointestinal tract	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed in gastrointestinal tract
SA	Exposed Skin Surface Area	cm^2	6,032 (adult) 2,690 (child)	USEPA, 2014	Adult: Source references USEPA, 2011, Tables 7-2 and 7-12; weighted average of mean values for head, hands, forearms, lower legs, and feet (male and female, 21+ years. Child: Source references Tables 7-2 and 7-8; weighted average of mean values for head, hands, forearms, lower legs, and feet (male and female, birth to < 6 years)	3,470	USEPA, 2014	Source references USEPA, 2011, Table 7-2; weighted average of mean values for head, hands, and forearms (male and female adults); assumes wearing shoes and long pants	3,470	USEPA, 2014	Source references USEPA, 2011, Table 7-2; weighted average of mean values for head, hands, and forearms (male and female adults); assumes wearing shoes and long pants	3,470 (adult) 2,160 (adl)	USEPA, 2014; USEPA, 2011	Adult: Source references USEPA, 2011, Table 7-2; weighted average of mean values for head, hands, and forearms (male and female adults); assume wearing shoes and long pants Adl: Table 7-2, weighted average of mean values for head, hands, and arms (mean value for arm times 45% to account for forearm) (Age 6 to <16 years of age); assume wearing shoes and long pants

Table F.2.2 (Continued) Soil Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptor	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rationale	Recreational User	Sources	Rationale
AF	Adherence Factor	mg/cm^2	0.07 (adult) 0.2 (child)	USEPA, 2014	Adult and child: Source references USEPA, 2004 (Exhibit 3-5)	0.12 (1)	USEPA, 2014	Source references USEPA, 2011, Table 7-2, Table 7-20 and Section 7.2.2; arithmetic mean of weighted average of body part-specific (hands, forearms, and face) mean adherence factors for adult commercial/ industrial activities	0.20	USEPA, 2011	Table 7-2, Table 7-20 and Section 7.2.2; arithmetic mean of weighted average of body part-specific (hands, forearms, and face) mean adherence factors for adult utility worker number 1	0.09 (adult) 0.04 (adl) (1)	USEPA, 2011	Adult: Table 7-2, Table 7-20 and Section 7.2.2; arithmetic mean of weighted average of body part-specific (hands, forearms, and face) mean adherence factors for adult Gardener number 1 Adl: Table 7-2, Table 7-4, and Section 7.2.2; arithmetic mean of weighted average of body part-specific (hands, forearms, face, mean adherence factors for child playing outdoor sports
ABS_d	Dermal Absorption Factor	unitless	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed dermally; USPEA RSL Summary Table -	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed dermally; USPEA RSL Summary Table-	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed dermally; USPEA RSL Summary Table -	Chemical-specific	USEPA, 2017g	Fraction of contaminant absorbed dermally; USPEA RSL Summary Table -
ET	Exposure Time	hour/day	24	USEPA, 2014	The whole day	8	USEPA, 2014	The work day	8	USEPA, 2014	The work day	2	Professional judgment	Assumes recreational users on site for two hours each event
VF	Volatilization Factor-soil	m^3/kg	Chemical Specific	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document	Chemical Specific	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document	Chemical Specific	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document	Chemical specific	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document

Table F.2.2 (Continued) Soil Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptor	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rationale	Recreational User	Sources	Rationale
PEF	Particulate Emission Factor	m^3/kg	3.23E-09	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document	3.23E-09	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document	3.23E-09	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document	3.23E-09	USEPA, 2002, 2017c	Calculated using inputs in Table 4 of this document

(1) Adherence factor (AF) users calculated as USEPA, 2011, Section 7.2.2. The AF values for adults are from USEPA Table 7-20 and the Surface Areas (SA) are from USEPA Table 7-2. The AF values for adolescents are from USEPA Table 7-4, outdoor sports for children, and the Surface Areas (SA) are from USEPA Table 7-2. The weighted AF for each receptor is calculated as [$AF_{weighted} = (AF_{hands})(SA_{hands}) + (AF_{face})(SA_{head}) + (AF_{arms})(SA_{arms}) / (SA_{hands} + SA_{head} + SA_{arms})$]. Note that the SA_{arms} is multiplied by 45% to account for only the forearms.

Table F.2.3 Groundwater Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptors	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rational	Recreational User	Sources	Rationale
IRW	Groundwater or Surface Water Ingestion	L/day	2.5 (adult) 0.78 (child)	USEPA, 2017c	For UU/UE receptors, assumes groundwater is used as a potable water source Adult: source references USEPA, 2011, Table 3-33; 90th percentile of consumer-only ingestion of drinking water (≥ 21 years) Child: source references USEPA, 2011, Tables 3-15 and 3-33; weighted average of 90th percentile consumer-only ingestion of drinking water (birth to <6 years)	0.02	USEPA, 2014d	Section 4.5; During wading activities, water ingestion of 10 ml/hour for adults, converted to L/day assuming the outdoor worker is in contact with surface water for 2 hours per day	0.02	USEPA, 2014d	Section 4.5; During wading activities, water ingestion of 10 ml/hour for adults, converted to L/day assuming the utility worker is in contact with groundwater in a trench for 2 hours per day	0.02 (adult) 0.02(adl)	USEPA, 2014d	Section 4-5; During wading activities, water ingestion of 10 ml/hour for adolescents and adults, converted to L/day assuming the recreational user is in contact with surface water for 2 hours per day
K_p	Permeability Constant	cm/hour	Chemical-specific	USEPA, 2017d	Dermal permeability coefficient of compound in water	Chemical-specific	USEPA, 2017d	Dermal permeability coefficient of compound in water	Chemical-specific	USEPA, 2017d	Dermal permeability coefficient of compound in water	Chemical-specific	USEPA, 2017d	Dermal permeability coefficient of compound in water

Table F.2.3 (Continued) Groundwater Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptors	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rational	Recreational User	Sources	Rationale
SA	Skin Surface Area	cm^2	20,900 (adult) 6,378 (child)	USEPA, 2017c	Assume potable water used for bathing Adult: source references USEPA, 2011, Table 7.10; weighted average of mean values for adults, male and female 21+. Child: source references USEPA, 2011, Table 7.10; weighted average of mean values for children <6 years	4,835	USEPA, 2011	Table 7-2; weighted average of mean values for hands, feet, and lower legs (mean value for legs times 40% to account for lower leg) (male and female, 21+years)	4,840	USEPA, 2011	Table 7-2; weighted average of mean values for hands, feet, and lower legs (mean value for legs times 40% to account for lower leg) (male and female, 21+years)	4,835 (adult) 3093 (adl)	USEPA, 2011	Adult: Table 7-2; weighted average of mean values for hands, feet, and lower legs (mean value for legs times 40% to account for lower leg) (male and female, 21+years). Adl: Table 7-2; weighted average of mean values for hands, feet, and lower legs (mean value for legs times 40% to account for lower leg) (6 to <16 years of age)
VF_{air}	Volatilization Factor	L/m^3	0.5	USEPA, 2017c	Source references USEPA, 1991b, page 20	0.5	USEPA, 2017c	Source references USEPA, 1991b, page 20	0.5	USEPA, 2017c	Source references USEPA, 1991b, page 20	0.5	USEPA, 2017c	Source references USEPA, 1991b, page 20
EV	Event Frequency	events/day	1	USEPA 2004 Exhibit 3-2	RME scenario for Showering/Bathing.	1	Professional judgment	Assumes an outdoor worker may come into contact with surface water during routine maintenance activities, for one event per day.	1	USEPA, 2002	Exhibit 1-2. Assumes a worker may come into contact with groundwater during excavation or trenching activities, for one event per day.	1	Professional judgment	Assumes a recreational user may come into contact with surface water during wading activities, for one event per day.

Table F.2.3 (Continued) Groundwater Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptors	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rational	Recreational User	Sources	Rationale
ET	Exposure time as a fraction of the day spent at the site	unitless	0.030 (adult) 0.023 (child)	USEPA, 2014	Adult: calculated as (0.71 ED/24 hours) Child; calucated as 0.54 ED / 24 hours).	0.083 (2 hours/day)	Professional judgment	Assumes an outdoor worker may come into contact with surface water during work activities, for one event per day, 2 hours per event.	0.083 (2 hours/day)	Professional judgment	Assumes an utility worker may come into contact with groundwater during work activities, for one event per day, 2 hours per event.	0.083 (2 hours/day)	Professional judgment	Assumes a recreational user may come into contact with surface water during wading activities, for one event per day, 2 hours per event.
t_{event}	Event Duration	hours/event	0.71 (adult) 0.54 (child)	USEPA, 2014	Adult: U.S. EPA 2011, Tables 16-30 and 16-31; weighted average of adult (21 to 78) 90th percentile of time spent bathing/ showering in a day, divided by mean number of baths/showers taken in a day. Child: U.S. EPA 2011, Table 16-28; weighted average of 90th percentile time spent bathing (birth to <6 years)	2	Professional judgment	Assumes an outdoor worker may come into contact with surface water during work activities, for one event per day, 2 hours per event.	2	Professional judgment	Assumes an utility worker may come into contact with groundwater during work activities, for one event per day, 2 hours per event.	2	Professional judgment	Assumes a recreational user may come into contact with surface water during wading activities, for one event per day, 2 hours per event.
EF	Exposure Frequency	days/year	350	USEPA, 2014	USEPA, 1991a (pg. 15)	225	USEPA, 2014	Source references USEPA, 1991aa, page 15, outdoor worker RME scenario	30	Professional judgment	Assumes project of one month duration	50	Professional judgment	Assumes recreational user on site once per week every week of the year, except for 2 weeks vacation

Table F.2.3 (Continued) Groundwater Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptors	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rational	Recreational User	Sources	Rationale
ED	Exposure Duration	year	20 (adult) 6 (child)	USEPA, 2014	Adult: Source references USEPA, 2011 Table 16-108; 90th percentile for current residence time. Child: Source references USEPA,1991a, Pages 6 and 15	25	USEPA, 2014	Source references USEPA, 1991a, Page 15; RME scenario for industrial worker	1	USEPA, 2002	Exhibit 5-1; USEPA, default value for construction workers	14 (adult) 10 (adl)	Professional judgment	Adult: Represents the number of years returning to the same location as an adult, age 16 to <30 years of age Adl: Represents the number of years returning to the same location as an adolescent; assumes adolescent recreational user 6 to <16 years of age
ED	Exposure Duration-for inhalation	year	26	USEPA, 2014	Source references USEPA, 2011a, Table 16-108; 90th percentile for current residence time.	--	--	--	--	--	--	23	Professional judgment	Combined 10 years as adolescent and 14 years as adult
BW	Body Weight	kg	80 (adult) 15 (child)	USEPA, 2014	Adult: Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 – 78 Child: Source references USEPA, 2011, Table 8-1; weighted average of mean body weights (birth to <6 years)	80	USEPA, 2014	Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 – 78	80	USEPA, 2014	Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 – 78	80 (adult) 44 (adl)	USEPA, 2014, USEPA, 2011	Adult: Source references USEPA, 2011, Table 8-3; weighted mean values for adults 21 – 78 Adl: Table 8-3, weighted mean value for adolescent age 6 to <16 years of age

Table F.2.3 (Continued) Groundwater Exposure Parameters

Abbreviation	Parameter	Units	UU/UE Receptors	Sources	Rationale	Outdoor Worker	Sources	Rationale	Utility Worker	Sources	Rational	Recreational User	Sources	Rationale
AT_{nc}	Averaging Time – noncarcinogens	days	7,300 (adult) 2,190 (child)	USEPA, 1989	Exhibit 6-9; Period over which exposure is averaged; ED expressed in days (20 years adult x 365 days or 6 years child x 365 days)	9,125	USEPA, 1989	Exhibit 6-9; Period over which exposure is averaged; ED expressed in days (25 years x 365 days)	365	USEPA, 2014	Source references USEPA, 1989, page 6-23; ED expressed in days (1 year x 365 days)	5,110 (adult) 3,650 (adl)	USEPA, 1989	Exhibit 6-9; Period over which exposure is averaged; ED expressed in days (14 years adult x 365 days or 10 years adl x 365 days)
AT_c	Averaging Time – carcinogens	days	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)	25,550	USEPA, 2014 as "lifetime"	70-year lifetime expressed in days (70 years x 365 days)
FA	Fraction absorbed	unitless	Chemical-specific	USEPA, 2004	Exhibit B-3	Chemical-specific	USEPA, 2004	Exhibit B-3	Chemical-specific	USEPA, 2004	Exhibit B-3	Chemical-specific	USEPA, 2004	Exhibit B-3
B	Relative contribution of permeability coefficient	unitless	Chemical-specific	USEPA, 2017d	--	Chemical-specific	USEPA, 2017d	--	Chemical-specific	USEPA, 2017d	--	Chemical-specific	USEPA, 2017d	--
t^*	Time it takes to reach steady state	hours	Chemical-specific	USEPA, 2004	Exhibit B-3	Chemical-specific	USEPA, 2004	Exhibit B-3	Chemical-specific	USEPA, 2004	Exhibit B-3	Chemical-specific	USEPA, 2004	Exhibit B-3
τ_{event}	Lag Time per Event	hr/event	Chemical-specific	USEPA, 2017d	--	Chemical-specific	USEPA, 2017d	--	Chemical-specific	USEPA, 2017d	--	Chemical-specific	USEPA, 2017d	--

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	FTMM-57-SB-01-2.5-3		FTMM-57-SB-01-6-6.5		FTMM-57-SB-01-8-8.5		FTMM-57-SB-02-2.5-3		FTMM-57-SB-02-7-7.5	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.029 J	0.0029	0.078 U	0.0078	0.083 U	0.0083	0.073 U	0.0073	0.065 J	0.0065
Benzo(a)pyrene	1	0.033 J	0.033	0.078 U	0.078	0.083 U	0.083	0.073 U	0.073	0.046 J	0.046
Benzo(b)fluoranthene	0.1	0.039 J	0.0039	0.078 U	0.0078	0.083 U	0.0083	0.073 U	0.0073	0.084 J	0.0084
Benzo(k)fluoranthene	0.01	0.018 J	0.00018	0.078 U	0.00078	0.083 U	0.00083	0.073 U	0.00073	0.022 J	0.00022
Chrysene	0.001	0.027 J	0.000027	0.078 U	0.000078	0.083 U	0.000083	0.073 U	0.000073	0.036 J	0.000036
Dibenz(a,h)anthracene	1	0.013 J	0.013	0.078 U	0.078	0.083 U	0.083	0.073 U	0.073	0.016 J	0.016
Indeno(1,2,3-cd)pyrene	0.1	0.077 U	0.0077	0.078 U	0.0078	0.083 U	0.0083	0.073 U	0.0073	0.023 J	0.0023
BaP Equivalent			**0.061**		**0.18 U**		**0.19 U**		**0.17 U**		**0.079**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	FTMM-57-SB-102-7-7.5		FTMM-57-SB-02-8-8.5		Bldg108 S-1-4-4		Bldg108 S-2-4-4		Bldg108 S-3-4-4	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.057 J	0.0057	0.02 J	0.002	0.14 J	0.014	0.41 U	0.041	2.3	0.23
Benzo(a)pyrene	1	0.02 J	0.02	0.029 J	0.029	0.13 J	0.13	0.25 J	0.25	1.8	1.8
Benzo(b)fluoranthene	0.1	0.059 J	0.0059	0.042 J	0.0042	0.2 J	0.02	0.41 U	0.041	1.8	0.18
Benzo(k)fluoranthene	0.01	0.031 J	0.00031	0.017 J	0.00017		0		0		0
Chrysene	0.001	0.056 J	0.000056	0.017 J	0.000017	0.16 J	0.00016	0.41 U	0.00041	2.2	0.0022
Dibenz(a,h)anthracene	1	0.074 U	0.074	0.076 U	0.076	0.41 U	0.41	0.41 U	0.41	0.35 J	0.35
Indeno(1,2,3-cd)pyrene	0.1	0.036 J	0.0036	0.076 U	0.0076	0.09 J	0.009	0.41 U	0.041	1.1	0.11
BaP Equivalent			**0.11**		**0.12**		**0.58**		**0.78**		**2.7**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	Bldg108 S-4-1-1		Bldg108 S-5-6-6		Bldg108 S-6-5-5		Bldg108 S-7-7-7		Bldg108 S-8-6-6	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.35	0.035	0.87	0.087	1.2	0.12	0.4 U	0.04	0.05 J	0.005
Benzo(a)pyrene	1	0.34 J	0.34	0.63	0.63	1.1	1.1	0.4 U	0.4	0.41 U	0.41
Benzo(b)fluoranthene	0.1	0.22 J	0.022	0.4 U	0.04	0.95	0.095	0.4 U	0.04	0.41 U	0.041
Benzo(k)fluoranthene	0.01		0		0		0		0		0
Chrysene	0.001	0.36	0.00036	0.87	0.00087	1.2	0.0012	0.4 U	0.0004	0.055 J	0.000055
Dibenz(a,h)anthracene	1	0.074 J	0.074	0.19 J	0.19	0.3	0.3	0.4 U	0.4	0.41 U	0.41
Indeno(1,2,3-cd)pyrene	0.1	0.19 J	0.019	0.33 J	0.033	0.68	0.068	0.4 U	0.04	0.41 U	0.041
BaP Equivalent			**0.49**		**0.98**		**1.7**		**0.92 U**		**0.91**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	Bldg108 S-9-5-5		Bldg108 S-10-5-5		Bldg108 S-11-5-5		Bldg108 S-13-1.5-1.5		Bldg108 S-14-3-3	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.19 J	0.019	0.13 J	0.013	0.13 J	0.013	0.11 J	0.011	1.4	0.14
Benzo(a)pyrene	1	0.17 J	0.17	0.14 J	0.14	0.43	0.43	0.11 J	0.11	1.3	1.3
Benzo(b)fluoranthene	0.1	0.17 J	0.017	0.11 J	0.011	0.43	0.043	0.12 J	0.012	1	0.1
Benzo(k)fluoranthene	0.01		0		0		0		0		0
Chrysene	0.001	0.23 J	0.00023	0.15 J	0.00015	0.53	0.00053	0.13 J	0.00013	1.5	0.0015
Dibenz(a,h)anthracene	1	0.07 J	0.07	0.38 U	0.38	0.4 J	0.4	0.36 U	0.36	0.37 J	0.37
Indeno(1,2,3-cd)pyrene	0.1	0.13 J	0.013	0.11 J	0.011	0.29 J	0.029	0.07 J	0.007	0.8	0.08
BaP Equivalent			**0.29**		**0.56**		**0.92**		**0.50**		**2.0**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	Bldg108 S-15-4-4		Bldg108 S-16-6-6		Bldg108 S-17-6-6		Bldg108 S-18-4-4		Bldg108 S-19-3-3	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.39 U	0.039	0.22 J	0.022	0.32 J	0.032	0.05 J	0.005	3.7	0.37
Benzo(a)pyrene	1	0.39 U	0.39	0.16 J	0.16	0.25 J	0.25	0.39 U	0.39	3.3	3.3
Benzo(b)fluoranthene	0.1	0.39 U	0.039	0.13 J	0.013	0.2 J	0.02	0.06 J	0.006	5.3	0.53
Benzo(k)fluoranthene	0.01		0		0		0		0		0
Chrysene	0.001	0.39 U	0.00039	0.21 J	0.00021	0.37 J	0.00037	0.04 J	0.00004	4	0.004
Dibenz(a,h)anthracene	1	0.39 U	0.39	0.41 U	0.41	0.07 J	0.07	0.39 U	0.39	0.97	0.97
Indeno(1,2,3-cd)pyrene	0.1	0.39 U	0.039	0.09 J	0.009	0.14 J	0.014	0.39 U	0.039	2.3	0.23
BaP Equivalent			**0.90 U**		**0.61**		**0.39**		**0.83**		**5.4**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	Bldg488 BL-1-3.5-4		Bldg488 BL-2-2.5-3		Bldg488 BL-3-2-2.5		Bldg488 BL-4-3.5-4		Bldg488 BL-6-5.5-6	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.5 J	0.05	1.36	0.136	0.665 U	0.0665	0.328 U	0.0328	0.52 J	0.052
Benzo(a)pyrene	1	0.44 J	0.44	1.1	1.1	0.513 U	0.513	0.253 U	0.253	0.43 J	0.43
Benzo(b)fluoranthene	0.1	0.64	0.064	1.46	0.146	0.477 U	0.0477	0.236 U	0.0236	0.67	0.067
Benzo(k)fluoranthene	0.01	0.298 U	0.00298	0.59	0.0059	0.573 U	0.00573	0.283 U	0.00283	0.306 U	0.00306
Chrysene	0.001	0.49 J	0.00049	1.34	0.00134	0.627 U	0.000627	0.309 U	0.000309	0.5 J	0.0005
Dibenz(a,h)anthracene	1	0.211 U	0.211	0.201 U	0.201	0.406 U	0.406	0.2 U	0.2	0.217 U	0.217
Indeno(1,2,3-cd)pyrene	0.1	0.24 J	0.024	0.64	0.064	0.435 U	0.0435	0.215 U	0.0215	0.232 U	0.0232
BaP Equivalent			**0.79**		**1.7**		**1.1 U**		**0.53 U**		**0.79**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	Bldg488 BL-7-3-3.5		Bldg488 BL-8-3-3.5		Bldg488 BL-9-2.5-3		Bldg488 BL-10-2-2.5		Bldg488 BL-11-2-2.5	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.66	0.066	0.333 U	0.0333	0.343 U	0.0343	0.332 U	0.0332	0.323 U	0.0323
Benzo(a)pyrene	1	0.58	0.58	0.257 U	0.257	0.265 U	0.265	0.256 U	0.256	0.249 U	0.249
Benzo(b)fluoranthene	0.1	0.81	0.081	0.239 U	0.0239	0.246 U	0.0246	0.238 U	0.0238	0.232 U	0.0232
Benzo(k)fluoranthene	0.01	0.288 U	0.00288	0.287 U	0.00287	0.296 U	0.00296	0.286 U	0.00286	0.28 U	0.0028
Chrysene	0.001	0.67	0.00067	0.314 U	0.000314	0.323 U	0.000323	0.313 U	0.000313	0.304 U	0.000304
Dibenz(a,h)anthracene	1	0.204 U	0.204	0.204 U	0.204	0.209 U	0.209	0.203 U	0.203	0.197 U	0.197
Indeno(1,2,3-cd)pyrene	0.1	0.35 J	0.035	0.218 U	0.0218	0.224 U	0.0224	0.217 U	0.0217	0.211 U	0.0211
BaP Equivalent			**0.97**		**0.54 U**		**0.56 U**		**0.54 U**		**0.53 U**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	PAR-83-SB-12-1-1.5		PAR-83-SB-12-2.5-3		PAR-83-SB-14-0.5-1		PAR-83-SB-14-2.5-3		PAR-83-SB-34-2-2.5	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.0061 J	0.00061	0.17 J	0.017	0.62	0.062	0.017	0.0017	0.011 J	0.0011
Benzo(a)pyrene	1	0.0079 B	0.0079	0.39 U	0.39	0.73	0.73	0.014 B	0.014	0.083 U	0.083
Benzo(b)fluoranthene	0.1	0.0097	0.00097	0.39 U	0.039	0.92	0.092	0.02	0.002	0.014 J	0.0014
Benzo(k)fluoranthene	0.01	0.0043 J	0.000043	0.39 U	0.0039	0.33	0.0033	0.0064 J	0.000064	0.083 U	0.00083
Chrysene	0.001	0.0069 J	0.0000069	0.39 U	0.00039	0.63	0.00063	0.012	0.000012	0.083 U	0.000083
Dibenz(a,h)anthracene	1	0.0071 U	0.0071	0.39 U	0.39	0.086	0.086	0.0081 U	0.0081	0.083 U	0.083
Indeno(1,2,3-cd)pyrene	0.1	0.0063 J	0.00063	0.39 U	0.039	0.4	0.04	0.0081 U	0.00081	0.083 U	0.0083
BaP Equivalent			**0.017**		**0.88**		**1.0**		**0.027**		**0.18**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	PAR-83-482-SB-01-0.5-1		PAR-83-482-SB-01-1.5-2		PAR-83-482-SB-01-7.5-8		PAR-83-482-SB-02-5.5-6		PAR-83-482-SB-02-7.5-8	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.073 U	0.0073	0.078 U	0.0078	0.082 U	0.0082	0.69	0.069	0.087 U	0.0087
Benzo(a)pyrene	1	0.073 **U**	0.073	0.078 U	0.078	0.082 U	0.082	0.68	0.68	0.087 U	0.087
Benzo(b)fluoranthene	0.1	0.0082 J	0.00082	0.078 U	0.0078	0.082 U	0.0082	0.98	0.098	0.087 U	0.0087
Benzo(k)fluoranthene	0.01	0.073 U	0.00073	0.078 U	0.00078	0.082 U	0.00082	0.39	0.0039	0.087 U	0.00087
Chrysene	0.001	0.073 U	0.000073	0.078 U	0.000078	0.082 U	0.000082	0.72	0.00072	0.087 U	0.000087
Dibenz(a,h)anthracene	1	0.073 U	0.073	0.078 U	0.078	0.082 U	0.082	0.13	0.13	0.087 U	0.087
Indeno(1,2,3-cd)pyrene	0.1	0.073 U	0.0073	0.078 U	0.0078	0.082 U	0.0082	0.47	0.047	0.087 U	0.0087
BaP Equivalent			**0.16**		**0.18 U**		**0.19 U**		**1.0**		**0.20 U**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.4
BENZO(A)PYRENE-EQUIVALENT
FTMM-57
Fort Monmouth, New Jersey

	Sample ID	PAR-83-482-SB-02-12.5-13		PAR-83-482-SB-03-1.5-2		PAR-83-482-SB-03-5-5.5		PAR-83-482-SB-03-6-6.5	
Analyte	**Relative Potency Factors [1]**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**	**Concentration [2] (mg/kg)**	**B(a)P-Equivalent Concentration (mg/kg)**
Benzo(a)anthracene	0.1	0.094 U	0.0094	0.32	0.032	4.2	0.42	0.21	0.021
Benzo(a)pyrene	1	0.094 U	0.094	0.33	0.33	3.3	3.3	0.25	0.25
Benzo(b)fluoranthene	0.1	0.094 U	0.0094	0.47	0.047	4.1	0.41	0.32	0.032
Benzo(k)fluoranthene	0.01	0.094 U	0.00094	0.18	0.0018	1.6	0.016	0.13	0.0013
Chrysene	0.001	0.094 U	0.000094	0.35	0.00035	3.7	0.0037	0.13	0.00013
Dibenz(a,h)anthracene	1	0.094 U	0.094	0.024 J	0.024	0.47	0.47	0.042 J	0.042
Indeno(1,2,3-cd)pyrene	0.1	0.094 U	0.0094	0.23	0.023	1.7	0.17	0.15	0.015
BaP Equivalent			**0.22 U**		**0.46**		**4.8**		**0.36**

Notes:

[1] Relative Potency Factors as described in Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993a).

[2] Concentration in soil sample. If not detected, then the maximum method detection limit used to calculate B(a)P-equivalent.

J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

U = analyte not detected above method detection limit (MDL).

