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REMEDIAL BUREAU A

LETTER OF TRANSMITTAL

DATE: April 12, 2012

TO: Mr. Chek Beng Ng, P.E.
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 11th Floor
Albany, New York 12233-7015

FROM: Michael Moore

RE: Final Remedial Investigation/Interim Remedial Action Report and Human Health Risk Assessment
Niagara Falls Armed Forces Reserve Center

PARS PROJECT NO: 773-04

Enclosed please find: _X_ Report __ Letter __ Proposal __ Other

No. of Copies Enclosed: 1

This is being sent to you: __ For approval X For your use __ For Completion

Enclosed please find one hard copy of Volume I of the Final Remedial Investigation/Interim Remedial Action Report and Human Health Risk Assessment for the Niagara Falls US Armed Forces Reserve Center. I have also enclosed a CD with a copy of Volume I and Volume II.

NYSDEC comments have been addressed and incorporated into the final report. Additionally, responses to the comments are included in Appendix J. The only recommendation that was not implemented was the addition of insert tables to the figures. Because of the scale of the figures and the close proximately of sample locations, it was determined that adding tables would result in cluttered maps.

If you have any questions or comments, please do not hesitate to contact me at 609-890-7277.

Sincerely,

PARS Environmental, Inc.

Michael Moore, PG
Senior Project Manager

cc: Ms. Laura Dell'Olio, USAR, 99th RSC (2 copies)
Mr. Lenard Gunnell, USACE (1 copy)
Mr. Nathan Freeman, NYSDOH (1 copy)

PARS
Environmental
Inc.

FINAL - REMEDIAL INVESTIGATION/ INTERIM REMEDIAL ACTION REPORT AND HUMAN HEALTH RISK ASSESSMENT

Niagara Falls Armed Forces Reserve Center
9400 Porter Road
Niagara Falls, NY

VOLUME I OF II

Contract No. W912QR-11-D-0022
Delivery Order No. 001 (Item No. 0004)

PREPARED FOR
U.S Army Corps of Engineers-Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, KY 40202

PREPARED BY
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PARS PROJECT NO. 773-04

APRIL 2012

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VOLUME I OF II

STATEMENT OF TECHNICAL REVIEW

PARS Environmental, Inc. has completed the Final Remedial Investigation/Interim Remedial Action Report and Human Health Risk Assessment for the Niagara Falls Armed Forces Reserve Center (AFRC).

Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy, principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures and materials used in analyses; the appropriateness of data used and level of data obtained; and reasonableness of the results including whether the product meets the customer's needs consistent with the law and existing US Army Corp policy.

Significant concerns and explanation of the resolutions are documented within the project file. As noted above, all concerns resulting from the independent technical review of the project have been considered.

4/11/12

Senior Project Manager
Michael D. Moore, P.G.

Date

Thomas P. Dobinson

4/11/12

Independent Technical Review Team Leader
Thomas P. Dobinson

Date

1.0 INTRODUCTION

The United States Corps of Engineers (USACE), Louisville District has retained the services of PARS Environmental, Inc. (PARS), under Contract No. W912QR-11-D-0022, Delivery Order No. 001, to conduct a remedial investigation (RI), human health risk assessment (HHRA), feasibility study and interim remedial action (IRA) at the Niagara Falls Armed Forces Reserve Center (AFRC). The AFRC is located at 9400 Porter Road in Niagara Falls, New York, hereinafter the "Site." A Site Location Map and Site Plan are included as Figure 1 and Figure 2, respectively.

On August 21, 2011, a notice of 30 day period for comment was advertised in the Buffalo News for the remedial investigation at the Site. The public notice completed in accordance with Section 120 (h) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCA). A document repository for public review of files related to the investigation was established at the Niagara Falls Public Library located in Niagara Falls, New York. No public comments were received pertaining to the Site. The public notice ad proof is included in Appendix I.

An investigation was conducted of soil and groundwater in the vicinity of six former underground storage tanks (USTs), former vehicle fueling area and the cast iron fire protection main that discharged to a 24-inch corrugated metal storm sewer line on the eastern boundary of the Site. The scope of work completed for this project was based on the approved Quality Assurance Project Plan (QAPP)/Sampling Plan (PARS, September 2011). The investigation was performed to investigate a potential source of the discharge that occurred at Outfall No. 5 into the drainage swale at the southeast corner of the Site in 2008 (see Section 2.7).

The New York State Department of Environmental Conservation (NYSDEC) was notified on June 24, 2008 and Spill # 0803478 was assigned for the discharge

An IRA in the area of the fire protection main was also performed based on the findings of the site inspection conducted in November and December 2010. Residual product was observed within the fill material in an exploratory excavation (TP-12) installed adjacent to the 24-inch corrugated metal storm sewer line. A sample of impacted groundwater was collected and several compounds, including polychlorinated biphenyls (PCBs), were detected at concentrations exceeding the New York State Department of Environmental Conservation (NYSDEC) Class GA Objectives. The IRA included the removal of approximately 50 tons of soil, as well as residual product and groundwater with a visible sheen.

Based on the findings of the remedial investigation, a HHRA was performed. The objective of the HHRA was to evaluate potential risks to human health under current and reasonably foreseeable future conditions. The risk assessment was completed in accordance with the regulations and guidelines set forth by the United States Environmental Protection Agency (USEPA) and the USACE. Additionally, a feasibility study/remedial action alternatives evaluation was performed to evaluate remediation at the Site.

On March 23, 2012, NYSDEC and the NY Department of Health (NYDOH) issued comments on the draft RI/IRA/HHRA Report. Comments have been incorporated into the final report. A copy of the letter from NYSDEC and responses are included in Appendix J.

2.0 BACKGROUND

2.1 SITE SETTING

The Niagara Falls AFRC is an approximate 19.5 acre parcel located on the southern portion of Niagara Township, in Niagara Falls, Niagara County, New York. The Site is bound to the south by Porter Road and the property located immediately south of Porter Road is undeveloped forested land. Niagara Falls International Airport is located immediately north and east of the Site. Other properties in the vicinity of the Site are used primarily for commercial purposes.

2.2 TOPOGRAPHY AND DRAINAGE

The Site is located on the USGS 7.5-minute Tonawanda West topographic map. Topography at the Site is relatively flat with a slight gradient to the west/southwest. The elevation at the Site is approximately 575 feet above mean sea level.

The Site is located within the Niagara Watershed. Surface and storm water drainage is to Cayuga Creek located immediately west of the Site. Cayuga Creek is an intermittent tributary of the Niagara River. Storm sewer lines, drainage swales and outfalls are depicted in Figure 2.

2.3 CLIMATE

According to the National Oceanic and Atmospheric Administration (NOAA), the average monthly temperature ranges from 24.8º Fahrenheit in February to 71.6º Fahrenheit in July. The annual mean temperature is 47.8º Fahrenheit. The lowest temperature recorded in Niagara Falls was -15º Fahrenheit and the highest temperature was 97º Fahrenheit.

The average annual precipitation is 33.93 inches and the average monthly precipitation ranges from 2.32 inches in February to 3.52 inches in September.

2.4 GEOLOGY

The Site is located in the Erie-Ontario Lowlands Physiographic Province. The region is characterized by relatively flat topography and dissected by east-west trending escarpments. The Site is located about 5 miles south of the Niagara Escarpment (*Environmental Condition of Property Report*, CH2MHill, June 2007).

The Niagara Falls area is underlain by glacial sediment consisting mainly of till and lacustrine silt and clay, which is approximately 5 to 80 feet thick. The glacial deposits overlay weathered dolomite and limestone of the Lockport Group (Niagaran Series of Middle Silurian age). The Lockport Group is underlain by approximately 100 feet of shale and limestone (Clinton Group), which is underlain by 110 feet of sandstone and shale (Medina Group).

Soils encountered during the site inspection consisted of non-cohesive fill from 0 to 4 feet below ground surface (bgs). Fill material at some probe locations extended from 8 to 13 feet bgs. The fill material encountered was comprised of a coarse-grained mixture of sand and gravel with varying amounts of fine-grained silt and clay. Varying amounts of brick, slag, concrete, rebar, asphalt and wood were observed within this matrix. Native surficial soils are comprised of silty clay with trace fine sand. Borings were not advanced beyond 13 feet bgs as part of the inspection activities.

2.5 HYDROGEOLOGY

The Site is underlain by the Lakemont silty clay loam and the Fonda mucky silt loam. Both soil types are fine-to moderately fine-textured and have a low permeability. These soils are subject to ponding and the water table in the vicinity of the Site is at a depth of less than 4 feet bgs (*Environmental Condition of Property Report*, CH2MHill, June 2007).

The glacial deposits at the Site act as a confining unit for the weathered bedrock below. The hydraulic properties in the Lockport dolomite and limestone are related to secondary porosity and permeability owing to the presence of factures and solutioning. The main water-bearing zones in the Lockport Group are the weathered bedrock surface and horizontal fracture zones near stratigraphic contacts. The rock matrix transmits negligible amounts of groundwater because primary porosity is very low. The horizontal hydraulic conductivity of the weathered bedrock is estimated at 40 feet per day.

Groundwater was encountered at depths ranging from 2 to 6 feet bgs in soil probes and exploratory excavations during the site inspection. It is likely that the coarse-grained fill material overlying the less-permeable native fine-grained clay is creating the perched groundwater conditions at the Site.

2.6 HISTORY OF OPERATIONS

The United States Government acquired the Site in 1955 and the United States Navy used the Site to service helicopters and airplanes. Most of the buildings at the Site were constructed by 1956. The Army obtained the Site from the Navy in 1962. From 1970 to 1975, the Site was used to service Nike Missiles from missile batteries around the state of New York.

The Site was most recently occupied by the 277th Quartermaster Company, the 865th Combat Support Hospital, the 1982nd Forward Surgical Unit and Area Maintenance Support Activity 76. A small presence was also maintained by personnel of the Department of Public Works (DPW), Fort Drum, New York (*Environmental Condition of Property Report*, CH2MHill, June 2007). No personnel or units have occupied the Site as of September 15, 2011 per Base Realignment and Closure (BRAC) law.

2.7 PREVIOUS INVESTIGATIONS

A yellow substance was observed discharging from the 24-inch diameter corrugated storm sewer at outfall (Outfall No. 5) into the drainage swale at the southeast corner of the Site. An investigation was performed by United States Army Reserve (USAR) in 2008.

The New York State Department of Environmental Conservation (NYSDEC) was notified on June 24, 2008 and Spill # 0803478 was assigned for the discharge. Product was observed discharging from the 6-inch diameter cast iron fire protection main into the 24-inch diameter corrugated storm sewer and the 6-inch line was capped. The drain valve for the 6-inch line was uncovered and dislodged in June 2008. After dislodging the valve, product was observed in the excavated hole. A sample was collected and the product was identified as diesel fuel. PCBs were detected in the sample at a concentration of 2.1 mg/kg (Aroclor 1254).

As part of the investigation, a sediment sample was collected from the 24-inch diameter storm sewer adjacent to the cast iron pipe. A sample of the yellow substance was also collected from the drainage swale. The sample results revealed that the sediment in the pipe and the yellow substance present in the swale contained detectable levels of PCBs. PCB concentrations in the sediment and yellow substance were 220 mg/kg (Aroclor 1254) and 2.81 mg/kg (Aroclor 1254), respectively.

Storm Sewer and Drainage Swale Investigation/Remediation

The USACE and the USAR 99th Regional Support Command (99th RSC) retained the services of PARS to investigate and remediate the drainage swale at Outfall No. 5. The 24-inch diameter storm sewer was also cleaned as part of the remedial action. Approximately 134 tons of PCB impacted soil was excavated from the drainage swale.

PCB concentrations in the post-excavation soil samples at Outfall No. 5 and from the drainage swale were below the maximum contaminant level of 1 milligram per kilogram (mg/kg) that was established by the NYSDEC. Investigation and remediation activities are outlined in the *Remedial Action Report* (PARS, March 2010).

Site Inspection

Six USTs were reportedly present along the eastern and western sides of former Building 2. Additionally, a vehicle fueling area was located immediately west of the building. No documentation was available regarding the closure of these USTs and fueling area.

In November and December 2010, PARS conducted a site inspection to evaluate potential impacts associated with the former USTs at Building 2 and the fire protection main. Inspection activities consisted of a geophysical survey, exploratory excavations and soil and water sampling. The findings were outlined in the *Site Inspection Report* (PARS, June 2011).

The geophysical survey noted three anomalies identified as debris from former Building 2. An approximate 150-foot long linear anomaly was identified in the general vicinity of the fire protection main that terminates at the 24-inch diameter corrugated storm sewer line. No anomalies consistent with USTs were identified as part of the geophysical survey.

Twelve exploratory excavations (TP-1 through TP-12) were completed based on the findings of the geophysical survey, previous investigations and field observations. A soil sample for laboratory analysis was collected from TP-1. Several SVOCs were detected in the sample at concentrations exceeding the NYSDEC Unrestricted and Restricted Use Soil Cleanup Objectives.

The 6-inch diameter cast iron fire protection water main was encountered in six exploratory excavations (TP-2, TP-3, TP-4, TP-11 and TP-12). At TP-11, the 6-inch diameter pipe terminated at a concrete catch basin presumed to be the 500,000-gallon reservoir drain. A sample was collected from the water flowing from the 6-inch diameter line into the concrete catch basin. Several compounds including toluene, naphthalene, PCBs and chromium were detected in the water sample at concentrations exceeding the NYSDEC Class GA Objectives. Petroleum product and a heavy sheen was observed within the fill material and on the groundwater surface in one of the exploratory excavations (TP-12). Several compounds, including PCBs, were detected in a water sample collected from TP-12 at concentrations exceeding the NYSDEC Class GA Objectives. A drum vacuum was used to remove petroleum impacted water from the excavation.

Twenty-one soil probes were completed as part of the site inspection. One soil sample was collected from each probe for laboratory analysis. Acetone, metals and PCBs were detected in several samples at concentrations exceeding the Unrestricted Use Soil Cleanup Objective. Several metals were detected at concentrations exceeding the Restricted Use Soil Cleanup Objectives. Soil probe and test pit locations from the Site Inspection are shown on Figure 3.

PARS recommended conducting an investigation to further evaluate soil and groundwater impacts at the locations of the former USTs at Building 2 and in the vicinity of the fire protection main. Additionally, PARS recommended that the residual petroleum product observed within the fill material at TP-12 be removed part of an IRA because of the close proximately of the residual product to the 24-inch corrugated metal storm sewer line.

In September 2011, PARS submitted a QAPP/Sampling Plan for the RI/IRA to NYSDEC. Comments received from the NYSDEC Case Manager, Chek Ng, stated that fill material brought on-site may be the cause of the elevated concentrations for certain metals in the soil, which should nullify any concerns for high metal content in the soils. The origin of the fill material is unknown, but the fill material does contain some slag. Iron blast slag and open hearth slag from production of carbon steel is commonly found throughout western New York. Slag from steel production facilities in the area was commonly used as fill material in the region. Comments received from NYSDEC are included in Appendix J.

3.0 SOIL INVESTIGATION

Prior to initiating the field activities, Dig Safe New York was contacted to locate the underground utilities in the public right-of-way. The soil investigation was performed as outlined in the approved QAPP/Sampling Plan. As instructed by USAR and based on NYSDEC workplan comments, metals were eliminated as a potential contaminant of concern at the Site because of regional fill material. Therefore, soil samples were not analyzed for metals.

3.1 SOIL INVESTIGATION METHODS

3.1.1 Soil Probes

Thirty soil probes (16 primary and 14 secondary) were completed on September 26, 27 and 28, 2011 using a Geoprobe 54 OUD track-mounted rig equipped with a pneumatic hammer. Soil boring locations are depicted in Figure 4. Soil probe logs are included in Appendix A.

The soil probes were advanced using direct-push methods via a 2-inch diameter, 48-inch long macro-core sampler that was driven continuously at 48-inch intervals. A dedicated acetate sampler liner was used between sampling intervals.

Material recovered in each acetate sample liner was field screened for total organic vapors using an OVM (MiniRAE 2000) equipped with a photo-ionization detector (PID) and a 10.6 eV ultraviolet lamp. The OVM used was calibrated daily in accordance with manufacturer's specifications using a gas standard of isobutylene at an equivalent concentration of 100 parts per million (ppm). Ambient air at the Site was used to establish background organic vapor concentrations.

Following field screening, when sufficient sample recovery was obtained, representative portions of the recovered soils were placed in zip-lock bags for further classification and headspace analysis. The headspace in the bag above each collected soil sample was screened for total organic vapors. With the exception of the headspace sample result of 38.6 parts per million (ppm) measured at SP-49 from 0-4 feet bgs, total organic vapor concentrations were non-detect in the headspace screening of the soil samples collected during the investigation.

Two soil samples were selected for submittal to the laboratory from each of the 30 probes completed. One sample was collected from the upper 4 feet and a second sample was collected from an interval between 4 feet and the bottom of the probe. Soil samples collected from the primary soil probe locations were submitted for TCL VOCs, TCL SVOCs and PCBs analysis. Soil samples from the secondary soil probe locations were submitted to the laboratory and placed on hold. Secondary soil probe samples were analyzed at select locations based on the results from the primary soil sample locations. Samples were each given a unique sample designation [(e.g., SP-22-2-4 = SP (soil probe); 22 (sample location); 2-4 (sample depth in feet)].

Upon probe completion, the soil probe holes were backfilled with the soil cuttings.

3.1.2 Outfall Soil Sampling

At the request of NYSDEC, a surface soil sample was collected at the discharge location of Outfall 4 on September 27, 2011. The soil sample was collected immediately below the vegetative cover at the discharge location within the drainage swale along Porter Road. No standing water was present in the swale at the time of sampling and there was no flow from Outfall 4. The sample was analyzed for TCL VOCs, TCL SVOCs and PCBs. The location of the soil sample collected at the outfall is depicted in Figure 4.

3.2 SOIL SAMPLE RESULTS

Findings of the laboratory testing of the soil samples analyzed are presented in the following subsections. An analytical results summary table is included in Table 1. The analytical results for the soil samples are summarized on Table 2. The analytical laboratory reports are provided in Volume II.

The analytical test results for the soil samples were compared to:

- NYSDEC, 6 NYCRR, Subpart 375-6, Unrestricted Soil Cleanup Objectives (USCOs) and Commercial Soil Cleanup Objectives (CSCOs), effective December 14, 2006; and
- NYSDEC Final Commissioners Policy, CP-51, Supplemental Soil Cleanup Objectives (SSCOs) dated October 21, 2010 (CP-51 SCGs).

3.2.1 Soil Probes

Volatile Organic Compounds

Acetone was detected in soil sample SP-23-2-4 at a concentration of 60 micrograms per kilogram (µg/kg) which slightly exceeds the USCO for the compound of 50 µg/kg. Acetone did not exceed the CSCO for the compound of 500,000 µg/kg. Acetone is a common laboratory contaminant and is not considered a contaminant of concern at the Site. All other detected VOCs were at concentrations below their respective USCOs and CSCO.