Table F.2.5
SURFACE SOIL EXPOSURE POINT CONCENTRATIONS
FTMM-57
Fort Monmouth, New Jersey

		FTMM-57				Exposure Area			
CAS Number [1]	COPC [2]	Maximum Surface Soil Exposure Point Concentration (mg/kg)	95% UCL Surface Soil Exposure Point Concentration (mg/kg)	Selected Surface Soil Concentration [3] (mg/kg)	Source (Max or UCL)	Maximum Surface Soil Exposure Point Concentration (mg/kg)	95% UCL Surface Soil Exposure Point Concentration (mg/kg)	Selected Surface Soil Concentration [3] (mg/kg)	Source (Max or UCL)
VOCs									
71-43-2	Benzene	0.005 U	NC	0.005 U	Max	0.005 U	NC	0.005 U	Max
100-41-4	Ethylbenzene	0.00018 J	NC	0.00018 J	Max	0.005 U	NC	0.005 U	Max
108-38-3	Meta/Para Xylene	0.0072 U	NC	0.0072 U	Max	0.005 U	NC	0.005 U	Max
95-47-6	Ortho Xylene	0.005 U	NC	0.005 U	Max	0.005 U	NC	0.005 U	Max
SVOCs									
91-57-6	2-Methylnaphthalene	0.054	NC	0.054	Max	0.054 J	NC	0.054 J	Max
91-20-3	Naphthalene	0.14	NC	0.14	Max	0.13	NC	0.13	Max
Polycyclic Aromatic Hydrocarbons									
50-32-8	BaP Equivalent	1.0	NC	1	Max	0.5	NC	0.5	Max
Inorganics									
7440-38-2	Arsenic	195.74	NC	195.74	Max	195.74	93	93	UCL

Table F.2.6
COMBINED SURFACE SOIL AND SUBSURFACE SOIL EXPOSURE POINT CONCENTRATIONS
FTMM-57
Fort Monmouth, New Jersey

		FTMM-57				Exposure Area			
CAS Number [1]	COPC [2]	Maximum Surface Soil Exposure Point Concentration (mg/kg)	95% UCL Surface Soil Exposure Point Concentration (mg/kg)	Selected Surface Soil Concentration [3] (mg/kg)	Source (Max or UCL)	Maximum Surface Soil Exposure Point Concentration (mg/kg)	95% UCL Surface Soil Exposure Point Concentration (mg/kg)	Selected Surface Soil Concentration [3] (mg/kg)	Source (Max or UCL)
VOCs									
71-43-2	Benzene	4	NC	4	Max	4	NC	4	Max
100-41-4	Ethylbenzene	21	NC	21	Max	21	NC	21	Max
108-38-3	Meta/Para Xylene	170 D	NC	170 D	Max	170 D	NC	170 D	Max
95-47-6	Ortho Xylene	69	NC	69	Max	69	NC	69	Max
SVOCs									
91-57-6	2-Methylnaphthalene	53	NC	53	Max	4.3	NC	4.3	Max
91-20-3	Naphthalene	5.3	NC	5.3	Max	5.3	NC	5.3	Max
Polycyclic Aromatic Hydrocarbons									
50-32-8	BaP Equivalent	5.4	NC	5.4	Max	4.8	NC	4.8	Max
Inorganics									
7440-38-2	Arsenic	297.03	NC	297.03	Max	297.03	59	59	UCL

Table F.2.7
GROUNDWATER EXPOSURE POINT CONCENTRATIONS
FTMM-57
Fort Monmouth, New Jersey

		FTMM-57				**108MW01**				**108MW02**				**108MW03**				**108MW04**			
CAS Number	COPC	Groundwater Exposure Point Concentration (µg/L)	95% UCL Exposure Point Concentration (µg/L)	Selected Expsure Point Concentration (µg/L)	Source (Max or UCL)	Groundwater Exposure Point Concentration (µg/L)	95% UCL Exposure Point Concentration (µg/L)	Selected Expsure Point Concentration (µg/L)	Source (Max or UCL)	Groundwater Exposure Point Concentration (µg/L)	95% UCL Exposure Point Concentration (µg/L)	Selected Expsure Point Concentration (µg/L)	Source (Max or UCL)	Groundwater Exposure Point Concentration (µg/L)	95% UCL Exposure Point Concentration (µg/L)	Selected Expsure Point Concentration (µg/L)	Source (Max or UCL)	Groundwater Exposure Point Concentration (µg/L)	95% UCL Exposure Point Concentration (µg/L)	Selected Expsure Point Concentration (µg/L)	Source (Max or UCL)
	Inorganics (ug/l)																				
7440-36-0	Antimony	9.33 J	NC	9.33 J	Max	8.8 J	NC	8.82 J	Max	9.33 J	NC	9.33 J	Max	7.97 J	NC	7.97 J	Max	7.91 J	NC	7.91 J	Max
7440-38-2	Arsenic	34	NC	34	Max	15.6	9.3	9.3	UCL	15.9	13	13	UCL	9.1	6.7	6.7	UCL	34	77	34	Max
7440-48-4	Cobalt	1.2 J	NC	1.2 J	Max	ND	NC	ND	ND	1.2 J	NC	1.2 J	Max	ND	NC	ND	ND	ND	NC	ND	ND
7439-96-5	Manganese	363	NC	363	Max	19.8	NC	19.8	Max	363	NC	363	Max	52.3	NC	52.3	Max	1.5 J	NC	1.5 J	Max
7440-62-2	Vanadium	12.3	NC	12.3	Max	6.4	NC	6.4	Max	12.3	NC	12.3	Max	11.2	NC	11.2	Max	2.3 J	NC	2.3 J	Max

Table F.2.8
PARTICULATE EMISSION FACTOR AND VOLATILIZATION FACTOR EXPOSURE PARAMETERS
FTMM-57
Fort Monmouth, New Jersey

Abbreviation	Parameter	Units	All Receptors	Sources	Rationale
Q/C	Inverse of mean concentration at center of square source area for Philadelphia, Pennsylvania	g/m^2-s per kg/m^3	87.36898	USEPA, 2014b	Source references USEPA, 2002, Exhibit D-2
V	Fraction of vegetative cover	unitless	0.5	USEPA, 2014b	Source references USEPA, 2002, Equation 4-5
U_m	Mean annual wind speed	m/s	4.69	USEPA, 2014b	Source references USEPA, 2002, Equation 4-5
U_t	Equivalent threshold value of wind speed at 7m	m/s	11.32	USEPA, 2014b	Source references USEPA, 2002, Equation 4-5
F(x)	Function Dependent on U_m/U_t	unitless	0.194	USEPA, 2014b, Cowherd et. al. 1985	Source references USEPA, 2002, Equation 4-5
D_A	Apparent diffusivity	cm^2/s	Chemical-specific	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8
T	Exposure interval	seconds	9.50E+08	USEPA, 2002	USEPA, 2002, Equation 4-8
ρ_b	Dry soil bulk density	g/cm^3	1.5	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8
θ_a	Air-filled Soil Porosity (calculated as $n - \theta_w$)	L_{air}/L_{soil}	0.28	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8
n	Total Soil Porosity	L_{pore}/L_{soil}	0.43	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8
θ_w	Water-filled Soil Porosity	L_{water}/L_{soil}	0.15	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8
ρ_s	Soil particle density	g/cm^3	2.65	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8
D_i	Diffusivity in Air	cm^2/second	Chemical-specific	USEPA, 2015c	--
H'	Henry's law constant	dimensionless	Chemical-specific	USEPA, 2015c	--
D_w	Diffusivity in Water	cm^2/second	Chemical-specific	USEPA, 2015c	--
K_d	Soil-water Partition Coefficient	L/kg	Chemical-specific	USEPA, 2015c	Calculated as K_{OC} X f_{OC}
K_{OC}	Soil organic carbon-water Partition Coefficient	L/kg	Chemical-specific	USEPA, 2015c	--
f_{OC}	Organic Carbon Content of Soil	g/g	0.006	USEPA, 2014b	Source references USEPA, 2002, Equation 4-8

Table F.2.9
CALCULATION OF PARTICULATE EMISSION FACTOR
FTMM-57
Fort Monmouth, New Jersey

Parameters				Equation
Parameter	**Abbreviation**	**Value**	**Units**	
Inverse of mean concentration at center of square source area [(1)]	Q/C	87.37	g/m^2-s per kg/m^3	$PEF = Q/C \times \frac{3{,}600 s/hr}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$
Fraction of vegetative cover	V	0.5	unitless	
Mean annual wind speed	U_m	4.69	m/s	
Equivalent threshold value of wind speed at 7m	U_t	11.32	m/s	
Function Dependent on Um /Ut	F(x)	0.194	unitless	
Particulate emission factor	PEF	1.27E+09	m^3/kg	

Notes:
(1) Nearest city with air dispersion model data and Q/C value is Philadelphia, PA.

Table F.2.10
CALCULATION OF VOLATILIZATION FACTOR
FTMM-57
Fort Monmouth, New Jersey

Parameters	Abbreviation	Value	Units
Inverse of mean concentration at center of square source area [1]	Q/C	87.37	g/m^2-s per kg/m^3
Apparent diffusivity	D_a	chemical specific	cm^2 per s
Exposure interval	T	9.50E+08	s
Dry soil bulk density	ρ_b	1.50	g/cm^3
Air-filled Soil Porosity (calculated as n - θw)	θ_a	0.28	L_{air}/L_{soil}
Total Soil Porosity	n	0.43	L_{pore}/L_{soil}
Soil particle density	ρ_s	2.65	g/cm^3
Water-filled Soil Porosity	θ_w	0.15	L_{water}/L_{soil}
Diffusivity in Air	D_i	Chemical-specific	cm^2/s
Henry's law constant	H'	Chemical-specific	unitless
Diffusivity in Water	D_w	Chemical-specific	cm^2/s
Soil-water Partition Coefficient	K_d	Chemical-specific	cm^3/g
Soil organic carbon-water Partition Coefficient	K_{OC}	Chemical-specific	cm^3/g
Organic Carbon Content of Soil	f_{OC}	0.006	g/g

Equations

$$VF = (Q/C)\left(\frac{((3.14)(D_A)(T))^{1/2}}{((2)(\rho_b)(D_A))}\right)(10^{-4}\,m^2/cm^2)$$

where:

$$D_A = \frac{\left[\left(\left(\theta_a^{10/3}\right)(D_i)(H')\right)+\left(\left(\theta_w^{10/3}\right)(D_w)\right)\right]/n^2}{((\rho_b)(K_d))+\theta_w+((\theta_a)(H'))}$$

where:

$$\theta_a = n - \theta_w$$

$$n = 1 - \left(\rho_b / \rho_s\right)$$

where, for organics:

$$K_d = (K_{OC})(f_{OC})$$

COPC [2]	CAS Number [3]	Diffusivity in Air (D_i) [4] (cm^2/s)	Henry's Law Constant (H') [4] (unitless)	Diffusivity in Water (D_w) [4] (cm^2/s)	Soil-water Partition Coefficient (K_d) [4] (cm^3/g)	Soil Organic Carbon-water Partition Coefficient (K_{OC}) [4] (cm^3/g)	D_A (cm^2/s)	Volatilization Factor (VF) (m^3/kg)
Volatile Organic Compounds								
Benzene	71-43-2	8.95E-02	2.27E-01	1.03E-05	8.75E-01	1.46E+02	1.0E-03	4.9E+03
Ethylbenzene	100-41-4	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	4.0E-04	7.9E+03
Meta/Para Xylene	108-38-3	6.84E-02	2.94E-01	8.44E-06	2.25E+00	3.75E+02	4.3E-04	7.7E+03
Ortho Xylene	95-47-6	6.89E-02	2.12E-01	8.53E-06	2.30E+00	3.83E+02	3.1E-04	9.0E+03
Semivolatile Organic Compounds								
2-Methylnaphthalene	91-57-6	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	3.8E-06	8.1E+04
Benzo(a)pyrene	50-32-8	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05	2.3E-11	3.3E+07
Naphthalene	91-20-3	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	6.0E-06	6.5E+04
Inorganics								
Antimony	7440-36-0	--	--	--	4.50E+01	--	--	--
Arsenic	7440-38-2	--	--	--	2.90E+01	--	--	--
Cobalt	7440-48-4	--	--	--	4.50E+01	--	--	--
Manganese	7439-96-5	--	--	--	6.50E+01	--	--	--
Vanadium	7440-62-2	--	--	--	1.00E+03	--	--	--

Notes:
[1] Nearest city with air dispersion model data and Q/C value is Philadelphia, PA.
[2] COPC = Constituent of potential concern.
[3] CAS = Chemical Abstracts Service number. For Extractable/Volatile Petroleum Hydrocarbons, the CAS number is the Total Petroleum Hydrocarbon consistent with the USEPA RSLs that was used for the calculation.
[4] Values consistent with the USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (TR = 1E-06; THQ = 1.0), Chemical Specific Parameters Supporting Table, June 2017. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017.

-- = toxicity data not available.

Table F.2.11
TOXICITY VALUES
FTMM-57
Fort Monmouth, New Jersey

					Ingestion					Dermal Contact		Inhalation				
CAS Number [1]	Analyte	Volatile Organic Compound (Yes/No)	Mutagenic Compound (Yes/No)	ABS_d [2] (unitless)	RfD_o [2] (mg/kg-day)	Reference	Sfo [2] $((mg/kg\text{-}day)^{-1})$	Reference	GIABS [2] (unitless)	RfD_d [3] (mg/kg-day)	SF_d [3] $((mg/kg\text{-}day)^{-1})$	RfC_i [2] (mg/m^3)	Reference	IUR [2] $((\mu g/m^3)^{-1})$	Reference	C_{sat} [2] (mg/kg)
	VOCs															
71-43-2	Benzene	Yes	No	--	4.00E-03	I	5.5E-02	I	1	4.00E-03	5.5E-02	3.00E-02	I	7.80E-06	I	1820
100-41-4	Ethylbenzene	Yes	No	--	1.00E-01	I	1.1E-02	C	1	1.00E-01	1.1E-02	1.00E+00	I	2.50E-06	C	480
108-38-3	Meta/Para Xylene	Yes	No	--	2.00E-01	S	--		1	2.00E-01	--	1.00E-01	S	--		388
95-47-6	Ortho Xylene	Yes	No	--	2.00E-01	S	--		1	2.00E-01	--	1.00E-01	S	--		434
	SVOCs															
91-57-6	2-Methylnaphthalene	Yes	No	0.13	4.00E-03	I	--		1	4.00E-03	--	--		--		--
50-32-8	Benzo(a)pyrene	No	Yes	0.13	3.00E-04	I	1.0E+00	I	1	3.00E-04	1.0E+00	2.00E-06	I	6.00E-04	I	--
91-20-3	Naphthalene	Yes	No	0.13	2.00E-02	I	--		1	2.00E-02	--	3.00E-03	I	3.40E-05	C	--
	Inorganics															
7440-36-0	Antimony	No	No	--	4.00E-04	I	--		0.15	6.00E-05	--	--		--		--
7440-38-2	Arsenic	No	No	0.03	3.00E-04	I	1.5E+00	I	1	3.00E-04	1.5E+00	1.50E-05	C	4.30E-03	I	--
7440-48-4	Cobalt	No	No	--	3.00E-04	P	--		1	3.00E-04	--	6.00E-06	P	9.00E-03	P	--
7439-96-5	Manganese	No	No	--	2.40E-02	S	--		0.04	9.60E-04	--	5.00E-05	I	--		--
7440-62-2	Vanadium	No	No	--	5.00E-03	S	--		0.026	1.30E-04	--	1.00E-04	A	--		--

[1] CAS = Chemical Abstracts Service number.

[2] ABSd is the recommended dermal absorption fraction of contaminants in soil. SFo is the oral slope factor. RfDo is the oral slope reference dose. GIABS is the oral absorption factor of analytes that are absorbed in the intestinal tract. RfCi in the inhalation reference dose. IUR is the inhalation slope factor. Csat is the inhalation sat is the soil saturation concentration. All values are consistent with the USEPA RSLs for Chemical Contaminants at Superfund Sites (TR = 1E-06; THQ = 1.0), Summary Table, June 2017. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017.

[3] RfD_d is the dermal reference dose and is based on the absorbed dose. The RFD_d is calculated as RfD_o*GIABS. SFd is the dermal slope factor and is based on absorbed dose. The SFd is calculated as SFo / GIABS.

-- = toxicity data not available or analyte not in USEPA RSL table.

References:
A = ATSDR
C = Cal EPA
I = IRIS
J = New Jersey Department of Environmental Protection. See Section 5.6 of the RSL User Guide
P= PPRTV
S = RSL User Guide, Section 5.3
X= PPRTV Appendix
H = HEAST

Table F.2.12
CHEMICAL-SPECIFIC PARAMETERS
FTMM-57
Fort Monmouth, New Jersey

		Volatility Parameters [1]					Diffusivity in Air and Water [1]			Partition Coefficients [1]				Water Solubility [1]		Tapwater Dermal Parameters [1]					
Analyte	**CAS #**	H` (unitless)	HLC (atm-m^3/mole)	H` and HLC Ref	Vapor Pressure	VP Ref	Dia (cm^2/s)	Diw (cm^2/s)	Dia Ref	K_d (L/kg)	K_d Ref	K_{oc} (L/kg)	K_{oc} Ref	S (mg/L)	S Ref	B (unitless)	τ_{event} (hr/event)	t* (hr)	K_p (cm/hr)	KPREF	FA [2]
Volatile Organic Compounds																					
Acetone	67-64-1	1.43E-03	3.50E-05	PHYSPROP	2.32E+02	PHYSPROP	1.06E-01	1.15E-05	WATER9 (U.S. EPA, 2001)	--	--	2.36E+00	EPI	1.00E+06	PHYSPROP	1.50E-03	2.22E-01	5.34E-01	5.12E-04	EPI	1
Benzene	71-43-2	2.27E-01	5.55E-03	PHYSPROP	9.48E+01	PHYSPROP	8.95E-02	1.03E-05	WATER9 (U.S. EPA, 2001)	--	--	1.46E+02	EPI	1.79E+03	PHYSPROP	5.07E-02	2.88E-01	6.91E-01	1.49E-02	EPI	1
Ethylbenzene	100-41-4	3.22E-01	7.88E-03	PHYSPROP	9.60E+00	PHYSPROP	6.85E-02	8.46E-06	WATER9 (U.S. EPA, 2001)	--	--	4.46E+02	EPI	1.69E+02	PHYSPROP	1.95E-01	4.13E-01	9.92E-01	4.93E-02	EPI	1
Meta/Para Xylene	108-38-3	2.94E-01	7.18E-03	PHYSPROP	8.29E+00	PHYSPROP	6.84E-02	8.44E-06	WATER9 (U.S. EPA, 2001)	--	--	3.75E+02	EPI	1.61E+02	PHYSPROP	2.11E-01	4.13E-01	9.92E-01	5.32E-02	EPI	1
Ortho Xylene	95-47-6	2.12E-01	5.18E-03	PHYSPROP	6.61E+00	PHYSPROP	6.89E-02	8.53E-06	WATER9 (U.S. EPA, 2001)	--	--	3.83E+02	EPI	1.78E+02	PHYSPROP	1.87E-01	4.13E-01	9.92E-01	4.71E-02	EPI	1
Semivolatile Organic Compounds																					
2-Methylnaphthalene	91-57-6	2.12E-02	5.18E-04	PHYSPROP	5.50E-02	PHYSPROP	5.24E-02	7.78E-06	WATER9 (U.S. EPA, 2001)	--	--	2.48E+03	EPI	2.46E+01	PHYSPROP	4.21E-01	6.58E-01	1.58E+00	9.17E-02	EPI	1
Benzo(a)pyrene	50-32-8	1.87E-05	4.57E-07	PHYSPROP	5.49E-09	EPI	4.76E-02	5.56E-06	WATER9 (U.S. EPA, 2001)	--	--	5.87E+05	EPI	1.62E-03	PHYSPROP	4.36E+00	2.72E+00	1.18E+01	7.13E-01	EPI	1
Naphthalene	91-20-3	1.80E-02	4.40E-04	PHYSPROP	8.50E-02	PHYSPROP	6.05E-02	8.38E-06	WATER9 (U.S. EPA, 2001)	--	--	1.54E+03	EPI	3.10E+01	PHYSPROP	2.03E-01	5.49E-01	1.32E+00	4.66E-02	EPI	1
Inorganics																					
Antimony	7440-36-0	--	--	--	0.00E+00	NIOSH	--	--	--	4.50E+01	SSL	--	--	--	--	4.24E-03	5.05E-01	1.21E+00	1.00E-03	RAGSE	1
Arsenic	7440-38-2	--	--	--	--	--	--	--	--	2.90E+01	SSL	--	--	--	--	3.33E-03	2.76E-01	6.63E-01	1.00E-03	RAGSE	1
Cobalt	7440-48-4	--	--	--	0.00E+00	NIOSH	--	--	--	4.50E+01	BAES	--	--	--	--	1.18E-03	2.25E-01	5.40E-01	4.00E-04	RAGSE	1
Manganese	7439-96-5	--	--	--	0.00E+00	NIOSH	--	--	--	6.50E+01	BAES	--	--	--	--	2.85E-03	2.14E-01	5.13E-01	1.00E-03	RAGSE	1
Vanadium	7440-62-2	--	--	--	--	--	--	--	--	1.00E+03	SSL	--	--	--	--	2.75E-03	2.03E-01	4.87E-01	1.00E-03	RAGSE	1

[1] Values will be consistent with the USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (TR = 1E-06; THQ = 1.0), Chemical Specific Parameters Supporting Table, June 2017. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017.

[2] FA values consistent with the USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (TR = 1E-06; THQ = 1.0), Residential Tapwater Table, June 2017. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017.

Table F.2.13
RISK AND HAZARD ESTIMATES -- INCIDENTAL INGESTION OF SURFACE SOIL (0-2')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	100	mg/day
Soil Ingestion Rate - child	IRS_{child}	200	mg/day
Age-adjusted soil ingestion factor	IFS_{adj}	105	(mg-year)/(kg-day)
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	years
Exposure Duration - child	ED_{child}	6	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg
Fraction Ingested	FI	1	unitless
Oral Reference Dose	RfD_o	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in soil for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_s)(IFS_{adj})(EF)(CF_S)(FI)}{(AT_c)}$$

where: $$IFS_{adj} = \frac{(ED_{child})(IRS_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRS_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in soil for separate age groups:

$$Ingestion = \frac{(C_s)(IRS)(EF)(ED)(CF_S)(FI)}{(AT_{nc})(BW)}$$

Carcinogenic Risk: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic Hazard: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Carcinogenic $Ingestion_{age-adj}$ (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	RfDo [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds															
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds															
2-Methylnaphthalene	91-57-6	0.054	J	Max	--	0.00000069	0.000000065	--	4.0E-03	--	--	0.00017	0.0043%	0.000016	0.0043%
BaP-equivalent [5]	50-32-8	0.5		Max	3.3E-06 [6]	0.0000064	0.00000060	1.0E+00	3.0E-04	3.3E-06	1.62%	0.021	0.53%	0.0020	0.53%
Naphthalene	91-20-3	0.13		Max	--	0.0000017	0.00000016	--	2.0E-02	--	--	0.000083	0.0021%	0.0000078	0.0021%
Inorganics															
Arsenic	7440-38-2	93		UCL	1.3E-04	0.00119	0.000111	1.5E+00	3.0E-04	2.0E-04	98%	4.0	99%	0.37	99%
										Cancer Risk		**Hazard Index**		**Hazard Index**	
									Pathway Sums:	2E-04	100%	4	100%	0.4	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[4] Human Health Toxicity Values shown in Table F.2.11.
[5] See Table F.2.4 for B(a)P-equivalent calculation.
[6] See Table F.2.14 for mutagenic mode of action ingestion intake calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.14
MUTAGENIC MODE OF ACTION -- INCIDENTAL INGESTION OF SURFACE SOIL (0-2')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Risk Equation

$$Ingestion = \frac{C_s \times \left(\frac{((ED_{0-2})(IRS_{child})(10))}{BW_{child}} + \frac{((ED_{2-6})(IRS_{child})(3))}{BW_{child}} + \frac{((ED_{6-16})(IRS_{adult})(3))}{BW_{adult}} + \frac{((ED_{16-30})(IRS_{adult})(1))}{BW_{adult}} \right) \times EF \times CF_s}{AT_c}$$

Mutagenic Risk: $Risk = (Ingestion)(SF_o)$

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil (C_s)	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	100	mg/day
Soil Ingestion Rate - child	IRS_{child}	200	mg/day
Exposure Frequency	EF	350	days/year
Exposure Duration, 0 to 2 years of age	ED_{0-2}	2	years
Exposure Duration, 2 to 6 years of age	ED_{2-6}	4	years
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg

COPC [1]	CAS Number [2]	Cs [3] (mg/kg)	Carcinogenic Ingestion (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	Cancer Risk
BaP-equivalent [5]	50-32-8	0.5	3.3E-06	1.0E+00	3.3E-06

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.15
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH SURFACE SOIL (0-2')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	years
Exposure Duration - child	ED_{child}	6	years
Event Frequency	EV	1	events/day
Exposed Skin Surface Area - adult	SA_{adult}	6032	cm^2
Exposed Skin Surface Area - child	SA_{child}	2690	cm^2
Age-adjusted dermal contact factor	SFS_{adj}	321	(mg-year)/(kg-event)
Adherence Factor - adult	AF_{adult}	0.07	mg/cm^2
Adherence Factor - child	AF_{child}	0.2	mg/cm^2
Dermal Absorption Factor	ABS_d	chemical-specific	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Conversion Factor-soil	CF_s	0.000001	kg/mg
Fraction of contaminantt absorbed in gastrointestinal tract	GIABS	chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal absorbed dose for carcinogenic COPCs in soil for multiple age groups simultaneously:

$$DAD = \frac{(C_s)(SFS_{adj})(ABS_d)(EF)(EV)(CF)}{(AT)}$$

where: $$SFS_{adj} = \frac{(ED_{child})(AF_{child})(SA_{child})}{(BW_{child})} + \frac{(ED_{adult})(AF_{adult})(SA_{adult})}{(BW_{adult})}$$

Dermal absorbed dose of noncarcinogenic COPCs in soil for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where: $$DA_{event} = (C_S)(CF_S)(AF)(ABS_d)$$

Carcinogenic Risk: $$Risk = (DAD)(SF_d)$$

where: $$SF_d = SF_o / GIABS$$

Noncarcinogenic Hazard: $$HQ = DAD / Rf_d$$

where: $$RfD_d = (RfD_o)(GIABS)$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	ABS_d [4] (unitless)	SF_d [4] $(mg/kg\text{-}day)^{-1}$	RfD_d [4] (mg/kg-day)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - Child (mg/kg-day)	Noncarcinogenic DAD - Adult (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	0.005	U	Max	--	5.5E-02	4.0E-03	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.005	U	Max	--	1.1E-02	1.0E-01	--	--	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.005	U	Max	--	--	2.0E-01	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	2.0E-01	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	0.054	J	Max	0.13	--	4.0E-03	--	2.4E-07	3.6E-08	--	--	0.000060	0.0184%	0.0000089	0.018%
BaP-equivalent [5]	50-32-8	0.5		Max	0.13	1.0E+00	3.0E-04	1.2E-06 [6]	2.2E-06	3.3E-07	1.2E-06	6%	0.0075	2.3%	0.0011	2.3%
Naphthalene	91-20-3	0.13		Max	0.13	--	2.0E-02	--	5.8E-07	8.6E-08	--	--	0.000029	0.0089%	0.0000043	0.0089%
Inorganics																
Arsenic	7440-38-2	93		UCL	0.03	1.5E+00	3.0E-04	1.2E-05	9.6E-05	1.4E-05	1.8E-05	94%	0.32	98%	0.05	98%
											Cancer Risk		**Hazard Index**		**Hazard Index**	
										Pathway Sums:	2E-05	100%	0.3	100%	0.05	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[4] Human Health Toxicity Values shown in Table F.2.11.
[5] See Table F.2.4 for B(a)P-equivalent calculation.
[6] See Table F.2.16 for mutagenic mode of action dermal contact calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.16
MUTAGENIC MODE OF ACTION -- DERMAL CONTACT WITH SURFACE SOIL (0-2')
UU/UE RECEPTOR
FTMM-57
Fort Monmouth, New Jersey

Equations

$$DAD = \frac{(C_s)\left(\frac{((ED_{0-2})(AF_{child})(SA_{child})(10))}{BW_{child}} + \frac{((ED_{2-6})(AF_{child})(SA_{child})(3))}{BW_{child}} + \frac{((ED_{6-16})(AF_{adult})(SA_{adult})(3))}{BW_{adult}} + \frac{((ED_{16-30})(AF_{adult})(SA_{adult})(1))}{BW_{adult}}\right)(ABS)(EF)(CF)}{AT_c}$$

Mutagenic Risk: $Risk = (DAD)(SF_d)$

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	Cs	chemical-specific	mg/kg
Adherence Factor - adult	AF_{adult}	0.07	mg/cm2
Adherence Factor - child	AF_{child}	0.2	mg/cm2
Exposed Skin Surface Area - adult	SA_{adult}	6032	cm2
Exposed Skin Surface Area - child	SA_{child}	2690	cm2
Dermal Absorption Factor	ABS	chemical-specific	unitless
Exposure Frequency	EF	350	days/year
Exposure Duration, 0 to 2 years of age	ED_{0-2}	2	years
Exposure Duration, 2 to 6 years of age	ED_{2-6}	4	years
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$

COPC [1]	CAS Number [2]	Cs [3] (mg/kg)	ABS [4] (unitless)	Carcinogenic DAD (mg/kg-day)	SF_d $(mg/kg\text{-}day)^{-1}$	Cancer Risk
BaP-equivalent [5]	50-32-8	0.5	1.3E-01	1.2E-06	1.0E+00	1.2E-06

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.17
RISK AND HAZARD ESTIMATES -- INHALATION OF VOLATILES/FUGITIVE DUST FROM SURFACE SOIL (0-2')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC concentration in air (C_a)	C_a	chemical-specific	µg/m^3
COPC concentration in surface soil (C_s)	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	350	days/year
Exposure Duration - inhalation	ED_{inh}	26	years
Exposure Time	ET	1	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time - noncarcinogens, inhalation	$AT_{nc\ -\ inh}$	9490	days
Inhalation Unit Risk	IUR	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration	RfC	chemical-specific	mg/m^3
Volatilization Factor	VF	chemical-specific	m^3/kg
Particulate emission factor [1]	PEF	1.27E+09	m^3/kg
Soil saturation	C_{sat}	chemical-specific	mg/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

Equations

Exposure concentration in air for soil particulates and vapors emitted from soil for carcinogens and noncarcinogens:

$$EC(air) = \frac{(C_a)(ET)(EF)(ED_{inh})}{(AT)}$$

Where for inorganics, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)$$

Where for organics with $C_s \le C_{sat}$, or if no C_{sat}, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{VF} + \frac{1}{PEF}\right)$$

Where for organics with $C_s > C_{sat}$, C_a calculated as:

$$C_a = \left[(C_s)\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat})\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{VF}\right)\right]$$

$$Risk = [EC(air)](IUR)$$

$$HQ = \frac{EC(air)}{(RfC)\left(1{,}000\ {}^{\mu g}/_{mg}\right)}$$

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)		UCL or Max	C_{sat} [5] (mg/kg)	Is $C_s \le C_{sat}$?	Volatilization Factor [6] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	Noncarcinogenic EC(air) (µg/m^3)	IUR [5] (µg/m3)$^{-1}$	RfC_i [5] (mg/m^3)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	0.005	U	Max	--	--	4.9E+03	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.005	U	Max	--	--	7.9E+03	--	--	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.005	U	Max	--	--	7.7E+03	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	9.0E+03	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	0.054	J	Max	--	--	8.1E+04	6.7E-04	--	--	--	--	--	--	--	--
BaP-equivalent [5]	50-32-8	0.5		Max	--	--	3.3E+07	1.6E-05	1.6E-05 [8]	1.5E-05	6.0E-04	2.0E-06	9.7E-09	6.6%	0.0075	58%
Naphthalene	91-20-3	0.13		Max	--	--	6.5E+04	2.0E-03	7.1E-04	1.9E-03	3.4E-05	3.0E-03	2.4E-08	17%	0.00064	5.0%
Inorganics																
Arsenic	7440-38-2	93		UCL	--	--	--	7.3E-05	2.6E-05	7.0E-05	4.3E-03	1.5E-05	1.1E-07	77%	0.0047	37%
													Cancer Risk		**Hazard Index**	
												Pathway Sums:	1E-07	100%	0.01	100%

[1] PEF calculated as shown in Table F.2.9.
[2] COPC = Constituent of potential concern.
[3] CAS = Chemical Abstracts Service number.
[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[5] Human Health Toxicity Values shown in Table F.2.11.
[6] See Table F.2.10 for VF calculation.
[7] See Table F.2.4 for B(a)P-equivalent calculation.
[8] See Table F.2.18 for mutagenic mode of action inhalation calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.18
MUTAGENIC MODE OF ACTION -- INHALATION OF VOLATILES/FUGITIVE DUST FROM SURFACE SOIL (0-2')
UU/UE RECEPTOR
FTMM-57
Fort Monmouth, New Jersey

Equations

$$EC(air) = \frac{(C_a)(ET)(EF)[((ED_{0-2})(10))+((ED_{2-6})(3))+((ED_{6-16})(3))+((ED_{6-30})(1))]}{AT_c}$$

where: $$C_a = (C_s)(1{,}000\,\mu g/mg)\left(\frac{1}{VF}+\frac{1}{PEF}\right)$$

$$Mutagenic\ Risk_{inh} = [(EC(air))(IUR)]$$

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air	C_a	chemical-specific	µg/m^3
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	350	days/year
Exposure Duration, 0 to 2 years of age	ED_{0-2}	2	years
Exposure Duration, 2 to 6 years of age	ED_{2-6}	4	years
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Exposure Time	ET	1	unitless
Averaging Time – carcinogens	AT_c	25550	days
Inhalation Unit Risk	IUR	chemical-specific	(µg/m^3)$^{-1}$
Volatilization Factor (VF)	VF	chemical-specific	m^3/kg
Particulate emission factor (PEF) [1]	PEF	1.27E+09	m^3/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)	Volatilization Factor [5] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	IUR [6] (µg/m^3)$^{-1}$	Cancer Risk
BaP-equivalent [7]	50-32-8	0.5	3.3E+07	1.6E-05	1.6E-05	6.0E-04	9.7E-09

[1] PEF calculated as shown in Table F.2.9.