Based on primary soil sample results, secondary soil probe samples were not submitted for VOC analysis.

Semi-volatile Organic Compounds

Several SVOCs were detected at concentrations exceeding their respective USCO in soil samples SP-25-2-4 and SP-25-6-8. Dibenzo(a,h)anthracene and benzo(a)pyrene were also detected at concentrations exceeding their respective CSCO in these two samples.

Six SVOCs were detected at concentrations exceeding their respective USCO in soil sample SP-29-1-3. Benzo(a)pyrene was also detected at a concentration exceeding the CSCO in this sample. Benzo(b)fluoranthene was detected at a concentration exceeding the USCO in SP-37-1-3.

Based on primary soil sample results, 6 secondary soil probe samples (SP-41-1-3, SP-41-6-8, SP-50-1-3, SP-50-6-8, SP-51-1-3, and SP-51-6-8) were taken of hold and tested for SVOCs. No SVOCs were detected in these secondary soil probe samples at concentrations exceeding the respective USCO.

Polychlorinated Biphenyls

Total PCB concentrations exceeding the USCO of 100 µg/kg were identified in the following 5 samples; SP-28-1-3 (1,100 µg/kg), SP-29-1-3 (320 µg/kg), SP-30-1-3 (150 µg/kg), SP-32-2-4 (410 µg/kg) and SP-33-0-2 (940 µg/kg). The concentration of PCBs detected at SP-28-1-3 (1,100 µg/kg) also exceeds the CSCO of 1,000 µg/kg.

Based on primary soil sample results, 8 secondary soil probe samples (SP-41-1-3, SP-41-6-8, SP-47-1-3, SP-47-6-8, SP-50-1-3, SP-50-6-8, SP-51-1-3, and SP-51-6-8) were taken of hold and tested for PCBs. PCBs were not detected above MDLs in the 8 secondary soil probe samples.

3.2.2 Outfall Sampling

Volatile Organic Compounds

VOCs were not detected above MDLs in the soil sample from Outfall 4.

Semi-Volatile Organic Compounds

Nine SVOCs were detected at concentrations exceeding the respective USCO and 5 SVOCs were detected at concentrations exceeding the respective CSCO.

Polychlorinated Biphenyls

Total PCBs were detected in the outfall sample at a concentration of 210 µg/kg, which exceeds the USCO for the compound of 100 µg/kg. PCBs were not detected in the sample above the CSCO of 1,000 µg/kg, which was the cleanup objective established by NYSDEC for the previous remediation of the drainage swale.

4.0 GROUND WATER INVESTIGATION

The groundwater investigation was performed as outlined in the approved QAPP/Sampling Plan. As instructed by USAR and based on correspondence with NYSDEC workplan comments, metals were eliminated as a potential contaminant of concern at the Site because of regional fill material. Therefore, groundwater samples were not analyzed for metals.

4.1 SAMPLE METHODS

On September 26 and 27, 2011, nine temporary microwells were installed in the open probe-holes at SP-22, 25, 30, 32, 34, 36, 42, 46 and 49. The locations of the temporary microwells are depicted in Figure 4.

The microwells were constructed using one-inch diameter Schedule 40 PVC casing and screen. Groundwater was encountered in temporary microwells at a depth of 3-4 feet bgs. A peristaltic pump was used to purge the microwells prior to sampling to remove suspended particulates and to ensure that a representative groundwater sample was collected. Microwells located at SP-36, SP-42 and SP-49 were not purged due to limited recharge.

Eight groundwater samples were collected from the 9 temporary microwells using disposable Teflon© bailers. The temporary microwell installed at soil probe location SP-46 was dry following several attempts to collect a sample. Groundwater samples from SP-22, SP-25, SP-30, SP-32, SP-36 were analyzed for VOCs, SVOCs, and PCBs. Samples collected at SP-42 and SP-49 were not analyzed for SVOCs and PCBs due to insufficient groundwater recharge.

4.2 SAMPLE RESULTS

Findings of the laboratory testing of the soil samples analyzed are presented in the following subsections. An analytical results summary table is included in Table 1. The analytical results for the groundwater samples are summarized on Table 3. The analytical laboratory reports are provided in Volume II.

The analytical test results for the groundwater samples were compared to:

- NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations dated October 1993; Revised June 1998; ERRATA Sheet dated January 1999; and Addendum dated April 2000 (Class GA criteria).

Volatile Organic Compounds

Benzene was detected at SP-49 and trichlorofluoromethane was detected at SP-22 at concentrations slightly exceeding the respective Class GA criteria. No other VOCs were detected in the groundwater samples at concentrations exceeding the respective Class GA criteria.

Semi-Volatile Organic Compounds
Four SVOCs were detected at concentrations exceeding the respective Class GA criteria at 3 locations (SP-22, SP-25 and SP-34). These compounds are benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene.

Polychlorinated Biphenyls
Total PCBs were detected in groundwater samples from locations SP-30, SP-32 and SP-36 at concentrations exceeding the Class GA Criteria for the compound of 0.09 µg/kg. PCB concentrations in these three samples were 0.77 µg/kg (SP-30), 3 µg/kg (SP-32), and 13 µg/kg (SP-36). PCBs were not detected in the other groundwater samples at concentrations above the laboratory MDL.

5.0 INTERIM REMEDIAL ACTION

5.1 INTERIM REMEDIAL ACTION METHODOLOGY

On September 29, 2011, PARS performed IRA activities at the Site. Photographs taken during the IRA are included in Appendix B of this report.

As part of the IRA, an approximately 10-foot (north-south) by 12-foot (east-west) area was excavated to a depth of approximately 5 feet bgs in the vicinity of the former exploratory excavation, TP-12. Excavation boundaries are depicted in Figure 5.

Excavation activities were performed using a small track excavator. Approximately 6 to 12 inches of surficial stone material was removed and stockpiled for reuse as cover, following backfill of the excavation. Approximately 40 tons of soil was removed from the excavation and stockpiled within an impoundment made of polyethylene sheeting and hay bales. The soil pile was covered and secured using polyethylene sheeting upon completion of excavation activities. A waste composite sample was collected from the soil pile following excavation activities and analyzed for TCLP VOCs, SVOCs, metals, and PCBs, pH, and ignitability. Analytical results for the waste composite sample are included in Volume II.

During soil excavation activities, perched groundwater was observed at approximately 2 feet bgs. Perched groundwater exhibiting a surface sheen was pumped from the excavation using a vacuum truck operated by Environmental Service Group, Inc. (ESG) of Tonawanda, New York. Approximately 2,000-gallons of groundwater was removed from the excavation and properly disposed of at Covanta Energy in Niagara Falls, New York. Waste disposal documentation is included in Appendix C.

At the completion of soil removal activities, an approximate 8-foot long section of the 6-inch diameter cast iron fire protection main was removed from within the limits of the excavation. The open endsof the pipe were fitted with a Fernco and PVC cap prior to backfilling. The section of pipe that was removed appeared to be in good condition with no holes observed.

On December 8, 2011, the stockpiled soil from the excavation was loaded onto trucks and transported to the Allied Waste Niagara Falls Landfill, Division of Republic Services in Niagara Falls, New York. Disposal documentation is included in Appendix C.

The excavation was backfilled with approximately 40 tons of clay from Seven Springs Gravel Products, LLC in Batavia, New York. The clay backfill material was placed into the excavation in approximately 1-foot thick lifts and compacted using the bucket of the excavator. Once at grade, the gravel material initially removed was placed over the top of the backfilled excavation. Clean Fill documentation is provided in Appendix D.

5.2 CONFIRMATORY SOIL SAMPLING

Five confirmatory soil samples, four (4) sidewall samples and one (1) bottom of excavation sample, were collected from the excavation. The confirmatory soil samples were analyzed for TCL VOCs, TCL SVOCs and PCBs. The samples were analyzed for TCL VOCs, TCL SVOCs and PCBs. Sample locations are depicted in Figure 5.

VOCs, SVOCs and PCBs were not detected in the confirmatory samples at concentrations exceeding the applicable USCOs and CSCOs. The analytical results for the soil samples are summarized in Table 2. The analytical laboratory report is provided in Volume II.

6.0 TECHNICAL OVERVIEW

6.1 RELIABILITY OF ANALYTICAL DATA

A total of 47 soil samples, including one duplicate sample, were collected as part of the investigation and remediation. Forty-two (42) were collected as part of the investigation and five (5) confirmatory soil samples were collected as part of the interim remedial action. Nine groundwater samples, including one (1) duplicate sample were also collected during the investigation phase of the project.

The reliability of data generated for this report was evaluated and is presented in two sections. The first section addresses conformance with the field-sampling event and the second section addresses laboratory conformance during analysis of the samples.

The analytical test results for the soil samples were compared to NYSDEC, 6 NYCRR, Subpart 375-6, Unrestricted Soil Cleanup Objectives (USCOs) and Commercial Soil Cleanup Objectives (CSCOs), effective December 14, 2006; and NYSDEC Final Commissioners Policy, CP-51, Supplemental Soil Cleanup Objectives (October 21, 2010).

The analytical test results for the water samples were compared to NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations dated October 1993; Revised June 1998; ERRATA Sheet dated January 1999 and Addendum dated April 2000 (Class GA Objective).

6.1.1 Field Event Conformance

Field quality control and quality assurance procedures outlined in the *Quality Assurance Project Plan/Sampling Plan* (PARS, September 2011) were implemented as part of the project. These procedures included field calibration of equipment, field sampling procedures, field decontamination of equipment and sample management.

An OVM was used to field screen soils for total organic vapors. The OVM was calibrated daily in accordance with manufacturer specifications using a gas standard of isobutylene at an equivalent concentration of 100 ppm. Ambient air was used to establish background organic vapor concentrations.

Samples were collected in laboratory provided sample containers. The samples were immediately transferred to insulated coolers, provided by the laboratory, containing ice. A chain-of-custody form was used to trace the path of sample containers from the Site to the laboratory.

One field duplicate soil sample was collected to assess the variability of a matrix at a specific sampling point and to assess the reproducibility of the sampling method. The field duplicate sample was a separate aliquot of the same sample. Prior to dividing the sample into "sample" and "duplicate" aliquots, the samples were homogenized (except for the VOC aliquots). A duplicate sample of SP-34-6-8 was collected. The duplicate soil sample results are summarized in Table 2. Overall, detected compounds and concentrations were consistent for the sample and field duplicate sample.

One field duplicate groundwater sample was collected as part of the remedial investigation by alternately filling the laboratory sample containers during sample collection. A duplicate sample of SP-34-110926 was collected. The duplicate groundwater sample results are summarized in Table 3. Overall, detected compounds and concentrations were consistent for the sample and field duplicate sample.

A soil rinsate sample (rinsate-soil) and a groundwater rinsate sample (rinsate-groundwater) were collected as part of the remedial investigation by passing analyte-free water through the sampling equipment into sample containers. The rinsate samples were analyzed for TCL VOCs, TCL SVOCS and PCBs. No compounds were detected in the rinsate samples at concentrations above the laboratory method detection limits. Rinsate sample results are summarized in Table 2 and 3. The laboratory analytical results are included in Volume II.

Trip blanks were prepared by the laboratory and accompanied the groundwater samples. Two trip blanks were analyzed for TCL VOCs. Methylene chloride was detected in both of the trip blanks. Methylene chloride was detected at concentrations below the Class GA Objective and was not detected in any of the groundwater samples, which indicates laboratory contamination of the samples. Analytical results for the trip blanks are summarized in Table 3. The laboratory analytical results are included in Volume II.

6.1.2 Laboratory Conformance

Soil and groundwater samples were collected for laboratory analysis as part of the project. Laboratory analysis was performed by TestAmerica Laboratories in Amherst, New York (NY Certification # NY455). Samples were analyzed for TCL VOCs, TCL SVOCs and PCBs in accordance with United States Environmental Protection Agency (USEPA) methods as summarized in Table 1.

Laboratory instruments and equipment were calibrated following SW-846 analytical method protocols. Initial calibrations and calibration checks were performed at a frequency specified in each analytical method.

Method blanks and instrument blanks were used by the laboratory to evaluate data quality. The purpose of the method blank is to assess contamination introduced during sample preparation. Method blanks are prepared and analyzed in the same manner as the field samples. Instrument blanks are analyzed with field samples to assess the presence or absence of instrument contamination. The frequency of instrument blanks is defined by the analytical method. The laboratory reports provided by Test America Laboratories are included in Volume II. The laboratory reports were prepared in accordance with the New York Analytical Services Protocol (Category B deliverable).

Analytical results with analytes identified in both the method or instrument blanks and the field sample are qualified with a “B” qualifier. Compounds identified with a “B” qualifier in soil samples were chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, phenanthrene and benzo(g,h,i)perylene. Compounds identified in groundwater samples with a “B” qualifier were di-n-butyl phthalate and phenanthrene.

Analytical results qualified with a “J” qualifer indicate that the results are estimated. The concentration detected falls between the method detection limit (MDL) and the reporting limit (RL). The MDL is the lowest concentration that the instrument can detect an analyte and the RL is the lowest concentration at which an analyte can be detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

7.0 HUMAN HEALTH RISK ASSESSMENT

7.1 HHRA OBJECTIVES

The objective of the HHRA is to evaluate potential risks to human health under current and reasonably foreseeable future conditions. The risk assessment is consistent with the regulations and guidelines set forth by the USEPA and the USACE.

The evaluation of human health risks was divided into four major sections: hazard identification, exposure assessment, toxicity assessment and risk characterization. Risks were examined with respect to exposure to chemicals detected in subsurface soil and groundwater at the Site or under the influence of the Site.

7.2 IDENTIFICATION/SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The first step in the risk assessment process was to identify Site-related chemicals. Site-related chemicals selected for quantitative evaluation were defined as Chemicals of Potential Concern (CPCs). CPCs were identified based on analytical results collected as part of remedial investigation activities (see Sections 2.7, 3.0 and 4.0).

One surface soil sample was collected from Outfall 004 during the Remedial Investigation. This sample was not used in the risk assessment because SVOCs from the swale are not suspected to be from a point source release. The SVOCs detected in the sample from the drainage swale are commonly found in ditches that receive storm water runoff from asphalt paved surfaces. PCBs were detected in this sample at a concentration that exceeds the USCO for the compound of 100 µg/kg, but less than the cleanup objective established by the NYSDEC for the remediation of the swale of 1,000 µg/kg.

In addition to the samples collected during the Remedial Investigation, groundwater and subsurface soil samples collected during the Site Inspection in November 2010 (*Site Inspection Report*, PARS, June 2011) and post-excavation subsurface soil sample results collected in 2009 from the drainage swale excavation *(Remedial Action Report*, PARS, March 2010) were also used to evaluate subsurface CPCs. The drainage swale is dry most of the time; therefore, all post-excavation sample results from the ditch remediation were analyzed in the risk assessment as subsurface soil. Analytical result summary tables for samples used for the CPC selection are included in Appendix F.

7.3 INITIAL SCREENING

The analytical results from the sampling events were evaluated and compared to applicable regulatory standards. Compounds detected at concentrations above the applicable standards were selected as part of the initial screening process.

The following subsections outline the findings of the sampling events.

7.3.1 Soil

Soil sample results were compared to the applicable NYSDEC USCO and the NYSDEC CSCO, which are more stringent than the EPA RSL. A compound was selected for secondary screening if the concentration exceeded the USCO which are the more conservative cleanup objective. All soil samples collected were evaluated as subsurface soil, which is defined as any soil sample collected at a depth greater than 1.0 feet bgs.

The compounds that were detected at concentrations above the applicable USCO in subsurface soils were acetone, benzo(a)anthracene, dibenz(a,h)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and PCBs (Aroclor 1254 and Aroclor 1260). These compounds were selected for further evaluation as CPCs using the secondary screening process (see Section 7.4).

7.3.2 Groundwater

Groundwater sample results were compared to the NYSDEC Class GA criteria. The compounds that were detected at concentrations above the criteria were benzene, naphthalene, toluene, trichlorofloromethane, 2,4-dimethylphenol, 4-methylphenol, 2-methylnaphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, carbazole, chrysene, indeno(1,2,3-cd)pyrene, phenol and PCBs (Aroclor 1254 and 1260). These compounds were selected for further evaluation as CPCs using the secondary screening process (Section 7.4).

7.4 SECONDARY SCREENING

All compounds selected as part of the initial screening process, which were detected at concentrations above the applicable USCO, were carried into the secondary screening process. Evaluation of compounds for the secondary screening process is based on the guidelines set forth in the USEPA *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (RAGS).*

The frequency of detection, mean, range, and maximum detection concentration were calculated for each compound and media type. The frequency of detection was calculated by dividing the total number of samples collected during the sampling events by the total number of detections for each compound. The range is the minimum and maximum detected concentration for the compound for all sampling events.

The mean was calculated for each compound by adding the detected concentrations and dividing by the total number of samples. If the compound was not detected in the sample, one half the method detection limit was used. For field duplicate samples, the average compound concentration or one half the method detection limit was used for the sample location to calculate the mean. Samples denoted with the lab qualifier J and B were also used in the risk assessment. A description of these qualifiers is listed in Section 6.1.2.

The 95% upper concentration limit (UCL) was calculated using PRO UCL 4.1 Software developed by Lockheed Martin and the USEPA (*Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites)* using the appropriate statistical method based on the distribution of data. All detected and non-detected concentrations were included. In some cases, there was an insufficient number of detections and the 95% UCL could not be calculated for the compound.

Based on the distribution of statistical data for some of the groundwater and subsurface soil samples, the Pro UCL Software recommended using the 97.5% UCL, which yields a more conservative assessment. The results of the 95% and 97.5% UCL calculations are included in Appendix G.

The 95% UCL was used as the exposure point concentration (EPC) for each compound. The EPC is an estimate of the mean concentration of a compound found in a specific medium at an exposure point. If the compound was selected for additional analysis in the HHRA, the 95% UCL was used as the EPC for the rest of assessment. If the 95% UCL could not be determined, the maximum detected concentration for the compound was used as the EPC.

The maximum detected concentration for each compound identified as part of the initial screening process was compared to the respective Regional Screening Level (RSL) presented in the USEPA Regional Screening Tables. Groundwater samples were compared to the RSL Tapwater Supporting Table and subsurface soil samples were compared to the RSL Industrial Soil Table. The RSL is a chemical-specific, conservative, risk-based concentration for individual contaminants in air, drinking water and soil that may warrant further investigation or site cleanup. The RSL was used for the secondary screening selection to ensure a conservative assessment. RSL values and results of the secondary screening calculations are presented in Tables 4 and Table 5. CPCs identified as part of the secondary screening process are shown in Table 6.

7.4.1 Evaluation of Subsurface Soil Compounds

Based on the initial screening of subsurface soil samples, compounds evaluated using the secondary screening process were acetone, benzo(a)anthracene, dibenz(a,h)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, Aroclor 1254 and Aroclor 1260. The maximum detected concentration was compared to the RSL presented in the USEPA Regional Screening Tables for Industrial Soil. The RSL values are shown in Table 4.