[2] COPC = Constituent of potential concern.

[3] CAS = Chemical Abstracts Service number.

[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[5] Human Health Toxicity Values shown in Table F.2.11.

[6] See Table F.2.10 for VF calculation.

[7] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.19
HUMAN HEALTH RISK EVALUATION SUMMARY FOR SURFACE SOIL (0-2')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Volatile Organic Compounds															
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds															
2-Methylnaphthalene	91-57-6	0.054	J	Max	--	--	--	--	0.00017	0.000060	0.000016	0.0000089	--	**0.0002**	**0.00003**
BaP-equivalent [4]	50-32-8	0.5		Max	3.3E-06	1.2E-06	9.7E-09	**5E-06**	0.021	0.0075	0.0020	0.0011	0.0075	**0.04**	**0.01**
Naphthalene	91-20-3	0.13		Max	--	--	2.4E-08	**2E-08**	0.000083	0.000029	0.0000078	0.0000043	0.00064	**0.0008**	**0.00065**
Inorganics															
Arsenic	7440-38-2	93		UCL	2.0E-04	1.8E-05	1.1E-07	**2E-04**	4.0	0.32	0.37	0.047	0.0047	**4**	**0.4**
				Pathway Risk	**2E-04**	**2E-05**	**1E-07**	**--**	**4**	**0.3**	**0.4**	**0.05**	**0.01**	**--**	**--**
							Total Risk	**2E-04**					**Hazard Index**	**4**	**0.4**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] See Table F.2.4 for B(a)P-equivalent calculation.

-- Risk/hazard not calculated because toxicity value was not available.

Table F.2.20
RISK AND HAZARD ESTIMATES -- INCIDENTAL INGESTION OF SURFACE SOIL (0-2')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UTILITY WORKER

Parameter	Abbreviation	Value	Units
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	330	mg/day
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	365	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose	RfD_o	chemical-specific	mg/kg-day
Fraction Ingested	FI	1	unitless

Equations

Incidental ingestion of noncarcinogenic and carcinogenic COPCs in soil :

$$Ingestion = \frac{(C_s)(IRS_{adult})(EF)(ED_{adult})(CF_S)(FI)}{(AT)(BW_{adult})}$$

Carcinogenic Risk: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic Hazard: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	RfDo [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds												
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	8.7E-13	6.1E-11	1.1E-02	1.0E-01	9.6E-15	0.00000067%	0.00000000061	0.00000027%
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds												
2-Methylnaphthalene	91-57-6	0.054		Max	--	1.8E-08	--	4.0E-03	--	--	0.0000046	0.0021%
BaP-equivalent [5]	50-32-8	1		Max	4.8E-09	3.4E-07	1.0E+00	3.0E-04	4.8E-09	0.34%	0.0011	0.51%
Naphthalene	91-20-3	0.14		Max	--	4.7E-08	--	2.0E-02	--	--	0.0000024	0.0011%
Inorganics												
Arsenic	7440-38-2	195.74		Max	9.5E-07	6.6E-05	1.5E+00	3.0E-04	1.4E-06	100%	0.22	99%
									Cancer Risk		**Hazard Index**	
								Pathway Sums:	1E-06	100%	0.2	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.21
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH SURFACE SOIL (0-2')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor		UTILITY WORKER	
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	years
Event Frequency	EV	1	events/day
Exposed Skin Surface Area - adult	SA_{adult}	3470	cm2
Adherence Factor - adult	AF_{adult}	0.2	mg/cm2
Dermal Absorption Factor	ABS	chemical-specific	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	365	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Conversion Factor-soil	CF_s	0.000001	kg/mg
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal absorbed dose of noncarcinogenic and carcinogenic COPCs in soil:

$$DAD = \frac{(DA_{event})(EF)(ED_{adult})(EV)(SA_{adult})}{(BW_{adult})(AT)}$$

where: $$DA_{event} = (C_s)(AF_a)(ABS)(CF)$$

Carcinogenic Risk: $$Risk = (DAD)(SF_d)$$

$$SF_d = SF_o / GIABS$$

Noncarcinogenic Hazard: $$HQ = DAD / Rf_d$$

where: $$RfD_d = (RfD_o)(GIABS)$$

COPC [1]	CAS Number [2]	Exposure Point Concentration [3] (mg/kg)		UCL or Max	ABS [4] (unitless)	SF_d [4] $(mg/kg\text{-}day)^{-1}$	RfD_d [4] (mg/kg-day)	DAevent $(mg/cm^2\text{-}event)$	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds														
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	--	1.1E-02	1.0E-01	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds														
2-Methylnaphthalene	91-57-6	0.054		Max	0.13	--	4.0E-03	1.4E-09	7.2E-11	5.0E-09	--	--	0.0000013	0.0088%
BaP-equivalent [5]	50-32-8	1		Max	0.13	1.0E+00	3.0E-04	2.6E-08	1.3E-09	9.3E-08	1.3E-09	1.5%	0.00031	2.2%
Naphthalene	91-20-3	0.14		Max	0.13	--	2.0E-02	3.6E-09	1.9E-10	1.3E-08	--	--	0.00000065	0.0045%
Inorganics														
Arsenic	7440-38-2	195.74		Max	0.03	1.5E+00	3.0E-04	1.2E-06	6.0E-08	4.2E-06	9.0E-08	99%	0.014	98%
											Cancer Risk		**Hazard Index**	
										Pathway Sums:	9E-08	100%	0.01	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[4] Human Health Toxicity Values shown in Table F.2.11.
[5] See Table F.2.4 for B(a)P-equivalent calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.
NA = Not analyzed in any sample
J = Estimated concentration exceeds the method detection limit (MDL) and is less than the reporting limit (RL)

Table F.2.22
RISK AND HAZARD ESTIMATES -- INHALATION OF VOLATILES/FUGITIVE DUST FROM SURFACE SOIL (0-2')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	UTILITY WORKER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air	C_a	chemical-specific	µg/m^3
COPC in surface soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	years
Exposure Time	ET	0.33	unitless
Averaging Time – carcinogens	AT_C	25550	days
Averaging Time – noncarcinogens, adult	ATnc - adult	365	days
Inhalation Unit Risk (IUR)	IUR	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	RfC	chemical-specific	mg/m^3
Volatilization Factor (VF)	VF	chemical-specific	m^3/kg
Particulate emission factor (PEF) [1]	PEF	1.27E+09	m^3/kg
Soil saturation	C_{sat}	chemical-specific	mg/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

Equations

Exposure concentration in air for soil particulates and vapors emitted from soil for carcinogens and noncarcinogens:

$$EC\ (air) = \frac{(C_a)(ET)(EF)(ED)}{(AT)}$$

Where for inorganics, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}\!/_{mg}\right)\left(\frac{1}{PEF}\right)$$

Where for organics with $C_s \le C_{sat}$, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\,{}^{\mu g}\!/_{mg}\right)\left(\frac{1}{VF}+\frac{1}{PEF}\right)$$

Where for organics with $C_s > C_{sat}$, C_a calculated as:

$$C_a = \left[(C_S)\left(1{,}000\ {}^{\mu g}\!/_{mg}\right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat})\left(1{,}000\ {}^{\mu g}\!/_{mg}\right)\left(\frac{1}{VF}\right)\right]$$

Carcinogenic Risk: $Risk_{inh} = [EC(air)][IUR]$

Noncarcinogenic Hazard: $HQ_{inh} = \frac{EC(air)}{(RfC)\left(1{,}000\ {}^{\mu g}\!/_{mg}\right)}$

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)		UCL or Max	C_{sat} [5] (mg/kg)	Is $C_s \le$ Csat?	Volatilization Factor [6] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	Noncarcinogenic EC(air) (µg/m^3)	IUR [5] (µg/m^3)$^{-1}$	RfC_i [5] (mg/m3)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	4.8E+02	Yes	7.9E+03	2.3E-05	8.8E-09	6.2E-07	2.5E-06	1.0E+00	2.2E-14	0.0075%	0.00000000062	0.000085%
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	0.054		Max	--	Yes	8.1E+04	6.7E-04	--	--	--	--	--	--	--	--
BaP-equivalent [7]	50-32-8	1		Max	--	Yes	3.3E+07	3.1E-05	1.2E-08	8.4E-07	6.0E-04	2.0E-06	7.2E-12	2.5%	0.00042	59%
Naphthalene	91-20-3	0.14		Max	--	Yes	6.5E+04	2.2E-03	8.4E-07	5.9E-05	3.4E-05	3.0E-03	2.8E-11	10%	0.000020	2.7%
Inorganics																
Arsenic	7440-38-2	195.74		Max	--	Yes	--	1.5E-04	6.0E-08	4.2E-06	4.3E-03	1.5E-05	2.6E-10	88%	0.00028	39%
													Cancer Risk		**Hazard Index**	
												Pathway Sums:	3E-10	100%	0.0007	100%

[1] PEF calculated as shown in Table F.2.9.
[2] COPC = Constituent of potential concern.
[3] CAS = Chemical Abstracts Service number.
[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[5] Human Health Toxicity Values shown in Table F.2.11.
[6] See Table F.2.10 for VF calculation.
[7] See Table F.2.4 for B(a)P-equivalent calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.23
HUMAN HEALTH RISK EVALUATION SUMMARY FOR SURFACE SOIL (0-2')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Adult Only Ingestion Carcinogenic Risk	Adult Only Dermal Carcinogenic Risk	Adult Only Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Adult Inhalation Hazard Quotient	Total Hazard Quotient
Volatile Organic Compounds												
Benzene	71-43-2	0.005	U	Max	--	--	--	**--**	--	--	--	**--**
Ethylbenzene	100-41-4	0.00018	J	Max	9.6E-15	--	2.2E-14	**3E-14**	0.00000000061	--	0.00000000062	**0.000000001**
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	**--**	--	--	--	**--**
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	**--**	--	--	--	**--**
Semivolatile Organic Compounds												
2-Methylnaphthalene	91-57-6	0.054		Max	--	--	--	**--**	0.0000046	0.0000013	--	**0.000006**
BaP-equivalent [4]	50-32-8	1		Max	4.8E-09	1.3E-09	7.2E-12	**6E-09**	0.0011	0.00031	0.00042	**0.002**
Naphthalene	91-20-3	0.14		Max	--	--	2.8E-11	**3E-11**	0.0000024	0.00000065	0.000020	**0.00002**
Inorganics												
Arsenic	7440-38-2	195.74		Max	1.4E-06	9.0E-08	2.6E-10	**2E-06**	0.22	0.014	0.00028	**0.2**
				Pathway Risk	**1E-06**	**9E-08**	**3E-10**	**--**	**0.2**	**0.01**	**0.0007**	**--**
							Total Risk	**2E-06**			**Hazard Index**	**0.2**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] See Table F.2.4 for B(a)P-equivalent calculation.

-- Risk/hazard not calculated because toxicity value was not available.
NA = Not analyzed in any sample

Table F.2.24
RISK AND HAZARD ESTIMATES -- INCIDENTAL INGESTION OF SURFACE SOIL (0-2')
OUTDOOR WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: OUTDOOR WORKER

Parameter	Abbreviation	Value	Units
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	100	mg/day
Exposure Frequency	EF	225	days/year
Exposure Duration - adult	ED_{adult}	25	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	9125	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose	RfD_o	chemical-specific	mg/kg-day
Fraction Ingested	FI	1	unitless

Equations

Incidental ingestion of noncarcinogenic and carcinogenic COPCs in soil:

$$Ingestion = \frac{(C_s)(IRS_{adult})(EF)(ED_{adult})(CF_S)(FI)}{(AT)(BW_{adult})}$$

Carcinogenic Risk: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic Hazard: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	RfDo [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds												
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	5.0E-11	1.4E-10	1.1E-02	1.0E-01	5.4E-13	0.00000067%	0.0000000014	0.00000027%
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds												
2-Methylnaphthalene	91-57-6	0.054		Max	--	4.2E-08	--	4.0E-03	--	--	0.000010	0.0021%
BaP-equivalent [5]	50-32-8	1		Max	2.8E-07	7.7E-07	1.0E+00	3.0E-04	2.8E-07	0.34%	0.0026	0.51%
Naphthalene	91-20-3	0.14		Max	--	1.1E-07	--	2.0E-02	--	--	0.0000054	0.0011%
Inorganics												
Arsenic	7440-38-2	195.74		Max	5.4E-05	1.5E-04	1.5E+00	3.0E-04	8.1E-05	100%	0.50	99%
									Cancer Risk		**Hazard Index**	
								Pathway Sums:	8E-05	100%	0.5	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.25
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH SURFACE SOIL (0-2')
OUTDOOR WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor		OUTDOOR WORKER	
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	225	days/year
Exposure Duration - adult	ED_{adult}	25	years
Event Frequency	EV	1	events/day
Exposed Skin Surface Area - adult	SA_{adult}	3470	cm2
Adherence Factor - adult	AF_{adult}	0.12	mg/cm2
Dermal Absorption Factor	ABS	chemical-specific	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	9125	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Conversion Factor-soil	CF_s	0.000001	kg/mg
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal absorbed dose of noncarcinogenic and carcinogenic COPCs in soil:

$$DAD = \frac{(DA_{event})(EF)(ED_{adult})(EV)(SA_{adult})}{(BW_{adult})(AT)}$$

where: $$DA_{event} = (C_s)(AF_a)(ABS)(CF)$$

Carcinogenic Risk: $$Risk = (DAD)(SF_d)$$

$$SF_d = SF_o / GIABS$$

Noncarcinogenic Hazard: $$HQ = DAD / Rf_d$$

where: $$RfD_d = (RfD_o)(GIABS)$$

COPC [1]	CAS Number [2]	Exposure Point Concentration [3] (mg/kg)		UCL or Max	ABS [4] (unitless)	SF_d [4] $(mg/kg\text{-}day)^{-1}$	RfD_d [4] (mg/kg-day)	DAevent $(mg/cm^2\text{-}event)$	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds														
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	--	1.1E-02	1.0E-01	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds														
2-Methylnaphthalene	91-57-6	0.054		Max	0.13	--	4.0E-03	8.4E-10	8.0E-09	2.3E-08	--	--	0.0000056	0.0088%
BaP-equivalent [5]	50-32-8	1		Max	0.13	1.0E+00	3.0E-04	1.6E-08	1.5E-07	4.2E-07	1.5E-07	1.5%	0.0014	2.2%
Naphthalene	91-20-3	0.14		Max	0.13	--	2.0E-02	2.2E-09	2.1E-08	5.8E-08	--	--	0.0000029	0.0045%
Inorganics														
Arsenic	7440-38-2	195.74		Max	0.03	1.5E+00	3.0E-04	7.0E-07	6.7E-06	1.9E-05	1.0E-05	99%	0.063	98%
											Cancer Risk		**Hazard Index**	
										Pathway Sums:	1E-05	100%	0.06	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.26
RISK AND HAZARD ESTIMATES -- INHALATION OF VOLATILES/FUGITIVE DUST FROM SURFACE SOIL (0-2')
OUTDOOR WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	OUTDOOR WORKER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air	C_a	chemical-specific	µg/m^3
COPC in surface soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	225	days/year
Exposure Duration - adult	ED_{adult}	25	years
Exposure Time	ET	0.33	unitless
Averaging Time – carcinogens	AT_C	25550	days
Averaging Time – noncarcinogens, adult	ATnc - adult	9125	days
Inhalation Unit Risk (IUR)	IUR	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	RfC	chemical-specific	mg/m^3
Volatilization Factor (VF)	VF	chemical-specific	m^3/kg
Particulate emission factor (PEF) [1]	PEF	1.27E+09	m^3/kg
Soil saturation	C_{sat}	chemical-specific	mg/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

Equations

Exposure concentration in air for soil particulates and vapors emitted from soil for carcinogens and noncarcinogens:

$$EC\ (air\ ) = \frac{(C_a)(ET\ )(EF\ )(ED\ )}{(AT\ )}$$

Where for inorganics, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ \mu g/mg\ \right)\left(\frac{1}{PEF}\right)$$

Where for organics with $C_s \leq C_{sat}$, C_a calculated as:

$$C_a = (C_S)\left(1{,}000 \mu g/mg\right)\left(\frac{1}{VF} + \frac{1}{PEF}\right)$$

Where for organics with $C_s > C_{sat}$, C_a calculated as:

$$C_a = \left[(C_S)\left(1{,}000\ \mu g/mg\ \right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat})\left(1{,}000\ \mu g/mg\ \right)\left(\frac{1}{VF}\right)\right]$$

Carcinogenic Risk: $$Risk_{inh} = [EC(air)](IUR)$$

Noncarcinogenic Hazard: $$HQ_{inh} = \frac{EC(air)}{(RfC)\left(1{,}000\ \mu g/mg\right)}$$

COPC [2]	CAS Number [3]	Exposure Point Concentration [4] (mg/kg)		UCL or Max	C_{sat} [5] (mg/kg)	Is EPC ≤ Csat? [6]	Volatilization Factor [6] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	Noncarcinogenic EC(air) (µg/m^3)	IUR [5] (µg/m^3)$^{-1}$	RfC_i [5] (mg/m^3)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	4.8E+02	Yes	7.9E+03	2.3E-05	1.6E-06	4.6E-06	2.5E-06	1.0E+00	4.1E-12	0.0075%	0.0000000046	0.000085%
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	0.054		Max	--	Yes	8.1E+04	6.7E-04	--	--	--	--	--	--	--	--
BaP-equivalent [7]	50-32-8	1		Max	--	Yes	3.3E+07	3.1E-05	2.3E-06	6.3E-06	6.0E-04	2.0E-06	1.4E-09	2.5%	0.0032	59%
Naphthalene	91-20-3	0.14		Max	--	Yes	6.5E+04	2.2E-03	1.6E-04	4.4E-04	3.4E-05	3.0E-03	5.3E-09	10%	0.00015	2.7%
Inorganics																
Arsenic	7440-38-2	195.74		Max	--	Yes	--	1.5E-04	1.1E-05	3.1E-05	4.3E-03	1.5E-05	4.8E-08	88%	0.0021	39%
													Cancer Risk		**Hazard Index**	
												Pathway Sums:	5E-08	100%	0.005	100%

[1] PEF calculated as shown in Table G.2.9.

[2] COPC = Constituent of potential concern.

[3] CAS = Chemical Abstracts Service number.

[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[5] Human Health Toxicity Values shown in Table F.2.11.

[6] See Table F.2.10 for VF calculation.

[7] See Table F.2.4 for B(a)P-equivalent calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.27
HUMAN HEALTH RISK EVALUATION SUMMARY FOR SURFACE SOIL (0-2')
OUTDOOR WORKER
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Adult Only Ingestion Carcinogenic Risk	Adult Only Dermal Carcinogenic Risk	Adult Only Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Adult Inhalation Hazard Quotient	Total Hazard Quotient
Volatile Organic Compounds												
Benzene	71-43-2	0.005	U	Max	--	--	--	**--**	--	--	--	**--**
Ethylbenzene	100-41-4	0.00018	J	Max	5.4E-13	--	4.1E-12	**5E-12**	0.0000000014	--	0.0000000046	**0.000000006**
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	**--**	--	--	--	**--**
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	**--**	--	--	--	**--**
Semivolatile Organic Compounds												
2-Methylnaphthalene	91-57-6	0.054		Max	--	--	--	**--**	0.000010	0.0000056	--	**0.00002**
BaP-equivalent [4]	50-32-8	1		Max	2.8E-07	1.5E-07	1.4E-09	**4E-07**	0.0026	0.0014	0.0032	**0.007**
Naphthalene	91-20-3	0.14		Max	--	--	5.3E-09	**5E-09**	0.0000054	0.0000029	0.00015	**0.0002**
Inorganics												
Arsenic	7440-38-2	195.74		Max	8.1E-05	1.0E-05	4.8E-08	**9E-05**	0.50	0.063	0.0021	**0.6**
				Pathway Risk	**8E-05**	**1E-05**	**5E-08**	**--**	**0.5**	**0.06**	**0.005**	**--**
							Total Risk	**9E-05**			**Hazard Index**	**0.6**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] See Table F.2.4 for B(a)P-equivalent calculation.

-- Risk/hazard not calculated because toxicity value was not available.

NA = Not analyzed in any sample

Table F.2.28
RISK AND HAZARD ESTIMATES -- INCIDENTAL INGESTION OF SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: RECREATIONAL USER

Parameter	Abbreviation	Value	Units
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	50	mg/day
Soil Ingestion Rate - adolescent	IRS_{adl}	100	mg/day
Age-adjusted soil ingestion factor	IFS_{adj}	31.5	(mg-year)/(kg-day)
Exposure Frequency	EF	50	days/year
Exposure Duration - adult	ED_{adult}	14	years
Exposure Duration - adolescent	Ed_{adl}	10	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adolescent	AT_{nc} - adl	3650	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	5110	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - adolescent	Bw_{adl}	44	kg
Fraction Ingested	FI	1	unitless
Oral Reference Dose	RfD_o	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in soil for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_s)(IFS_{adj})(EF)(CF_S)(FI)}{(AT_c)}$$

where: $$IFS_{adj} = \frac{(ED_{adl})(IRS_{adl})}{(BW_{adl})} + \frac{(ED_{adult})(IRS_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in soil for separate age groups:

$$Ingestion = \frac{(C_s)(IRS)(EF)(ED)(CF_S)(FI)}{(AT_{nc})(BW)}$$

Carcinogenic Risk: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic Hazard: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Carcinogenic $Ingestion_{age-adj}$ (mg/kg-day)	Noncarcinogenic Ingestion - Adolescent (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	RfDo [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adolescent	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds															
Benzene	71-43-2	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	1.1E-11	0.00000000006	0.00000000002	1.1E-02	1.0E-01	1.2E-13	0.00000067%	0.00000000056	0.00000027%	0.00000000015	0.00000027%
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds															
2-Methylnaphthalene	91-57-6	0.054		Max	--	0.0000000	0.00000000	--	4.0E-03	--	--	0.0000042	0.0021%	0.0000012	0.0021%
BaP-equivalent [5]	50-32-8	1		Max	1.5E-07 [6]	0.0000003	0.00000009	1.0E+00	3.0E-04	1.5E-07	0.83%	0.0010	0.51%	0.00029	0.51%
Naphthalene	91-20-3	0.14		Max	--	0.0000000	0.00000001	--	2.0E-02	--	--	0.0000022	0.0011%	0.00000060	0.0011%
Inorganics															
Arsenic	7440-38-2	195.74		Max	1.2E-05	0.0000609	0.00001676	1.5E+00	3.0E-04	1.8E-05	99%	0.20	99%	0.056	99%
										Cancer Risk		**Hazard Index**		**Hazard Index**	
									Pathway Sums:	2E-05	100%	0.2	100%	0.06	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[4] Human Health Toxicity Values shown in Table F.2.11.
[5] See Table F.2.4 for B(a)P-equivalent calculation.
[6] See Table F.2.29 for mutagenic mode of action ingestion intake calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.29
MUTAGENIC MODE OF ACTION -- INCIDENTAL INGESTION OF SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

Risk Equation

Incidental ingestion for multiple age groups simultaneously of mutagenic COPCs in soil for recreational user receptors:

$$Ingestion = \frac{C_s \times \left(\frac{((ED_{6-16})(IRS_{adl})(3))}{BW_{adl}} + \frac{((ED_{16-30})(IRS_{adult})(1))}{BW_{adult}} \right) \times EF \times CF_s}{AT_c}$$

Mutagenic Risk: $Risk = (Ingestion)(SF_o)$

Exposure Assumptions

Receptor	RECREATIONAL USER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil (C_s)	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	50	mg/day
Soil Ingestion Rate - adolescent	IRS_{adl}	100	mg/day
Exposure Frequency	EF	50	days/year
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - adolescent	BW_{adl}	44	kg

COPC [1]	CAS Number [2]	Cs [3] (mg/kg)	Carcinogenic Ingestion (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	Cancer Risk
BaP-equivalent [5]	50-32-8	1.0	1.5E-07	1.0E+00	1.5E-07

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.30
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	RECREATIONAL USER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	50	days/year
Exposure Duration - adult	ED_{adult}	14	years
Exposure Duration - adolescent	ED_{adl}	10	years
Event Frequency	EV	1	events/day
Exposed Skin Surface Area - adult	SA_{adult}	3470	cm^2
Exposed Skin Surface Area - adolescent	SA_{adl}	2160	cm^2
Age-adjusted dermal contact factor	SFS_{adj}	74	(mg-year)/(kg-event)
Adherence Factor - adult	AF_{adult}	0.09	mg/cm^2
Adherence Factor - adolescent	AF_{adl}	0.04	mg/cm^2
Dermal Absorption Factor	ABS_d	chemical-specific	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adolescent	AT_{nc} - adl	3650	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	5110	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - adolescent	BW_{adl}	44	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Conversion Factor-soil	CF_s	0.000001	kg/mg
Fraction of contaminantt absorbed in gastrointestinal tract	GIABS	chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal absorbed dose for carcinogenic COPCs in soil for multiple age groups simultaneously:

$$DAD_{age-adj} = \frac{(C_s)(SFS_{adj})(ABS_d)(EF)(EV)(CF)}{(AT)}$$

where:
$$SFS_{adj} = \frac{(ED_{adl})(AF_{adl})(SA_{adl})}{(BW_{adl})} + \frac{(ED_{adult})(AF_{adult})(SA_{adult})}{(BW_{adult})}$$