Acetone was detected in 37 of the 52 subsurface soil samples at concentrations ranging from 0.0019 to 0.34 milligrams per kilogram (mg/kg). The 95% UCL was calculated to be 0.037 mg/kg using the 95% KM (Percentile Bootstrap) Method. The maximum detected concentration of 0.34 mg/kg was less than the industrial soil RSL for acetone of 630,000 mg/kg. Acetone is not considered a CPC at the Site.

Benzo(a)anthracene was detected in 43 of the 65 subsurface soil samples at concentrations ranging from 0.0034to 10.0 mg/kg. The 97.5% UCL was calculated using the KM Chebyshev Method and was determined to be 1.575 mg/kg. The maximum detected concentration of 10.0 mg/kg was greater than the industrial soil RSL for benzo(a)anthracene of 2.1 mg/kg. Therefore, benzo(a)anthracene is considered a CPC at the Site.

Dibenz(a,h)anthracene was detected in 15 of the 65 subsurface soil samples at concentrations ranging from 0.01 to 2.3 mg/kg. The 95% UCL was calculated using the KM Chebyshev Method and was determined to be 0.257 mg/kg. The maximum detected concentration of 2.3 mg/kg was greater than the industrial soil RSL for dibenz(a,h)anthracene of 0.21 mg/kg. Therefore, dibenz(a,h)anthracene is considered a CPC at the Site.

Chrysene was detected in 40 of the 65 subsurface soil samples at concentrations ranging from 0.0079 to 9.7 mg/kg. The 97.5% UCL was determined to be 1.54 mg/kg using the KM Chebyshev Method. The maximum detected concentration of 9.7 mg/kg was less than the industrial soil RSL for chrysene of 210 mg/kg. Chrysene is not considered a CPC at the Site.

Benzo(b)fluoranthene was detected in 49 of the 65 subsurface soil samples at concentrations ranging from 0.0045 to 14.0 mg/kg. The 97.5% UCL was determined to be 2.052 mg/kg using the KM Chebyshev Method. The maximum detected concentration of 14.0 mg/kg was greater than the industrial soil RSL for benzo(b)fluoranthene of 2.1 mg/kg. Benzo(b)fluoranthene is considered a CPC at the Site.

Benzo(k)fluoranthene was detected in 44 of the 65 subsurface soil samples at concentrations ranging from 0.0024-6.5 mg/kg. The 97.5% UCL was determined to be 0.966 mg/kg using the KM Chebyshev Method. The maximum detected concentration of 6.5 mg/kg was less than the industrial soil RSL for benzo(k)fluoranthene of 21.0 mg/kg. Benzo(k)fluoranthene is not considered a CPC at the Site.

Benzo(a)pyrene was detected in 40 of the 65 subsurface soil samples at concentrations ranging from 0.007 to 14.0 mg/kg. The 97.5% UCL was determined to be 1.992 mg/kg using the KM Chebyshev Method. The maximum detected concentration of 14.0 mg/kg was greater than the industrial soil RSL for benzo(a)pyrene of 0.210 mg/kg. Benzo(a)pyrene is considered a CPC at the Site.

Indeno(1,2,3-cd)pyrene was detected in 36 of the 65 subsurface soil samples at concentrations ranging from 0.0062 to 8.8 mg/kg. The 97.5% UCL was determined to be 1.131 mg/kg using the KM Chebyshev Method. The maximum detected concentration of 8.8 mg/kg was greater than the industrial soil RSL for indeno(1,2,3-cd)pyrene of 2.1 mg/kg. Indeno(1,2,3-cd)pyrene is considered a CPC at the Site.

Aroclor 1254 was detected in 27 of the 82 subsurface soil samples at concentrations ranging from 0.007 to 15.0 mg/kg. The 95% UCL was determined to be 1.241 mg/kg using the KM Percentile Bootstrap Method. The maximum detected concentration of 15.0 mg/kg was greater than the industrial soil RSL for Aroclor 1254 of 0.74 mg/kg. Aroclor 1254 is considered a CPC at the Site.

Aroclor 1260 was detected in 16 of the 82 subsurface soil samples at concentrations ranging from 0.025 to 1.6 mg/kg. The 95% UCL was determined to be 0.158 mg/kg using the KM Percentile Bootstrap Method. The maximum detected concentration of 1.6 mg/kg was greater than the industrial soil RSL for Aroclor 1260 of 0.74 mg/kg. Aroclor 1260 is considered a CPC at the Site.

7.4.2 Evaluation of Groundwater Compounds

Compounds evaluated as part of the secondary screening process for groundwater were benzene, naphthalene, toluene, trichlorofloromethane, 2,4-dimethylphenol, 4-methylphenol, 2-methylnaphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, carbazole, chrysene, indeno(1,2,3-cd)pyrene, phenol and PCBs (Aroclor 1254 and 1260). The maximum detected concentration was compared to the RSL presented in the USEPA Regional Screening Tables for tap water. The RSL values are shown in Table 5.

Benzene was detected in 1 of the 10 groundwater samples at a concentration of 1.6 µg/L. The 95% UCL was not calculated because only one distinct data value was in the data set. The maximum detected concentration of 1.6 µg/L was greater than the tap water RSL for benzene of 0.41 µg/L. Therefore, benzene is considered a CPC at the Site.

Naphthalene was detected in 2 of the 8 groundwater samples at concentrations of 3.8 to 13.0 µg/L. The 95% UCL was not calculated because only two distinct values were in the data set. The maximum detected concentration of 13.0 µg/L was greater than the tap water RSL for naphthalene of 0.14 µg/L. Therefore, naphthalene is considered a CPC at the Site.

Toluene was detected in 2 of the 10 groundwater samples at concentrations of 2.7 and 89.0 µg/L. The 95% UCL was not calculated because only two distinct values were in the data set. The maximum detected concentration of 89.0 µg/L was less than the tap water RSL for toluene of 2,300 µg/L. Therefore, toluene is not considered a CPC at the Site.

Trichlorofloromethane was detected in 2 of the 10 groundwater samples at concentrations of 1.75 and 6.3 µg/L. The 95% UCL was not calculated because only two distinct values were in the data set. The maximum detected concentration of 6.3 µg/L was less than the tap water RSL for trichlorofloromethane of 1,300 µg/L. Therefore, trichlorofloromethane is not considered a CPC at the Site.

2,4-Dimethylphenol was detected in 1 of the 8 groundwater samples at a concentrations of 3.7 µg/L. The 95% UCL was not calculated because only one distinct value was in the data set. The maximum detected concentration of 3.7 µg/L was less than the tap water RSL for 2,4-dimethylphenol of 730 µg/L. Therefore, 2,4-dimethylphenol is not considered a CPC at the Site.

4-Methylphenol was detected in 1 of the 8 groundwater samples at a concentration of 44.0 µg/L. The 95% UCL was not calculated because only one distinct value was in the data set. There is no tap water RSL for 4-methylphenol. In addition, no quantitative data exists from the USEPA for a toxicity assessment. Therefore, 4-methylphenol will not be included as a CPC at the Site.

2-Methylnaphthalene was detected in 1 of the 8 groundwater samples at a concentration of 16.0 µg/L. The 95% UCL was not calculated because only one distinct value was in the data set. The maximum detected concentration of 16.0 µg/L was less than the tap water RSL for 2-methylnaphthalene of 150 µg/L. Therefore, 2-methylnaphthalene is not considered a CPC at the Site.

Benzo(a)anthracene was detected in 2 of the 8 groundwater samples at concentrations of 0.44 and 8.3 µg/L. The 95% UCL was determined to be 3.653 µg/L using the Kaplan-Meier BCA Method. The maximum detected concentration of 8.3 µg/L was greater than the tap water RSL for benzo(a)anthracene of 0.029 µg/L. Therefore, benzo(a)anthracene is considered a CPC at the Site.

Benzo(b)fluoranthene was detected in 2 of the 8 groundwater samples at concentrations of 1.1 and 7.3 µg/L. The 95% UCL was determined to be 7.3 µg/L using the Kaplan-Meier BCA Method. The maximum detected concentration of 7.3µg/L is greater the RSL for benzo(b)fluoranthene of 0.029 µg/L. Therefore, benzo(b)fluoranthene is considered a CPC at the Site.

Carbazole was detected in 4 of the 8 groundwater samples at concentrations ranging from 0.41 to 92.0 µg/L. The 95% UCL was calculated using the 95% KM (t) Method and was determined to be 35.42 µg/L. There is no tap water RSL for carbazole. In addition, no quantitative data exists from the USEPA for a toxicity assessment. Therefore, carbazole will not be included as a CPC at the Site.

Benzo(a)pyrene was detected in 2 of the 8 groundwater samples at concentrations of 0.95 and 4.9 µg/L. The 95% UCL was not calculated because only two distinct values were in the data set. The maximum detected concentration of 4.9 µg/L was greater than the tap water RSL for benzo(a)pyrene of 0.0029 µg/L. Therefore, benzo(a)pyrene is considered a CPC at the Site.

Chrysene was detected in 5 of the 8 groundwater samples at concentrations ranging from 0.41 to 2.229 µg/L. The 95% UCL was calculated using the 99% KM Chebyshev Method and was determined to be 13.29 µg/L. When limited data are available or when the data are extremely variable, the 95% UCL can be greater than the highest detected concentration. Since the calculated UCL is unrealistic, the maximum detected concentration of 2.229 µg/L will be used as the EPC. The maximum detected concentration of 2.229 µg/L was less than the tap water RSL for chrysene of 2.9 µg/L. Therefore, chrysene is not considered a CPC at the Site.

Indeno(1,2,3-cd)pyrene was detected in 1 of the 8 groundwater samples at a concentration of 0.91 µg/L. The 95% UCL was not calculated because only one distinct value was in the data set. The maximum detected concentration of 0.91 µg/L is greater the RSL for indeno(1,2,3-cd)pyrene of 0.029 µg/L. Therefore, indeno(1,2,3-cd)pyrene is considered a CPC at the Site.

Phenol was detected in 1 of the 8 groundwater samples at a concentration of 330 µg/L. The 95% UCL was not calculated because only one distinct value was in the data set. The maximum detected concentration of 330 µg/L is less than the RSL for phenol of 11,000 µg/L. Therefore, phenol is not considered at CPC at the Site.

Aroclor 1254 was detected in 3 of the 8 groundwater samples at concentrations ranging from 1.7 to 6.1 µg/L. The 95% UCL determined to be 3.472 µg/L using KM(t) Method. The maximum detected concentration of 6.1 µg/L is greater the RSL for Aroclor 1254 of 0.034 µg/L. Therefore, Aroclor 1254 is considered a CPC at the Site.

Aroclor 1260 was detected in 5 of the 8 groundwater samples at concentrations ranging from 0.52 to 13.0 µg/L. The 95% UCL was calculated using the 97.5% KM (Chebyshev) method and was determined to be 12.29 µg/L. The maximum detected concentration of 13.0 µg/L is greater than the RSL for Aroclor 1260 of 0.034 µg/L. Therefore, Aroclor 1260 is considered a CPC at the Site.

7.5 SUMMARY OF CPC SELECTION

All compounds identified through the secondary screening process as CPCs will be considered in the risk assessment. A summary table showing the final selected compounds for each medium is shown in Table 6.

The CPCs identified in subsurface soil are benzo(a)anthracene, dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, Aroclor 1254 and Aroclor 1260.

The CPCs identified in groundwater are benzene, naphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, Aroclor 1254 and Aroclor 1260.

7.6 EXPOSURE ASSESSMENT

7.6.1 Characterization of Exposure Setting

An exposure assessment was conducted to identify the potential for human contact to compounds detected in soil and ground water at the Site. Current land use and future planned land use conditions were examined to evaluate actual and potential exposures. The physical and geologic conditions at the Site are described in Section 2.0.

7.6.2 Potentially Exposed Population

The Site is currently vacant and adjacent to an airport. Changes in the season do not affect the activities at the Site and there are no residential or recreational activities. The proposed future reuse within the impacted area includes a paved parking lot and commercial building. There is no anticipated future use of the Site for residential purposes. Therefore, residential populations will not be considered as part of the assessment. While a trespasser might gain access to the Site, they would not come into contact with subsurface soil or groundwater and will not be considered as part of the risk assessment. The Site is secured by a chain link fence and locked gate. Therefore, it is unlikely that a trespasser would gain access to the Site.

Based on types of current and future human activity and land use patterns in the vicinity of the Site, the following populations will be evaluated in the risk assessment: commercial/industrial workers and construction workers.

7.6.3 Identification of Exposure Pathway – Subsurface Soils

Release of potential compounds of concern in subsurface soil may result in exposure to individuals through three major pathways (direct contact, inhalation and ingestion).

7.6.3.1 Dermal Exposure through Direct Contact

Direct contact with contaminated soil through construction may result in dermal exposure. Both organic and inorganic compounds may be absorbed through the skin from exposure to soil. Future use of the Site is commercial/industrial; therefore, the potential exists for direct exposure by construction crews and other workers performing intrusive activities at the Site. Dermal exposure to subsurface soil by the construction worker and commercial/industrial worker will be considered as a pathway of concern.

7.6.3.2 Inhalation from Particulates

If the correct conditions exist, contaminated soils can become airborne resulting in exposure through inhalation.

While the Site does contain some vegetation and grass, there is a potential for land disturbance during construction activities that may allow soil particulates to become airborne. Based on this information, inhalation from soil particulates is considered a pathway of concern for future construction and commercial/industrial workers at the Site.

7.6.3.3 Incidental Ingestion

Incidental ingestion of soil can occur in adults by consuming or placing in one's mouth objects, food, cosmetics, cigarettes and hands that may have either come in direct contact with soil or been contaminated with soil particulates carried by the wind. Therefore, incidental ingestion is considered a pathway of concern and will be analyzed for the construction and commercial/industrial worker.

7.6.3.4 Vapor Intrusion to Indoor Air Pathway from Soil

Subsurface soil sample results were compared to the screening levels in the USEPA OSWER *Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance* (USEPA, 2002a). Compounds detected in subsurface soil samples do not have screening levels; therefore, vapor intrusion to indoor air from subsurface soils will not be considered in this risk assessment.

7.6.4 Identification of Exposure Pathway – Groundwater

Release of CPCs to groundwater may result in exposure to individuals through three major pathways, including ingestion of groundwater as a drinking source, inhalation of vapor phase chemicals through showering or bathing and dermal exposure through direct contact of groundwater.

7.6.4.1 Drinking Source

Contaminated water used for drinking or cooking can cause exposure to individuals and population. Drinking water at the Niagara Falls AFRC is derived from public water. In addition, incidental ingestion of exposed groundwater during construction activities or trenching would be extremely rare, sporadic and difficult to quantify. Therefore, the pathway of ingestion of groundwater is not a potential risk.

7.6.4.2 Inhalation of Volatiles through Bathing and Other Tasks or Exposed Groundwater

The relatively high temperature of water used for showering tends to produce rapid volatilization of chemicals from domestic water into the confined volume of a bathroom. The current and future use of the Site is for commercial/industrial use; therefore, the pathway of inhalation exposure through bathing and other domestic tasks is not a concern to the worker.

Since future use of the Site is industrial/commercial and depth to water varies from 2.0 to 6.0 feet bgs, it is possible for groundwater to be exposed during excavation and trenching work. Therefore, the pathway of inhalation will be considered for exposed groundwater to the construction worker.

Contaminants with molecular weights less than 200 g/mol and a Henry's Law constant greater than $1.0E^{-5}$ atm-m^3/mol have the highest potential for volatilization (EPA, 1996).

Only two of the eight CPCs identified in groundwater have molecular weights less than 200 g/mol and Henry’s Law Constant greater than $1.0E^{-5}$ atm-m^3/mol. Volatilization of contaminants from groundwater will be considered as a pathway of concern for benzene and naphthalene.

7.6.4.3 Dermal Exposure

Direct dermal exposure to groundwater can cause both inorganic and organic contaminants in water to be absorbed through the skin. Potential dermal exposure to groundwater could occur during drilling, excavation and other construction activities at the Site. Therefore, dermal exposure to groundwater to the construction worker will be considered as a pathway of concern.

7.6.4.4 Vapor Intrusion to Indoor Air from Groundwater

In accordance with USEPA OSWER *Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance* (USEPA, 2002a), benzene and naphthalene in groundwater were selected in the primary screening level as contaminants with potential toxic and volatile properties for vapor intrusion.

The maximum detected concentrations in groundwater samples for benzene and naphthalene were 1.6 and 8.4 ug/L, respectively. These concentrations were compared to the Tier II Screening Tables for target groundwater concentration. The target groundwater concentration is defined as the concentration corresponding to target indoor air concentration where the soil gas to indoor air attenuation factor is equal to 0.001 and partitioning across the water table obeys Henry’s Law.

The Tier II groundwater screening levels for benzene and naphthalene are 5.0 and 150 ug/L, respectively. Since the maximum detected concentrations of benzene and naphthalene in groundwater do not exceed these levels, vapor intrusion to indoor air from groundwater will not be considered in this risk assessment.

7.6.5 Summary of Exposure Pathways

A summary of potential exposure pathways at the Site is outlined in Table 7. After examining current and reasonably foreseeable future uses of the Site, as well as contaminated media and the nature of the contaminants, five pathways of exposure have been identified. These exposures are dermal exposure to subsurface soil and groundwater, inhalation of subsurface soil particulates, incidental ingestion of subsurface soil and inhalation of groundwater. The construction worker will be examined for all pathways. The industrial/commercial worker will be examined for exposure to subsurface soil via dermal exposure, inhalation of particulates and incidental ingestion.

7.6.6 Estimation of Exposure

Once potential exposure pathways and potentially-exposed populations have been identified, the degree of exposure must be estimated as part of the assessment. The degree of exposure is evaluated by determining the contaminant concentrations that the population may be exposed, as well as the duration of the exposure and exposure pathways. These steps are necessary to estimate the dose of the contaminant to the exposed individual. This analysis is presented in the following subsections.

7.6.6.1 Estimation of Exposure Point Concentrations

To quantitatively estimate the risk of exposure to an individual, the concentration of the CPC must be known or estimated. This concentration is referred to as the EPC.

The EPC calculations follow the guidance of USEPA regulations, which recommends using the 95 % UCL of the mean concentration. The 95% UCL was calculated using the recommended PRO UCL 4.0 software. EPC values are shown in Section 7.4.1 and 7.4.2. All calculations are included in Appendix G. For data sets that could not be tested for normality due to the small sample size, the maximum detected concentration was used as the EPC. The EPCs for all CPCs are included in Table 4 and Table 5.

Quantitative exposure estimates are derived by combining EPCs with information describing the extent, frequency and duration of exposure for each receptor of concern. An overview of the approach used to quantify exposures is presented in the following subsection. The approach is consistent with guidance provided by the USEPA.