Carcinogenic Risk: $$Risk = (DAD)(SF_d)$$

Dermal absorbed dose of noncarcinogenic COPCs in soil for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where:
$$DA_{event} = (C_S)(CF_S)(AF)(ABS_d)$$

where: $$SF_d = SF_o / GIABS$$

Noncarcinogenic Hazard: $$HQ = DAD / Rf_d$$

where: $$RfD_d = (RfD_o)(GIABS)$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	ABS_d [4] (unitless)	SF_d [4] $(mg/kg\text{-}day)^{-1}$	RfD_d [4] (mg/kg-day)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - Adolescent (mg/kg-day)	Noncarcinogenic DAD - Adult (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adolescent	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	0.005	U	Max	--	5.5E-02	4.0E-03	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	--	1.1E-02	1.0E-01	--	--	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	2.0E-01	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	2.0E-01	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	0.054		Max	0.13	--	4.0E-03	--	1.9E-09	3.8E-09	--	--	0.00000047	0.0088%	0.00000094	0.0088%
BaP-equivalent [5]	50-32-8	1		Max	0.13	1.0E+00	3.0E-04	2.9E-08 [6]	3.5E-08	7.0E-08	2.9E-08	2.2%	0.00012	2.2%	0.00023	2.2%
Naphthalene	91-20-3	0.14		Max	0.13	--	2.0E-02	--	4.9E-09	9.7E-09	--	--	0.00000024	0.0045%	0.00000049	0.0045%
Inorganics																
Arsenic	7440-38-2	195.74		Max	0.03	1.5E+00	3.0E-04	8.5E-07	1.6E-06	3.1E-06	1.3E-06	98%	0.0053	98%	0.010	98%
											Cancer Risk		**Hazard Index**		**Hazard Index**	
										Pathway Sums:	1E-06	100%	0.005	100%	0.01	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[4] Human Health Toxicity Values shown in Table F.2.11.
[5] See Table F.2.4 for B(a)P-equivalent calculation.
[6] See Table F.2.61 for mutagenic mode of action dermal contact calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.31
MUTAGENIC MODE OF ACTION -- DERMAL CONTACT WITH SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

Equations

$$DAD = \frac{(C_s)\left(\frac{((ED_{6-16})(AF_{adl})(SA_{adl})(3))}{BW_{adl}} + \frac{((ED_{16-30})(AF_{adult})(SA_{adult})(1))}{BW_{adult}}\right)(ABS)(EF)(CF)}{AT_c}$$

Mutagenic Risk: $Risk = (DAD)(SF_d)$

Exposure Assumptions

Receptor: RECREATIONAL USER

Parameter	Abbreviation	Value	Units
COPC Concentration in Soil	Cs	chemical-specific	mg/kg
Adherence Factor - adult	AF_{adult}	0.09	mg/cm^2
Adherence Factor - adolescent	AF_{adl}	0.04	mg/cm^2
Exposed Skin Surface Area - adult	SA_{adult}	3470	cm^2
Exposed Skin Surface Area - adolescent	SA_{adl}	2160	cm^2
Dermal Absorption Factor	ABS	chemical-specific	unitless
Exposure Frequency	EF	50	days/year
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Body Weight - adult	BW_{adult}	80	kg
Body Weight - adolescent	BW_{adl}	44	kg
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$

COPC [1]	CAS Number [2]	C_s [3]	ABS [4] (unitless)	Carcinogenic DAD (mg/kg-day)	SF_d $(mg/kg\text{-}day)^{-1}$	Cancer Risk
BaP-equivalent [5]	50-32-8	1.0	1.3E-01	2.9E-08	1.0E+00	2.9E-08

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.32
RISK AND HAZARD ESTIMATES -- INHALATION OF VOLATILES/FUGITIVE DUST FROM SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	RECREATIONAL USER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air (C_a)	C_a	chemical-specific	µg/m^3
COPC in surface soil (C_s)	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	50	days/year
Exposure Duration - inhalation	ED_{inh}	24	years
Exposure Time	ET	0.083	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time - noncarcinogens, inhalation	$AT_{nc\ -\ inh}$	8760	days
Inhalation Unit Risk (IUR)	IUR	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	RfC	chemical-specific	mg/m^3
Volatilization Factor (VF)	VF	chemical-specific	m^3/kg
Particulate emission factor (PEF) [1]	PEF	1.27E+09	m^3/kg
Soil saturation	C_{sat}	chemical-specific	mg/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

Equations

Exposure concentration in air for soil particulates and vapors emitted from soil for carcinogens and noncarcinogens:

$$EC(air) = \frac{(C_a)(ET)(EF)(ED_{inh})}{(AT)}$$

Where for inorganics, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)$$

$$Risk = [EC(air)](IUR)$$

Where for organics with $C_s \leq C_{sat}$, or if no C_{sat}, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{VF} + \frac{1}{PEF}\right)$$

$$HQ = \frac{EC(air)}{(RfC)\left(1{,}000\ {}^{\mu g}/_{mg}\right)}$$

Where for organics with $C_s > C_{sat}$, C_a calculated as:

$$C_a = \left[(C_s)\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat})\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{VF}\right)\right]$$

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)		UCL or Max	C_{sat} [5] (mg/kg)	Is $C_s \leq C_{sat}$? [5]	Volatilization Factor [6] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	Noncarcinogenic EC(air) (µg/m^3)	IUR [5] (µg/m^3)$^{-1}$	RfC$_i$ [5] (mg/m^3)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	0.005	U	Max	--	--	4.9E+03	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	0.00018	J	Max	4.8E+02	Yes	7.9E+03	1.4E-10	5.5E-13	1.6E-12	2.5E-06	1.0E+00	1.4E-18	0.000000046%	0.0000000000000016	0.00000000053%
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	7.7E+03	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	0.005	U	Max	--	--	9.0E+03	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	0.054		Max	--	--	8.1E+04	6.7E-04	--	--	--	--	--	--	--	--
BaP-equivalent [7]	50-32-8	1		Max	--	--	3.3E+07	3.1E-05	2.2E-07 [8]	3.5E-07	6.0E-04	2.0E-06	1.3E-10	4.4%	0.00018	59%
Naphthalene	91-20-3	0.14		Max	--	--	6.5E+04	2.2E-03	8.4E-06	2.5E-05	3.4E-05	3.0E-03	2.9E-10	10%	0.0000082	2.7%
Inorganics																
Arsenic	7440-38-2	195.74		Max	--	--	--	1.5E-04	6.0E-07	1.8E-06	4.3E-03	1.5E-05	2.6E-09	86%	0.00012	39%
													Cancer Risk		**Hazard Index**	
												Pathway Sums:	3.0E-09	100%	0.0003	100%

[1] PEF calculated as shown in Table F.2.9.
[2] COPC = Constituent of potential concern.
[3] CAS = Chemical Abstracts Service number.
[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.
[5] Human Health Toxicity Values shown in Table F.2.11.
[6] See Table F.2.10 for VF calculation.
[7] See Table F.2.4 for B(a)P-equivalent calculation.
[8] See Table F.2.33 for mutagenic mode of action inhalation calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.33
MUTAGENIC MODE OF ACTION -- INHALATION OF VOLATILES/FUGITIVE DUST FROM SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

Equations

$$EC(air) = \frac{(C_a)(ET)(EF)[((ED_{6-16})(3))+((ED_{6-30})(1))]}{AT_c}$$

where: $$C_a = (C_s)(1{,}000\,\mu g/mg)\left(\frac{1}{VF}+\frac{1}{PEF}\right)$$

$$Mutagenic\ \ Risk_{inh} = \left[\left(EC(air)\right)\left(IUR\right)\right]$$

Exposure Assumptions

Receptor	RECREATIONAL USER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air	C_a	chemical-specific	µg/m^3
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	50	days/year
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Exposure Time	ET	0.083	unitless
Averaging Time – carcinogens	AT_c	25550	days
Inhalation Unit Risk	IUR	chemical-specific	(µg/m^3)$^{-1}$
Volatilization Factor	VF	chemical-specific	m^3/kg
Particulate emission factor [1]	PEF	1.27E+09	m^3/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)	Volatilization Factor [5] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	IUR [6] (µg/m^3)$^{-1}$	Cancer Risk
BaP-equivalent [7]	50-32-8	1.0	3.3E+07	3.1E-05	2.2E-07	6.0E-04	1.3E-10

[1] PEF calculated as shown in Table F.2.9.

[2] COPC = Constituent of potential concern.

[3] CAS = Chemical Abstracts Service number.

[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[5] Human Health Toxicity Values shown in Table F.2.11.

[6] See Table F.2.10 for VF calculation.

[7] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.34
HUMAN HEALTH RISK EVALUATION SUMMARY FOR SURFACE SOIL (0-2')
RECREATIONAL USER
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Adolescent Ingestion Hazard Quotient	Adolescent Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Adolescent	Total Hazard Quotient - Adult
Volatile Organic Compounds															
Benzene	71-43-2	0.005	U	Max	--	--	--	**--**	--	--	--	--	--	**--**	**--**
Ethylbenzene	100-41-4	0.00018	J	Max	1.2E-13	--	1.4E-18	**1E-13**	0.00000000056	--	0.00000000015	--	0.0000000000000016	**0.0000000006**	**0.0000000002**
Meta/Para Xylene	108-38-3	0.0072	U	Max	--	--	--	**--**	--	--	--	--	--	**--**	**--**
Ortho Xylene	95-47-6	0.005	U	Max	--	--	--	**--**	--	--	--	--	--	**--**	**--**
Semivolatile Organic Compounds															
2-Methylnaphthalene	91-57-6	0.054		Max	--	--	--	**--**	0.0000042	0.00000047	0.0000012	0.00000094	--	**0.000005**	**0.000002**
BaP-equivalent [4]	50-32-8	1		Max	1.5E-07	2.9E-08	1.3E-10	**2E-07**	0.0010	0.00012	0.00029	0.00023	0.00018	**0.001**	**0.0007**
Naphthalene	91-20-3	0.14		Max	--	--	2.9E-10	**3E-10**	0.0000022	0.00000024	0.00000060	0.00000049	0.00000818613	**0.000011**	**0.000009**
Inorganics															
Arsenic	7440-38-2	195.74		Max	1.8E-05	1.3E-06	2.6E-09	**2E-05**	0.20	0.0053	0.056	0.010	0.00012	**0.2**	**0.07**
				Pathway Risk	**2E-05**	**1E-06**	**3E-09**	**--**	**0.2**	**0.005**	**0.06**	**0.01**	**0.0003**	**--**	**--**
							Total Risk	**2E-05**					**Hazard Index**	**0.2**	**0.07**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.5.

[4] See Table F.2.4 for B(a)P-equivalent calculation.

-- Risk/hazard not calculated because toxicity value was not available.

Table F.2.35
RISK AND HAZARD ESTIMATES -- INCIDENTAL INGESTION OF COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	100	mg/day
Soil Ingestion Rate - child	IRS_{child}	200	mg/day
Age-adjusted soil ingestion factor	IFS_{adj}	105	(mg-year)/(kg-day)
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	years
Exposure Duration - child	ED_{child}	6	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg
Fraction Ingested	FI	1	unitless
Oral Reference Dose	RfD_o	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in soil for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_s)(IFS_{adj})(EF)(CF_S)(FI)}{(AT_c)}$$

where: $$IFS_{adj} = \frac{(ED_{child})(IRS_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRS_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in soil for separate age groups:

$$Ingestion = \frac{(C_s)(IRS)(EF)(ED)(CF_S)(FI)}{(AT_{nc})(BW)}$$

Carcinogenic Risk: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic Hazard: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Carcinogenic $Ingestion_{age-adj}$ (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	RfDo [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds															
Benzene	71-43-2	4		Max	5.8E-06	0.00005	0.000005	5.5E-02	4.0E-03	3.2E-07	0.20%	0.013	0.46%	0.0012	0.46%
Ethylbenzene	100-41-4	21		Max	3.0E-05	0.00027	0.000025	1.1E-02	1.0E-01	3.3E-07	0.21%	0.0027	0.097%	0.00025	0.097%
Meta/Para Xylene	108-38-3	170	D	Max	--	0.00217	0.000204	--	2.0E-01	--	--	0.011	0.39%	0.0010	0.39%
Ortho Xylene	95-47-6	69		Max	--	0.00088	0.000083	--	2.0E-01	--	--	0.0044	0.16%	0.00041	0.16%
Semivolatile Organic Compounds															
2-Methylnaphthalene	91-57-6	4.3		Max	--	0.00005	0.000005	--	4.0E-03	--	--	0.014	0.50%	0.0013	0.50%
BaP-equivalent [5]	50-32-8	4.8		Max	3.2E-05 [6]	0.000061	0.0000058	1.0E+00	3.0E-04	3.2E-05	20%	0.20	7.4%	0.019	7.4%
Naphthalene	91-20-3	5.3		Max	--	0.00007	0.000006	--	2.0E-02	--	--	0.0034	0.12%	0.00032	0.12%
Inorganics															
Arsenic	7440-38-2	59		UCL	8.5E-05	0.00075	0.000071	1.5E+00	3.0E-04	1.3E-04	80%	2.5	91%	0.24	91%
										Cancer Risk		**Hazard Index**		**Hazard Index**	
									Pathway Sums:	2E-04	100%	3	100%	0.3	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.
[4] Human Health Toxicity Values shown in Table F.2.11.
[5] See Table F.2.4 for B(a)P-equivalent calculation.
[6] See Table F.2.66 for mutagenic mode of action ingestion intake calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.36
MUTAGENIC MODE OF ACTION -- INCIDENTAL INGESTION OF COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Risk Equation

$$Ingestion = \frac{C_s \times \left(\frac{((ED_{0-2})(IRS_{child})(10))}{BW_{child}} + \frac{((ED_{2-6})(IRS_{child})(3))}{BW_{child}} + \frac{((ED_{6-16})(IRS_{adult})(3))}{BW_{adult}} + \frac{((ED_{16-30})(IRS_{adult})(1))}{BW_{adult}} \right) \times EF \times CF_s}{AT_c}$$

Mutagenic Risk: $Risk = (Ingestion)(SF_o)$

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil (C_s)	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	100	mg/day
Soil Ingestion Rate - child	IRS_{child}	200	mg/day
Exposure Frequency	EF	350	days/year
Exposure Duration, 0 to 2 years of age	ED_{0-2}	2	years
Exposure Duration, 2 to 6 years of age	ED_{2-6}	4	years
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg

COPC [1]	CAS Number [2]	Cs [3] (mg/kg)	Carcinogenic Ingestion (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	Cancer Risk
BaP-equivalent [5]	50-32-8	4.8	3.2E-05	1.0E+00	3.2E-05

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.37
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	years
Exposure Duration - child	ED_{child}	6	years
Event Frequency	EV	1	events/day
Exposed Skin Surface Area - adult	SA_{adult}	6032	cm^2
Exposed Skin Surface Area - child	SA_{child}	2690	cm^2
Age-adjusted dermal contact factor	SFS_{adj}	321	(mg-year)/(kg-event)
Adherence Factor - adult	AF_{adult}	0.07	mg/cm^2
Adherence Factor - child	AF_{child}	0.2	mg/cm^2
Dermal Absorption Factor	ABS_d	chemical-specific	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Conversion Factor-soil	CF_s	0.000001	kg/mg
Fraction of contaminantt absorbed in gastrointestinal tract	GIABS	chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal absorbed dose for carcinogenic COPCs in soil for multiple age groups simultaneously:

$$DAD_{age-adj} = \frac{(C_s)(SFS_{adj})(ABS_d)(EF)(EV)(CF)}{(AT)}$$

where:
$$SFS_{adj} = \frac{(ED_{child})(AF_{child})(SA_{child})}{(BW_{child})} + \frac{(ED_{adult})(AF_{adult})(SA_{adult})}{(BW_{adult})}$$

Carcinogenic Risk: $Risk = (DAD)(SF_d)$

Dermal absorbed dose of noncarcinogenic COPCs in soil for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where:
$$DA_{event} = (C_S)(CF_S)(AF)(ABS_d)$$

where: $SF_d = SF_o / GIABS$

Noncarcinogenic Hazard: $HQ = DAD / Rf_d$

where: $RfD_d = (RfD_o)(GIABS)$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	ABS_d [4] (unitless)	SF_d [4] $(mg/kg\text{-}day)^{-1}$	RfD_d [4] (mg/kg-day)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - Child (mg/kg-day)	Noncarcinogenic DAD - Adult (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	4		Max	--	5.5E-02	4.0E-03	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	21		Max	--	1.1E-02	1.0E-01	--	--	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	170	D	Max	--	--	2.0E-01	--	--	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	69		Max	--	--	2.0E-01	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	4.3		Max	0.13	--	4.0E-03	--	1.9E-05	2.8E-06	--	--	0.0048	1.7%	0.00071	1.7%
BaP-equivalent [5]	50-32-8	4.8		Max	0.13	1.0E+00	3.0E-04	1.2E-05 [6]	2.1E-05	3.2E-06	1.2E-05	50%	0.072	26%	0.011	26%
Naphthalene	91-20-3	5.3		Max	0.13	--	2.0E-02	--	2.4E-05	3.5E-06	--	--	0.0012	0.42%	0.00017	0.42%
Inorganics																
Arsenic	7440-38-2	59		UCL	0.03	1.5E+00	3.0E-04	7.8E-06	6.1E-05	9.0E-06	1.2E-05	50%	0.2	72%	0.03	72%
											Cancer Risk		**Hazard Index**		**Hazard Index**	
										Pathway Sums:	2E-05	100%	0.3	100%	0.04	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

[6] See Table F.2.38 for mutagenic mode of action dermal contact calculation and risk calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.38
MUTAGENIC MODE OF ACTION -- DERMAL CONTACT WITH COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Equations

$$DAD = \frac{(C_s)\left(\frac{((ED_{0-2})(AF_{child})(SA_{child})(10))}{BW_{child}} + \frac{((ED_{2-6})(AF_{child})(SA_{child})(3))}{BW_{child}} + \frac{((ED_{6-16})(AF_{adult})(SA_{adult})(3))}{BW_{adult}} + \frac{((ED_{16-30})(AF_{adult})(SA_{adult})(1))}{BW_{adult}}\right)(ABS)(EF)(CF)}{AT_c}$$

Mutagenic Risk: $Risk = (DAD)(SF_d)$

Exposure Assumptions

Receptor: UU/UE RECEPTOR

Parameter	Abbreviation	Value	Units
COPC Concentration in Soil	Cs	chemical-specific	mg/kg
Adherence Factor - adult	AF_{adult}	0.07	mg/cm2
Adherence Factor - child	AF_{child}	0.2	mg/cm2
Exposed Skin Surface Area - adult	SA_{adult}	6032	cm2
Exposed Skin Surface Area - child	SA_{child}	2690	cm2
Dermal Absorption Factor	ABS	chemical-specific	unitless
Exposure Frequency	EF	350	days/year
Exposure Duration, 0 to 2 years of age	ED_{0-2}	2	years
Exposure Duration, 2 to 6 years of age	ED_{2-6}	4	years
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Body Weight - adult	BW_{adult}	80	kg
Body Weight - child	BW_{child}	15	kg
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$

COPC [1]	CAS Number [2]	C_s [3]	ABS [4] (unitless)	Carcinogenic DAD (mg/kg-day)	SF_d $(mg/kg\text{-}day)^{-1}$	Cancer Risk
BaP-equivalent [5]	50-32-8	4.8	1.3E-01	1.2E-05	1.0E+00	1.2E-05

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.39
RISK AND HAZARD ESTIMATES -- INHALATION OF VOLATILES/FUGITIVE DUST FROM COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air (C_a)	C_a	chemical-specific	µg/m^3
COPC in surface soil (C_s)	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	350	days/year
Exposure Duration - inhalation	ED_{inh}	26	years
Exposure Time	ET	1	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time - noncarcinogens, inhalation	$AT_{nc\ -\ inh}$	9490	days
Inhalation Unit Risk (IUR)	IUR	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	RfC	chemical-specific	mg/m^3
Volatilization Factor (VF)	VF	chemical-specific	m^3/kg
Particulate emission factor (PEF) (1)	PEF	1.27E+09	m^3/kg
Soil saturation	C_{sat}	chemical-specific	mg/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

Equations

Exposure concentration in air for soil particulates and vapors emitted from soil for carcinogens and noncarcinogens:

$$EC(air) = \frac{(C_a)(ET)(EF)(ED_{inh})}{(AT)}$$

Where for inorganics, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)$$

Where for organics with $C_s \le C_{sat}$, or if no C_{sat} value, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{VF} + \frac{1}{PEF}\right)$$

Where for organics with $C_s > C_{sat}$, C_a calculated as:

$$C_a = \left[(C_s)\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat})\left(1000\ {}^{\mu g}/_{mg}\right)\left(\frac{1}{VF}\right)\right]$$

$$Risk = [EC(air)](IUR)$$

$$HQ = \frac{EC(air)}{(RfC)\left(1{,}000\ {}^{\mu g}/_{mg}\right)}$$

COPC (2)	CAS Number (3)	C_s (4) (mg/kg)		UCL or Max	C_{sat} (5) (mg/kg)	Is $C_s \le C_{sat}$? (5)	Volatilization Factor (6) (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	Noncarcinogenic EC(air) (µg/m^3)	IUR (5) (µg/m^3)$^{-1}$	RfC_i (5) (mg/m^3)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	4		Max	1.8E+03	Yes	4.9E+03	8.1E-01	2.9E-01	7.8E-01	7.8E-06	3.0E-02	2.2E-06	39%	0.026	6.2%
Ethylbenzene	100-41-4	21		Max	4.8E+02	Yes	7.9E+03	2.6E+00	9.4E-01	2.5E+00	2.5E-06	1.0E+00	2.4E-06	41%	0.0025	0.61%
Meta/Para Xylene	108-38-3	170	D	Max	3.9E+02	Yes	7.7E+03	2.2E+01	--	2.1E+01	--	1.0E-01	--	--	0.21	51%
Ortho Xylene	95-47-6	69		Max	4.3E+02	Yes	9.0E+03	7.6E+00	--	7.3E+00	--	1.0E-01	--	--	0.073	18%
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	4.3		Max	--	--	8.1E+04	5.3E-02	--	--	--	--	--	--	--	--
BaP-equivalent (7)	50-32-8	4.8		Max	--	--	3.3E+07	1.5E-04	1.6E-04 (8)	1.4E-04	6.0E-04	2.0E-06	9.3E-08	1.6%	0.072	17%
Naphthalene	91-20-3	5.3		Max	--	--	6.5E+04	8.2E-02	2.9E-02	7.8E-02	3.4E-05	3.0E-03	9.9E-07	17%	0.026	6.3%
Inorganics																
Arsenic	7440-38-2	59		UCL	--	--	--	4.7E-05	1.7E-05	4.5E-05	4.3E-03	1.5E-05	7.1E-08	1.2%	0.0030	0.72%
													Cancer Risk		**Hazard Index**	
												Pathway Sums:	6E-06	100%	0.4	100%

(1) PEF calculated as shown in Table F.2.9.
(2) COPC = Constituent of potential concern.
(3) CAS = Chemical Abstracts Service number.
(4) COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.
(5) Human Health Toxicity Values shown in Table F.2.11.
(6) See Table F.2.10 for VF calculation.
(7) See Table F.2.4 for B(a)P-equivalent calculation.
(8) See Table F.2.40 for mutagenic mode of action inhalation calculation and risk calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.40
MUTAGENIC MODE OF ACTION -- INHALATION OF VOLATILES/FUGITIVE DUST FROM COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

Equations

$$EC(air) = \frac{(C_a)(ET)(EF)[((ED_{0-2})(10))+((ED_{2-6})(3))+((ED_{6-16})(3))+((ED_{6-30})(1))]}{AT_c}$$

where: $$C_a = (C_s)(1{,}000\,\mu g/mg)\left(\frac{1}{VF}+\frac{1}{PEF}\right)$$

$$Mutagenic\ Risk_{inh} = [(EC(air))(IUR)]$$

Exposure Assumptions

Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC in air	C_a	chemical-specific	µg/m^3
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	350	days/year
Exposure Duration, 0 to 2 years of age	ED_{0-2}	2	years
Exposure Duration, 2 to 6 years of age	ED_{2-6}	4	years
Exposure Duration, 6 to 16 years of age	ED_{6-16}	10	years
Exposure Duration, 16 to 30 years of age	ED_{16-30}	14	years
Exposure Time	ET	1	unitless
Averaging Time – carcinogens	AT_c	25550	days
Inhalation Unit Risk	IUR	chemical-specific	(µg/m^3)$^{-1}$
Volatilization Factor	VF	chemical-specific	m^3/kg
Particulate emission factor [1]	PEF	1.27E+09	m^3/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)	Volatilization Factor [5] (m^3/kg)	C_a (µg/m^3)	Carcinogenic EC(air) (µg/m^3)	IUR [6] (µg/m^3)$^{-1}$	Cancer Risk
BaP-equivalent [7]	50-32-8	4.8	3.3E+07	1.5E-04	1.6E-04	6.0E-04	9.3E-08

[1] PEF calculated as shown in Table F.2.9.

[2] COPC = Constituent of potential concern.

[3] CAS = Chemical Abstracts Service number.

[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[5] Human Health Toxicity Values shown in Table F.2.11.

[6] See Table F.2.10 for VF calculation.

[7] See Table F.2.4 for B(a)P-equivalent calculation.

Table F.2.41
HUMAN HEALTH RISK EVALUATION SUMMARY FOR COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UU/UE RECEPTOR

FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Volatile Organic Compounds															
Benzene	71-43-2	4		Max	3.2E-07	--	2.2E-06	**3E-06**	0.013	--	0.0012	--	0.026	**0.04**	**0.03**
Ethylbenzene	100-41-4	21		Max	3.3E-07	--	2.4E-06	**3E-06**	0.0027	--	0.00025	--	0.0025	**0.005**	**0.003**
Meta/Para Xylene	108-38-3	170	D	Max	--	--	--	**--**	0.011	--	0.0010	--	0.21	**0.2**	**0.2**
Ortho Xylene	95-47-6	69		Max	--	--	--	**--**	0.0044	--	0.00041	--	0.073	**0.08**	**0.07**
Semivolatile Organic Compounds															
2-Methylnaphthalene	91-57-6	4.3		Max	--	--	--	**--**	0.014	0.0048	0.0013	0.00071	--	**0.02**	**0.002**
BaP-equivalent [4]	50-32-8	4.8		Max	3.2E-05	1.2E-05	9.3E-08	**4E-05**	0.20	0.072	0.019	0.011	0.072	**0.3**	**0.1**
Naphthalene	91-20-3	5.3		Max	--	--	9.9E-07	**1E-06**	0.0034	0.0012	0.00032	0.00017	0.026	**0.03**	**0.03**
Inorganics															
Arsenic	7440-38-2	59		UCL	1.3E-04	1.2E-05	7.1E-08	**1E-04**	2.5	0.20	0.24	0.030	0.0030	**3**	**0.3**
				Pathway Risk	**2E-04**	**2E-05**	**6E-06**	**--**	**3**	**0.3**	**0.3**	**0.04**	**0.4**	**--**	**--**
							Total Risk	**2E-04**					**Hazard Index**	**3**	**0.7**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] See Table F.2.4 for B(a)P-equivalent calculation.

-- Risk/hazard not calculated because toxicity value was not available.