7.6.6.2 Reasonable Maximum Exposure

Based on USEPA risk assessment guidance, exposures are quantified by estimating the Reasonable Maximum Exposure (RME) associated with each pathway of concern. The RME is the maximum exposure that is reasonably expected to occur at a site under both current and future land-use conditions. The RME or intake estimate for a given pathway is derived by combining the EPC for each compound with reasonable maximum values describing the extent, frequency and duration of exposure (USEPA, 1989b). The RME is intended to place a conservative upper-bound limit on the potential risk.

The general equation used for calculating chemical intake in this risk assessment is:

$$\text{Intake} = \frac{C \times CR \times RAF \times EF \times ED}{BW \times AT \times CF}$$

Where:

Intake	daily intake averaged over the exposure period
C	concentration of the chemical in the exposure medium (EPC)
CR	contact rate for the medium of concern
RAF	relative absorption factor
EF	exposure frequency

ED	duration of exposure
BW	body weight of the exposed individual (estimated)
AT	average timing (for carcinogens, 70 years, for non-carcinogens, the equivalent of the exposure duration)
CF	units conversion factor (365 days/year)

Intake calculations were performed for the construction worker and commercial/industrial worker at the Site. In accordance with the RAGS guidelines and to ensure a conservative estimation for the commercial/industrial worker, the exposure frequency was 250 days. The exposure duration was 25 years. For the construction worker, the exposure frequency was 180 days and the exposure duration was 0.5 years. The average time period for lifetime exposure was 70 years (25,550 days) for carcinogenic risk. The body weight used for an adult is 70 kilograms, which is the standard default value for body weight. Additional values specific to each pathway are detailed in the next subsection.

7.6.7 Calculation of Intake

Below are the equations used to calculate total intakes for the identified potential pathways.

Dermal exposure from subsurface soil (worker)

$$DA_{event} = C_{soil} \text{ x } CF \text{ x } AF \text{ x } ABS_d$$

$$\text{Dermal absorbed dose (mg/kg-day)} = \frac{DA \text{ x } EF \text{ x } ED \text{ x } EV \text{ x } SA}{BW \text{ x } AT}$$

DA	Absorbed dose per event (mg/cm^2-event)
C_{soil}	Chemical concentration (EPC in mg/kg)
CF	Conversion factor
AF	Soil to Skin Adherence Factor
ABS	Absorption Factor
EF	Exposure frequency (days/year)
ED	Exposure duration (years)
EV	Event frequency (events/day)
SA	Skin surface area available for contact
BW	Body weight
AT	Averaging Time

The EPC was expressed in mg/kg and varied for each specific compound. The skin surface available for contact by a worker assumed exposure of the head, hands and arms of an adult male (3,300 cm^2) as recommended by RAGS. The soil to skin adherence factor was assumed to be 0.2 mg/cm^2 for the industrial worker and 0.3 mg/cm^2 for the construction worker. (RAGS, Part E-Exhibit 3-5 and the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, USEPA 2002). The absorption factor (ABS) value varies for each compound and was obtained from the Regional Screening Level Soil Table. Calculations for dermal exposure from subsurface soil are presented in Tables 8 and 9.

Inhalation exposure from subsurface soil (worker)

$$\text{Exposure concentration } (\text{ug/m}^3) = \frac{\text{CA x ET x EF x ED}}{\text{AT}}$$

Where:

CA	Chemical concentration in air (ug/m^3)
ET	Exposure time (hours/day)
EF	Exposure frequency (days/year)
ED	Exposure duration
AT	Averaging Time

The inhalation exposure equation was taken from *RAGS Part F: Supplemental Guidance for Inhalation Risk Assessments*. The EPC was converted to ug/m^3 and varied for each specific compound. The average time was calculated by converting the exposure duration to total amount of hours exposed. Exposure concentration calculations for inhalation from subsurface soil are presented in Tables 10 and 11.

In order to convert the concentration of compounds in soil to air, the soil concentration was divided by a calculated particle emission factor (PEF). To model outdoor air particulate concentrations of CPCs, a generic particulate emission factor was developed based on the method described in the *Soil Screening Guide* (USEPA 1996b) and the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA, 2002). The particulate emission factor describes the fraction of each COPC in surface or exposed subsurface soil that becomes airborne in particulate form. The PEF was calculated at 6.83E8 using values obtained from Table 4-5: Derivation of the PEF- Commercial/Industrial Scenario from the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA, 2002).

$$\text{PEF} = Q/C \text{ x } \frac{3{,}600 \text{ sec/hour}}{0.036 \text{ x } (1-V) \text{ x } (U_m/U_t)^3 \text{ x } F(x)}$$

Q/C	Ratio of the geometric mean air concentration to the emission flux at the center of a square source, calculated using Site specific information to be 47.07 (g/m^2-s)(kg/m^3)
V	Fraction of vegetative cover (50%)
U_m	Mean annual wind speed (4.69 m/s)
U_t	Equivalent threshold wind speed at 7 m (11.32 m/s)
F(x)	Function of wind speed over threshold wind speed (0.194)

Incidental ingestion from subsurface soil (worker)

$$\text{Intake (mg/kg-day)} = \frac{\text{CS x IR x CF x FI x EF x ED}}{\text{BW X AT}}$$

CS	Chemical concentration (EPC)
IR	Ingestion rate (mg of soil per day)
CF	Conversion factor
FI	Fraction Ingested from Contaminated Source
EF	Exposure frequency
ED	Exposure duration
BW	Body weight
AT	Averaging Time

The EPC was expressed in mg/kg and varied for each specific compound. The ingestion rate was assumed to be 100 mg/day for the commercial/industrial worker and 330 mg/day for the construction worker based on *RAGS Part A* (USEPA, 1992) and the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA 2002). The conversion factor was 10^{-6} mg/kg. The fraction ingested from a contaminated source was assumed to be 100%. Absorbed dose calculations for incidental ingestion from sub surface soil are presented in Tables 12 and 13.

Inhalation of volatiles from exposed groundwater (worker)

$$\text{Exposure concentration (ug/m}^3\text{)} = \frac{\text{CA x ET x EF x ED}}{\text{AT}}$$

Where:

CA	Chemical concentration in air (ug/m^3)
ET	Exposure time (hours/day)
EF	Exposure frequency (days/year)
ED	Exposure duration
AT	Averaging Time

The inhalation exposure equation was taken from *RAGS Part F: Supplemental Guidance for Inhalation Risk Assessments*. The EPC was converted to ug/m^3 and varied for each specific compound. The average time was calculated by converting the exposure duration to total amount of hours exposed. Exposure concentration calculations for inhalation from groundwater are presented in Table 14.

In order to convert the concentration of compounds in groundwater to air, guidance provided by the Virginia Department of Environmental Quality (VDEQ), *Exposures of Workers to Volatiles in a Construction/Utility Trench*, was used. Using Equation 3-1 from the VDEQ guidance, the airborne concentration of a contaminant in a trench is calculated below.

$$C_{trench} = C_{groundwater} \times VF$$

Where:

C_{trench}	Concentration of the contaminant in the trench (ug/m^3)
$C_{groundwater}$	Concentration of the contaminant in groundwater (ug/L)
VF	Volatilization factor (L/m^3)

The volatilization factor was calculated for each compound using the Equation 3-4: VF for Groundwater Less Than or Equal to 15 Feet and default values provided in Table 3.8 in the VDEQ guidance

$$VF = \frac{K_i \times A \times F \times 10^{-3} \times 10^{4} \times 3{,}600}{ACH \times V}$$

Where:

K_i	Overall mass transfer coefficient of contaminant (cm/s)
A	Area of the trench floor (m^2)
F	Fraction of floor through which contaminant can enter (unitless)
ACH	Air changes per hour (h^{-1})
V	Volume of trench (m^3)
10^{-3}	Conversion factor (L/cm^3)
10^{4}	Conversion factor (cm^2/m^2)
3,600	Conversion factor (s/hr)

The K_i values are compound specific and values were obtained from Table 3.8 of the VDEQ guidance. The trench was assumed to be 3 feet wide by 8 feet long by 8 feet deep. It was assumed that there are two air changes per hour.

Dermal exposure from groundwater (worker)

$$\text{Dermal Absorbed dose (mg/kg-day)} = \frac{DA_{event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

DA_{event}	Absorbed dose per event (mg/cm^2-event)
EV	Event frequency
ED	Exposure duration
EF	Exposure frequency
SA	Skin averaging surface
BW	Body weight
AT	Averaging Time

The EPC was expressed in milligrams per cubic centimeter (mg/cm^3) and varied for each specific compound. The skin surface available for contact by an adult worker was $3{,}300 cm^2$, as recommended by RAGS Part E, Exhibit 2. Body weight was assumed to be 70 kg. Absorbed dose calculations for dermal exposure from groundwater are presented in Table 15. When the event duration is less than the time it takes for a compound to reach a steady state, the following equation is used:

$$DA_{event} = 2 \text{ x } FA \text{ x } Kp \text{ x } CW \text{ x } \sqrt{} \, [(6 \text{ x } J_{event} \text{ x } T_{event}) / \pi]$$

FA Fraction absorbed from water
Kp Dermal permeability coefficient
CW Chemical concentration in water
J_{event} Lag time per event
T_{event} Event duration

The fraction absorbed from water is chemical specific and was obtained from RAGS Part E, Exhibit B-3. The dermal permeability constant (Kp) varied for each compound. Kp values were obtained from RAGS Part E: Exhibit B5. The J_{event} is the chemical specific lag time between exposure events located in RAGS Part E, Appendix B. The T_{event} is the hours per event and was assumed to be 0.58 in accordance with RAGS Part E, Exhibit 3-2.

7.7 TOXICITY ASSESSMENT

7.7.1 Hazard Identification

The purpose of the toxicity assessment is to define the relationship between the dose of a compound and the probability that a carcinogenic or non-carcinogenic effect will occur. The toxicity assessment is divided into two parts: hazard identification and dose-response evaluation. As stated in RAGS, hazard identification is the process of determining whether exposure to a compound will cause an increase in the incidence of a particular adverse health effect and whether the health effect is likely to occur in humans. The dose-response evaluation quantifies the toxicological information and characterizes the relationship between the dose of a compound and the incidence of adverse health effects in a population. Toxicity values are expressed as reference doses (RfD) for oral non-carcinogenic effects and slope factors for carcinogenic effects.

Each compound was classified by its degree of carcinogenetic properties. This information was obtained from the USEPA Integrated Risk Information System (IRIS). The USEPA uses a weight of evidence narrative to define the level of a carcinogen (Guidelines for Carcinogenic Risk Assessment, 2005). However, the compounds used in this risk assessment are still listed with IRIS under the old alphanumerical classification system (USEPA, 1986). Ratings for the compounds evaluated as part of the risk assessment are included in Tables 16 through 23.

Alphanumerical USEPA Cancer Classification:

A-	Human Carcinogen: There is enough evidence to conclude that it can cause cancer in humans.
B1-	Probable Human Carcinogen: There is limited evidence that it can cause cancer in humans, but at present it is not conclusive.
B2-	Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans, but at present it is far from conclusive.
C-	Possible Human Carcinogen: There is limited evidence that it can cause cancer in animals in the absence of human data, but at present it is not conclusive.
D-	Not classifiable as to Human Carcinogenicity: There is no evidence at present that it causes cancer in humans.
E-	Evidence of Non-Carcinogenicity for Humans: There is strong evidence that it does not cause cancer in humans.

All subsurface soil compounds identified in this risk assessment were rated as B2 by the USEPA classification system. Therefore all toxicity values were evaluated as carcinogens.

In the groundwater compounds, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, Aroclor 1254 and Aroclor 1260 were rated as B2 by the USEPA classification system. Benzene was rated an A. All toxicity values were evaluated as carcinogens.

Although Aroclor 1254 is rated as a B2 carcinogen, risk characterization data exists for non-cancer risk to dermal exposure. Therefore, Aroclor 1254 will examined for carcinogenic and non-carcinogenic risk to dermal exposure.

Naphthalene was rated a C by the USEPA classification system. Risk characterization data for naphthalene is only available as non-cancer risk for dermal exposure, but carcinogenic risk characterization data does exist for inhalation exposure. Therefore, naphthalene in groundwater is evaluated as a non-carcinogen for dermal exposure and as a carcinogen for inhalation exposure.

Summaries of the Agency for Toxic Substances & Diseases Registry (ATSDR) toxicological profiles (ToxFAQs™) were reviewed to determine possible health effects from chronic exposure. The ToxFAQs™ are included in Appendix H.

7.7.2 Dose Response Evaluation

The hierarchy of sources for identifying dose-response values was followed using the guidelines set forth in Memorandum: *Human Health Toxicity Values in Superfund Risk Assessments* which replaces the guidelines of RAGS Part A. The USEPA IRIS database was first consulted for all compounds. For compounds not available through IRIS, the USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs) and California EPA values (CALEPA) were consulted.

Using the recommended equations for each pathway, the absorbed dose for each CPC was calculated for all carcinogens and non-carcinogens. The slope factor for each compound was obtained from the Regional Screening Level Tables. The slope factor was adjusted for all dermal routes of exposure to subsurface soil to represent the absorbed amount and not the administered. In accordance with RAGS Part E, Exhibit 4-1, toxicity factors for PCBs and PAHs were not adjusted for exposure to groundwater. Therefore only benzene required adjustment. The slope factor for benzene was divided by the oral absorbed efficiency value, which was obtained from the RSL tables. The calculated absorbed dose for the compounds is presented in Tables 16, 17 and 23.

7.8 RISK CHARACTERIZATION

The exposure analysis and toxicity assessment are integrated to develop both the quantitative and qualitative risk evaluations. The average daily intakes calculated as part of the exposure assessment were combined with the dose-response values from the toxicity assessment. The methodology used to quantitatively assess carcinogenic risk is described in detail in the following subsection.

All compounds with potential carcinogenic effects were evaluated based on guidance from the USEPA RAGs. An individual upper-bound excess lifetime cancer risk was calculated by multiplying the calculated estimated daily intake by the appropriate carcinogenic slope factor (CSF) for each compound. The total lifetime cancer risk for simultaneous exposure to all chemicals within a pathway was calculated by using the summation of each individual chemical.

Non-carcinogens were evaluated based on guidance from the USEPA RAGS. A non-cancer hazard quotient was calculated by dividing the calculated exposure intake by the appropriate reference dose for each compound.

The USEPA has developed an estimate of the potential risk for carcinogenic compounds. Potential carcinogenic effects are expressed as a probability or risk of cancer resulting from exposure to a compound. The USEPA considers a cancer risk value greater than 1.0E-4 to 1.0E-6 to represent a potentially unacceptable level of risk (*EPA Memo: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*).

The non-cancer hazard quotient assumes that there is a level of exposure below which it is unlikely for even sensitive populations to experience adverse health effects. At this point, the hazard quotient would equal one. If the exposure level exceeds this threshold, there may be a concern for potential non-cancer effects.

Receptors may have contact with more than one contaminated medium. The risks of these exposures are summed and evaluated to provide a complete characterization of health risks associated with contamination at the Site. The risk characterization summary tables are included as Tables 26 and 27.

7.8.1 Summary of Risk – Subsurface Soil – Commercial/Industrial Worker

The total carcinogenic risk for the future commercial/industrial worker exposure to dermal contact from subsurface soil is 5.23E-05. Cancer risks for dermal contact from subsurface soil for each carcinogenic compound are summarized in Table 16. Benzo(a)pyrene had the highest lifetime cancer risk of dermal contact from subsurface soil (3.4E-05).

The total carcinogenic risk for the commercial/industrial worker exposure to inhalation of particles from subsurface soil is 2.58E-08. Cancer risks for inhalation of particles from subsurface soil for each carcinogenic compound are summarized in Table 18. Indeno(1,2,3-cd)pyrene had the highest lifetime cancer risk of inhalation from sub surface soil particulates (1.21E-08).

The total carcinogenic risk for the commercial/industrial worker exposure to ingestion from subsurface soil is 7.90E-06. Cancer risks for ingestion from subsurface soil for each carcinogenic compound are summarized in Table 20. Benzo(a)pyrene had the highest lifetime cancer risk from ingestion of subsurface soil (5.08E-06).

The total cancer risk for workers from exposure to subsurface soil is 6.0E-05. This value is within the acceptable range set by USEPA from 1E-04 to 1E-06. Total cancer risk for workers from exposure to subsurface soil is summarized in Table 26.

7.8.2 Summary of Risk – Subsurface Soil – Construction Worker

The total carcinogenic risk for the construction worker exposure to dermal contact from subsurface soil is 1.13E-06. Cancer risks for dermal contact from subsurface soil for each carcinogenic compound are summarized in Table 17. Benzo(a)pyrene had the highest lifetime cancer risk of dermal contact from subsurface soil (7.2E-07).

The total carcinogenic risk for the construction worker exposure to inhalation of particles from subsurface soil is 1.02E-08. Cancer risks for inhalation of particles from subsurface soil for each carcinogenic compound are summarized in Table 19. Benzo(a)pyrene had the highest lifetime cancer risk of inhalation from sub surface soil particulates (5.45E-09).

The total carcinogenic risk for the construction worker exposure to ingestion from subsurface soil is 3.77E-07. Cancer risks for ingestion from subsurface soil for each carcinogenic compound are summarized in Table 21. Benzo(a)pyrene had the highest lifetime cancer risk from ingestion of subsurface soil (2.42E-07).

The total cancer risk for workers from exposure to subsurface soil is 1.5E-06. This value is within the acceptable range set by USEPA from 1E-04 to 1E-06. Total cancer risk for workers from exposure to subsurface soil is summarized in Table 26.

7.8.3 Summary of Risk – Groundwater – Carcinogenic – Construction Worker

The total carcinogenic risk for the construction worker exposure to inhalation of volatiles from groundwater is 3.29E-04. Cancer risks for the future worker exposure to inhalation of volatiles from groundwater for each carcinogenic compound are summarized in Table 22. Naphthalene had the highest lifetime cancer risk of inhalation of volatiles from groundwater (3.10E-04).

The total carcinogenic risk for the construction worker exposure to dermal contact from groundwater is 1.75E-05. Cancer risks for worker exposure to dermal contact from groundwater for each carcinogenic compound are summarized in Table 23. Benzo(a)pyrene had the highest lifetime cancer risk of dermal contact from groundwater (1.67E-05).

The total cancer risk for workers from exposure to groundwater is 3.5E-04. This value is slightly outside the acceptable range set by USEPA of 1E-04 to 1E-06. Total cancer risk for workers from exposure to groundwater is summarized in Table 26.

7.8.4 Summary of Risk – Groundwater – Non Carcinogenic - Worker

The total non-carcinogenic risk for the future worker exposure to dermal contact from groundwater is 7.25E-06. Non cancer risks are summarized in Table 27.

The total non-carcinogenic risk for the future worker exposure to groundwater is 7.3E-05, which is less than the hazard quotient of 1 set by the USEPA. Total non-cancer risks for workers exposed to groundwater is summarized in Table 27.

7.8.5 Summary of Risk – Subsurface Soil – Non Carcinogenic - Worker

The total non-carcinogenic risk for the commercial/industrial worker exposure to dermal contact from subsurface soil is 2.01E-02. Non cancer risks are summarized in Table 24.

The total non-carcinogenic risk for the construction worker exposure to subsurface soil is 4.33E-04, which is less than the hazard quotient of 1 set by the USEPA. Total non-cancer risks for workers exposed to subsurface soil is summarized in Table 27.

7.9 UNCERTAINTY IN RISK ESTIMATES

The interpretation of risk estimates is subject to a number of uncertainties as a result of conservative assumptions inherent in risk assessments. Quantitative human health risk estimates are based on numerous conservative assumptions. These conservative estimates lead to uncertainty in exposure and toxicity. Major sources of uncertainty and their potential effects are detailed in Table 28.

Exposure point concentrations for each compound were calculated utilizing the 95% UCL. In some instances, due to statistical distribution, the 97.5% UCL was calculated, yielding even more conservative numerical estimates of concentrations at the Site.

Dermal cancer slope factors (CSFd) and reference doses (RfDd) were not listed in the USEPA Regional Screening Tables or the IRIS database. To obtain the correct dermal doses, the ingestion dose values were converted following guidelines presented in RAGS Part A.

The tap water RSLs are calculated using residential land use assumptions. As such, these RSLs are not reflective of industrial exposures and may overestimate exposures via the water pathways.

8.0 REMEDIAL ALTERNATIVES EVALUATION/FEASIBILITY STUDY

8.1 REMEDIAL ACTION OBJECTIVES

Remedial measures for the Site must satisfy Remedial Action Objectives (RAOs) in accordance with the NYSDEC Technical Guidance for Site Investigation and Remediation. The RAOs are statements that convey the goals for minimizing or eliminating substantial risks to public health and the environment. The RAOs for the Site are as follows:

Subsurface Soil

- Prevent ingestion/direct contact with contaminated soil;
- Prevent inhalation of, or exposure from contaminants volatilizing from contamination in soil; and
- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Groundwater

- Prevent ingestion of groundwater with contaminants levels exceeding drinking water standards;
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater;
- Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practical; and
- Prevent the discharge of contaminants to surface water.

The results of the HHRA (see Section 7.0) concluded that there is an unacceptable risk associated with the potential exposure of construction workers to groundwater via inhalation.

8.2 REMEDIAL ALTERNATIVE EVALUATION CRITERIA

In addition to achieving the RAOs, the Site remedy must be evaluated in accordance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010. Specifically, the guidance states “When proposing an appropriate remedy, the person responsible for conducting the investigation and/or remediation should identify and develop a remedial action that is based on the following criteria”.

1. Short-Term Impacts and Effectiveness: This criterion addresses the impacts of the alternative during the construction and implementation phase until the remedial action objectives are met. Factors to be evaluated include protection of the community during the remedial actions; protection of workers during the remedial actions; and the time required achieving the remedial action objectives.

2. Long-Term Effectiveness and Permanence: This criterion addresses the long-term protection of human health and the environment after completion of the remedial action. An assessment is made of the effectiveness of the remedial action in managing the risk posed by untreated wastes and the long-term reliability of the remedial action.

3. Reduction of Toxicity, Mobility, and Volume: This criterion addresses NYSDEC's preference for selecting "remedial technologies that permanently and significantly reduce the toxicity, mobility and volume" of the contaminants of concern at a site. This evaluation consists of assessing the extent that the treatment technology destroys toxic contaminants, reduces mobility of the contaminants using irreversible treatment processes, and/or reduces the total volume of contaminated media.

4. Implementability: This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of services and materials. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at a site and the availability of necessary equipment and technical specialists. Technical feasibility also includes the future operation and maintenance, replacement and monitoring that may be required for a remedial action. Administrative feasibility refers to compliance with applicable rules, regulations, statutes and the ability to obtain permits or approvals from other government agencies or offices; and the availability of adequate capacity at permitted treatment, storage and disposal facilities and related services.

5. Compliance with Applicable or Relevant and Appropriate Standard Criteria and Guidance (SCGs) and Remediation Goals: This criterion is used to evaluate the extent to which each alternative may achieve the RAOs which were outlined in Section 8.1.

6. Overall Protection of Human Health and the Environment: This criterion provides an overall assessment of protection with respect to long-term and short-term effectiveness and compliance with cleanup goals.

7. Cost: The estimated capital costs, long-term operation and maintenance costs, and environmental monitoring costs are evaluated. The comparative cost estimates are intended to reflect actual costs with an accuracy of +50 percent to -30 percent.

8.3 LAND USE EVALUATION

In developing and screening remedial alternatives, NYSDEC Part 375 regulations require that the reasonableness of the anticipated future land be factored into the evaluation. The future land use for the Site is restricted commercial usage.

Although the Site is to be used for commercial purposes, evaluating a more restricted-use scenario is required. DER-10 guidance also requires the evaluation of a “no-action” alterative to provide a baseline for comparison against other alternatives. Since an IRA has been completed for the Site, the following alternatives were evaluated.

- No Action (Alternative No. 1);

- Implementation of a Site Management Plan (Alternative No. 2); and
- Unrestricted Use Cleanup (Alternative No. 3).

The following section discusses the evaluation of these alternatives.

8.3 ALTERNATIVE EVALUATION

8.3.1 No Further Action

Under this alternative, the Site would remain in its current state, with no additional controls in-place.

Short-Term Impacts and Effectiveness: There are potential short-term impacts associated with this alternative. Future subsurface construction activities at the Site could result in potential exposure to groundwater contamination at levels deemed unacceptable according to the HHRA.

Long-Term Effectiveness and Permanence: The no further action alternative involves no additional equipment, institutional/engineering controls or facilities subject to maintenance.

Reduction of Toxicity, Mobility, and Volume: The IRA completed at the Site has reduced the toxicity, mobility and volume of contaminants at the Site.

Implementability: No technical or administrative implementability issues are associated with the no further action alternative.

Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals:
Under the current and reasonably anticipated future use scenario, this alternative is not expected to meet the chemical-specific SCGs for the identified soil (i.e., CSCOs) and groundwater (i.e., Class GA criteria) at all locations and it does not meet the RAOs for the construction worker exposure scenario, as there is potential exposure to groundwater at levels deemed unacceptable by unknowing workers according to the HHRA.

Overall Protection of Human Health and the Environment: As the Site exists, there is a potential for worker exposure to groundwater levels via inhalation at levels deemed unacceptable according to the HHRA.

Cost: There would be no capital or long-term operation, maintenance or monitoring costs associated with the no further action alternative.

8.3.2 Implementation of a Site Management Plan

The second alternative is a Site Management Plan (SMP), which would be developed to address contaminated soil and groundwater remaining at the Site in the event subsurface activities were performed (i.e., site upgrades, utility repair, new construction, etc.).

Short-Term Impacts and Effectiveness: This alternative is considered an adequate remedy related to short-term impacts and effectiveness. The risks associated with direct contact with soil and groundwater contaminants from future construction activities would be prevented as the SMP would address the methods and practices for dealing with contamination encountered, decontamination of equipment, particulate vapor release, dust monitoring, etc. The implementation of this alternative will be effective in preventing exposure to workers and construction personnel and meet the RAOs for soil.

Long-Term Effectiveness and Permanence: This alternative would have long-term effectiveness in managing the risks associated with exposure to soil and groundwater contaminants through implementation of the SMP.

Reduction of Toxicity, Mobility, and Volume: This alternative does not involve the removal and/or treatment of soil contamination although the SMP would identify how to properly handle and manage contaminated soil and groundwater when and if encountered.

If construction or excavation activities are conducted; any soil, groundwater or material generated will be managed and disposed in accordance with the SMP.

Implementability: This alternative is readily implementable on a technical basis.

Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals:
This alternative is not expected to meet the chemical-specific SCGs for the identified soil (i.e., CSCOs) and groundwater (i.e., Class GA criteria) contamination at all locations contamination, unless these materials are removed for disposal due to planned maintenance or construction activities. These would be managed in accordance with the SMP and would meet the RAOs.

Overall Protection of Human Health and the Environment: This alternative is considered an adequate remedy to reduce the risk or exposure for human health. Implementation of this alternative would result in eliminating potential exposure to contaminants during construction or excavation activities. Although the alternative will not meet the chemical SCGs, it will manage soil, groundwater or materials generated during maintenance or construction activities.

Cost: Total capital costs for this alternative are estimated to total approximately $13,200 for the preparation and implementation of a SMP as shown in Appendix H. Annual costs associated with the SMP, which include inspection and verification of institutional and engineering controls and submittal of an annual Periodic Review Report is approximately $3,360, which has a net present value (assuming 30 years) of approximately $83,200.

8.3.3 Unrestricted Use Soil Cleanup & Groundwater Removal

The Unrestricted Use alternative would necessitate remediation of soil and fill material where concentrations exceed the USCOs. For unrestricted use scenarios, excavation and off-Site disposal of impacted soil and fill is generally regarded as the most applicable remedial measure. This alternative assumes that those non-building areas which exceed USCOs would be excavated and disposed at an approved off-Site landfill. During the excavations, groundwater encountered would also be captured, stored and disposed of off-Site (assumed disposal into the City of Niagara Falls sanitary sewer system).

Based on the Site analytical data from this and previous investigations, it is estimated that an approximately 20,500 square foot area or 3,034 cubic yards of soil would be excavated and 92,000 gallons of perched groundwater would be pumped from the excavations. The soil and groundwater would be disposed of off-site.

Short-Term Impacts and Effectiveness: There are several potential short-term impacts associated with this alternative.

There is potential for impacts to human health (workers and construction personnel) due to direct contact, potential vapor and particulate releases during excavation. Thus, field personnel would wear appropriate personal protective equipment during excavation in order to limit health risks due to exposure to contaminants and physical hazards and monitoring would be required in order to mitigate potential conditions.

Contamination of equipment used for excavation purposes could carry contamination off-site. Therefore, equipment would require decontamination prior to removal, as necessary, in order to avoid the transport of contaminants.

Human health and the environment would be protected under this alternative for soils and it would remove potential source areas of groundwater contamination. This alternative is expected to meet the RAOs for the soils at completion of the excavation because the soil contamination will be removed from the Site. Confirmatory soil sampling would be performed to verify the effectiveness of the alternative.

Long-Term Effectiveness and Permanence: This alternative is considered an adequate, reliable and permanent remedy for soil and groundwater and, as such, the risks involved with the migration of contaminants and direct contact with soil and groundwater contaminants would be reduced. Remediation of contaminated soils could be completed within about 1 month.

Reduction of Toxicity, Mobility, and Volume: This alternative involves the removal and off-site disposal of the impacted soil and groundwater. The toxicity, mobility and volume of this contamination will be reduced by excavation of contaminated soils. Additionally, impacted groundwater would be containerized and treated via the City of Niagara Falls sanitary sewer treatment plant.

Implementability: This alternative is implementable on a technical basis with standard construction methods and equipment. Materials and services necessary for construction are readily available

<u>Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals</u>:
This alternative is expected to meet the RAOs and chemical-specific SCGs for the soils.

<u>Overall Protection of Human Health and the Environment</u>: This alternative is considered to be protective of human health and the environment.

<u>Cost</u>: Total capital costs for this alternative are estimated to total approximately $ 335,800 for remediation to Unrestricted SCOs as shown in Appendix H. The quantities and cost associated assumptions, estimated for comparative purposes, are presented in Appendix H.

8.4 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

The remedial alternatives discussed in Section 8.3 are compared below on the basis of the six (6) environmental and one (1) cost criteria, based on the detailed analysis provided above.

<u>Short Term Impacts and Effectiveness</u>
Alternative No. 3 involves excavation work, which could possibly cause exposure to contamination during remediation. Alternatives No. 1 and No. 2 would not cause disruption to the facility. Alternatives No. 2 and 3 would reduce potential exposures to existing soil contamination and Alternative No. 2 would properly manage materials generated from scheduled maintenance or construction activities.

Alternative Nos. 2 and 3 are expected to achieve the RAOs, however Alternative No. 1 will not.

<u>Long Term Effectiveness and Permanence</u>
Alternative Nos. 2 and 3 are considered to be adequate, reliable remedies for the management and/or remediation of soil contamination. The risks involved with the exposure to contaminants or direct contact with soil contaminants, although considered low, would still exist with Alterative No. 1.

<u>Reduction of Toxicity, Mobility and Volume</u>
Alternative No. 3 provides for the greatest reduction of toxicity, mobility and volume of soil and groundwater contamination, as the majority of the contamination would be removed and disposed of off-site.

Alternatives Nos. 1 and 2 will not reduce the toxicity, mobility and volume of the contamination; however, Alternative No. 2 will reduce the risk of exposure to contaminants should they be encountered during scheduled or planned maintenance or construction activities performed at the Site. Should contaminants be encountered, the SMP would identify management, handling and disposal procedures.

Implementability
Alternatives No. 1, 2 and 3 are technically and administratively implementable and can be implemented with readily available methods, equipment, materials and/or services.

Compliance with Applicable or Relevant and Appropriate SCGs and Remedial Goals
Alternative No. 3 is expected to achieve compliance with the chemical-specific SCGs for soil. Alternatives No. 2 and 3 will achieve compliance with RAOs and Alternative No. 1 will not achieve compliance with the RAOs related to the construction worker exposure scenario.

Overall Protection of Human Health and the Environment
Alternative No. 1 involves taking no further action. As the Site exists, there is a potential for construction worker exposure to groundwater levels via inhalation act at levels deemed unacceptable according to the HHRA.

Alternative No. 2 involves the implementation of a SMP. It is considered an adequate remedy to reduce the risk of exposure for human health. Implementation of this alternative would result in eliminating potential exposure to contaminants during construction or excavation activities. Although the alternative will not meet the chemical SCGs, it will manage soil, groundwater or materials generated during maintenance or construction activities.

Alternative No. 3 involves the removal of the contaminated soil and groundwater, and would be the most protective of human health and the environment.

Cost
Alternative No. 1, which involves taking no further action, has the lowest capital and O&M cost as there will be no additional remedial activities completed.

Alternative No. 2, which is the implementation of a SMP, has the second highest capital cost of approximately $13,200. O&M costs would associated with Alternative No. 2 include annual inspection and report preparation which are approximately $3,360.

Alternative No. 3, which includes removal of contaminated soil and groundwater, has the highest capital cost estimated at approximately $335,800 for remediation to Unrestricted SCOs. There is no long term O&M cost associated with Alternative No. 3.

8.5 RECOMMENDED REMEDIAL MEASURE

Based on the alternative evaluation, the IRA completed at the Site and that the only exposure scenario identified by the HHRA as concern was exposure to impacted groundwater by construction workers, the implementation of a Site Management Plan would satisfy the RAOs for the Site. Accordingly, the implementation of a Site Management Plan is the recommended as the remedial alternative for the Site. The future owner will be responsible for developing and implementing the Site Management Plan, which will be based on the planned redevelopment and use of the Site.

9.0 CONCLUSIONS/RECOMMENDATIONS

9.1 CONCLUSIONS

The USACE, Louisville District retained the services of PARS to conduct a RI, IRA, HHRA and feasibility study at the Niagara Falls Armed Forces Reserve Center located at 9400 Porter Road in Niagara Falls, New York. The RI and IRA were conducted in accordance with the approved *QAPP/Sampling Plan* (PARS, September 2011).

9.1.1 Soil Samples

On September 26 through September 28, 2011, thirty soil probes (16 primary locations and 14 secondary locations) were advanced at the Site using direct push methods via a 2-inch diameter macro-core sampler. Soil boring locations are shown in Figure 4 and soil probe logs are included in Appendix A.

Two samples were collected for laboratory analysis from each of the probes. Soil samples collected from the primary locations were submitted for TCL VOCs, TCL SVOCs and PCBs analysis. Secondary soil samples were analyzed at select locations based on the results of the primary samples.

Acetone was detected in soil sample SP-23-2-4 at a concentration slightly exceeding the USCO for the compound of 50 µg/kg. Acetone is a common laboratory contaminant and is not considered a contaminant of concern at the Site. All other detected VOCs were at concentrations below their respective USCO and CSCO.

Six SVOCs were detected at concentrations exceeding their respective USCO in soil sample SP-29-1-3. Benzo(a)pyrene was also detected at a concentration exceeding the CSCO in this sample. Benzo(b)fluoranthene was detected at a concentration exceeding the USCO in soil sample SP-37-1-3. SVOCs were not detected in any other samples at concentrations exceeding the respective USCO and CSCO.

Total PCB concentrations exceeding the USCO were identified in 5 samples (SP-28-1-3, SP-29-1-3, SP-30-1-3, SP-32-2-4 and SP-33-0-2. The concentration of PCBs detected at SP-28-1-3 also exceeds the CSCO of 1,000 µg/kg. PCBs were not detected in the remaining samples at concentrations exceeding the USCO and CSCO.

At the request of NYSDEC, a surface soil sample was collected at Outfall 4. The soil sample was collected immediately below the vegetative cover within the drainage swale along Porter Road. The sample was analyzed for TCL VOCs, TCL SVOCs and PCBs. Nine SVOCs were detected at concentrations exceeding the respective USCO and 5 SVOCs were detected at concentrations exceeding the respective CSCO. The SVOCs detected in the sample from the drainage swale are commonly found in ditches that receive storm water runoff from asphalt paved surfaces. Based on maps of the storm water drainage system for the Site, discharge to Outfall No. 4 is only from runoff from parking areas.

Total PCBs were detected in the outfall sample at a concentration of 210 µg/kg. This concentration exceeded the USCO for the compound of 100 µg/kg, but not the CSCO of 1,000 µg/kg, which was the cleanup objective established by NYSDEC for the previous remediation of the drainage swale.

9.1.2 Groundwater Samples

On September 26 and 27, 2011, 9 temporary microwells were installed in the open probe-holes at SP-22, 25, 30, 32, 34, 36, 42, 46 and 49. Groundwater was encountered in temporary microwells at a depth of 3-4 feet bgs. The locations of the microwells are depicted in Figure 4.

Eight groundwater samples were collected from the 9 temporary microwells using disposable Teflon© bailers. The temporary microwell installed at soil probe location SP-46 was dry following several attempts to collect a sample. Groundwater samples were analyzed for VOCs, SVOCs, and PCBs. Samples collected at SP-42 and SP-49 were not analyzed for SVOCs and PCBs due to insufficient groundwater recharge.

Benzene was detected at SP-49 and trichlorofluoromethane was detected at SP-22 at concentrations slightly exceeding the respective Class GA criteria. No other VOCs were detected in the groundwater samples at concentrations exceeding the respective Class GA criteria.

Four SVOCs were detected at concentrations exceeding the respective Class GA criteria at 3 locations (SP-22, SP-25 and SP-34). These compounds are benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene.

Total PCBs were detected in groundwater samples from locations SP-30, SP-32 and SP-36 at concentrations exceeding the Class GA Criteria for the compound of 0.09 µg/L. PCB concentrations in these three samples were 0.77 µg/L (SP-30), 3 µg/L (SP-32), and 13 µg/L (SP-36). PCBs were not detected in the other groundwater samples at concentrations above the laboratory MDL.