Table F.2.42
RISK AND HAZARD ESTIMATES -- INCIDENTAL INGESTION OF COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	UTILITY WORKER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Soil Ingestion Rate - adult	IRS_{adult}	330	mg/day
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	years
Conversion Factor-soil	CF_s	0.000001	kg/mg
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	365	days
Oral Slope Factor	SF_o	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose	RfD_o	chemical-specific	mg/kg-day
Fraction Ingested	FI	1	unitless

Equations

Incidental ingestion of noncarcinogenic and carcinogenic COPCs in soil:

$$Ingestion = \frac{(C_s)(IRS_{adult})(EF)(ED_{adult})(CF_S)(FI)}{(AT)(BW_{adult})}$$

Carcinogenic Risk: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic Hazard: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SFo [4] $(mg/kg\text{-}day)^{-1}$	RfDo [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adult	% of Total
Volatile Organic Compounds												
Benzene	71-43-2	4		Max	1.9E-08	1.4E-06	5.5E-02	4.00E-03	1.1E-09	0.049%	0.00034	0.10%
Ethylbenzene	100-41-4	21		Max	1.0E-07	7.1E-06	1.1E-02	1.00E-01	1.1E-09	0.051%	0.000071	0.021%
Meta/Para Xylene	108-38-3	170	D	Max	--	5.8E-05	--	2.00E-01	--	--	0.00029	0.083%
Ortho Xylene	95-47-6	69		Max	--	2.3E-05	--	2.00E-01	--	--	0.00012	0.034%
Semivolatile Organic Compounds												
2-Methylnaphthalene	91-57-6	53		Max	--	1.8E-05	--	4.00E-03	--	--	0.0045	1.3%
BaP-equivalent [5]	50-32-8	5.4		Max	2.6E-08	1.8E-06	1.0E+00	3.00E-04	2.6E-08	1.2%	0.0061	1.8%
Naphthalene	91-20-3	5.3		Max	--	1.8E-06	--	2.00E-02	--	--	0.000090	0.026%
Inorganics												
Arsenic	7440-38-2	297.03		Max	1.4E-06	1.0E-04	1.5E+00	3.00E-04	2.2E-06	99%	0.34	97%
									Cancer Risk		**Hazard Index**	
								Pathway Sums:	2E-06	100%	0.3	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.43
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor		UTILITY WORKER	
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	years
Event Frequency	EV	1	events/day
Exposed Skin Surface Area - adult	SA_{adult}	3470	cm2
Adherence Factor - adult	AF_{adult}	0.2	mg/cm2
Dermal Absorption Factor	ABS	chemical-specific	unitless
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	365	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Conversion Factor-soil	CF_s	0.000001	kg/mg
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal absorbed dose of noncarcinogenic and carcinogenic COPCs in soil:

$$DAD = \frac{(DA_{event})(EF)(ED_{adult})(EV)(SA_{adult})}{(BW_{adult})(AT)}$$

where: $$DA_{event} = (C_s)(AF_a)(ABS)(CF)$$

Carcinogenic Risk: $$Risk = (DAD)(SF_d)$$

$$SF_d = SF_o / GIABS$$

Noncarcinogenic Hazard: $$HQ = DAD / Rf_d$$

where: $$RfD_d = (RfD_o)(GIABS)$$

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	ABS [4] (unitless)	SF_d [4] $(mg/kg\text{-}day)^{-1}$	RfD_d [4] (mg/kg-day)	DAevent $(mg/cm^2$-event)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds														
Benzene	71-43-2	4		Max	--	5.5E-02	4.0E-03	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	21		Max	--	1.1E-02	1.0E-01	--	--	--	--	--	--	--
Meta/Para Xylene	108-38-3	170	D	Max	--	--	2.0E-01	--	--	--	--	--	--	--
Ortho Xylene	95-47-6	69		Max	--	--	2.0E-01	--	--	--	--	--	--	--
Semivolatile Organic Compounds														
2-Methylnaphthalene	91-57-6	53		Max	0.13	--	4.0E-03	1.4E-06	--	4.9E-06	--	--	0.0012	5.1%
BaP-equivalent [5]	50-32-8	5.4		Max	0.13	1.0E+00	3.0E-04	1.4E-07	7.2E-09	5.0E-07	7.2E-09	5.0%	0.0017	6.9%
Naphthalene	91-20-3	5.3		Max	0.13	--	2.0E-02	1.4E-07	--	4.9E-07	--	--	0.000025	0.10%
Inorganics														
Arsenic	7440-38-2	297.03		Max	0.03	1.5E+00	3.0E-04	1.8E-06	9.1E-08	6.4E-06	1.4E-07	95%	0.021	88%
											Cancer Risk		**Hazard Index**	
										Pathway Sums:	1E-07	100%	0.02	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] Human Health Toxicity Values shown in Table F.2.11.

[5] See Table F.2.4 for B(a)P-equivalent calculation.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.44
RISK AND HAZARD ESTIMATES -- INHALATION OF VOLATILES/FUGITIVE DUST FROM COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UTILITY WORKER

Parameter	Abbreviation	Value	Units
COPC in air	C_a	chemical-specific	µg/m^3
COPC in surface soil	C_s	chemical-specific	mg/kg
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	years
Exposure Time	ET	0.33	unitless
Averaging Time – carcinogens	AT_C	25550	days
Averaging Time – noncarcinogens, adult	ATnc - adult	365	days
Inhalation Unit Risk (IUR)	IUR	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	RfC	chemical-specific	mg/m^3
Volatilization Factor (VF)	VF	chemical-specific	m^3/kg
Particulate emission factor (PEF) [1]	PEF	1.27E+09	m^3/kg
Soil saturation	C_{sat}	chemical-specific	mg/kg
Exposure concentration in air	EC(air)	chemical-specific	µg/m^3

Equations

Exposure concentration in air for soil particulates and vapors emitted from soil for carcinogens and noncarcinogens:

$$EC\,(air) = \frac{(C_a)(ET)(EF)(ED)}{(AT)}$$

Where for inorganics, C_a calculated as:

$$C_a = (C_S)\left(1{,}000\ \mu g/mg\right)\left(\frac{1}{PEF}\right)$$

Where for organics with $C_s \le C_{sat}$, C_a calculated as:

$$C_a = (C_S)\left(1{,}000 \mu g/mg\right)\left(\frac{1}{VF} + \frac{1}{PEF}\right)$$

Where for organics with $C_s > C_{sat}$, C_a calculated as:

$$C_a = \left[(C_S)\left(1{,}000\ \mu g/mg\right)\left(\frac{1}{PEF}\right)\right] + \left[(C_{sat})\left(1{,}000\ \mu g/mg\right)\left(\frac{1}{VF}\right)\right]$$

Carcinogenic Risk: $Risk_{inh} = [EC(air)](IUR)$

Noncarcinogenic Hazard: $HQ_{inh} = \frac{EC(air)}{(RfC)\left(1{,}000\ \mu g/mg\right)}$

COPC [2]	CAS Number [3]	C_s [4] (mg/kg)		UCL or Max	C_{sat} [5] (mg/kg)	Is EPC ≤ Csat?	Volatilization Factor [6] (m^3/kg)	C_a (µg/m$_3$)	Carcinogenic EC(air) (µg/m^3)	Noncarcinogenic EC(air) (µg/m3)	IUR [5] (µg/m^3)$^{-1}$	RfC_i [5] (mg/m^3)	Cancer Risk	% of Total	Hazard Quotient	% of Total
Volatile Organic Compounds																
Benzene	71-43-2	4		Max	1.8E+03	Yes	4.9E+03	8.1E-01	3.1E-04	2.2E-02	7.8E-06	3.0E-02	2.4E-09	38%	0.00073	5.9%
Ethylbenzene	100-41-4	21		Max	4.8E+02	Yes	7.9E+03	2.6E+00	1.0E-03	7.2E-02	2.5E-06	1.0E+00	2.6E-09	39%	0.000072	0.58%
Meta/Para Xylene	108-38-3	170	D	Max	3.9E+02	Yes	7.7E+03	2.2E+01	--	6.0E-01	--	1.0E-01	--	--	0.0060	49%
Ortho Xylene	95-47-6	69		Max	4.3E+02	Yes	9.0E+03	7.6E+00	--	2.1E-01	--	1.0E-01	--	--	0.0021	17%
Semivolatile Organic Compounds																
2-Methylnaphthalene	91-57-6	53		Max	--	Yes	8.1E+04	6.5E-01	--	--	--	--	--	--	--	--
BaP-equivalent [7]	50-32-8	5.4		Max	--	Yes	3.3E+07	1.7E-04	6.5E-08	4.6E-06	6.0E-04	2.0E-06	3.9E-11	0.60%	0.0023	18%
Naphthalene	91-20-3	5.3		Max	--	Yes	6.5E+04	8.2E-02	3.2E-05	2.2E-03	3.4E-05	3.0E-03	1.1E-09	17%	0.00074	6.0%
Inorganics																
Arsenic	7440-38-2	297.03		Max	--	Yes	--	2.3E-04	9.1E-08	6.4E-06	4.3E-03	1.5E-05	3.9E-10	6.0%	0.00042	3.4%
													Cancer Risk		**Hazard Index**	
												Pathway Sums:	7E-09	100%	0.01	100%

[1] PEF calculated as shown in Table G.2.9.
[2] COPC = Constituent of potential concern.
[3] CAS = Chemical Abstracts Service number.
[4] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.
[5] Human Health Toxicity Values shown in Table F.2.11.
[6] See Table F.2.10 for VF calculation.
[7] See Table F.2.4 for B(a)P-equivalent calculation.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.45
HUMAN HEALTH RISK EVALUATION SUMMARY FOR COMBINED SURFACE AND SUBSURFACE SOIL (0-15')
UTILITY WORKER
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_s [3] (mg/kg)		UCL or Max	Adult Only Ingestion Carcinogenic Risk	Adult Only Dermal Carcinogenic Risk	Adult Only Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Adult Inhalation Hazard Quotient	Total Hazard Quotient
Semivolatile Organic Compounds												
Benzene	71-43-2	4		Max	1.1E-09	--	2.4E-09	**4E-09**	0.00034	--	0.00073	**0.001**
Ethylbenzene	100-41-4	21		Max	1.1E-09	--	2.6E-09	**4E-09**	0.000071	--	0.000072	**0.0001**
Meta/Para Xylene	108-38-3	170	D	Max	--	--	--	**--**	0.00029	--	0.0060	**0.006**
Ortho Xylene	95-47-6	69		Max	--	--	--	**--**	0.00012	--	0.0021	**0.002**
Semivolatile Organic Compounds												
2-Methylnaphthalene	91-57-6	53		Max	--	--	--	**--**	0.0045	0.0012	--	**0.006**
BaP-equivalent [4]	50-32-8	5.4		Max	2.6E-08	7.2E-09	3.9E-11	**3E-08**	0.0061	0.0017	0.0023	**0.01**
Naphthalene	91-20-3	5.3		Max	--	--	1.1E-09	**1E-09**	0.000090	0.000025	0.00074	**0.0009**
Inorganics												
Arsenic	7440-38-2	297.03		Max	2.2E-06	1.4E-07	3.9E-10	**2E-06**	0.34	0.021	0.00042	**0.4**
				Pathway Risk	**2E-06**	**1E-07**	**7E-09**	**--**	**0.3**	**0.02**	**0.01**	**--**

Total Risk	**2E-06**

Hazard Index	**0.4**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Soil (C_s) is the 95% UCL or the maximum detected concentration. See Table F.2.6.

[4] See Table F.2.4 for B(a)P-equivalent calculation.

-- Risk/hazard not calculated because toxicity value was not available.

Table F.2.46
RISK AND HAZARD ESTIMATES -- INGESTION OF GROUNDWATER
UU/UE RECEPTOR
ALL WELLS COMBINED
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Groundwater	C_w	chemical-specific	mg/L
Age-adjusted Groundwater Ingestion Rate	IFW_{adj}	0.94	L-yr/kg-day
Groundwater Ingestion - child	IRW_{child}	0.78	L/day
Groundwater Ingestion - adult	IRW_{adult}	2.50	L/day
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	year
Exposure Duration - child	ED_{child}	6	year
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor (SF_o)	SFo	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose (RfD_o)	RfDo	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_W)(IFW_{adj})(EF)}{(AT)}$$

where: $$IFW_{adj} = \frac{(ED_{child})(IRW_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRW_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in groundwater for separate age groups:

$$Ingestion = \frac{(C_W)(ED)(IRW)(EF)}{(BW)(AT)}$$

Carcinogenic: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SF_o [4] $(mg/kg\text{-}day)^{-1}$	RfD_o [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																	
Antimony	7440-36-0	9.33	J	0.00933	J	Max	1.2E-04	0.00047	0.00028	--	4.0E-04	--	--	1.2	15%	0.70	15%
Arsenic	7440-38-2	34		0.034		Max	4.4E-04	0.00170	0.00102	1.5E+00	3.0E-04	6.5E-04	100%	5.7	72%	3.4	72%
Cobalt	7440-48-4	1.2	J	0.0012	J	Max	1.5E-05	0.000060	0.000036	--	3.0E-04	--	--	0.20	2.5%	0.12	2.5%
Manganese	7439-96-5	363		0.363		Max	4.7E-03	0.018	0.011	--	2.4E-02	--	--	0.75	10%	0.45	10%
Vanadium	7440-62-2	12.3		0.0123		Max	1.6E-04	0.00061	0.00037	--	5.0E-03	--	--	0.12	1.6%	0.074	1.6%
												Cancer Risk		**Hazard Index**		**Hazard Index**	
											Pathway Sums:	7E-04	100%	8	100%	5	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.47
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH GROUNDWATER
UU/UE RECEPTOR
ALL WELLS COMBINED
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UU/UE RECEPTOR

Parameter	Abbreviation	Value	Units
Age-adjusted Dermal Factor	SFW_{adj}	chemical-specific	events-cm^2/kg
Exposure Frequency	EF	350	days/year
Event Duration - child	t_{event} - child	0.54	hours/event
Event Duration - adult	t_{event} - adult	0.71	hours/event
0	t*	0	0
Event Frequency	EV	1	events/day
Exposure Duration - child	ED_{child}	6	year
Exposure Duration - adult	ED_{adult}	20	year
Exposed Skin Surface Area - child	SA_{child}	6378	cm^2
Exposed Skin Surface Area - adult	SA_{adult}	20900	cm^2
Permeability Constant	K_p	chemical-specific	cm/hour
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	(mg/kg-day)$^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_{abs}	chemical-specific	mg/kg-day
Concentration in water	C_w	chemical-specific	mg/cm^3
Fraction absorbed	FA	Chemical-specific	unitless
Lag Time per Event	τ_{event}	Chemical-specific	hr/event
Relative contribution of permeability coefficient	B	Chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal contact of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$DAD = \frac{(EV)(EF)(SFW_{adj})}{(AT)}$$

where:

$$SFW_{adj} = \left[\frac{(ED_{child})(SA_{child})(DA_{event\text{-}child})}{(BW_{child})}\right] + \left[\frac{(ED_{adult})(SA_{adult})(DA_{event\text{-}adult})}{(BW_{adult})}\right]$$

Dermal contact of noncarcinogenic COPCs in groundwater for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where for inorganic compounds:
Note: t_{event} is different for adult and child

$$DA_{event} = (K_p)(C_w)(t_{event})$$

where for organic compounds if $t_{event} \le t^*$, then:
Note: t_{event} is different for adult and child

$$DA_{event} = (2)(FA)(K_p)(C_w)\sqrt{\frac{((6)(\tau_{event})(t_{event}))}{\pi}}$$

where for organic compounds if $t_{event} > t^*$, then:

$$DA_{event} = (FA)(K_p)(C_w)\left[\left(\frac{(t_{event})}{(1+B)}\right) + ((2)(\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Note: t_{event} is different for adult and child

Carcinogenic: $Risk = (DAD)(SF_d)$

where: $SF_d = SF_o / GIABS$

Noncarcinogenic: $HQ = DAD / RfD_d$

where: $RfD_d = (RfD_o)(GIABS)$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/cm^3)	UCL or Max	K_p [4] (cm/hour)	t^* [4] (hours)	For organic compounds, is $t_{event\text{-}child} \le t^*$? (Yes/No)	For organic compounds, is $t_{event\text{-}adult} \le t^*$? (Yes/No)	FA [4] (unitless)	τ_{event} [4] (hour/event)	B [4] (unitless)	DA_{event} - child (mg/cm^2-event)	DA_{event} - adult (mg/cm^2-event)	SFW_{adj} (events-cm^2/kg)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - child (mg/kg-day)	Noncarcinogenic DAD - adult (mg/kg-day)	SF_d [5] (mg/kg-day)$^{-1}$	RfD_d [5] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																								
Antimony	7440-36-0	9.33 J	0.00000933 J	Max	1.0E-03	1.2E+00	--	--	1	0.51	0.0042	5.0E-09	6.6E-09	--	--	2.1E-06	1.7E-06	--	0.00006	--	--	0.034	18%	0.028	18%
Arsenic	7440-38-2	34	0.000034	Max	1.0E-03	6.6E-01	--	--	1	0.28	0.0033	1.8E-08	2.4E-08	1.7E-04	2.4E-06	7.5E-06	6.0E-06	1.50E+00	0.00015	3.6E-06	100%	0.050	26%	0.040	26%
Cobalt	7440-48-4	1.2 J	0.0000012 J	Max	4.0E-04	5.4E-01	--	--	1	0.22	0.0012	2.6E-10	3.4E-10	--	--	1.1E-07	8.5E-08	--	0.0003	--	--	0.00035	0%	0.00028	0.19%
Manganese	7439-96-5	363	0.000363	Max	1.0E-03	5.1E-01	--	--	1	0.21	0.0029	2.0E-07	2.6E-07	--	--	8.0E-05	6.5E-05	--	0.00096	--	--	0.083	44%	0.067	44%
Vanadium	7440-62-2	12.3	0.0000123	Max	1.0E-03	4.9E-01	--	--	1	0.20	0.0027	6.6E-09	8.7E-09	--	--	2.7E-06	2.2E-06	--	0.00013	--	--	0.021	11%	0.017	11%
																				Cancer Risk		**Hazard Index**		**Hazard Index**	
																			Pathway Sums	4E-06	100%	0.2	100%	0.2	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Chemical specific parameters shown in Table F.2.12.
[5] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.48
HUMAN HEALTH RISK EVALUATION SUMMARY FOR GROUNDWATER
UU/UE RECEPTOR
ALL WELLS COMBINED
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Inorganics																	
Antimony	7440-36-0	9.33	J	0.00933	J	Max	--	--	NC	--	1.2	0.034	0.70	0.028	NC	**1**	**0.7**
Arsenic	7440-38-2	34		0.034		Max	6.5E-04	4E-06	NC	**7E-04**	5.7	0.050	3.4	0.040	NC	**6**	**3**
Cobalt	7440-48-4	1.2	J	0.0012	J	Max	--	--	NC	--	0.20	0.00035	0.12	0.00028	NC	**0.2**	**0.1**
Manganese	7439-96-5	363		0.363		Max	--	--	NC	--	0.75	0.083	0.45	0.067	NC	**0.8**	**0.5**
Vanadium	7440-62-2	12.3		0.0123		Max	--	--	NC	--	0.12	0.021	0.074	0.017	NC	**0.1**	**0.09**
						Pathway Sum	**7E-04**	**4E-06**	**--**	**--**	**8**	**0.2**	**5**	**0.2**	**--**	**--**	**--**
									Total Risk	**7E-04**					**Hazard Index**	**8**	**5**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.49
RISK AND HAZARD ESTIMATES -- INGESTION OF GROUNDWATER
UTILITY WORKER
ALL WELLS COMBINED
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor	UTILITY WORKER		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Groundwater (C_W)	C_W	chemical-specific	mg/L
Groundwater Ingestion - adult	IRW_{adult}	0.02	L/day
Exposure Frequency	EF	30	days/year
Exposure Duration - adult	ED_{adult}	1	year
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	365	days
Oral Slope Factor	SFo	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose	RfDo	chemical-specific	mg/kg-day

Equations

Incidental ingestion of noncarcinogenic and carcinogenic COPCs in groundwater:

$$Ingestion = \frac{(C_W)(ED_{adult})(IRW_{adult})(EF)}{(BW_{adult})(AT)}$$

Carcinogenic: $Risk = (Ingestion)(SF_o)$

Noncarcinogenic: $HQ = Ingestion / RfD_o$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SF_o [4] $(mg/kg\text{-}day)^{-1}$	RfD_o [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adult	% of Total
Inorganics														
Antimony	7440-36-0	9.33	J	0.00933	J	Max	2.7E-09	1.9E-07	--	4.0E-04	--	--	0.00048	15%
Arsenic	7440-38-2	34		0.034		Max	1.0E-08	7.0E-07	1.5E+00	3.0E-04	1.5E-08	100%	0.0023	72%
Cobalt	7440-48-4	1.2	J	0.0012		Max	3.5E-10	2.5E-08	--	3.0E-04	--	--	0.000082	2.5%
Manganese	7439-96-5	363		0.363		Max	1.1E-07	7.5E-06	--	2.4E-02	--	--	0.00031	10%
Vanadium	7440-62-2	12.3		0.0123		Max	3.6E-09	2.5E-07	--	5.0E-03	--	--	0.000051	1.6%
											Cancer Risk		**Hazard Index**	
										Pathway Sums:	1E-08	100%	0.003	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

[4] Human Health Toxicity Values shown in Table F.2.11.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.50
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH GROUNDWATER
UTILITY WORKER
ALL WELLS COMBINED
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor		UTILITY WORKER	
Parameter	**Abbreviation**	**Value**	**Units**
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event
Exposure Frequency	EF	30	kg
Event Duration - adult	t_{event} - adult	2	year
Time it takes to reach steady state	t*	chemical-specific	hours
Event Frequency	EV	1	unitless
Exposure Duration - adult	ED_{adult}	1	kg
Exposed Skin Surface Area - adult	SA_{adult}	4840	hours
Permeability Constant	K_p	Chemical-specific	cm/hour
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	365	unitless
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	(mg/kg-day)$^{-1}$
Body Weight - adult	BW_{adult}	80	days
Oral Reference Dose Adjusted for GI Absorption	RfD_d	chemical-specific	mg/kg-day
Concentration in water	C_w	chemical-specific	mg/cm^3
Fraction absorbed	FA	chemical-specific	unitless
Lag Time per Event	τ_{event}	chemical-specific	hr/event
Relative contribution of permeability coefficient	B	chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal contact of noncarcinogenic and carcinogenic COPCs in groundwater:

$$DAD = \frac{(DA_{event})(EV)(ED_{adult})(EF)(SA_{adult})}{(BW_{adult})(AT)}$$

for inorganic compounds: $$DA_{event} = (K_p)(C_w)(t_{event})$$

for organic compounds:

where for organic compounds if $t_{event} \le t^*$, then:

$$DA_{event} = (2)(FA)(K_p)(C_w)\sqrt{\frac{((6)(\tau_{event})(t_{event}))}{\pi}}$$

If $t_{event} > t^*$, then: $$DA_{event} = (FA)(K_p)(C_w)\left[\left(\frac{t_{event}}{(1+B)}\right)+((2)(\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Carcinogenic: $$Risk = (DAD)(SF_d)$$

where: $$SF_d = SF_o / GIABS$$

Noncarcinogenic: $$HQ = DAD / RfD_d$$

where: $$RfD_d = (RfD_o)(GIABS)$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/cm^3)	UCL or Max	K_p [4] (cm/hour)	t^* [4] (hours)	For organics, is $t_{event-adult} \le t^*$? (Yes/No)	FA [4] (unitless)	τ_{event} [4] (hour/event)	B [4] (unitless)	DA_{event} (mg/cm^2-event)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD (mg/kg-day)	GIABS [5] (unitless)	SFo [5] (mg/kg-day)$^{-1}$	RfDo [5] (mg/kg-day)	SF_d [5] (mg/kg-day)$^{-1}$	RfD_d [5] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																						
Antimony	7440-36-0	9.33 J	0.00000933 J	Max	1.00E-03	1.21	--	1	0.5055	0.0042	1.9E-08	--	0.00000009	0.15	--	4.0E-04	--	6.0E-05	--	--	0.0015	21%
Arsenic	7440-38-2	34	0.000034	Max	1.00E-03	0.66	--	1	0.2763	0.0033	6.8E-08	4.8E-09	0.00000034	1	1.50E+00	3.0E-04	1.5E+00	3.0E-04	7.2E-09	100%	0.0011	15%
Cobalt	7440-48-4	1.2 J	0.0000012	Max	4.00E-04	0.54	--	1	0.2248	0.0012	9.6E-10	--	0.00000000	1	--	3.0E-04	--	3.0E-04	--	--	0.000016	0.22%
Manganese	7439-96-5	363	0.000363	Max	1.00E-03	0.51	--	1	0.2136	0.0029	7.3E-07	--	0.00000361	0.04	--	2.4E-02	--	9.6E-04	--	--	0.0038	51%
Vanadium	7440-62-2	12.3	0.0000123	Max	1.00E-03	0.49	--	1	0.2028	0.0027	2.5E-08	--	0.00000012	0.026	--	5.0E-03	--	1.3E-04	--	--	0.00094	13%
																			Cancer Risk		**Hazard Index**	
																		Pathway sums:	7E-09	100%	0.007	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Chemical specific parameters shown in Table F.2.12.
[5] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.51
HUMAN HEALTH RISK EVALUATION SUMMARY FOR GROUNDWATER
UTILITY WORKER
ALL WELLS COMBINED
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number (2)	C_w [3] (µg/L)		$C_{w\ (mg/L)}$		UCL or Max	Adult Only Ingestion Carcinogenic Risk	Adult Only Dermal Carcinogenic Risk	Adult Only Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Adult Inhalation Hazard Quotient	Total Hazard Quotient
Inorganics														
Antimony	7440-36-0	9.33	J	0.00933	J	Max	--	--	NC	--	0.00048	0.0015	NC	**0.002**
Arsenic	7440-38-2	34		0.034		Max	1.5E-08	7.2E-09	NC	**2E-08**	0.0023	0.0011	NC	**0.003**
Cobalt	7440-48-4	1.2	J	0.0012		Max	--	--	NC	--	0.000082	0.000016	NC	**0.0001**
Manganese	7439-96-5	363		0.363		Max	--	--	NC	--	0.00031	0.0038	NC	**0.004**
Vanadium	7440-62-2	12.3		0.0123		Max	--	--	NC	--	0.000051	0.00094	NC	**0.001**
						Pathway Risk	**1E-08**	**7E-09**	NC	--	**0.003**	**0.007**	NC	--
									Total Risk	**2E-08**			**Hazard Index**	**0.01**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

-- = value not calculated because analyte not detected, or because toxicity data not available.

NC = Exposure pathway is complete but not significant.

Table F.2.52
RISK AND HAZARD ESTIMATES -- INGESTION OF GROUNDWATER
UU/UE RECEPTOR
108MW01
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Groundwater	C_w	chemical-specific	mg/L
Age-adjusted Groundwater Ingestion Rate	IFW_{adj}	0.94	L-yr/kg-day
Groundwater Ingestion - child	IRW_{child}	0.78	L/day
Groundwater Ingestion - adult	IRW_{adult}	2.50	L/day
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	year
Exposure Duration - child	ED_{child}	6	year
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor (SF_o)	SFo	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose (RfD_o)	RfDo	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_W)(IFW_{adj})(EF)}{(AT)}$$

where: $$IFW_{adj} = \frac{(ED_{child})(IRW_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRW_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in groundwater for separate age groups:

$$Ingestion = \frac{(C_W)(ED)(IRW)(EF)}{(BW)(AT)}$$

Carcinogenic: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SF_o [4] $(mg/kg\text{-}day)^{-1}$	RfD_o [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																	
Antimony	7440-36-0	8.82	J	0.00882	J	Max	1.1E-04	0.000	0.000	--	4.0E-04	--	--	1.1	40%	0.66	40%
Arsenic	7440-38-2	9.3		0.0093		UCL	1.2E-04	0.000	0.000	1.5E+00	3.0E-04	1.8E-04	100%	1.5	56%	0.93	56%
Cobalt	7440-48-4	ND		ND		ND	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	19.8	0	0.0198	0	Max	2.5E-04	0.001	0.001	--	2.4E-02	--	--	0.041	1.5%	0.025	1.5%
Vanadium	7440-62-2	6.4		0.0064		Max	8.2E-05	0.00032	0.00019	--	5.0E-03	--	--	0.064	2.3%	0.038	2.3%
												Cancer Risk		**Hazard Index**		**Hazard Index**	
											Pathway Sums:	1.8E-04	100%	3	100%	2	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.53
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH GROUNDWATER
UU/UE RECEPTOR
108MW01
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UU/UE RECEPTOR

Parameter	Abbreviation	Value	Units
Age-adjusted Dermal Factor	SFW_{adj}	chemical-specific	events-cm^2/kg
Exposure Frequency	EF	350	days/year
Event Duration - child	t_{event} - child	0.54	hours/event
Event Duration - adult	t_{event} - adult	0.71	hours/event
Time it takes to reach steady state	t*	chemical-specific	hours
Event Frequency	EV	1	events/day
Exposure Duration - child	ED_{child}	6	year
Exposure Duration - adult	ED_{adult}	20	year
Exposed Skin Surface Area - child	SA_{child}	6378	cm^2
Exposed Skin Surface Area - adult	SA_{adult}	20900	cm^2
Permeability Constant	K_p	chemical-specific	cm/hour
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_{abs}	chemical-specific	mg/kg-day
Concentration in water	C_w	chemical-specific	mg/cm^3
Fraction absorbed	FA	Chemical-specific	unitless
Lag Time per Event	τ_{event}	Chemical-specific	hr/event
Relative contribution of permeability coefficient	B	Chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal contact of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$DAD = \frac{(EV)(EF)(SFW_{adj})}{(AT)}$$

where:

$$SFW_{adj} = \left[\frac{(ED_{child})(SA_{child})(DA_{event\text{-}child})}{(BW_{child})}\right] + \left[\frac{(ED_{adult})(SA_{adult})(DA_{event\text{-}adult})}{(BW_{adult})}\right]$$

Dermal contact of noncarcinogenic COPCs in groundwater for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where for inorganic compounds:
Note: t_{event} is different for adult and child

$$DA_{event} = (K_p)(C_w)(t_{event})$$

where for organic compounds if $t_{event} \le t^*$, then:
Note: t_{event} is different for adult and child

$$DA_{event} = (2)(FA)(K_p)(C_w)\sqrt{\frac{((6)(\tau_{event})(t_{event}))}{\pi}}$$

where for organic compounds if $t_{event} > t^*$, then:
Note: t_{event} is different for adult and child

$$DA_{event} = (FA)(K_p)(C_w)\left[\left(\frac{(t_{event})}{(1+B)}\right) + ((2)(\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Carcinogenic: $Risk = (DAD)(SF_d)$

where: $SF_d = SF_o / GIABS$

Noncarcinogenic: $HQ = DAD / RfD_d$

where: $RfD_d = (RfD_o)(GIABS)$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/cm^3)	UCL or Max	K_p [4] (cm/hour)	t^* [4] (hours)	For organic compounds, is $t_{event\text{-}child} \le t^*$? (Yes/No)	For organic compounds, is $t_{event\text{-}adult} \le t^*$? (Yes/No)	FA [4] (unitless)	τ_{event} [4] (hour/event)	B [4] (unitless)	DA_{event} - child (mg/cm^2-event)	DA_{event} - adult (mg/cm^2-event)	SFW_{adj} (events-cm^2/kg)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - child (mg/kg-day)	Noncarcinogenic DAD - adult (mg/kg-day)	SF_d [5] $(mg/kg\text{-}day)^{-1}$	RfD_d [5] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																									
Antimony	7440-36-0	8.82 J	0.00000882 J	Max	1.0E-03	1.2E+00	--	--	1	0.51	0.0042	4.8E-09	6.3E-09	--	--	1.9E-06	1.6E-06	--	0.00006	--	--	0.032	59%	0.026	59%
Arsenic	7440-38-2	9.3	0.0000093	UCL	1.0E-03	6.6E-01	--	--	1	0.28	0.0033	5.0E-09	6.6E-09	4.7E-05	6.5E-07	2.0E-06	1.7E-06	1.50E+00	0.0003	9.7E-07	100%	0.0068	13%	0.0055	13%
Cobalt	7440-48-4	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	19.8 0	0.0000198 0	Max	1.0E-03	5.1E-01	--	--	1	0.21	0.0029	1.1E-08	1.4E-08	--	--	4.4E-06	3.5E-06	--	0.00096	--	--	0.0045	8.3%	0.0037	8.3%
Vanadium	7440-62-2	6.4	0.0000064	Max	1.0E-03	4.9E-01	--	--	1	0.20	0.0027	3.5E-09	4.5E-09	--	--	1.4E-06	1.1E-06	--	0.00013	--	--	0.011	20%	0.0088	20%
																				Cancer Risk		**Hazard Index**		**Hazard Index**	
																			Pathway Sums	1E-06	100%	0.05	100%	0.04	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Chemical specific parameters shown in Table F.2.12.
[5] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.54
HUMAN HEALTH RISK EVALUATION SUMMARY FOR GROUNDWATER
UU/UE RECEPTOR
108MW01
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Inorganics																	
Antimony	7440-36-0	8.82	J	0.00882	J	Max	--	--	NC	--	1.1	0.032	0.66	0.026	NC	**1**	**0.7**
Arsenic	7440-38-2	9.3		0.0093		UCL	1.8E-04	9.7E-07	NC	**2E-04**	1.5	0.0068	0.93	0.0055	NC	**2**	**1**
Cobalt	7440-48-4	ND		ND		ND	--	--	NC	--	--	--	--	--	NC	--	--
Manganese	7439-96-5	19.8	0	0.0198	0	Max	--	--	NC	--	0.041	0.0045	0.025	0.0037	NC	**0.05**	**0.03**
Vanadium	7440-62-2	6.4		0.0064		Max	--	--	NC	--	0.064	0.011	0.038	0.0088	NC	**0.07**	**0.05**
						Pathway Sum	**2E-04**	**1E-06**	**--**	**--**	**3**	**0.1**	**2**	**0.04**	**--**	**--**	**--**
									Total Risk	**2E-04**					**Hazard Index**	**3**	**2**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.55
RISK AND HAZARD ESTIMATES -- INGESTION OF GROUNDWATER
UU/UE RECEPTOR
108MW02
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Groundwater	C_w	chemical-specific	mg/L
Age-adjusted Groundwater Ingestion Rate	IFW_{adj}	0.94	L-yr/kg-day
Groundwater Ingestion - child	IRW_{child}	0.78	L/day
Groundwater Ingestion - adult	IRW_{adult}	2.50	L/day
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	year
Exposure Duration - child	ED_{child}	6	year
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor (SF_o)	SFo	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose (RfD_o)	RfDo	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_W)(IFW_{adj})(EF)}{(AT)}$$

where: $$IFW_{adj} = \frac{(ED_{child})(IRW_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRW_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in groundwater for separate age groups:

$$Ingestion = \frac{(C_W)(ED)(IRW)(EF)}{(BW)(AT)}$$

Carcinogenic: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SF_o [4] $(mg/kg\text{-}day)^{-1}$	RfD_o [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																	
Antimony	7440-36-0	9.33	J	0.00933	J	Max	1.2E-04	0.000	0.0003	--	4.0E-04	--	--	1.2	26%	0.70	26%
Arsenic	7440-38-2	13		0.013		UCL	1.7E-04	0.001	0.0004	1.5E+00	3.0E-04	2.5E-04	100%	2.2	49%	1.3	49%
Cobalt	7440-48-4	1.2	J	0.0012	J	Max	1.5E-05	0.00006	0.00004	--	3.0E-04	--	--	0.20	4.5%	0.12	4.5%
Manganese	7439-96-5	363		0.363		Max	4.7E-03	0.01810	0.01088	--	2.4E-02	--	--	0.75	17%	0.45	17%
Vanadium	7440-62-2	12.3		0.0123		Max	1.6E-04	0.0006	0.0004	--	5.0E-03	--	--	0.12	2.8%	0.074	2.8%
												Cancer Risk		**Hazard Index**		**Hazard Index**	
											Pathway Sums:	3E-04	100%	4	100%	3	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

[4] Human Health Toxicity Values shown in Table F.2.11.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.56
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH GROUNDWATER
UU/UE RECEPTOR
108MW02
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UU/UE RECEPTOR

Parameter	Abbreviation	Value	Units
Age-adjusted Dermal Factor	SFW_{adj}	chemical-specific	events-cm^2/kg
Exposure Frequency	EF	350	days/year
Event Duration - child	t_{event} - child	0.54	hours/event
Event Duration - adult	t_{event} - adult	0.71	hours/event
Time it takes to reach steady state	t*	chemical-specific	hours
Event Frequency	EV	1	events/day
Exposure Duration - child	ED_{child}	6	year
Exposure Duration - adult	ED_{adult}	20	year
Exposed Skin Surface Area - child	SA_{child}	6378	cm^2
Exposed Skin Surface Area - adult	SA_{adult}	20900	cm^2
Permeability Constant	K_p	chemical-specific	cm/hour
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_{abs}	chemical-specific	mg/kg-day
Concentration in water	C_w	chemical-specific	mg/cm^3
Fraction absorbed	FA	Chemical-specific	unitless
Lag Time per Event	τ_{event}	Chemical-specific	hr/event
Relative contribution of permeability coefficient	B	Chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal contact of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$DAD = \frac{(EV)(EF)(SFW_{adj})}{(AT)}$$

where:

$$SFW_{adj} = \left[\frac{(ED_{child})(SA_{child})(DA_{event\text{-}child})}{(BW_{child})}\right] + \left[\frac{(ED_{adult})(SA_{adult})(DA_{event\text{-}adult})}{(BW_{adult})}\right]$$

Dermal contact of noncarcinogenic COPCs in groundwater for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where for inorganic compounds:
Note: t_{event} is different for adult and child

$$DA_{event} = (K_p)(C_w)(t_{event})$$

where for organic compounds if $t_{event} \le t^*$, then:
Note: t_{event} is different for adult and child

$$DA_{event} = (2)(FA)(K_p)(C_w)\sqrt{\frac{((6)(\tau_{event})(t_{event}))}{\pi}}$$

where for organic compounds if $t_{event} > t^*$, then:

$$DA_{event} = (FA)(K_p)(C_w)\left[\left(\frac{(t_{event})}{(1+B)}\right) + ((2)(\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Note: t_{event} is different for adult and child

Carcinogenic: $Risk = (DAD)(SF_d)$

where: $SF_d = SF_o / GIABS$

Noncarcinogenic: $HQ = DAD / RfD_d$

where: $RfD_d = (RfD_o)(GIABS)$

COPC [1]	CAS Number [2]	C_w [3] ($\mu g/L$)	C_w (mg/cm^3)	UCL or Max	K_p [4] (cm/hour)	t* [4] (hours)	For organic compounds, is $t_{event\text{-}child} \le t^*$? (Yes/No)	For organic compounds, is $t_{event\text{-}adult} \le t^*$? (Yes/No)	FA [4] (unitless)	τ_{event} [4] (hour/event)	B [4] (unitless)	DA_{event} - child (mg/cm^2-event)	DA_{event} - adult (mg/cm^2-event)	SFW_{adj} (events-cm^2/kg)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - child (mg/kg-day)	Noncarcinogenic DAD - adult (mg/kg-day)	SF_d [5] $(mg/kg\text{-}day)^{-1}$	RfD_d [5] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																								
Antimony	7440-36-0	9.33 J	0.00000933 J	Max	1.0E-03	1.2E+00	--	--	1	0.51	0.0042	5.0E-09	6.6E-09	--	--	2.1E-06	1.7E-06	--	0.00006	--	--	0.034	23%	0.028	23%
Arsenic	7440-38-2	13	0.000013	UCL	1.0E-03	6.6E-01	--	--	1	0.28	0.0033	7.0E-09	9.2E-09	6.6E-05	9.1E-07	2.9E-06	2.3E-06	1.50E+00	0.0003	1.4E-06	100%	0.010	6.4%	0.0077	6.4%
Cobalt	7440-48-4	1.2 J	0.0000012 J	Max	4.0E-04	5.4E-01	--	--	1	0.22	0.0012	2.6E-10	3.4E-10	--	--	1.1E-07	8.5E-08	--	0.0003	--	--	0.00035	0.24%	0.00028	0.24%
Manganese	7439-96-5	363	0.000363	Max	1.0E-03	5.1E-01	--	--	1	0.21	0.0029	2.0E-07	2.6E-07	--	--	8.0E-05	6.5E-05	--	0.00096	--	--	0.083	56%	0.067	56%
Vanadium	7440-62-2	12.3	0.0000123	Max	1.0E-03	4.9E-01	--	--	1	0.20	0.0027	6.6E-09	8.7E-09	--	--	2.7E-06	2.2E-06	--	0.00013	--	--	0.021	14%	0.017	14%
																				Cancer Risk		**Hazard Index**		**Hazard Index**	
																			Pathway Sums	1E-06	100%	0.1	100%	0.1	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Chemical specific parameters shown in Table F.2.12.
[5] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.57
HUMAN HEALTH RISK EVALUATION SUMMARY FOR GROUNDWATER
UU/UE RECEPTOR
108MW02
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Inorganics																	
Antimony	7440-36-0	9.33	J	0.00933	J	Max	--	--	NC	--	1.2	0.034	0.70	0.028	NC	**1**	**0.7**
Arsenic	7440-38-2	13		0.013		UCL	2.5E-04	1.36E-06	NC	**3E-04**	2.2	0.010	1.3	0.0077	NC	**2**	**1**
Cobalt	7440-48-4	1.2	J	0.0012	J	Max	--	--	NC	--	0.20	0.00035	0.12	0.00028	NC	**0**	**0.1**
Manganese	7439-96-5	363		0.363		Max	--	--	NC	--	0.75	0.083	0.45	0.067	NC	**0.8**	**0.5**
Vanadium	7440-62-2	12.3		0.0123		Max	--	--	NC	--	0.12	0.021	0.074	0.017	NC	**0.1**	**0.09**
						Pathway Sum	**3E-04**	**1E-06**	**--**	**--**	**4**	**0.1**	**3**	**0.1**	**--**	**--**	**--**
									Total Risk	**3E-04**					**Hazard Index**	**5**	**3**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.58
RISK AND HAZARD ESTIMATES -- INGESTION OF GROUNDWATER
UU/UE RECEPTOR
108MW03
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Groundwater	C_w	chemical-specific	mg/L
Age-adjusted Groundwater Ingestion Rate	IFW_{adj}	0.94	L-yr/kg-day
Groundwater Ingestion - child	IRW_{child}	0.78	L/day
Groundwater Ingestion - adult	IRW_{adult}	2.50	L/day
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	year
Exposure Duration - child	ED_{child}	6	year
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor (SF_o)	SFo	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose (RfD_o)	RfDo	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_W)(IFW_{adj})(EF)}{(AT)}$$

where: $$IFW_{adj} = \frac{(ED_{child})(IRW_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRW_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in groundwater for separate age groups:

$$Ingestion = \frac{(C_W)(ED)(IRW)(EF)}{(BW)(AT)}$$

Carcinogenic: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/L)	UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SF_o [4] $(mg/kg\text{-}day)^{-1}$	RfD_o [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics															
Antimony	7440-36-0	7.97 J	0.00797 J	Max	1.0E-04	0.00040	0.00024	--	4.0E-04	--	--	0.99	43%	0.60	43%
Arsenic	7440-38-2	6.7	0.0067	UCL	8.6E-05	0.00033	0.00020	1.5E+00	3.0E-04	1.3E-04	100%	1.1	48%	0.67	48%
Cobalt	7440-48-4	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	52.3	0.0523	Max	6.7E-04	0.0026	0.0016	--	2.4E-02	--	--	0.11	4.7%	0.065	4.7%
Vanadium	7440-62-2	11.2	0.0112	Max	1.4E-04	0.00056	0.00034	--	5.0E-03	--	--	0.11	4.8%	0.067	4.8%
										Cancer Risk		**Hazard Index**		**Hazard Index**	
									Pathway Sums:	1E-04	100%	2	100%	1	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.59
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH GROUNDWATER
UU/UE RECEPTOR
108MW03
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UU/UE RECEPTOR

Parameter	Abbreviation	Value	Units
Age-adjusted Dermal Factor	SFW_{adj}	chemical-specific	events-cm^2/kg
Exposure Frequency	EF	350	days/year
Event Duration - child	t_{event} - child	0.54	hours/event
Event Duration - adult	t_{event} - adult	0.71	hours/event
Time it takes to reach steady state	t*	chemical-specific	hours
Event Frequency	EV	1	events/day
Exposure Duration - child	ED_{child}	6	year
Exposure Duration - adult	ED_{adult}	20	year
Exposed Skin Surface Area - child	SA_{child}	6378	cm^2
Exposed Skin Surface Area - adult	SA_{adult}	20900	cm^2
Permeability Constant	K_p	chemical-specific	cm/hour
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_{abs}	chemical-specific	mg/kg-day
Concentration in water	C_w	chemical-specific	mg/cm^3
Fraction absorbed	FA	Chemical-specific	unitless
Lag Time per Event	τ_{event}	Chemical-specific	hr/event
Relative contribution of permeability coefficient	B	Chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal contact of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$DAD = \frac{(EV)(EF)(SFW_{adj})}{(AT)}$$

where:

$$SFW_{adj} = \left[\frac{(ED_{child})(SA_{child})(DA_{event\text{-}child})}{(BW_{child})}\right] + \left[\frac{(ED_{adult})(SA_{adult})(DA_{event\text{-}adult})}{(BW_{adult})}\right]$$

Carcinogenic: $Risk = (DAD)(SF_d)$

where: $SF_d = SF_o / GIABS$

Dermal contact of noncarcinogenic COPCs in groundwater for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

Noncarcinogenic: $HQ = DAD / RfD_d$

where: $RfD_d = (RfD_o)(GIABS)$

where for inorganic compounds:
Note: t_{event} is different for adult and child

$$DA_{event} = (K_p)(C_w)(t_{event})$$

where for organic compounds if $t_{event} \le t^*$, then:
Note: t_{event} is different for adult and child

$$DA_{event} = (2)(FA)(K_p)(C_w)\sqrt{\frac{((6)(\tau_{event})(t_{event}))}{\pi}}$$

where for organic compounds if $t_{event} > t^*$, then:

Note: t_{event} is different for adult and child

$$DA_{event} = (FA)(K_p)(C_w)\left[\left(\frac{(t_{event})}{(1+B)}\right) + ((2)(\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/cm^3)	UCL or Max	K_p [4] (cm/hour)	t* [4] (hours)	For organic compounds, is $t_{event\text{-}child} \le t^*$? (Yes/No)	For organic compounds, is $t_{event\text{-}adult} \le t^*$? (Yes/No)	FA [4] (unitless)	τ_{event} [4] (hour/event)	B [4] (unitless)	DA_{event} - child (mg/cm^2-event)	DA_{event} - adult (mg/cm^2-event)	SFW_{adj} (events-cm^2/kg)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - child (mg/kg-day)	Noncarcinogenic DAD - adult (mg/kg-day)	SF_d [5] $(mg/kg\text{-}day)^{-1}$	RfD_d [5] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																									
Antimony	7440-36-0	7.97 J	0.00000797 J	Max	1.0E-03	1.2E+00	--	--	1	0.51	0.0042	4.3E-09	5.7E-09	--	--	1.8E-06	1.4E-06	--	0.00006	--	--	0.029	45%	0.024	45%
Arsenic	7440-38-2	6.7	0.0000067	UCL	1.0E-03	6.6E-01	--	--	1	0.28	0.0033	3.6E-09	4.8E-09	3.4E-05	4.7E-07	1.5E-06	1.2E-06	1.50E+00	0.0003	7.0E-07	100%	0.0049	7.6%	0.0040	7.6%
Cobalt	7440-48-4	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	52.3	0.0000523	Max	1.0E-03	5.1E-01	--	--	1	0.21	0.0029	2.8E-08	3.7E-08	--	--	1.2E-05	9.3E-06	--	0.00096	--	--	0.012	18%	0.010	18%
Vanadium	7440-62-2	11.2	0.0000112	Max	1.0E-03	4.9E-01	--	--	1	0.20	0.0027	6.0E-09	8.0E-09	--	--	2.5E-06	2.0E-06	--	0.00013	--	--	0.019	29%	0.015	29%
																				Cancer Risk		**Hazard Index**		**Hazard Index**	
																			Pathway Sums	7E-07	100%	0.07	100%	0.05	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

[4] Chemical specific parameters shown in Table F.2.12.

[5] Human Health Toxicity Values shown in Table F.2.11.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.60
HUMAN HEALTH RISK EVALUATION SUMMARY FOR GROUNDWATER
UU/UE RECEPTOR
108MW03
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/L)	UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Inorganics															
Antimony	7440-36-0	7.97 J	0.00797 J	Max	--	--	NC	--	0.99	0.029	0.60	0.024	NC	**1**	**1**
Arsenic	7440-38-2	6.7	0.0067	UCL	1.3E-04	7.0E-07	NC	**1E-04**	1.1	0.0049	0.67	0.0040	NC	**1**	**0.7**
Cobalt	7440-48-4	ND	ND	ND	--	--	NC	--	--	--	--	--	NC	--	--
Manganese	7439-96-5	52.3	0.0523	Max	--	--	NC	--	0.11	0.012	0.065	0.010	NC	**0.1**	**0.1**
Vanadium	7440-62-2	11.2	0.0112	Max	--	--	NC	--	0.11	0.019	0.067	0.015	NC	**0.1**	**0.1**
				Pathway Sum	**1E-04**	**7E-07**	**--**	**--**	**2**	**0.07**	**1**	**0.05**	**--**	**--**	**--**
							Total Risk	**1E-04**					**Hazard Index**	**2**	**1**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.61
RISK AND HAZARD ESTIMATES -- INGESTION OF GROUNDWATER
UU/UE RECEPTOR
108MW04
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions			
Receptor	UU/UE RECEPTOR		
Parameter	**Abbreviation**	**Value**	**Units**
COPC Concentration in Groundwater	C_w	chemical-specific	mg/L
Age-adjusted Groundwater Ingestion Rate	IFW_{adj}	0.94	L-yr/kg-day
Groundwater Ingestion - child	IRW_{child}	0.78	L/day
Groundwater Ingestion - adult	IRW_{adult}	2.50	L/day
Exposure Frequency	EF	350	days/year
Exposure Duration - adult	ED_{adult}	20	year
Exposure Duration - child	ED_{child}	6	year
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor (SF_o)	SFo	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose (RfD_o)	RfDo	chemical-specific	mg/kg-day

Equations

Incidental ingestion of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$Ingestion_{age-adj} = \frac{(C_W)(IFW_{adj})(EF)}{(AT)}$$

where: $$IFW_{adj} = \frac{(ED_{child})(IRW_{child})}{(BW_{child})} + \frac{(ED_{adult})(IRW_{adult})}{(BW_{adult})}$$

Incidental ingestion of noncarcinogenic COPCs in groundwater for separate age groups:

$$Ingestion = \frac{(C_W)(ED)(IRW)(EF)}{(BW)(AT)}$$

Carcinogenic: $$Risk = (Ingestion)(SF_o)$$

Noncarcinogenic: $$HQ = Ingestion / RfD_o$$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Carcinogenic Ingestion (mg/kg-day)	Noncarcinogenic Ingestion - Child (mg/kg-day)	Noncarcinogenic Ingestion - Adult (mg/kg-day)	SF_o [4] $(mg/kg\text{-}day)^{-1}$	RfD_o [4] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																	
Antimony	7440-36-0	7.91	J	0.00791	J	Max	1.0E-04	0.0	0.00	--	4.0E-04	--	--	1.0	15%	0.59	15%
Arsenic	7440-38-2	34		0.034		Max	4.4E-04	0.0	0.00	1.5E+00	3.0E-04	6.5E-04	100%	5.7	85%	3.4	85%
Cobalt	7440-48-4	ND		ND		ND	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	1.5	J	0.0015	J	Max	1.9E-05	0.000	0.000	--	2.4E-02	--	--	0.0031	0.047%	0.0019	0.047%
Vanadium	7440-62-2	2.3	J	0.0023	J	Max	3.0E-05	0.000	0.000	--	5.0E-03	--	--	0.023	0.34%	0.014	0.34%
												Cancer Risk		**Hazard Index**		**Hazard Index**	
											Pathway Sums:	7E-04	100%	7	100%	4	100%

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

[4] Human Health Toxicity Values shown in Table F.2.11.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.62
RISK AND HAZARD ESTIMATES -- DERMAL CONTACT WITH GROUNDWATER
UU/UE RECEPTOR
108MW04
FTMM-57
Fort Monmouth, New Jersey

Exposure Assumptions

Receptor: UU/UE RECEPTOR

Parameter	Abbreviation	Value	Units
Age-adjusted Dermal Factor	SFW_{adj}	chemical-specific	events-cm^2/kg
Exposure Frequency	EF	350	days/year
Event Duration - child	t_{event} - child	0.54	hours/event
Event Duration - adult	t_{event} - adult	0.71	hours/event
0	t*	0	0
Event Frequency	EV	1	events/day
Exposure Duration - child	ED_{child}	6	year
Exposure Duration - adult	ED_{adult}	20	year
Exposed Skin Surface Area - child	SA_{child}	6378	cm^2
Exposed Skin Surface Area - adult	SA_{adult}	20900	cm^2
Permeability Constant	K_p	chemical-specific	cm/hour
Averaging Time – carcinogens	AT_c	25550	days
Averaging Time – noncarcinogens, child	AT_{nc} - child	2190	days
Averaging Time – noncarcinogens, adult	AT_{nc} - adult	7300	days
Oral Slope Factor Adjusted for GI Absorption	SF_d	chemical-specific	$(mg/kg\text{-}day)^{-1}$
Body Weight - child	BW_{child}	15	kg
Body Weight - adult	BW_{adult}	80	kg
Oral Reference Dose Adjusted for GI Absorption	RfD_{abs}	chemical-specific	mg/kg-day
Concentration in water	C_w	chemical-specific	mg/cm^3
Fraction absorbed	FA	Chemical-specific	unitless
Lag Time per Event	τ_{event}	Chemical-specific	hr/event
Relative contribution of permeability coefficient	B	Chemical-specific	unitless
Dermal Absorbed Dose	DAD	chemical-specific	mg/kg-day
Absorbed dose per event	DA_{event}	chemical-specific	mg/cm^2-event

Equations

Dermal contact of carcinogenic COPCs in groundwater for multiple age groups simultaneously:

$$DAD = \frac{(EV)(EF)(SFW_{adj})}{(AT)}$$

where:

$$SFW_{adj} = \left[\frac{(ED_{child})(SA_{child})(DA_{event\text{-}child})}{(BW_{child})}\right] + \left[\frac{(ED_{adult})(SA_{adult})(DA_{event\text{-}adult})}{(BW_{adult})}\right]$$

Dermal contact of noncarcinogenic COPCs in groundwater for separate age groups:

$$DAD = \frac{(DA_{event})(EF)(ED)(EV)(SA)}{(BW)(AT)}$$

where for inorganic compounds:
Note: t_{event} is different for adult and child

$$DA_{event} = (K_p)(C_w)(t_{event})$$

where for organic compounds if $t_{event} \le t^*$, then:
Note: t_{event} is different for adult and child

$$DA_{event} = (2)(FA)(K_p)(C_w)\sqrt{\frac{((6)(\tau_{event})(t_{event}))}{\pi}}$$

where for organic compounds if $t_{event} > t^*$, then:

$$DA_{event} = (FA)(K_p)(C_w)\left[\left(\frac{(t_{event})}{(1+B)}\right) + ((2)(\tau_{event}))\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Note: t_{event} is different for adult and child

Carcinogenic: $Risk = (DAD)(SF_d)$

where: $SF_d = SF_o / GIABS$

Noncarcinogenic: $HQ = DAD / RfD_d$

where: $RfD_d = (RfD_o)(GIABS)$

COPC [1]	CAS Number [2]	C_w [3] (µg/L)	C_w (mg/cm^3)	UCL or Max	K_p [4] (cm/hour)	t* [4] (hours)	For organic compounds, is $t_{event\text{-}child} \le t^*$? (Yes/No)	For organic compounds, is $t_{event\text{-}adult} \le t^*$? (Yes/No)	FA [4] (unitless)	τ_{event} [4] (hour/event)	B [4] (unitless)	DA_{event} - child (mg/cm^2-event)	DA_{event} - adult (mg/cm^2-event)	SFW_{adj} (events-cm^2/kg)	Carcinogenic DAD (mg/kg-day)	Noncarcinogenic DAD - child (mg/kg-day)	Noncarcinogenic DAD - adult (mg/kg-day)	SF_d [5] $(mg/kg\text{-}day)^{-1}$	RfD_d [5] (mg/kg-day)	Cancer Risk	% of Total	Hazard Quotient - Child	% of Total	Hazard Quotient - Adult	% of Total
Inorganics																								
Antimony	7440-36-0	7.91 J	0.00000791 J	Max	1.0E-03	1.2E+00	--	--	1	0.51	0.0042	4.3E-09	5.6E-09	--	--	1.7E-06	1.4E-06	--	0.00006	--	--	0.029	35%	0.023	35%
Arsenic	7440-38-2	34	0.000034	Max	1.0E-03	6.6E-01	--	--	1	0.28	0.0033	1.8E-08	2.4E-08	1.7E-04	2.4E-06	7.5E-06	6.0E-06	1.50E+00	0.00015	3.6E-06	100%	0.050	60%	0.040	60%
Cobalt	7440-48-4	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	1.5 J	0.0000015 J	Max	1.0E-03	5.1E-01	--	--	1	0.21	0.0029	8.1E-10	1.1E-09	--	--	3.3E-07	2.7E-07	--	0.00096	--	--	0.00034	0.41%	0.00028	0.41%
Vanadium	7440-62-2	2.3 J	0.0000023 J	Max	1.0E-03	4.9E-01	--	--	1	0.20	0.0027	1.2E-09	1.6E-09	--	--	5.1E-07	4.1E-07	--	0.00013	--	--	0.0039	4.7%	0.0031	4.7%
																				Cancer Risk		**Hazard Index**		**Hazard Index**	
																			Pathway Sums	4E-06	100%	0.08	100%	0.07	100%

[1] COPC = Constituent of potential concern.
[2] CAS = Chemical Abstracts Service number.
[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.
[4] Chemical specific parameters shown in Table F.2.12.
[5] Human Health Toxicity Values shown in Table F.2.11.
-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.63
HUMAN HEALTH RISK EVALUATION SUMMARY FOR GROUNDWATER
UU/UE RECEPTOR
108MW04
FTMM-57
Fort Monmouth, New Jersey

COPC [1]	CAS Number [2]	C_w [3] (µg/L)		C_w (mg/L)		UCL or Max	Age -adjusted Ingestion Carcinogenic Risk	Age-adjusted Dermal Carcinogenic Risk	Age-adjusted Inhalation Carcinogenic Risk	Total Carcinogenic Risk	Child Ingestion Hazard Quotient	Child Dermal Hazard Quotient	Adult Ingestion Hazard Quotient	Adult Dermal Hazard Quotient	Inhalation Hazard Quotient	Total Hazard Quotient - Child	Total Hazard Quotient - Adult
Inorganics																	
Antimony	7440-36-0	7.91	J	0.00791	J	Max	--	--	NC	--	1.0	0.029	0.59	0.023	NC	**1**	**1**
Arsenic	7440-38-2	34		0.034		Max	6.5E-04	3.6E-06	NC	**7E-04**	5.7	0.050	3.4	0.040	NC	**6**	**3**
Cobalt	7440-48-4	ND		ND		ND	--	--	NC	--	--	--	--	--	NC	--	--
Manganese	7439-96-5	1.5	J	0.0015	J	Max	--	--	NC	--	0.0031	0.00034	0.0019	0.00028	NC	**0.003**	**0.002**
Vanadium	7440-62-2	2.3	J	0.0023	J	Max	--	--	NC	--	0.023	0.0039	0.014	0.0031	NC	**0.03**	**0.02**
						Pathway Sum	**7E-04**	**4E-06**	**--**	**--**	**7**	**0.1**	**4**	**0.1**	**--**	**--**	**--**
									Total Risk	**7E-04**					**Hazard Index**	**7**	**4**

[1] COPC = Constituent of potential concern.