9.1.3 Interim Remedial Action

An IRA was performed on September 29, 2011. As part of the IRA, an approximately 10-foot (north-south) by 12-foot (east-west) area was excavated to a depth of approximately 5 feet bgs in the vicinity of the former exploratory excavation, TP-12. Approximately 40 tons of soil was removed from the excavation and stockpiled.

During soil excavation activities, perched groundwater was observed at approximately 2 feet bgs. Perched groundwater exhibiting a surface sheen was pumped from the excavation using a vacuum truck. Approximately 2,000-gallons of groundwater was removed from the excavation and properly disposed.

At the completion of soil removal activities, an approximate 8-foot long section of the 6-inch diameter cast iron fire protection main was removed from within the limits of the excavation. The open ends of the pipe were fitted with a Fernco and PVC cap prior to backfilling. On December 8, 2011, the stockpiled soil from the excavation was loaded onto trucks and transported off-Site for proper disposal.

Five confirmatory soil samples, four (4) sidewall samples and one (1) bottom of excavation sample, were collected from the excavation. The confirmatory soil samples were analyzed for TCL VOCs, TCL SVOCs and PCBs. VOCs, SVOCs and PCBs were not detected in the confirmatory samples at concentrations exceeding the applicable USCOs and CSCOs.

9.1.4 Human Health Risk Assessment

A HHRA was conducted at the Site to evaluate potential risks to human health under current and reasonably foreseeable future conditions from exposure to VOCs, SVOCs and PCBs in subsurface soils and groundwater. CPCs identified are presented in Table 6.

Potential exposure pathways were examined in the exposure assessment. Exposure point concentrations (EPCs) were calculated for each CPC with a potential pathway for exposure (see Tables 4 and 5). The EPC was used to calculate an absorbed dose or intake for each compound and potential pathway (see Tables 8 through 15). Each calculated absorbed dose or intake was compared to slope factors for carcinogenic compounds as part of the toxicity assessment (see Tables 16 through 23) or the reference dose for non-cancer (see Tables 24 and 25). The final quantitative cancer risk was calculated in the risk characterization summary (see Table 26) and the quantitative non-cancer risk was calculated in the risk characterization summary (see Table 27).

The USEPA has developed an estimate of the potential risk for carcinogenic compounds. Potential carcinogenic effects are expressed as a probability or risk of cancer resulting from exposure to a compound. The USEPA considers a cancer risk value greater than 1.0E-4 to 1.0E-6 to represent a potentially unacceptable level of risk (*EPA Memo: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*).

Under current or future conditions, the commercial/industrial and construction worker exposures to the individual subsurface soil pathways at the Site do not pose an unacceptable risk for carcinogens. The construction workers total potential exposure to groundwater is slightly above the USEPA acceptable carcinogenic risk range of greater than 1.0E-4 to 1.0E-6.

9.1.5 Remedial Alternatives Assessment/Feasibility Study

Potential remedial alternatives were evaluated based on the RAOs for the Site and criteria set forth in the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010. The criteria include Short-Term Impacts and Effectiveness, Long-Term Effectiveness and Permanence, Reduction of Toxicity, Mobility and Volume, Implementability, Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals, Overall Protection of Human Health and the Environment, and Cost.

Based on the evaluation, the IRA completed at the Site and that the only exposure scenario identified by the HHRA as concern was exposure to impacted groundwater by construction workers, the implementation of a Site Management Plan would satisfy the RAOs for the Site.

9.2 RECOMMENDATIONS

Based on the above conclusions, it has been determined that a Site Management Plan should be prepared and implemented at the Site to limit exposure to construction workers. Development and implementation of the Site Management Plan will be the responsibility of the future landowner and the plan will be based on the planned redevelopment and use of the Site.

10.0 REFERENCES

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FIGURES

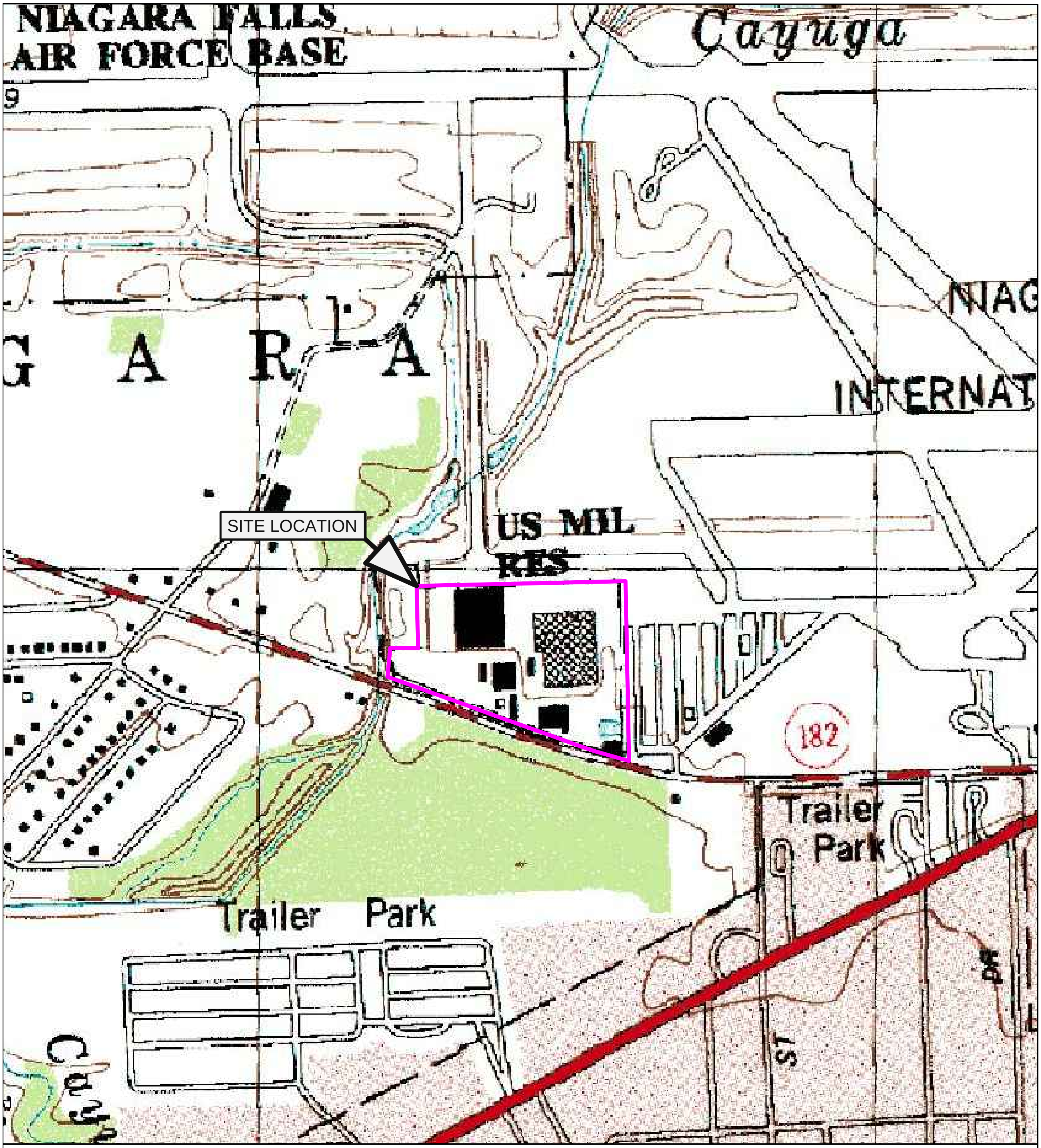
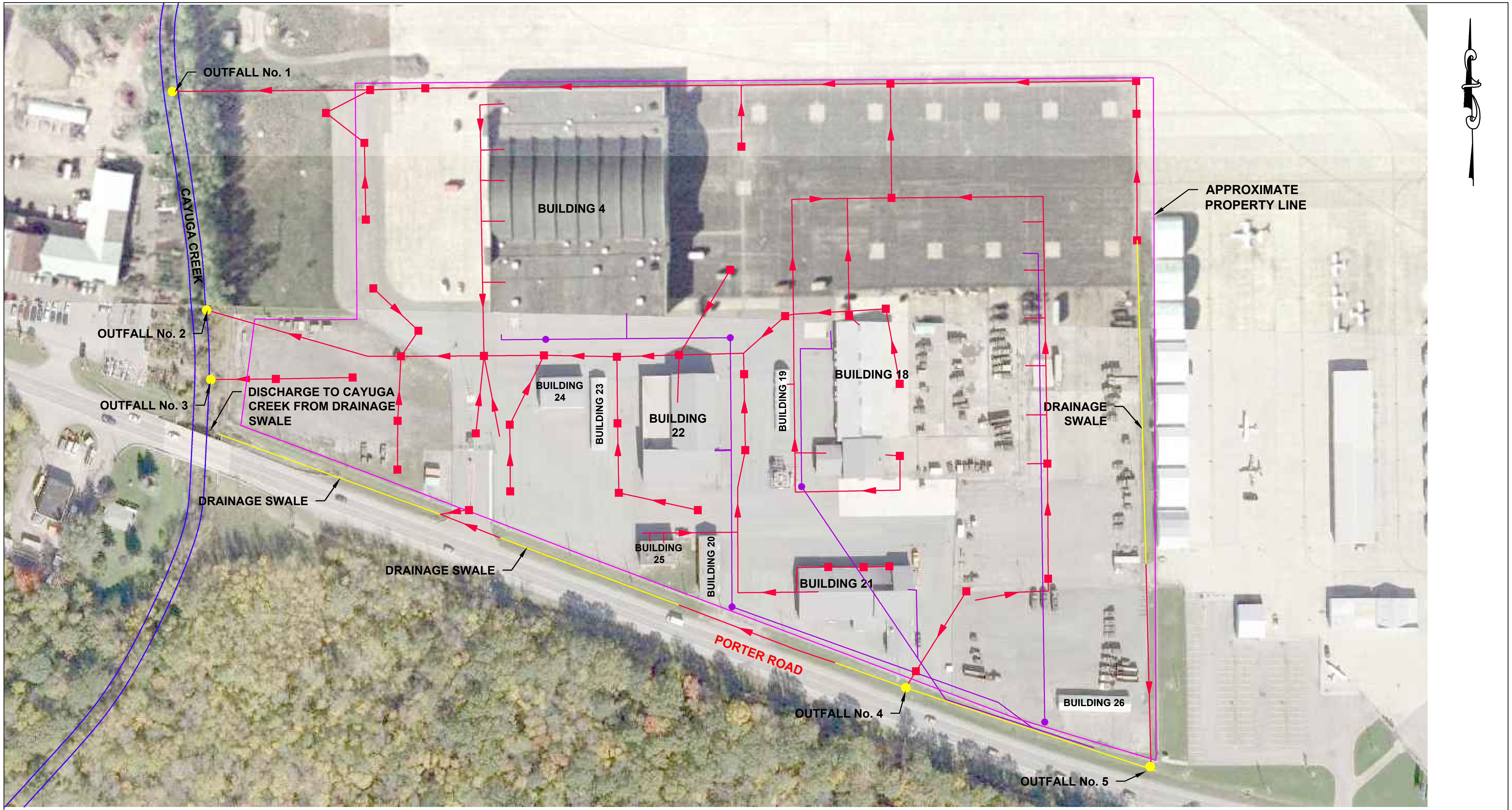


FIGURE 1
SITE LOCATION MAP
NIAGARA FALLS AFRC COMPLEX
NIAGARA FALLS, NEW YORK

PARS ENVIRONMENTAL, INC.
ROBBINSVILLE, NEW JERSEY

DR. BY: JA	SCALE: 1"=750'	JOB No.: 828-01
CK'D. BY: TD	DATE: 11/29/11	FILE NO.: 828-01
REV. NO. --	REV. DATE: --	FIGURE NO.:1



LEGEND:

—●— SANITARY SEWER LOCATION

—■— STORM SEWER LOCATION WITH FLOW DIRECTION

NOTES:

1. BASE MAP ADAPTED FROM AN AERIAL PHOTOGRAPH DOWNLOADED FROM http://www.bing.com/maps/, AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

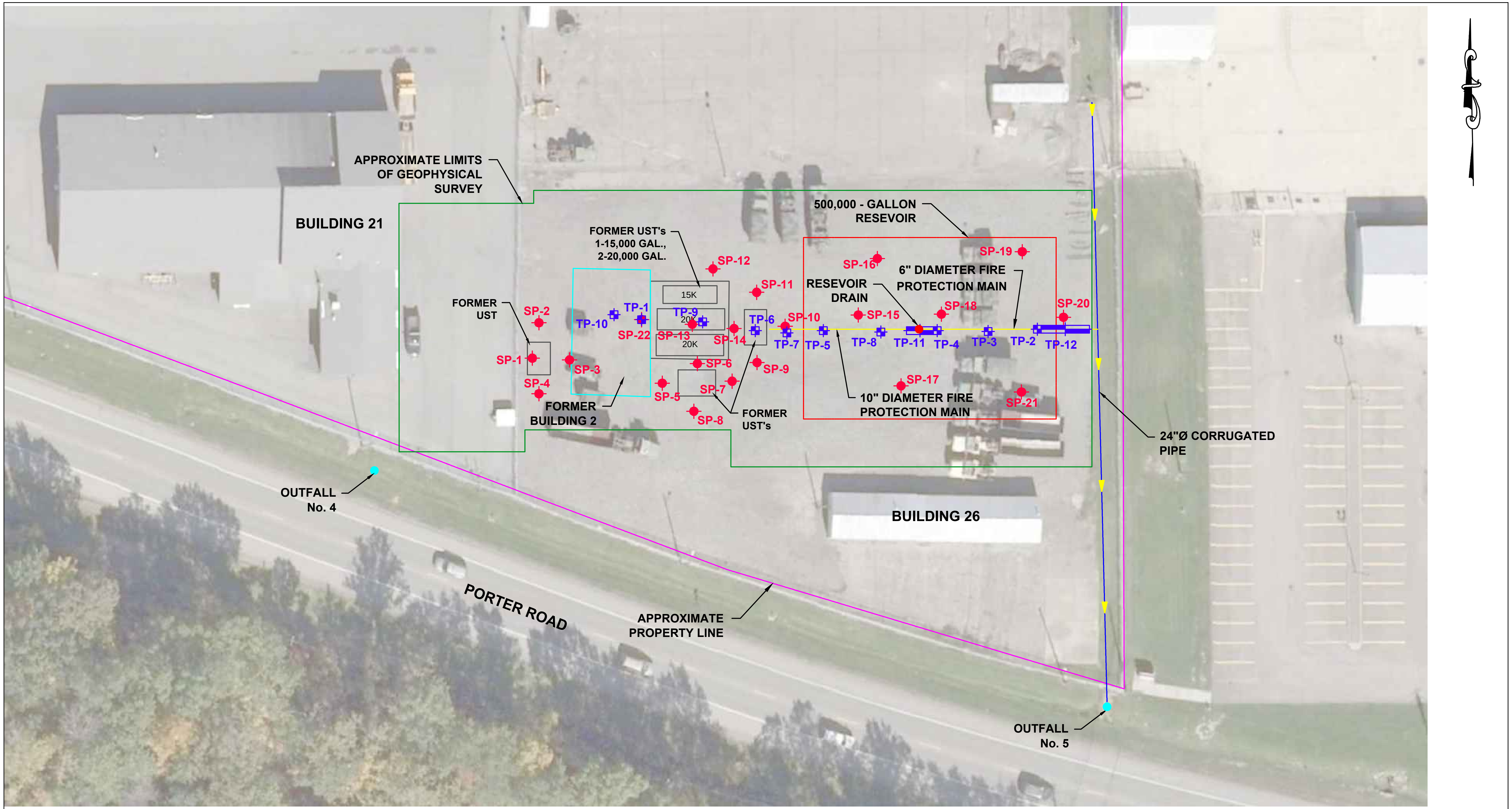
SCALE IN FEET

0 50 100 150

FIGURE 2
SITE PLAN
USAFRC
NIAGARA FALLS, NEW YORK

PARS ENVIRONMENTAL, INC.
ROBBINSVILLE, NEW JERSEY

DR. BY: JA	SCALE: 1"=150'	JOB No.: 727-04
CK'D. BY: TD	DATE: 11/29/11	FILE NO.: 727-04
REV. NO. --	REV. DATE: --	FIGURE NO.:2



LEGEND:

SP-19 — APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE COMPLETED ON DECEMBER 6 & 7, 2010 (21 LOCATIONS)

TP-3 — APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT COMPLETED ON DECEMBER 7 & 8, 2010 (12 LOCATIONS)

TP-1 SP-22 — APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE SP-22 CONVERTED TO TEST PIT, TP-1 DUE TO SUBSURFACE REFUSAL FOLLOWING SEVERAL ATTEMPTS COMPLETED ON DECEMBER 7, 2010.

NOTES:

1. BASE MAP ADAPTED FROM AN AERIAL PHOTOGRAPH DOWNLOADED FROM http://www.bing.com/maps/, AND FIELD OBSERVATIONS.

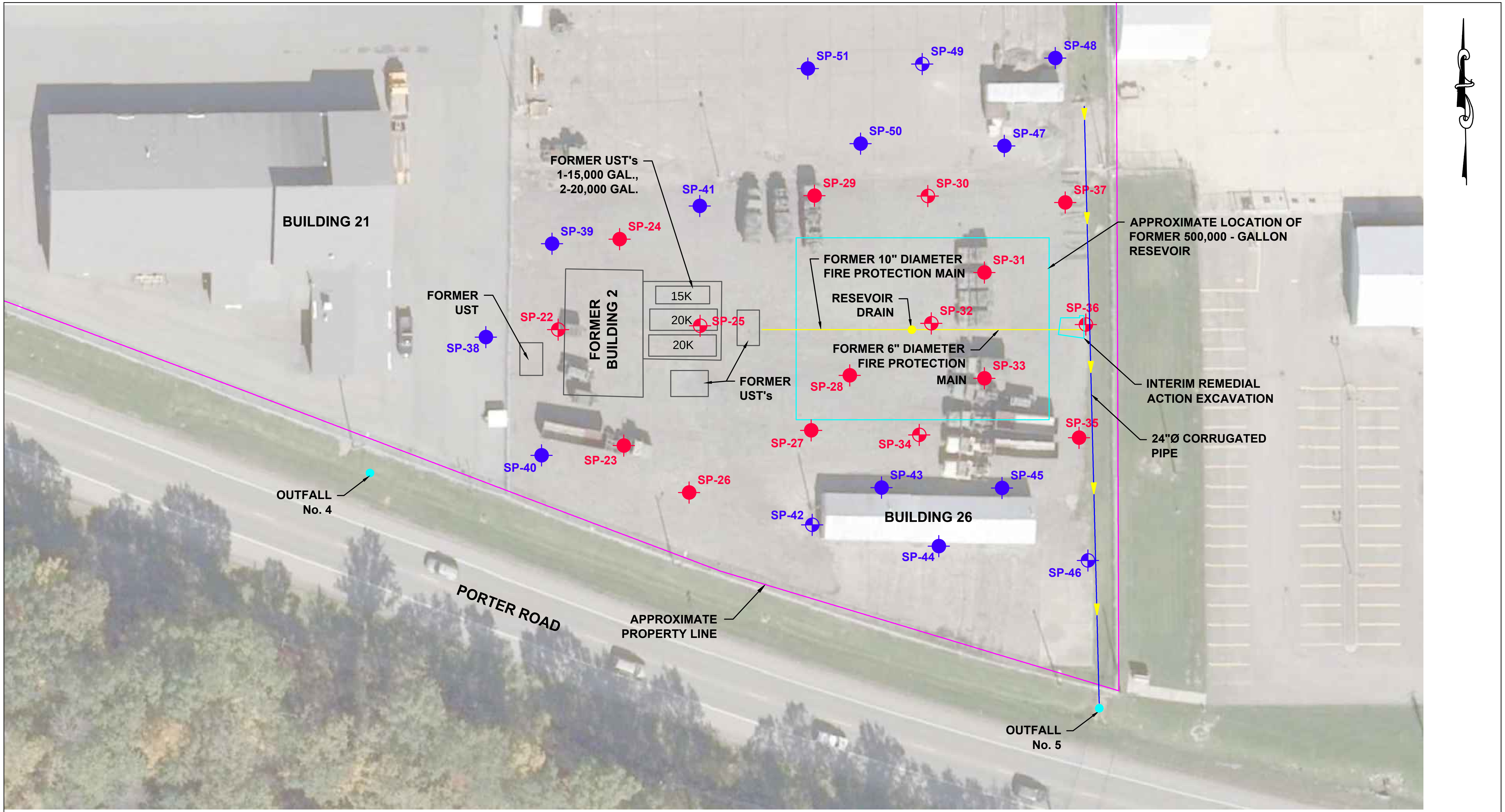
2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

SCALE IN FEET
0 10 20 30 40 50

FIGURE 3
SOIL SAMPLE LOCATION MAP – DECEMBER 2010
NIAGARA FALLS AFRC COMPLEX
NIAGARA FALLS, NEW YORK

PARS ENVIRONMENTAL, INC.
ROBBINSVILLE, NEW JERSEY

DR. BY: JA	SCALE: 1"=50'	JOB No.: 727-04
CK'D. BY: TD	DATE: 11/29/11	FILE NO.: 727-04
REV. NO. --	REV. DATE: --	FIGURE NO.:3



LEGEND:

SP-26 ● APPROXIMATE LOCATION AND DESIGNATION OF PRIMARY SOIL PROBE

SP-34 ⊕ APPROXIMATE LOCATION AND DESIGNATION OF PRIMARY SOIL PROBE WITH TEMPORARY PIEZOMETER INSTALLED

SP-40 ● APPROXIMATE LOCATION AND DESIGNATION OF SECONDARY SOIL PROBE

SP-42 ⊕ APPROXIMATE LOCATION AND DESIGNATION OF SECONDARY SOIL PROBE WITH TEMPORARY PIEZOMETER INSTALLED

NOTES:

1. BASE MAP ADAPTED FROM AN AERIAL PHOTOGRAPH DOWNLOADED FROM http://www.bing.com/maps/, AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

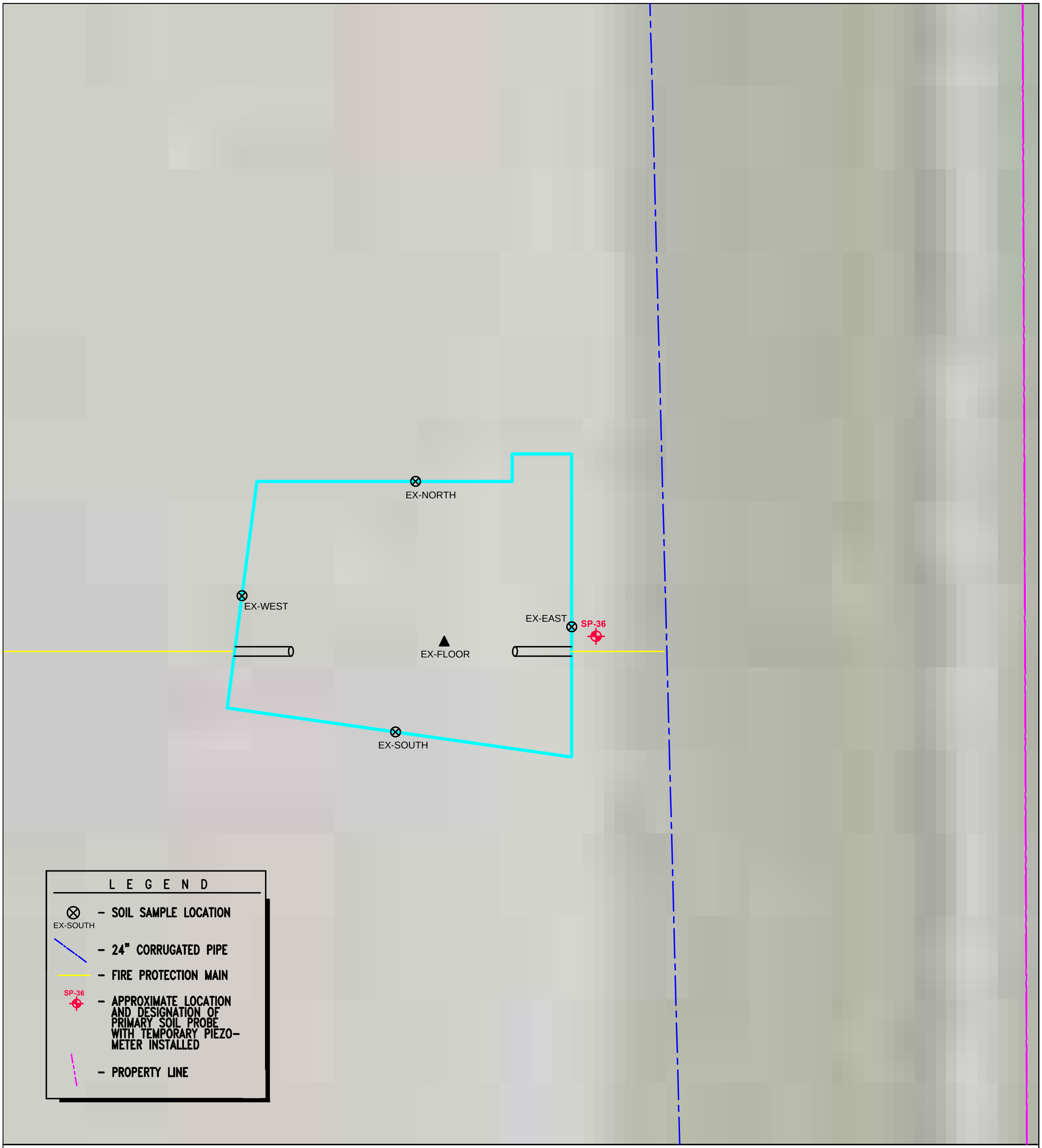
SCALE IN FEET

0 10 20 30 40 50

FIGURE 4
SOIL SAMPLE LOCATION MAP – SEPTEMBER 2011
NIAGARA FALLS AFRC COMPLEX
NIAGARA FALLS, NEW YORK

PARS ENVIRONMENTAL, INC.
ROBBINSVILLE, NEW JERSEY

DR. BY: JA	SCALE: 1"=50'	JOB No.: 727–04
CK'D. BY: TD	DATE: 11/29/11	FILE NO.: 727–04
REV. NO. ––	REV. DATE: ––	FIGURE NO.:4



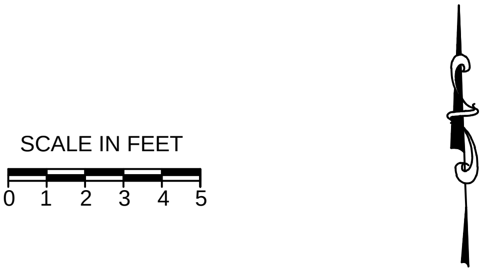


FIGURE 5
EXCAVATION LOCATION MAP
NIAGARA FALLS AFRC COMPLEX
NIAGARA FALLS, NEW YORK

PARS ENVIRONMENTAL, INC.
ROBBINSVILLE, NEW JERSEY

DR. BY: JA	SCALE: 1"=5'	JOB No.: 727-04
CK'D. BY: TD	DATE: 11/29/11	FILE NO.: 727-04
REV. NO. --	REV. DATE: --	FIGURE NO.:5

TABLES

Table 1
Analytical Results Summary Table
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Sample Identification	Date Collected	VOCs EPA Method 8260-TCL	SVOCs EPA Method 8270 - TCL	PCBs EPA Method 8082	Waste Characterization
Soil Probe Samples					
SP-22-2-4	9/26/2011	X	X	X	
SP-22-10-12	9/26/2011	X	X	X	
SP-23-2-4	9/26/2011	X	X	X	
SP-23-6-8	9/26/2011	X	X	X	
SP-24-2-4	9/26/2011	X	X	X	
SP-24-8-10	9/26/2011	X	X	X	
SP-25-2-4	9/26/2011	X	X	X	
SP-25-6-8	9/26/2011	X	X	X	
SP-26-1-3	9/26/2011	X	X	X	
SP-26-6-8	9/26/2011	X	X	X	
SP-27-2-4	9/26/2011	X	X	X	
SP-27-6-8	9/26/2011	X	X	X	
SP-28-1-3	9/26/2011	X	X	X	
SP-28-6-8	9/26/2011	X	X	X	
SP-29-1-3	9/26/2011	X	X	X	
SP-29-6-8	9/26/2011	X	X	X	
SP-30-1-3	9/27/2011	X	X	X	
SP-30-10-12	9/27/2011	X	X	X	
SP-31-1-3	9/27/2011	X	X	X	
SP-31-8-10	9/27/2011	X	X	X	
SP-32-2-4	9/26/2011	X	X	X	
SP-32-8-10	9/26/2011	X	X	X	
SP-33-0-2	9/27/2011	X	X	X	
SP-33-8-10	9/27/2011	X	X	X	
SP-34-2-4	9/26/2011	X	X	X	
SP-34-6-8	9/26/2011	X	X	X	
SP-35-1-3	9/27/2011	X	X	X	
SP-35-6-8	9/27/2011	X	X	X	
SP-36-1-3	9/27/2011	X	X	X	
SP-36-8-10	9/27/2011	X	X	X	
SP-37-1-3	9/27/2011	X	X	X	
SP-37-4-6	9/27/2011	X	X	X	
SP-41-1-3	9/28/2011		X	X	
SP-41-6-8	9/28/2011		X	X	
SP-47-1-3	9/27/2011			X	
SP-47-6-8	9/27/2011			X	
SP-50-1-3	9/28/2011		X	X	
SP-50-6-8	9/28/2011		X	X	
SP-51-1-3	9/28/2011		X	X	
SP-51-6-8	9/28/2011		X	X	
OUTFALL 004	9/27/2011	X	X	X	
Soil Excavation Samples					
EX-NORTH	9/29/2011	X	X	X	
EX-SOUTH	9/29/2011	X	X	X	
EX-EAST	9/29/2011	X	X	X	
EX-WEST	9/29/2011	X	X	X	
EX-FLOOR	9/29/2011	X	X	X	
WC-1-SOIL	9/29/2011				X[7]
Groundwater Samples					
SP-22-110926	9/26/2011	X	X	X	
SP-25-110926	9/26/2011	X	X	X	
SP-30-110927	9/27/2011	X	X	X	
SP-32-110926	9/26/2011	X	X	X	
SP-34-110926	9/26/2011	X	X	X	
SP-36-110927	9/27/2011	X	X	X	
SP-42-110927	9/27/2011	X	X	X	
SP-49-110927	9/27/2011	X	X	X	

Notes:

1. SP-22-2-4 = (SP-22), type of sample and number from which sample was obtained, (2-4) depth of sample below ground surface. SP = soil probe.
2. VOCs = Volatile Organic Compounds
3. SVOCs = Semi-Volatile Organic Compounds
4. TCL = Target Compound List
5. TAL = Target Analyte List
6. PCBs = Polychlorinated Biphenyls
7. Waste characterization sample (WC-1-SOIL) was analyzed for the following parameters:
   TCLP VOCs, SVOCs, RCRA Metals, PCBs, pH, and Ignitability.

Table 2
Draft Soil Analytical Results
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

	Unrestricted	Restricted Commmercial	SP-22-2-4	SP-22-10-12	SP-23-2-4	SP-23-6-8	SP-24-2-4	SP-24-8-10	SP-25-2-4	SP-25-6-8	SP-26-1-3	SP-26-6-8	SP-27-2-4	SP-27-6-8
Parameter	Soil Cleanup	Soil Cleanup												
	Objectives	Objectives	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)														
Acetone	50	*500,000*	ND	7.1 J	60	22 J	28 J	ND	ND	ND	27 J	6.7 J	ND	ND
Methylcyclohexane	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1,300	*150,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	50	*500,000*	4.9 J	5.6 J	4.8 J	5.1 J	5.1 J	3.9 J	5.1 J	5.6 J	4.6 J	4.8 J	4.9 J	5.0 J
2-Butanone (MEK)	100,000	*NV*	ND	ND	7.5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)														
Naphthalene	12,000	*500,000*	ND	51 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	410 [9]	*NV*	ND	12 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20,000	*500,000*	ND	68 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	30,000	*500,000*	ND	96 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100,000	*500,000*	500 J	210 J	ND	ND	ND	ND	5100 J	3300 J	ND	ND	83 J	ND
Anthracene	100,000	*500,000*	ND	97 J	ND	ND	ND	ND	1300 J	ND	ND	ND	ND	ND
Fluoranthene	100,000	*500,000*	830 J	250	ND	ND	ND	ND	7100 J	7000 J	16 J	ND	80 J	ND
Pyrene	100,000	*500,000*	590 J	160 J	ND	ND	ND	ND	4900 J	6100 J	11 J	ND	40 J	ND
Benzo(a)anthracene	1,000	*5,600*	650 J	110 J	12 J	ND	21 J	ND	3600 J	5600 J	14 J	ND	37 J	ND
Dibenzo(a,h)anthracene	330	*560*	ND	14 J	ND	ND	30 J	ND	**630 J**	**1200 J**	ND	ND	10 J	ND
Dibenzofuran	7,000	*NV*	ND	31 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	50,000 [9]	*NV*	ND	ND	ND	88 J	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	NV	*NV*	ND	17 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1,000	*56,000*	670 JB	100 JB	11 JB	ND	29 JB	ND	3500 JB	5400 JB	14 JB	ND	45 JB	ND
Benzo(b)fluoranthene	1,000	*5,600*	590 J	91 J	16 J	11 J	ND	11 J	4100 J	5600 J	19 J	12 J	59 J	15 J
Benzo(k)fluoranthene	800	*56,000*	420 J	64 J	13 J	11 J	ND	13 J	1700 J	3100 J	16 J	12 J	27 J	9.1 J
Biphenyl	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1,000	*1,000*	550 J	90 J	13 J	9.5 J	ND	ND	**3200 J**	**5800 J**	15 J	9.9 J	39 J	ND
Indeno(1,2,3-cd)pyrene	500	*5,600*	280 J	32 J	ND	ND	30 J	ND	1200 J	2100 J	9.3 J	8.8 J	23 J	ND
Benzo(g,h,i)perylene	100,000	*500,000*	310 J	33 J	ND	ND	35 J	ND	1400 J	2500 J	ND	9.8 J	26 J	ND
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)														
Aroclor 1254	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	100*	*1,000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 2
Draft Soil Analytical Results
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

	Unrestricted	Restricted Commmercial	SP-28-1-3	SP-28-6-8	SP-29-1-3	SP-29-6-8	SP-30-1-3	SP-30-10-12	SP-31-1-3	SP-31-8-10	SP-32-2-4	SP-32-8-10	SP-33-0-2	SP-33-8-10
Parameter	Soil Cleanup	Soil Cleanup												
	Objectives	Objectives	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)														
Acetone	50	*500,000*	ND	9.7 J	7.3 J	ND	12 J	ND	ND	ND	ND	30	ND	ND
Methylcyclohexane	NV	*NV*	ND	ND	ND	ND	3.0 J	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1,300	*150,000*	ND	ND	ND	ND	ND	<	ND	ND	ND	ND	ND	ND
Methylene Chloride	50	*500,000*	4.7 J	5.8 J	7.8	5.6 J	3.8 JB	2.9 JB	4.3 JB	3.2 JB	5.6 J	5.2 J	ND	ND
2-Butanone (MEK)	100,000	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)														
Naphthalene	12,000	*500,000*	ND	ND	ND	ND	17 J	ND	7.7 J	ND	ND	ND	ND	ND
2-Methylnaphthalene	410 [9]	*NV*	ND	ND	ND	ND	9.3 J	ND	ND	ND	ND	ND	52 J	ND
4-Methylphenol	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	*500,000*	ND	ND	ND	32 J	22 J	ND	15 J	ND	ND	ND	68 J	ND
Acenaphthene	20,000	*500,000*	ND	ND	ND	ND	25 J	ND	3.0 J	ND	ND	ND	ND	ND
Fluorene	30,000	*500,000*	ND	ND	ND	33 J	26 J	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100,000	*500,000*	15 J	18 J	1800 J	360	320 B	8.8 JB	96 JB	6.6 JB	88 J	ND	190 JB	ND
Anthracene	100,000	*500,000*	ND	ND	ND	97 J	52 J	ND	28 J	ND	22 J	ND	88 J	ND
Fluoranthene	100,000	*500,000*	36 J	77 J	3100 J	570	630 B	17 JB	250 B	13 JB	180 J	ND	560 JB	5.5 JB
Pyrene	100,000	*500,000*	25 J	57 J	2000 J	350	430 B	12 JB	170 JB	11 JB	120 J	ND	440 JB	4.9 JB
Benzo(a)anthracene	1,000	*5,600*	27 J	46 J	1700 J	210 J	260 B	14 JB	150 JB	15 JB	97 J	11 J	330 JB	9.1 JB
Dibenzo(a,h)anthracene	330	*560*	ND	12 J	ND	29 J	ND	ND	ND	ND	20 J	ND	ND	ND
Dibenzofuran	7,000	*NV*	ND	ND	ND	19 J	16 J	ND	6.4 J	ND	ND	ND	28 J	ND
Diethyl phthalate	NV	*NV*	ND	ND	ND	ND	14 JB	12 JB	16 JB	11 JB	ND	ND	ND	9.8 JB
Di-n-octyl phthalate	NV	*NV*	ND	ND	ND	ND	32 J	32 J	38 J	30 J	ND	ND	310 J	31 J
Di-n-butyl phthalate	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	50,000 [9]	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	NV	*NV*	ND	ND	ND	15 J	53 J	4.1 J	14 J	3.7 J	ND	ND	74 J	3.6 J
Chrysene	1,000	*56,000*	25 JB	47 JB	2300 JB	200 J	290 B	17 JB	140 JB	14 JB	110 JB	10 JB	380 JB	7.9 JB
Benzo(b)fluoranthene	1,000	*5,600*	40 J	72 J	3500 J	210 J	440 B	18 JB	190 JB	20 JB	140 J	14 J	740 JB	12 JB
Benzo(k)fluoranthene	800	*56,000*	19 J	35 J	1700 J	110 J	180 JB	16 JB	82 JB	15 JB	64 J	13 J	360 JB	10 JB
Biphenyl	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1,000	*1,000*	26 J	54 J	**2900 J**	160 J	290 B	15 JB	130 JB	15 JB	98 J	14 J	490 JB	7.0 JB
Indeno(1,2,3-cd)pyrene	500	*5,600*	16 J	27 J	1400 J	86 J	120 JB	10 JB	56 JB	10 JB	45 J	ND	210 JB	7.6 JB
Benzo(g,h,i)perylene	100,000	*500,000*	15 J	28 J	1800 J	91 J	120 JB	7.8 JB	57 JB	11 JB	52 J	ND	400 JB	8.8 JB
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)														
Aroclor 1254	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	NV	*NV*	1,100	ND	320	ND	150 J	ND	ND	ND	410	ND	940	ND
Total PCBs	100*	*1,000**	1,100	ND	320	ND	150	ND	ND	ND	410	ND	940	ND