[2] CAS = Chemical Abstracts Service number.

[3] COPC concentration in Water (C_w) is the maximum detected concentration. See Table F.2.7.

-- = value not calculated because analyte not detected, or because toxicity data not available.

Table F.2.64
SUMMARY OF RISK AND HAZARD FOR SOIL
FTMM-57
Fort Monmouth, New Jersey

Receptor and Medium	Cancer Risk [1]	Hazard Index - child [1]	Hazard Index - adolescent [1]	Hazard Index - adult [1]
UU/UE Receptor				
Surface Soil (Incidental Ingestion, Dermal Contact, and Inhalation)	2E-04	4	--	0.4
Combined Surface and Subsurface Soil (Incidental Ingeston, Dermal Contact, and Inhalation)	2E-04	3	--	0.7
Utility Worker Receptor				
Surface Soil (Incidental Ingestion, Dermal Contact, and Inhalation)	2E-06	--	--	0.2
Combined Surface and Subsurface Soil (Incidental Ingeston, Dermal Contact, and Inhalation)	2E-06	--	--	0.4
Outdoor Worker Receptor				
Surface Soil (Incidental Ingestion, Dermal Contact, and Inhalation)	9E-05	--	--	0.6
Combined Surface and Subsurface Soil (Incidental Ingeston, Dermal Contact, and Inhalation)	--	--	--	--
Recreational User Receptor				
Surface Soil (Incidental Ingestion, Dermal Contact, and Inhalation)	2E-05		0.2	0.07
Combined Surface and Subsurface Soil (Incidental Ingeston, Dermal Contact, and Inhalation)	--	--	--	--

[1] HI and Cancer Risks were calculated by summing across exposure routes for each receptor.

[2] Groundwater is the maximum detected concentration of all wells in the exposure area.

-- Not calculated because receptor or pathway not present.

Table F.2.65
SUMMARY OF RISK AND HAZARD FOR GROUNDWATER
FTMM-57
Fort Monmouth, New Jersey

Well ID	UU/UE			Utility Worker		Outdoor Worker		Recreational User		
	Carcinogenic Risk	Hazard Quotient - Child	Hazard Quotient - Adult	Carcinogenic Risk	Hazard Quotient	Carcinogenic Risk	Hazard Quotient	Carcinogenic Risk	Hazard Quotient - Adolescent	Hazard Quotient - Adult
FTMM-57 Maximum	7E-04	8	5	2E-08	0.01	--	--	--	--	--
108MW01	2E-04	3	2	--	--	--	--	--	--	--
108MW02	3E-04	5	3	--	--	--	--	--	--	--
108MW03	1E-04	2	1	--	--	--	--	--	--	--
108MW04	7E-04	7	4	--	--	--	--	--	--	--

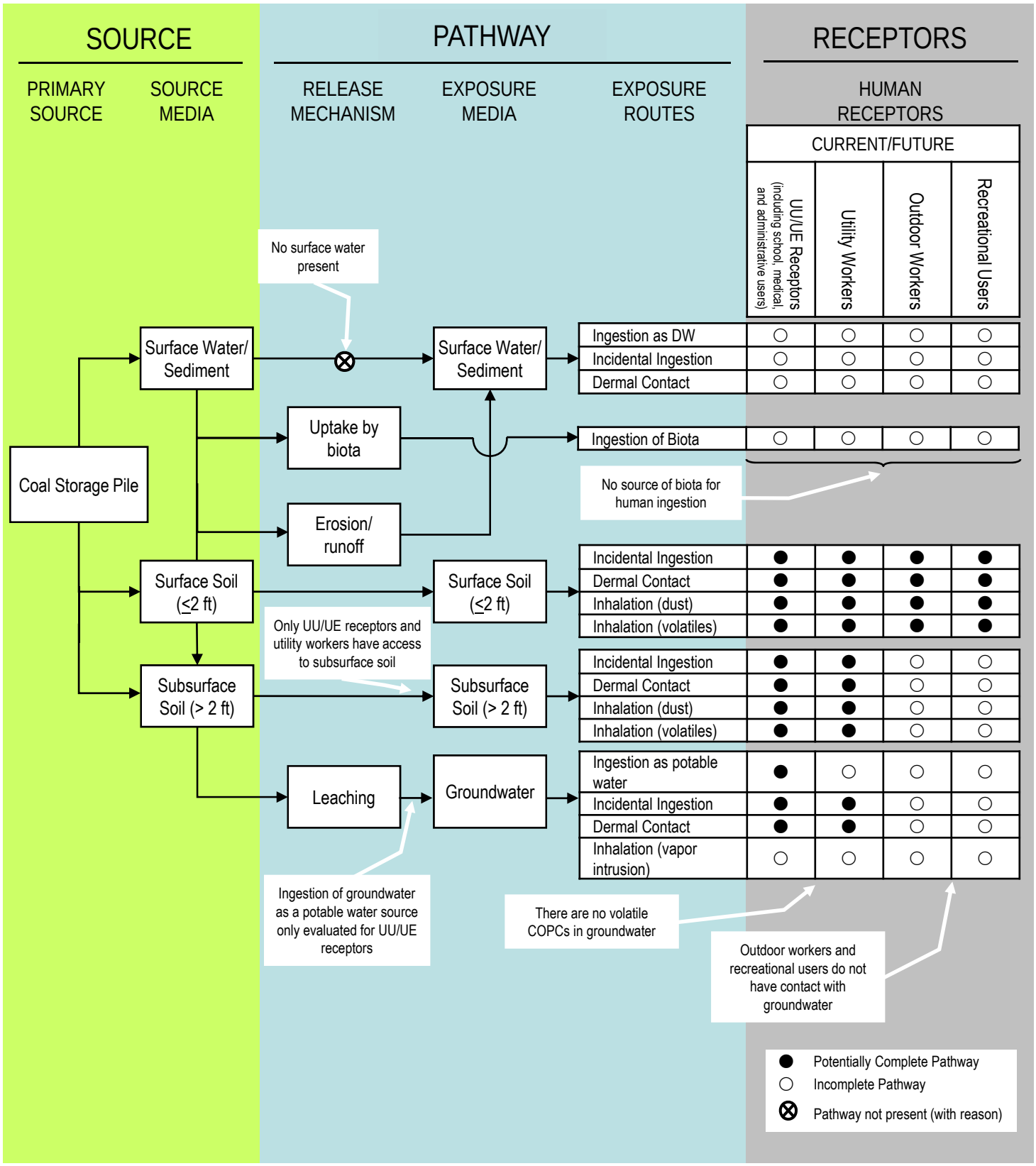
Notes:
-- indicates no risk/hazard calculated.
indicates cumulative hazard ratios greater than 1, or cumulative risk ratios greater than 1E-04

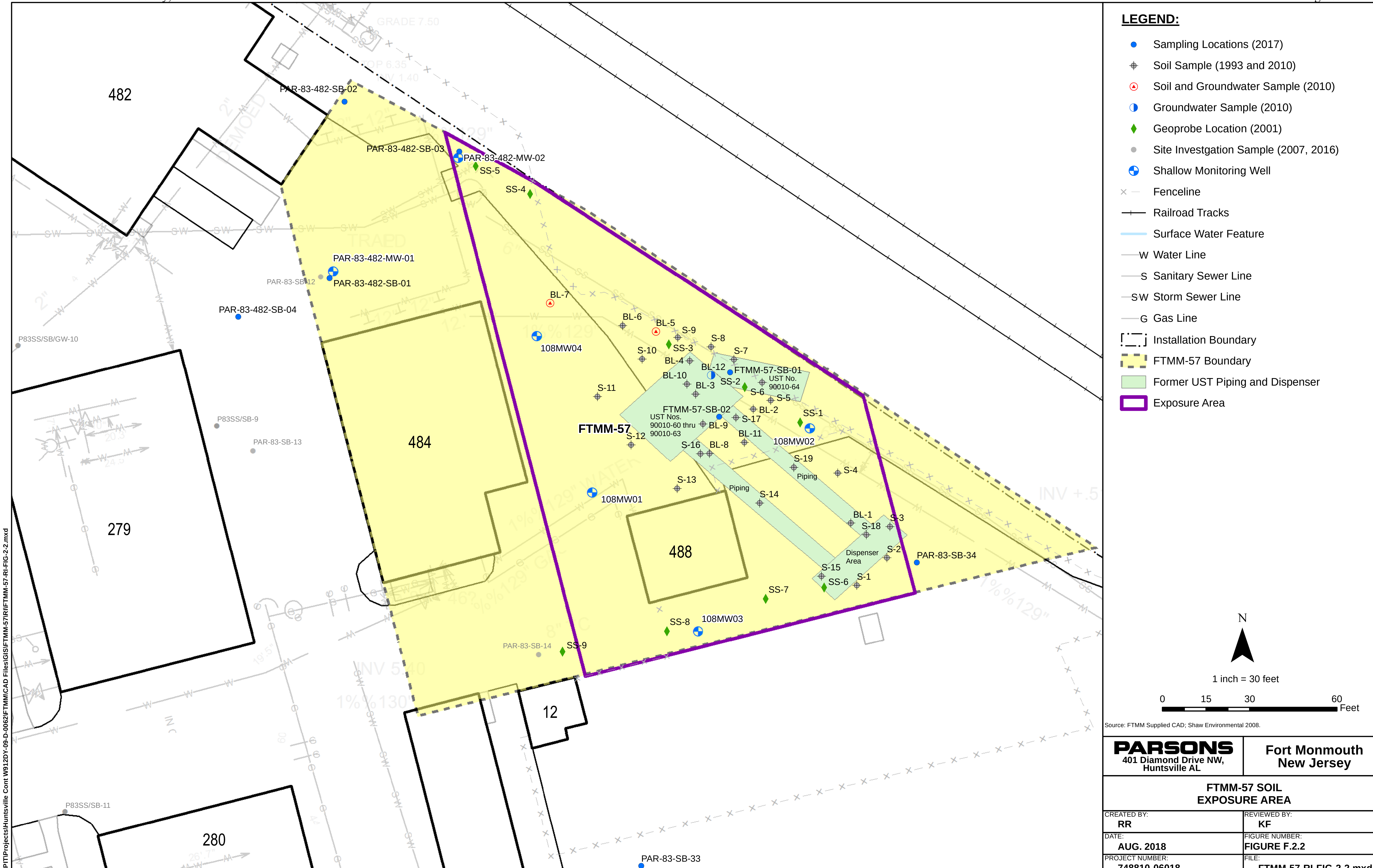
FIGURES

Figure F.2.1
CONCEPTUAL SITE MODEL DIAGRAM FOR FTMM-57

Site Name: Fort Monmouth, New Jersey, FTMM-57 (Building 108 UST Gasoline Release)

Completed By: Janelle Bartscherer - Parsons ***Date Completed:*** July 3, 2018




LEGEND:
Sampling Locations (2017)
Soil Sample (1993 and 2010)
Soil and Groundwater Sample (2010)
Groundwater Sample (2010)
Geoprobe Location (2001)
Site Investgation Sample (2007, 2016)
Shallow Monitoring Well
Fenceline
Railroad Tracks
Surface Water Feature
W Water Line
S Sanitary Sewer Line
SW Storm Sewer Line
G Gas Line
Installation Boundary
FTMM-57 Boundary
Former UST Piping and Dispenser
Exposure Area
482
484
488
279
280
12
FTMM-57
PAR-83-482-SB-02
PAR-83-482-SB-03
PAR-83-482-MW-02
PAR-83-482-MW-01
PAR-83-482-SB-01
PAR-83-SB-12
PAR-83-482-SB-04
P83SS/SB/GW-10
P83SS/SB-9
PAR-83-SB-13
P83SS/SB-11
PAR-83-SB-14
PAR-83-SB-33
PAR-83-SB-34
FTMM-57-SB-01
FTMM-57-SB-02
UST No. 90010-64
UST Nos. 90010-60 thru 90010-63
Piping
Dispenser Area
108MW01
108MW02
108MW03
108MW04
SS-1
SS-2
SS-3
SS-4
SS-5
SS-6
SS-7
SS-8
SS-9
BL-1
BL-2
BL-3
BL-4
BL-5
BL-6
BL-7
BL-8
BL-9
BL-10
BL-11
BL-12
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
S-9
S-10
S-11
S-12
S-13
S-14
S-15
S-16
S-17
S-18
S-19
N
1 inch = 30 feet
0 15 30 60 Feet
Source: FTMM Supplied CAD; Shaw Environmental 2008.
PARSONS
401 Diamond Drive NW, Huntsville AL
Fort Monmouth New Jersey
FTMM-57 SOIL EXPOSURE AREA
CREATED BY: RR
REVIEWED BY: KF
DATE: AUG. 2018
FIGURE NUMBER: FIGURE F.2.2
PROJECT NUMBER: 748810-06018
FILE: FTMM-57-RI-FIG-2-2.mxd
P:\PIT\Projects\Huntsville Cont W912DY-09-D-0062\FTMM\CAD Files\GIS\FTMM-57\RI\FTMM-57-RI-FIG-2-2.mxd

ATTACHMENT F.1

(included electronically on the CD of this report)

Exposure Area - Combined Surface and Subsurface Soil

Sample ID	Depth	Arsenic	d_Arsenic
FTMM-57-SB-01-2.5-3	2.5-3	5.9	1
FTMM-57-SB-01-6-6.5	6-6.5	4.6	1
FTMM-57-SB-01-8-8.5	8-8.5	5.4	1
FTMM-57-SB-02-2.5-3	2.5-3	3.9	1
FTMM-57-SB-102-7-7.5	7-7.5	5.6	1
FTMM-57-SB-02-8-8.5	8-8.5	4.4	1
Bldg108 SS-1-0-0.5	0-0.5	108.46	1
Bldg108 SS-1-1-1.5	1-1.5	30.96	1
Bldg108 SS-1-2-2.5	2-2.5	9.3	1
Bldg108 SS-2-0-0.5	0-0.5	10.4	0
Bldg108 SS-2-1-1.5	1-1.5	7.81	1
Bldg108 SS-2-2-2.5	2-2.5	44.06	1
Bldg108 SS-3-0-0.5	0-0.5	98.11	1
Bldg108 SS-3-1-1.5	1-1.5	10.9	0
Bldg108 SS-3-2-2.5	2-2.5	11	0
Bldg108 SS-4-0-0.5	0-0.5	4.95	1
Bldg108 SS-4-1-1.5	1-1.5	195.74	1
Bldg108 SS-4-2-2.5	2-2.5	12.1	0
Bldg108 SS-5-0-0.5	0-0.5	27.55	1
Bldg108 SS-5-1-1.5	1-1.5	28.31	1
Bldg108 SS-5-2-2.5	2-2.5	57.92	1
Bldg108 SS-6-0-0.5	0-0.5	17.86	1
Bldg108 SS-6-1-1.5	1-1.5	18.37	1
Bldg108 SS-6-2-2.5	2-2.5	22.99	1
Bldg108 SS-7-0-0.5	0-0.5	30.62	1
Bldg108 SS-7-1-1.5	1-1.5	32.9	1
Bldg108 SS-7-2-2.5	2-2.5	7.5	1
Bldg108 SS-8-0-0.5	0-0.5	24.37	1
Bldg108 SS-8-1-1.5	1-1.5	68.51	1
Bldg108 SS-8-2-2.5	2-2.5	297.03	1
PAR-83-482-SB-03-1.5-2	1.5-2	28.3	1
PAR-83-482-SB-03-5-5.5	5-5.5	9.7	1
PAR-83-482-SB-03-6-6.5	6-6.5	10.1	1

Exposure Area - Surface Soil

Sample ID	Depth	Arsenic	d_Arsenic
Bldg108 SS-1-0-0.5	0-0.5	108.46	1
Bldg108 SS-1-1-1.5	1-1.5	30.96	1
Bldg108 SS-2-0-0.5	0-0.5	10.4	0
Bldg108 SS-2-1-1.5	1-1.5	7.81	1
Bldg108 SS-3-0-0.5	0-0.5	98.11	1
Bldg108 SS-3-1-1.5	1-1.5	10.9	0
Bldg108 SS-4-0-0.5	0-0.5	4.95	1
Bldg108 SS-4-1-1.5	1-1.5	195.74	1
Bldg108 SS-5-0-0.5	0-0.5	27.55	1
Bldg108 SS-5-1-1.5	1-1.5	28.31	1
Bldg108 SS-6-0-0.5	0-0.5	17.86	1
Bldg108 SS-6-1-1.5	1-1.5	18.37	1
Bldg108 SS-7-0-0.5	0-0.5	30.62	1
Bldg108 SS-7-1-1.5	1-1.5	32.9	1
Bldg108 SS-8-0-0.5	0-0.5	24.37	1
Bldg108 SS-8-1-1.5	1-1.5	68.51	1
PAR-83-482-SB-03-1.5-2	1.5-2	28.3	1

Loc ID	Sample Date	Arsenic	d_Arsenic
108MW01	8/19/2010	3.16	1
	11/22/2010	1.19	1
	2/18/2011	3	0
	5/3/2011	3	0
	8/19/2011	15.6	1
	8/19/2013	10	0

Loc ID	Sample Date	Arsenic	d_Arsenic
108MW02	8/19/2010	6.68	1
	11/22/2010	4.24	1
	2/18/2011	3	0
	5/3/2011	15.9	1
	8/19/2011	12.3	1
	8/19/2013	9	1

Loc ID	Sample Date	Arsenic	d_Arsenic
108MW03	8/19/2010	9.1	1
	11/22/2010	2.83	1
	2/18/2011	3	0
	5/3/2011	4.9	1
	8/19/2011	3.3	1
	8/19/2013	5.4	1

Loc ID	Sample Date	Arsenic	d_Arsenic
	8/19/2010	1.79	1
	11/22/2010	1.95	1
	2/18/2011	17.7	1
108MW04	5/3/2011	4.3	1
	8/19/2011	34	1
	8/19/2013	10	0
	11/20/2015	2	1

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.17/31/2018 10:45:41 AM
From File	ProUCL Input_a.xls
Full Precision	OFF
Confidence Coefficient	95%
ımber of Bootstrap Operations	2000

Arsenic - Surface Soil, UU/UE Exposure Area

General Statistics

Total Number of Observations	17	Number of Distinct Observations	17
Number of Detects	15	Number of Non-Detects	2
Number of Distinct Detects	15	Number of Distinct Non-Detects	2
Minimum Detect	4.95	Minimum Non-Detect	10.4
Maximum Detect	195.7	Maximum Non-Detect	10.9
Variance Detects	2589	Percent Non-Detects	11.76%
Mean Detects	48.19	SD Detects	50.88
Median Detects	28.31	CV Detects	1.056
Skewness Detects	2.072	Kurtosis Detects	4.47
Mean of Logged Detects	3.451	SD of Logged Detects	0.958

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.729	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.351	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	43.27	KM Standard Error of Mean	12.08
KM SD	48.1	95% KM (BCA) UCL	65.55
95% KM (t) UCL	64.35	95% KM (Percentile Bootstrap) UCL	63.37
95% KM (z) UCL	63.13	95% KM Bootstrap t UCL	83.24
90% KM Chebyshev UCL	79.5	95% KM Chebyshev UCL	95.91
97.5% KM Chebyshev UCL	118.7	99% KM Chebyshev UCL	163.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.719	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.757	›etected data appear Gamma Distributed at 5% Significance Leve
K-S Test Statistic	0.278	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.226	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.321	k star (bias corrected MLE)	1.101
Theta hat (MLE)	36.47	Theta star (bias corrected MLE)	43.75
nu hat (MLE)	39.64	nu star (bias corrected)	33.04
Mean (detects)	48.19		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	42.52
Maximum	195.7	Median	28.3
SD	50.21	CV	1.181
k hat (MLE)	0.508	k star (bias corrected MLE)	0.458
Theta hat (MLE)	83.66	Theta star (bias corrected MLE)	92.89
nu hat (MLE)	17.28	nu star (bias corrected)	15.56
Adjusted Level of Significance (β)	0.0346		
Approximate Chi Square Value (15.56, α)	7.656	Adjusted Chi Square Value (15.56, β)	7.08
95% Gamma Approximate UCL (use when n>=50)	86.45	95% Gamma Adjusted UCL (use when n<50)	93.47

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	43.27	SD (KM)	48.1
Variance (KM)	2314	SE of Mean (KM)	12.08
k hat (KM)	0.809	k star (KM)	0.706
nu hat (KM)	27.51	nu star (KM)	23.99
theta hat (KM)	53.47	theta star (KM)	61.32
80% gamma percentile (KM)	71.11	90% gamma percentile (KM)	108.4
95% gamma percentile (KM)	146.9	99% gamma percentile (KM)	238.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.99, α)	13.84	Adjusted Chi Square Value (23.99, β)	13.04
5% Gamma Approximate KM-UCL (use when n>=50)	74.99	95% Gamma Adjusted KM-UCL (use when n<50)	79.62

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	43.33	Mean in Log Scale	3.272
SD in Original Scale	49.53	SD in Log Scale	1.029
95% t UCL (assumes normality of ROS data)	64.3	95% Percentile Bootstrap UCL	63.19
95% BCA Bootstrap UCL	71.51	95% Bootstrap t UCL	79.59
95% H-UCL (Log ROS)	90.02		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.26	KM Geo Mean	26.05
KM SD (logged)	1.018	95% Critical H Value (KM-Log)	2.696
KM Standard Error of Mean (logged)	0.257	95% H-UCL (KM -Log)	86.83
KM SD (logged)	1.018	95% Critical H Value (KM-Log)	2.696
KM Standard Error of Mean (logged)	0.257		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	43.15	Mean in Log Scale	3.242
SD in Original Scale	49.68	SD in Log Scale	1.074
95% t UCL (Assumes normality)	64.18	95% H-Stat UCL	95.99

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	79.62	95% GROS Adjusted Gamma UCL	93.47

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
lowever, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.18/6/2018 9:25:27 AM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
ımber of Bootstrap Operations	2000

Arsenic - Combined Surface and Subsurface Soil, UU/UE Exposure Area

General Statistics

Total Number of Observations	33	Number of Distinct Observations	33
Number of Detects	29	Number of Non-Detects	4
Number of Distinct Detects	29	Number of Distinct Non-Detects	4
Minimum Detect	3.9	Minimum Non-Detect	10.4
Maximum Detect	297	Maximum Non-Detect	12.1
Variance Detects	4108	Percent Non-Detects	12.12%
Mean Detects	41.77	SD Detects	64.09
Median Detects	22.99	CV Detects	1.535
Skewness Detects	2.944	Kurtosis Detects	9.391
Mean of Logged Detects	2.994	SD of Logged Detects	1.188

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.605	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	37.5	KM Standard Error of Mean	10.66
KM SD	60.15	95% KM (BCA) UCL	58.26
95% KM (t) UCL	55.56	95% KM (Percentile Bootstrap) UCL	55.56
95% KM (z) UCL	55.03	95% KM Bootstrap t UCL	75.89
90% KM Chebyshev UCL	69.47	95% KM Chebyshev UCL	83.96
97.5% KM Chebyshev UCL	104.1	99% KM Chebyshev UCL	143.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.183	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.169	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.804	k star (bias corrected MLE)	0.743
Theta hat (MLE)	51.98	Theta star (bias corrected MLE)	56.18
nu hat (MLE)	46.6	nu star (bias corrected)	43.12
Mean (detects)	41.77		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	36.7
Maximum	297	Median	17.86
SD	61.53	CV	1.676
k hat (MLE)	0.426	k star (bias corrected MLE)	0.407
Theta hat (MLE)	86.21	Theta star (bias corrected MLE)	90.12
nu hat (MLE)	28.1	nu star (bias corrected)	26.88
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (26.88, α)	16.06	Adjusted Chi Square Value (26.88, β)	15.63
95% Gamma Approximate UCL (use when n>=50)	61.44	95% Gamma Adjusted UCL (use when n<50)	63.13

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	37.5	SD (KM)	60.15
Variance (KM)	3618	SE of Mean (KM)	10.66
k hat (KM)	0.389	k star (KM)	0.374
nu hat (KM)	25.66	nu star (KM)	24.66
theta hat (KM)	96.47	theta star (KM)	100.4
80% gamma percentile (KM)	59.99	90% gamma percentile (KM)	107.2
95% gamma percentile (KM)	159.5	99% gamma percentile (KM)	292.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.66, α)	14.35	Adjusted Chi Square Value (24.66, β)	13.95
5% Gamma Approximate KM-UCL (use when n>=50)	64.44	95% Gamma Adjusted KM-UCL (use when n<50)	66.32

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.926	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.161	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	37.58	Mean in Log Scale	2.871
SD in Original Scale	61.04	SD in Log Scale	1.161
95% t UCL (assumes normality of ROS data)	55.58	95% Percentile Bootstrap UCL	55.92
95% BCA Bootstrap UCL	62.22	95% Bootstrap t UCL	77.68
95% H-UCL (Log ROS)	59.52		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.854	KM Geo Mean	17.35
KM SD (logged)	1.163	95% Critical H Value (KM-Log)	2.642
KM Standard Error of Mean (logged)	0.207	95% H-UCL (KM -Log)	58.71
KM SD (logged)	1.163	95% Critical H Value (KM-Log)	2.642
KM Standard Error of Mean (logged)	0.207		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	37.38	Mean in Log Scale	2.839
SD in Original Scale	61.14	SD in Log Scale	1.19
95% t UCL (Assumes normality)	55.41	95% H-Stat UCL	60.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	58.71

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
lowever, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.17/31/2018 9:36:09 AM
From File	Last 8.xls
Full Precision	OFF
Confidence Coefficient	95%
mber of Bootstrap Operations	2000

Arsenic - 108MW01

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	3	Number of Non-Detects	3
Number of Distinct Detects	3	Number of Distinct Non-Detects	2
Minimum Detect	1.19	Minimum Non-Detect	3
Maximum Detect	15.6	Maximum Non-Detect	10
Variance Detects	61.05	Percent Non-Detects	50%
Mean Detects	6.65	SD Detects	7.813
Median Detects	3.16	CV Detects	1.175
Skewness Detects	1.609	Kurtosis Detects	N/A
Mean of Logged Detects	1.357	SD of Logged Detects	1.299

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.85	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.002	KM Standard Error of Mean	2.63
KM SD	5.245	95% KM (BCA) UCL	N/A
95% KM (t) UCL	9.301	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	8.327	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	11.89	95% KM Chebyshev UCL	15.46
97.5% KM Chebyshev UCL	20.42	99% KM Chebyshev UCL	30.17

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.066	k star (bias corrected MLE)	N/A
Theta hat (MLE)	6.237	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.398	nu star (bias corrected)	N/A
Mean (detects)	6.65		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.569
Maximum	15.6	Median	0.959
SD	5.99	CV	1.678
k hat (MLE)	0.442	k star (bias corrected MLE)	0.332
Theta hat (MLE)	8.084	Theta star (bias corrected MLE)	10.76
nu hat (MLE)	5.298	nu star (bias corrected)	3.983
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (3.98, α)	0.715	Adjusted Chi Square Value (3.98, β)	0.348
95% Gamma Approximate UCL (use when n>=50)	19.89	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.002	SD (KM)	5.245
Variance (KM)	27.51	SE of Mean (KM)	2.63
k hat (KM)	0.582	k star (KM)	0.402
nu hat (KM)	6.987	nu star (KM)	4.827
theta hat (KM)	6.874	theta star (KM)	9.95
80% gamma percentile (KM)	6.463	90% gamma percentile (KM)	11.29
95% gamma percentile (KM)	16.6	99% gamma percentile (KM)	29.92

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.83, α)	1.073	Adjusted Chi Square Value (4.83, β)	0.568
5% Gamma Approximate KM-UCL (use when n>=50)	18	95% Gamma Adjusted KM-UCL (use when n<50)	34.02

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.934	Mean in Log Scale	0.745
SD in Original Scale	5.776	SD in Log Scale	1.101
95% t UCL (assumes normality of ROS data)	8.686	95% Percentile Bootstrap UCL	8.409
95% BCA Bootstrap UCL	9.102	95% Bootstrap t UCL	47.37
95% H-UCL (Log ROS)	35.05		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.806	KM Geo Mean	2.24
KM SD (logged)	0.95	95% Critical H Value (KM-Log)	3.94
KM Standard Error of Mean (logged)	0.485	95% H-UCL (KM -Log)	18.75
KM SD (logged)	0.95	95% Critical H Value (KM-Log)	3.94
KM Standard Error of Mean (logged)	0.485		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.658	Mean in Log Scale	1.082
SD in Original Scale	5.551	SD in Log Scale	0.979
95% t UCL (Assumes normality)	9.225	95% H-Stat UCL	28.07

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 9.301

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
lowever, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.17/31/2018 9:36:32 AM
From File	Last 8_a.xls
Full Precision	OFF
Confidence Coefficient	95%
mber of Bootstrap Operations	2000

Arsenic - 108MW02

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	4.24	Minimum Non-Detect	3
Maximum Detect	15.9	Maximum Non-Detect	3
Variance Detects	21.15	Percent Non-Detects	16.67%
Mean Detects	9.624	SD Detects	4.599
Median Detects	9	CV Detects	0.478
Skewness Detects	0.362	Kurtosis Detects	-0.962
Mean of Logged Detects	2.163	SD of Logged Detects	0.517

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.52	KM Standard Error of Mean	2.051
KM SD	4.494	95% KM (BCA) UCL	11.61
95% KM (t) UCL	12.65	95% KM (Percentile Bootstrap) UCL	11.68
95% KM (z) UCL	11.89	95% KM Bootstrap t UCL	13.25
90% KM Chebyshev UCL	14.67	95% KM Chebyshev UCL	17.46
97.5% KM Chebyshev UCL	21.33	99% KM Chebyshev UCL	28.93

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.174	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.681	Detected data appear Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.165	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Lev

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.116	k star (bias corrected MLE)	2.18
Theta hat (MLE)	1.881	Theta star (bias corrected MLE)	4.415
nu hat (MLE)	51.16	nu star (bias corrected)	21.8
Mean (detects)	9.624		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0852	Mean	8.034
Maximum	15.9	Median	7.84
SD	5.664	CV	0.705
k hat (MLE)	0.852	k star (bias corrected MLE)	0.537
Theta hat (MLE)	9.435	Theta star (bias corrected MLE)	14.96
nu hat (MLE)	10.22	nu star (bias corrected)	6.443
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (6.44, α)	1.87	Adjusted Chi Square Value (6.44, β)	1.113
95% Gamma Approximate UCL (use when n>=50)	27.68	95% Gamma Adjusted UCL (use when n<50)	46.49

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.52	SD (KM)	4.494
Variance (KM)	20.19	SE of Mean (KM)	2.051
k hat (KM)	3.595	k star (KM)	1.909
nu hat (KM)	43.14	nu star (KM)	22.9
theta hat (KM)	2.37	theta star (KM)	4.464
80% gamma percentile (KM)	12.83	90% gamma percentile (KM)	16.75
95% gamma percentile (KM)	20.51	99% gamma percentile (KM)	28.87

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.90, α)	13.02	Adjusted Chi Square Value (22.90, β)	10.43
5% Gamma Approximate KM-UCL (use when n>=50)	14.99	95% Gamma Adjusted KM-UCL (use when n<50)	18.71

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.399	Mean in Log Scale	1.94
SD in Original Scale	5.091	SD in Log Scale	0.717
95% t UCL (assumes normality of ROS data)	12.59	95% Percentile Bootstrap UCL	11.63
95% BCA Bootstrap UCL	11.49	95% Bootstrap t UCL	13.71
95% H-UCL (Log ROS)	25.27		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.986	KM Geo Mean	7.286
KM SD (logged)	0.58	95% Critical H Value (KM-Log)	2.838
KM Standard Error of Mean (logged)	0.265	95% H-UCL (KM -Log)	17.98
KM SD (logged)	0.58	95% Critical H Value (KM-Log)	2.838
KM Standard Error of Mean (logged)	0.265		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.27	Mean in Log Scale	1.87
SD in Original Scale	5.284	SD in Log Scale	0.854
95% t UCL (Assumes normality)	12.62	95% H-Stat UCL	37.48

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use
95% KM (t) UCL 12.65

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
lowever, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.18/6/2018 9:29:43 AM
From File	Last 8_c.xls
Full Precision	OFF
Confidence Coefficient	95%
mber of Bootstrap Operations	2000

Arsenic - 108MW03

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	2.83	Minimum Non-Detect	3
Maximum Detect	9.1	Maximum Non-Detect	3
Variance Detects	6.131	Percent Non-Detects	16.67%
Mean Detects	5.106	SD Detects	2.476
Median Detects	4.9	CV Detects	0.485
Skewness Detects	1.264	Kurtosis Detects	1.71
Mean of Logged Detects	1.544	SD of Logged Detects	0.458

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.253	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.727	KM Standard Error of Mean	1.001
KM SD	2.192	95% KM (BCA) UCL	6.31
95% KM (t) UCL	6.743	95% KM (Percentile Bootstrap) UCL	6.417
95% KM (z) UCL	6.373	95% KM Bootstrap t UCL	7.879
90% KM Chebyshev UCL	7.729	95% KM Chebyshev UCL	9.089
97.5% KM Chebyshev UCL	10.98	99% KM Chebyshev UCL	14.68

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.282	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.202	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Lev

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.922	k star (bias corrected MLE)	2.502
Theta hat (MLE)	0.862	Theta star (bias corrected MLE)	2.041
nu hat (MLE)	59.22	nu star (bias corrected)	25.02
Mean (detects)	5.106		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.944	Mean	4.579
Maximum	9.1	Median	4.1
SD	2.563	CV	0.56
k hat (MLE)	4.18	k star (bias corrected MLE)	2.201
Theta hat (MLE)	1.095	Theta star (bias corrected MLE)	2.08
nu hat (MLE)	50.16	nu star (bias corrected)	26.42
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (26.42, α)	15.7	Adjusted Chi Square Value (26.42, β)	12.81
95% Gamma Approximate UCL (use when n>=50)	7.704	95% Gamma Adjusted UCL (use when n<50)	9.439

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.727	SD (KM)	2.192
Variance (KM)	4.807	SE of Mean (KM)	1.001
k hat (KM)	4.648	k star (KM)	2.435
nu hat (KM)	55.78	nu star (KM)	29.22
theta hat (KM)	1.017	theta star (KM)	1.941
80% gamma percentile (KM)	6.913	90% gamma percentile (KM)	8.784
95% gamma percentile (KM)	10.55	99% gamma percentile (KM)	14.42

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (29.22, α)	17.88	Adjusted Chi Square Value (29.22, β)	14.77
5% Gamma Approximate KM-UCL (use when n>=50)	7.724	95% Gamma Adjusted KM-UCL (use when n<50)	9.349

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.667	Mean in Log Scale	1.437
SD in Original Scale	2.461	SD in Log Scale	0.486
95% t UCL (assumes normality of ROS data)	6.692	95% Percentile Bootstrap UCL	6.334
95% BCA Bootstrap UCL	6.733	95% Bootstrap t UCL	7.954
95% H-UCL (Log ROS)	8.336		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.46	KM Geo Mean	4.305
KM SD (logged)	0.419	95% Critical H Value (KM-Log)	2.454
KM Standard Error of Mean (logged)	0.191	95% H-UCL (KM -Log)	7.438
KM SD (logged)	0.419	95% Critical H Value (KM-Log)	2.454
KM Standard Error of Mean (logged)	0.191		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.505	Mean in Log Scale	1.354
SD in Original Scale	2.659	SD in Log Scale	0.62
95% t UCL (Assumes normality)	6.693	95% H-Stat UCL	10.61

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 6.743

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
lowever, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.18/6/2018 9:30:04 AM
From File	Last 8_d.xls
Full Precision	OFF
Confidence Coefficient	95%
mber of Bootstrap Operations	2000

Arsenic - 108MW04

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	1.79	Minimum Non-Detect	10
Maximum Detect	34	Maximum Non-Detect	10
Variance Detects	172.7	Percent Non-Detects	14.29%
Mean Detects	10.29	SD Detects	13.14
Median Detects	3.15	CV Detects	1.277
Skewness Detects	1.554	Kurtosis Detects	1.615
Mean of Logged Detects	1.634	SD of Logged Detects	1.271

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.743	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.342	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9.179	KM Standard Error of Mean	4.741
KM SD	11.44	95% KM (BCA) UCL	16.58
95% KM (t) UCL	18.39	95% KM (Percentile Bootstrap) UCL	16.55
95% KM (z) UCL	16.98	95% KM Bootstrap t UCL	76.82
90% KM Chebyshev UCL	23.4	95% KM Chebyshev UCL	29.84
97.5% KM Chebyshev UCL	38.79	99% KM Chebyshev UCL	56.35

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.659	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.291	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.342	Detected data appear Gamma Distributed at 5% Significance Lev

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.845	k star (bias corrected MLE)	0.534
Theta hat (MLE)	12.18	Theta star (bias corrected MLE)	19.29
nu hat (MLE)	10.14	nu star (bias corrected)	6.402
Mean (detects)	10.29		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.79	Mean	9.113
Maximum	34	Median	2.052
SD	12.39	CV	1.36
k hat (MLE)	0.835	k star (bias corrected MLE)	0.572
Theta hat (MLE)	10.91	Theta star (bias corrected MLE)	15.92
nu hat (MLE)	11.69	nu star (bias corrected)	8.014
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (8.01, α)	2.743	Adjusted Chi Square Value (8.01, β)	1.903
95% Gamma Approximate UCL (use when n>=50)	26.62	95% Gamma Adjusted UCL (use when n<50)	38.38

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.179	SD (KM)	11.44
Variance (KM)	130.9	SE of Mean (KM)	4.741
k hat (KM)	0.643	k star (KM)	0.463
nu hat (KM)	9.009	nu star (KM)	6.481
theta hat (KM)	14.26	theta star (KM)	19.83
80% gamma percentile (KM)	15.01	90% gamma percentile (KM)	25.22
95% gamma percentile (KM)	36.24	99% gamma percentile (KM)	63.52

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.48, α)	1.891	Adjusted Chi Square Value (6.48, β)	1.236
5% Gamma Approximate KM-UCL (use when n>=50)	31.47	95% Gamma Adjusted KM-UCL (use when n<50)	48.14

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.213	Mean in Log Scale	1.545
SD in Original Scale	12.33	SD in Log Scale	1.184
95% t UCL (assumes normality of ROS data)	18.27	95% Percentile Bootstrap UCL	17.9
95% BCA Bootstrap UCL	20.11	95% Bootstrap t UCL	100.2
95% H-UCL (Log ROS)	72.82		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.522	KM Geo Mean	4.58
KM SD (logged)	1.116	95% Critical H Value (KM-Log)	4.031
KM Standard Error of Mean (logged)	0.466	95% H-UCL (KM -Log)	53.63
KM SD (logged)	1.116	95% Critical H Value (KM-Log)	4.031
KM Standard Error of Mean (logged)	0.466		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.534	Mean in Log Scale	1.63
SD in Original Scale	12.16	SD in Log Scale	1.16
95% t UCL (Assumes normality)	18.47	95% H-Stat UCL	71.69

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL 76.82 95% KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 48.14

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia

APPENDIX G

Remedial Alternatives Cost Estimate

APPENDIX G
FEASIBILITY STUDY COST ESTIMATES
FTMM-57
FORT MONMOUTH, NEW JERSEY

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TABLE G.1
REMEDIAL ALTERNATIVES COST SUMMARY
FTMM-57
FORT MONMOUTH, NEW JERSEY

Remedial Alternative	Description	Capital Cost	Annual Operations and Maintenance Cost [a/]	Periodic Cost [a/]	Non-Discounted Constant Dollar Cost [b/]	TPV at 1.9% Discount Rate [c/]
1	No Action	$0	$0	$0	$0	$0
2	Land Use Controls (LUCs) - 30 year duration	$34,000	$0	$41,000	$418,000	$319,000
3	Containment via Capping with Alternative 2 - 30 year duration	$290,000	$0	$62,000	$936,000	$771,000
4	Source Removal via Direct Excavation and Backfill - 6 month duration	$416,000	$0	$0	$416,000	$416,000

Notes

[a/] Highest annual and periodic costs for remedial alternatives shown. Periodic costs may be less during a specific year.

[b/] Non-discounted constant dollar cost provided to show impact of discount rate on total present value (TPV).

[c/] TPV cost estimates are considered accurate to within -30% to +50% of actual costs. Time frames vary among alternatives and are based on the time required to achieve remedial action objective (RAO).

Other Notes/Assumptions

1. Design and construction contingencies have been added to capital and O&M costs based on USEPA (2000) and professional judgment.
   USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study.* USEPA 540-R-00-002. July.

	Source
Discount Rate	1.90%

TABLE G.2
ALTERNATIVE 2 LAND USE CONTROLS
COST BREAKDOWN
FTMM-57
FORT MONMOUTH, NEW JERSEY

Item		Units	Unit Cost	Extended
Capital				
Declaration of Environmental Restriction (DER)/Deed Notice	1	Lump Sum	$ 9,000	$ 9,000
Flood Hazard Area Control Act Rules Permit preparation and filing	1	Lump Sum	$ 3,000	$ 3,000
Coastal Area Facility Review Act permit preparation and filing	1	Lump Sum	$ 3,000	$ 3,000
Land survey for Deed Notice	1	Lump Sum	$ 2,500	$ 2,500
LUC Implementation Plan	1	Lump Sum	$ 10,000	$ 10,000
Contingency	25%			$ 6,875
			Capital Total	**$ 34,375**
Biennial Periodic Costs (every other year)				
Inspect & monitor LUCs to ensure restricted use of, or access	1	each	$ 2,500	$ 2,500
Reporting & long-term management	1	each	$ 10,000	$ 10,000
Contingency	25%			$ 3,100
		Biennial Periodic Costs Total		**$ 15,600**
Periodic Costs (every 5 years)				
Update/verify CEA and Deed Notice, inspect ECs	1	each	$ 5,000	$ 5,000
Five-Year Review and Reporting	1	each	$ 15,000	$ 15,000
Contingency	25%			$ 5,000
			Periodic Costs Total	**$ 25,000**

Assumptions:
LUCs have a duration of 30 years

TABLE G.3
ALTERNATIVE 2 LAND USE CONTROLS
PRESENT VALUE
FTMM-57
FORT MONMOUTH, NEW JERSEY

Year	Capital Cost ($)	Annual O&M ($) (LUCs)	Periodic Costs ($)	Total Cost	Discount Factor at 1.9%	Present Value at 1.9%
Annual Cost for Remedial Alternatives - Anticipated 30-Year Duration						
0	$ 34,400	$ -	$ -	$ 34,400	1.000	$ 34,400
1	$ -	$ -	$ -	$ -	0.981	$ -
2	$ -	$ -	$ 15,600	$ 15,600	0.963	$ 15,024
3	$ -	$ -	$ -	$ -	0.945	$ -
4	$ -	$ -	$ 15,600	$ 15,600	0.927	$ 14,469
5	$ -	$ -	$ 25,000	$ 25,000	0.910	$ 22,755
6	$ -	$ -	$ 15,600	$ 15,600	0.893	$ 13,935
7	$ -	$ -	$ -	$ -	0.877	$ -
8	$ -	$ -	$ 15,600	$ 15,600	0.860	$ 13,420
9	$ -	$ -	$ -	$ -	0.844	$ -
10	$ -	$ -	$ 40,600	$ 40,600	0.828	$ 33,635
11	$ -	$ -	$ -	$ -	0.813	$ -
12	$ -	$ -	$ 15,600	$ 15,600	0.798	$ 12,447
13	$ -	$ -	$ -	$ -	0.783	$ -
14	$ -	$ -	$ 15,600	$ 15,600	0.768	$ 11,987
15	$ -	$ -	$ 25,000	$ 25,000	0.754	$ 18,851
16	$ -	$ -	$ 15,600	$ 15,600	0.740	$ 11,544
17	$ -	$ -	$ -	$ -	0.726	$ -
18	$ -	$ -	$ 15,600	$ 15,600	0.713	$ 11,118
19	$ -	$ -	$ -	$ -	0.699	$ -
20	$ -	$ -	$ 40,600	$ 40,600	0.686	$ 27,864
21	$ -	$ -	$ -	$ -	0.674	$ -
22	$ -	$ -	$ 15,600	$ 15,600	0.661	$ 10,311
23	$ -	$ -	$ -	$ -	0.649	$ -
24	$ -	$ -	$ 15,600	$ 15,600	0.637	$ 9,930
25	$ -	$ -	$ 25,000	$ 25,000	0.625	$ 15,617
26	$ -	$ -	$ 15,600	$ 15,600	0.613	$ 9,564
27	$ -	$ -	$ -	$ -	0.602	$ -
28	$ -	$ -	$ 15,600	$ 15,600	0.590	$ 9,210
29	$ -	$ -	$ -	$ -	0.579	$ -
30	$ -	$ -	$ 40,600	$ 40,600	0.569	$ 23,084
TOTALS	**$ 34,400**	**$ -**	**$ 384,000**	**$ 418,400**		**$ 319,200**

TABLE G.4
ALTERNATIVE 3 CAPPING
COST BREAKDOWN
FTMM-57
FORT MONMOUTH, NEW JERSEY

Item		Units		Unit Cost		Extended
Capital						
LUCs capital cost	1	Lump Sum	$	34,400	$	34,400
Planning, Oversight, Scheduling, Meetings, Scope Preparation, Documents	1	Lump Sum	$	86,300	$	86,300
Demolition, earthwork, paving, waste management	1	Lump Sum	$	131,300	$	131,300
Reporting	1	Lump Sum	$	37,500	$	37,500
Note: 25% Contingency rolled into unit cost						
				Capital Total	**$**	**289,500**
Periodic Costs (biennial - every 2 years)						
Inspect & monitor LUCs to ensure restricted use of, or access	1	each	$	2,500	$	2,500
Reporting & long-term management	1	each	$	10,000	$	10,000
Cap maintenance	1	each	$	12,000	$	12,000
Contingency	25%				$	6,100
		2-Year Periodic Costs Total			**$**	**30,600**
Periodic Costs (every 5 years)						
Update/verify CEA and Deed Notice, inspect ECs	1	each	$	5,000	$	5,000
Five-Year Review and Reporting	1	each	$	20,000	$	20,000
Contingency	25%				$	6,300
		5-Year Periodic Costs Total			**$**	**31,300**

Assumptions:
LUCs have a duration of 30 years

TABLE G.5
ALTERNATIVE 3 CAPPING
PRESENT VALUE
FTMM-57
FORT MONMOUTH, NEW JERSEY

Year	Capital Cost ($)	Annual O&M ($) (LUCs)	Periodic Costs ($)	Total Cost	Discount Factor at 1.9%	Present Value at 1.9%
Annual Cost for Remedial Alternatives - Anticipated 30-Year Duration						
0	$ 289,500	$ -	$ -	$ 289,500	1.000	$ 289,500
1	$ -	$ -	$ -	$ -	0.981	$ -
2	$ -	$ -	$ 30,600	$ 30,600	0.963	$ 29,470
3	$ -	$ -	$ -	$ -	0.945	$ -
4	$ -	$ -	$ 30,600	$ 30,600	0.927	$ 28,381
5	$ -	$ -	$ 31,300	$ 31,300	0.910	$ 28,489
6	$ -	$ -	$ 30,600	$ 30,600	0.893	$ 27,333
7	$ -	$ -	$ -	$ -	0.877	$ -
8	$ -	$ -	$ 30,600	$ 30,600	0.860	$ 26,323
9	$ -	$ -	$ -	$ -	0.844	$ -
10	$ -	$ -	$ 61,900	$ 61,900	0.828	$ 51,281
11	$ -	$ -	$ -	$ -	0.813	$ -
12	$ -	$ -	$ 30,600	$ 30,600	0.798	$ 24,414
13	$ -	$ -	$ -	$ -	0.783	$ -
14	$ -	$ -	$ 30,600	$ 30,600	0.768	$ 23,512
15	$ -	$ -	$ 31,300	$ 31,300	0.754	$ 23,602
16	$ -	$ -	$ 30,600	$ 30,600	0.740	$ 22,644
17	$ -	$ -	$ -	$ -	0.726	$ -
18	$ -	$ -	$ 30,600	$ 30,600	0.713	$ 21,807
19	$ -	$ -	$ -	$ -	0.699	$ -
20	$ -	$ -	$ 61,900	$ 61,900	0.686	$ 42,483
21	$ -	$ -	$ -	$ -	0.674	$ -
22	$ -	$ -	$ 30,600	$ 30,600	0.661	$ 20,226
23	$ -	$ -	$ -	$ -	0.649	$ -
24	$ -	$ -	$ 30,600	$ 30,600	0.637	$ 19,478
25	$ -	$ -	$ 31,300	$ 31,300	0.625	$ 19,552
26	$ -	$ -	$ 30,600	$ 30,600	0.613	$ 18,759
27	$ -	$ -	$ -	$ -	0.602	$ -
28	$ -	$ -	$ 30,600	$ 30,600	0.590	$ 18,066
29	$ -	$ -	$ -	$ -	0.579	$ -
30	$ -	$ -	$ 61,900	$ 61,900	0.569	$ 35,194
TOTALS	**$ 289,500**	**$ -**	**$ 646,800**	**$ 936,300**		**$ 770,600**

TABLE G.6

ALTERNATIVE 3 DETAILED CAPITAL COST BREAKDOWN FOR ASPHALT CAP

FEASIBILITY STUDY COST SUMMARY FTMM-57 FORT MONMOUTH, NEW JERSEY

	Labor					Subcontractors						
Professional Category	**Senior Level**	**Mid Level**	**Junior Level**	**Total**	**Total**	**Sub**	**Quantity**	**Units**	**Unit Rate**	**Total**	**Number**	**Total Capitol Cost**
Approximate Billing Rate ($/hr)	**$130**	**$100**	**$75**	**Hours**	**Labor**	**Hours**				**Subs**	**of Events**	
Planning, Direction, Oversight, Scheduling, Meetings, Scope Preparation, and Planning Documents												
Planning, Direction, and Oversight	10	12	16	38	$ 3,700						1	$ 4,000
Schedule Preparation, Implementation, and Meetings	12	6	6	24	$ 2,610						1	$ 3,000
Scope Preparation/Permitting	8	180	120	40	$ 28,040						1	$ 29,000
Remedial Action WP/UFP-QAPP/APP/SSHP/QASP	12	100	120	232	$ 20,560						1	$ 21,000
Finalize RAWP and Submit to Regulators	6	40	88	134	$ 11,380						1	$ 12,000
Planning Subtotal	**48**	**338**	**350**	**736**	**$ 66,290**							**$ 69,000**
Demolition, Earthwork, Paving and Offsite Disposal												

		Material		Labor		Equipment		Other		Totals	
Description of Work	**Quantity**	**Unit Rate**	**Material Total**	**Unit Rate**	**Labor Total**	**Unit Rate**	**Equip. Total**	**Unit Rate**	**Other Total**	**Unit Rate**	**Amount**
Site Preparation	24,304 SF	$ 1.50	$ 36,456	$ 0.14	$ 3,403	$ 0.27	$ 6,562	$ 0.09	$ 2,187	$ 1.99	$ 49,000
Asphalt Paving	24,304 SF	$ 1.73	$ 42,046	$ 0.17	$ 4,132	$ 0.12	$ 2,916	$ 0.27	$ 6,562	$ 2.30	$ 56,000
Demo, Earthwork, Paving Subtotal			**78,502**		**7,534**		**$ 9,479**		**$ 8,749**		**$ 105,000**

	Labor					Subcontractors						
Professional Category	**Senior Level**	**Mid Level**	**Junior Level**	**Total**	**Total**	**Sub**	**Quantity**	**Units**	**Unit Rate**	**Total**	**Number**	**Total Capitol Cost**
Approximate Billing Rate ($/hr)	**$130**	**$100**	**$75**	**Hours**	**Labor**	**Hours**				**Subs**	**of Events**	
Reporting												
Draft Report Preparation on Excavation	40	60	88	200	$ 17,800						1	$ 18,000
Incorporate Comments from FTMM and USACE	12	20	32	60	$ 5,960						1	$ 6,000
Finalize Report and Submit to Regulators	10	20	24	40	$ 5,100						1	$ 6,000
Reporting Subtotal	**62**	**100**	**144**	**306**	**$ 28,860**							**$ 30,000**
Alternative 3 Capping Subtotal												***$ 204,000***
Contingency (25%)												***$ 51,000***
Alternative 3 Capping Total												**$ 255,000**

TABLE G.7

ALTERNATIVE 4 DETAILED CAPITAL COST BREAKDOWN FOR SOURCE REMOVAL

FEASIBILITY STUDY COST SUMMARY FTMM-57 FORT MONMOUTH, NEW JERSEY

	Labor					Subcontractors					
Professional Category	**Senior Level**	**Mid Level**	**Junior Level**	**Total**	**Total**	**Quantity**	**Units**	**Unit Rate**	**Total**	**Number**	**Total Capitol**
Approximate Billing Rate ($/hr)	**$130**	**$100**	**$75**	**Hours**	**Labor**				**Subs**	**of Events**	**Cost**
Planning, Direction, Oversight, Scheduling, Meetings, Scope Preparation, and Planning Documents											
Planning, Direction, and Oversight	10	12	16	38	$ 3,700					1	$ 3,700
Schedule Preparation, Implementation, and Meetings	12	6	6	24	$ 2,610					1	$ 2,610
Scope Preparation/Permitting	8	180	120	40	$ 28,040					1	$ 28,040
Flood Hazard Area Control Act Rules Permit preparation and filing						1	lump sum	$ 3,000	$ 3,000	1	$ 3,000
Coastal Area Facility Review Act permit preparation and filing						1	lump sum	$ 3,000	$ 3,000	1	$ 3,000
Remedial Action Work Plan/UFP-QAPP/APP/SSHP/QASP	12	100	120	232	$ 20,560					1	$ 20,560
Finalize RAWP and Submit to Regulators	6	40	88	134	$ 11,380					1	$ 11,380
Subtotal	**48**	**338**	**350**	**736**	**$ 66,290**						**$ 72,290**
Excavation and Offsite Disposal											
Mobilization/Set-up/Demobilization	2	6	12	20	$ 1,760	1	lump sum	$ 5,000	$ 5,000	1	$ 6,760
Utility Clearance		4	8	12	$ 1,000	1	day	$ 2,000	$ 2,000	1	$ 3,000
Surveying (pre excavation)		4	8	12	$ 1,000	1	day	$ 2,500	$ 2,500	1	$ 3,500
Perimeter Air Monitoring and Dust Control						1	lump sum	$ 1,500	$ 1,500	1	$ 1,500
Excavation & Disposal											
excavation/segregation/stockpiling	2	12	16	30	$ 2,660	1710	ton	$ 32	$ 54,720	1	$ 57,380
sorting/loading		6	8	14	$ 1,200	1	lump sum	$ 2,500	$ 2,500	1	$ 3,700
transport & disposal of excavated non-hazardous		6	6	12	$ 1,050	1710	ton	$ 90	$ 153,900	1	$ 154,950
waste characterization/profiling/tracking	2	6	8	16	$ 1,460					1	$ 1,460
Confirmation Sampling											
sample collection	1	4	8	13	$ 1,130					1	$ 1,130
Data Management		4	8	12	$ 1,000					1	$ 1,000
excavation (bottom and sidewalls) confirmation soil sampling						33	sample	$ 200	$ 6,600	1	$ 6,600
soil stockpile waste characterization suite						2	sample	$ 600	$ 1,200	1	$ 1,200
Backfill											
oversight of backfill operations	1	6	12	19	$ 1,630					1	$ 1,630
soil fill import (transport, placement, testing)		2	6	8	$ 650	1710	ton	$ 50	$ 85,500	1	$ 86,150
import material sampling suite						2	sample	$ 450	$ 900		
Geotechnical Services			4	4	$ 300	1	lump sum	$ 2,000	$ 2,000	1	$ 2,300
Subtotal	**8**	**60**	**104**	**172**	**$ 14,840**				**$ 318,320**		**$ 332,260**
Reporting											
Draft Report Preparation on Excavation	10	20	36	200	$ 6,000					1	$ 6,000
Incorporate Comments from FTMM and USACE	4	6	16	60	$ 2,320					1	$ 2,320
Finalize Report and Submit to Regulators	4	8	24	40	$ 3,120					1	$ 3,120
Subtotal	**18**	**34**	**76**	**128**	**$ 11,440**						**$ 11,440**
Alternative 4 Excavation Subtotal											***$ 350,460***
Contingency (25%)											***$ 87,615***
Alternative 4 Excavation Total	**74**	**432**	**530**	**1,036**	**$ 92,570**				**$ 318,320**		**$ 415,990**