Table 2
Draft Soil Analytical Results
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	Unrestricted	Restricted Commmercial	SP-34-2-4	SP-34-6-8	SP-34-6-8 (DUP)	SP-35-1-3	SP-35-6-8	SP-36-1-3	SP-36-8-10	SP-37-1-3	SP-37-4-6	SP-41-1-3	SP-41-6-8	SP-47-1-3
Parameter	Soil Cleanup	Soil Cleanup												
	Objectives	Objectives	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)														
Acetone	50	*500,000*	ND	6.7 J	ND	ND	ND	27 J	17 J	19 J	29 J	NT	NT	NT
Methylcyclohexane	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	NT	NT
Tetrachloroethene	1,300	*150,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	NT	NT
Methylene Chloride	50	*500,000*	6.9	5.9 J	3.9 J	ND	ND	2.9 JB	ND	2.9 J	ND	NT	NT	NT
2-Butanone (MEK)	100,000	*NV*	ND	ND	ND	ND	ND	5.2 J	ND	ND	ND	NT	NT	NT
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)														
Naphthalene	12,000	*500,000*	33 J	ND	ND	ND	ND	5.7 J	ND	45 J	ND	ND	ND	NT
2-Methylnaphthalene	410 [9]	*NV*	38 J	ND	ND	ND	ND	4.1 J	ND	28 J	ND	ND	ND	NT
4-Methylphenol	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	17 J	ND	NT
Acenaphthylene	100,000	*500,000*	ND	ND	ND	ND	ND	9.0 J	ND	9.8 J	ND	ND	ND	NT
Acenaphthene	20,000	*500,000*	ND	ND	ND	ND	ND	4.3 J	ND	160 J	ND	ND	ND	NT
Fluorene	30,000	*500,000*	ND	ND	ND	ND	ND	12 J	ND	320	ND	ND	ND	NT
Phenanthrene	100,000	*500,000*	120 J	ND	ND	7.7 JB	ND	89 JB	4.5 JB	2,400 B	10 JB	ND	ND	NT
Anthracene	100,000	*500,000*	ND	ND	ND	ND	ND	22 J	ND	690	ND	ND	ND	NT
Fluoranthene	100,000	*500,000*	140 J	ND	ND	27 JB	7.9 JB	130 JB	5.8 JB	2,700 B	17 JB	ND	ND	NT
Pyrene	100,000	*500,000*	89 J	ND	ND	20 JB	6.0 JB	98 JB	5.1 JB	1,700 B	9.8 JB	ND	ND	NT
Benzo(a)anthracene	1,000	*5,600*	66 J	15 J	15 J	23 JB	8.9 JB	55 JB	9.4 JB	950 B	13 JB	ND	21 J	NT
Dibenzo(a,h)anthracene	330	*560*	13 J	ND	ND	ND	ND	ND	ND	64 J	ND	ND	19 JB	NT
Dibenzofuran	7,000	*NV*	24 J	ND	ND	ND	ND	6.1 J	ND	190 J	ND	ND	ND	NT
Diethyl phthalate	NV	*NV*	ND	ND	ND	11 JB	7.4 JB	13 JB	12 JB	7.9 JB	10 JB	ND	ND	NT
Di-n-octyl phthalate	NV	*NV*	ND	ND	ND	30 J	28 J	ND	31 J	31 J	ND	ND	ND	NT
Di-n-butyl phthalate	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	380	ND	ND	ND	NT
Bis(2-ethylhexyl)phthalate	50,000 [9]	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT
Carbazole	NV	*NV*	ND	ND	ND	3.6 J	ND	14 J	4.4 J	230	ND	ND	ND	NT
Chrysene	1,000	*56,000*	78 J	14 JB	13 JB	24 JB	10 JB	62 JB	9.6 JB	940 B	9.7 JB	ND	24 J	NT
Benzo(b)fluoranthene	1,000	*5,600*	81 J	16 J	19 J	46 JB	20 JB	97 JB	8.8 JB	1,200 B	18 JB	ND	24 J	NT
Benzo(k)fluoranthene	800	*56,000*	40 J	14 J	12 J	24 JB	11 JB	43 JB	8.1 JB	620 B	16 JB	ND	29 J	NT
Biphenyl	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	17 J	ND	ND	ND	NT
Benzo(a)pyrene	1,000	*1,000*	59 J	14 J	14 J	30 JB	11 JB	63 JB	7.3 JB	920 B	11 JB	ND	17 J	NT
Indeno(1,2,3-cd)pyrene	500	*5,600*	38 J	ND	ND	17 JB	7.4 JB	30 JB	6.2 JB	270 B	9.0 JB	ND	19 JB	NT
Benzo(g,h,i)perylene	100,000	*500,000*	52 J	ND	ND	19 JB	6.9 JB	32 JB	6.0 JB	290 B	7.9 JB	ND	15 JB	NT
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)														
Aroclor 1254	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	100*	*1,000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 2
Draft Soil Analytical Results
Niagara Falls Armed Forces Reserve Center
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	Unrestricted	Restricted Commmercial	SP-47-6-8	SP-50-1-3	SP-50-6-8	SP-51-1-3	SP-51-6-8	EX-NORTH	EX-SOUTH	EX-EAST	EX-WEST	EX-FLOOR	OUTFALL 004	RINSATE-SOIL
Parameter	Soil Cleanup	Soil Cleanup												
	Objectives	Objectives	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)														
Acetone	50	*500,000*	NT	NT	NT	NT	NT	44	17 J	17 J	29	ND	ND	ND
Methylcyclohexane	NV	*NV*	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1,300	*150,000*	NT	NT	NT	NT	NT	2.4 JB	2.4 JB	2 JB	1.8 JB	2 JB	ND	ND
Methylene Chloride	50	*500,000*	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	100,000	*NV*	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)														
Naphthalene	12,000	*500,000*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	390 J	ND
2-Methylnaphthalene	410 [9]	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	460 J	ND
4-Methylphenol	NV	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	*500,000*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	180 J	ND
Acenaphthene	20,000	*500,000*	NT	21 J	ND	ND	ND	ND	ND	ND	ND	ND	4,500	ND
Fluorene	30,000	*500,000*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	5,400	ND
Phenanthrene	100,000	*500,000*	NT	750 J	160 J	ND	ND	ND	ND	ND	ND	85 J	56,000 B	ND
Anthracene	100,000	*500,000*	NT	160 J	ND	ND	ND	ND	ND	ND	ND	41 J	19,000	ND
Fluoranthene	100,000	*500,000*	NT	1,000 J	260 J	ND	19 J	ND	18 J	ND	ND	580	190,000	ND
Pyrene	100,000	*500,000*	NT	740 J	200 J	ND	ND	ND	18 J	ND	ND	550	160,000	ND
Benzo(a)anthracene	1,000	*5,600*	NT	410 J	140 J	ND	ND	ND	26 J	ND	ND	320	**120,000**	ND
Dibenzo(a,h)anthracene	330	*560*	NT	ND	ND	ND	ND	ND	20 J	ND	ND	47 J	ND	ND
Dibenzofuran	7,000	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	2,400 J	ND
Diethyl phthalate	NV	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	NV	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	NV	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	50,000 [9]	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	NV	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	8,600	ND
Chrysene	1,000	*56,000*	NT	390 J	120 J	ND	ND	ND	15 J	ND	ND	290	**120,000**	ND
Benzo(b)fluoranthene	1,000	*5,600*	NT	420 J	150 J	ND	ND	4.8 J	32 J	ND	ND	290	**120,000**	ND
Benzo(k)fluoranthene	800	*56,000*	NT	280 J	89 J	ND	ND	4.2 J	22 J	ND	ND	170 J	49,000 B	ND
Biphenyl	NV	*NV*	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1,000	*1,000*	NT	380 J	130 J	ND	ND	ND	28 J	ND	ND	270	**82,000 B**	ND
Indeno(1,2,3-cd)pyrene	500	*5,600*	NT	230 JB	93 JB	ND	ND	ND	26 J	ND	ND	130 J	**28,000 B**	ND
Benzo(g,h,i)perylene	100,000	*500,000*	NT	230 JB	97 JB	ND	17 JB	ND	27 J	ND	ND	140 J	29,000 B	ND
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)														
Aroclor 1254	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	70 J	ND	ND
Aroclor 1260	NV	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	210	ND
Total PCBs	100*	*1,000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	70	210	ND

Table 2
Draft Soil Analytical Results
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Notes:

1. Compounds detected in one or more samples are presented on this table. Refer to Attachment C for list of all compounds included in analysis.
2. Analytical testing completed by Test America Laboratories.
3. ug/kg = part per billion; mg/kg = parts per million
4. < indicates compound was not detected above method detection limits.
5. B = Compound was found in the blank and sample.
6. J = Result is less than the reporting limit but greater or equal to the method detection limit and the concentration is an approximate value.
7. NV = no value.
8. NT = not tested.
9. Shading indicates value exceeds Unrestricted Use Soil Cleanup Objectives.
10. **Bold** indicates value exceeds Restricted Commercial Use Soil Cleanup Objectives.
11. A duplicate sample (DUP-1) was collected at soil probe location SP-34, 6 to 8 feet.
12. *Soil cleanup objective is for the sum of the Aroclor compound concentrations detected (Total PCBs).
13. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6: Unrestricted Use Soil Cleanup Objectives and the Supplemetal Soil Cleanup Objectives (SSCOs) are from NYSDEC Final Commissioners Policy, CP-51, Dated October 21, 2010.

Table 3
Groundwater Analytical Results
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Class GA Criteria	SP-22-110926	SP-25-110926	SP-30-110927	SP-32-110926	SP-34-110926	SP-34-110926 (DUP)	SP-36-110927	SP-42-110927
Volatile Organic Compounds - EPA Method 8260 TCL (ug/L)									
2-Butanone (MEK)	50	ND	ND	ND	ND	ND	ND	ND	3.8 J
Acetone	50	ND	5.8 J	ND	3.0 J	3.4 J	3.8 J	6.6 J	23
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	NV	0.32 J	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	NV	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	NV	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	5	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	0.58 J	ND	ND	ND	ND
Trichlorofluoromethane	5	6.3	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	NV	6.6	5.8	ND	3.6	3.4	3.8	0.0	26.8
Semi-Volatile Organic Compounds - EPA Method 8270 (ug/L)									
2,4-Dimethylphenol	1	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	NV	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	1	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20	3.3 J	ND	ND	ND	ND	ND	ND	ND
Anthracene	50	0.91 J	0.43 J	ND	ND	ND	ND	ND	ND
Benzo [a] anthracene	0.002*	0.49 J	0.85 J	ND	ND	0.44 J	0.35 J	ND	ND
Benzo [a] pyrene	ND	ND	0.95 J	ND	ND	ND	ND	ND	ND
Benzo [b] fluoranthene	0.002*	ND	1.1 J	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	NV	ND	0.79 J	ND	ND	ND	ND	ND	ND
Carbazole	5	1.9 J	0.41 J	ND	ND	ND	ND	ND	ND
Chrysene	0.002*	0.39 J	0.77 J	ND	ND	0.43 J	0.47 J	ND	ND
Dibenzofuran	NV	1.2 J	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	50	4.0 J	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl-phthalate	NV	0.5 JB	0.46 JB	ND	0.47 JB	0.33 JB	0.44 JB	0.74 J	ND
Dibenz(a,h)anthracene	NV	ND	0.67 J	ND	ND	ND	ND	ND	ND
Fluoranthene	50	1.7 J	1.2 J	0.45 J	ND	0.90 J	0.77 J	ND	ND
Fluorene	50	2.8 J	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.002	ND	0.91 J	ND	ND	ND	ND	ND	ND
Naphthalene	10 *	3.8 J	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	50 *	3.7 J	0.59 J	ND	ND	0.44 J	0.44 JB	ND	ND
Pyrene	50	1.5 J	1.2 J	ND	ND	0.99 J	0.83 J	ND	ND
Total SVOCs	NV	26.2	10.3	0.5	0.5	3.5	3.3	0.7	0.0
PCBs - EPA Method 8082 (ug/L)									
Aroclor 1254	NV	ND	ND	ND	2	ND	ND	ND	ND
Aroclor 1260	NV	ND	ND	0.77	1	D	ND	13	ND
Total PCBs	0.09 [11]	0.0	0.0	0.77	3.0	0.0	0.0	13.0	0.0

Table 3
Groundwater Analytical Results
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Class GA Criteria	SP-49-110927	RINSATE	TRIP BLANK 1	TRIP BLANK 2
Volatile Organic Compounds - EPA Method 8260 TCL (ug/L)					
2-Butanone (MEK)	50	ND	ND	ND	ND
Acetone	50	ND	ND	ND	ND
Benzene	1	1.6	ND	ND	ND
Carbon disulfide	NV	ND	ND	ND	ND
cis-1,2-Dichloroethene	5	ND	ND	ND	ND
Cyclohexane	NV	0.95 J	ND	ND	ND
Ethylbenzene	5	1.3	ND	ND	ND
Methylcyclohexane	NV	1.1	ND	ND	ND
Methylene chloride	5	ND	ND	0.62 J	0.66 J
Toluene	5	2.7	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND
Trichlorofluoromethane	5	ND	ND	ND	ND
Total Xylenes	5	1.8 J	ND	ND	ND
Total VOCs	NV	6.7	ND	0.62	0.66
Semi-Volatile Organic Compounds - EPA Method 8270 (ug/L)					
2,4-Dimethylphenol	1	ND	ND	NT	NT
2-Methylnaphthalene	NV	ND	ND	NT	NT
4-Methylphenol	1	ND	ND	NT	NT
Acenaphthene	20	ND	ND	NT	NT
Anthracene	50	ND	ND	NT	NT
Benzo [a] anthracene	0.002*	ND	ND	NT	NT
Benzo [a] pyrene	ND	ND	ND	NT	NT
Benzo [b] fluoranthene	0.002*	ND	ND	NT	NT
Benzo(g,h,i)perylene	NV	ND	ND	NT	NT
Carbazole	5	ND	ND	NT	NT
Chrysene	0.002*	ND	ND	NT	NT
Dibenzofuran	NV	ND	ND	NT	NT
Diethyl phthalate	50	ND	ND	NT	NT
Di-n-butyl-phthalate	NV	ND	ND	NT	NT
Dibenz(a,h)anthracene	NV	ND	ND	NT	NT
Fluoranthene	50	ND	ND	NT	NT
Fluorene	50	ND	ND	NT	NT
Indeno(1,2,3-cd)pyrene	0.002	ND	ND	NT	NT
Naphthalene	10 *	ND	ND	NT	NT
Phenanthrene	50 *	ND	ND	NT	NT
Pyrene	50	ND	ND	NT	NT
Total SVOCs	NV	0.0	0.0	0.0	0.0
PCBs - EPA Method 8082 (ug/L)					
Aroclor 1254	NV	ND	ND	NT	NT
Aroclor 1260	NV	ND	ND	NT	NT
Total PCBs	0.09 [11]	0.0	0.0	0.0	0.0

Table 3
Groundwater Analytical Results
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Notes:
1. Compounds detected in one or more samples are presented on this table.
2. Analytical testing completed by Test America Laboratories.
3. NYSDEC Class GA criteria obtained from Division of Water Technical and Operational Guidance Series (TOGS 1.1.1)
4. ug/L = part per billion (ppb); mg/L = part per million (ppm)
5. Shading indicates values exceeding NYSDEC Class GA groundwater criteria.
6. Class GA criteria shown is for total xylene concentration.
7. < = compound was not detected.
8. * indicates a Guidance Value instead of a Standard Value.
9. NV = no value.
10. ND = non-detectable concentration by approved analytical methods.
11. Groundwater criteria is for the sum of the Aroclor compound concentrations detected (Total PCBs).

Table 4
Secondary Screening Process - Subsurface Soil CPC Selection
USACE Niagara - Niagara Falls, NY

Analyte	CAS Number	Frequency of Detection	Mean of Detected (mg/kg)	Range of Detected(mg/kg)	95% UCL (mg/kg)	Max. Detect (mg/kg)	EPC (mg/kg)	RSL (mg/kg)	CPC
Acetone	67-64-1	37/52	0.039	0.0019-0.34	0.037[a]	0.34	0.037	630,000	N
Benzo(a)anthracene	56-55-3	43/65	0.645	0.0034-10.0	1.575[b]	10.0	1.575	2.1	Y
Dibenzo(a,h)anthracene	53-70-3	15/65	0.296	0.01-2.3	0.257[c]	2.3	0.257	0.21	Y
Chrysene	218-01-9	40/65	0.678	0.0079-9.7	1.54[b]	9.7	1.540	210	N
Benzo(b)fluoranthene	205-99-2	49/65	0.716	0.0045-14.0	2.052[b]	14.0	2.052	2.1	Y
Benzo(k)fluoranthene	207-08-9	44/65	0.365	0.0024-6.5	0.966[b]	6.5	0.966	21	N
Benzo(a)pyrene	50-32-8	40/65	0.806	0.007-14.0	1.992[b]	14.0	1.992	0.210	Y
Indeno(1,2,3-cd)pyrene	193-39-5	36/65	0.445	0.0062-8.8	1.131[b]	8.80	1.131	2.1	Y
Aroclor 1254	11097-69-1	27/82	2.201	0.007-15.0	1.241[a]	15.0	1.241	0.74	Y
Aroclor 1260	11096-82-5	16/82	0.450	0.025-1.6	0.158[a]	1.60	0.158	0.74	Y

Notes:

mg/kg - Milligrams per Kilogram
UCL- Upper Concentration Limit
EPC - Exposure Point Concentration
RSL - Risk Based Concentration (USEPA Regional Screening Level (RSL) Tables for Industrial Soil, June 2011)
CPC - Contaminant of Potential Concern
Y - Yes
N- No
a- Calculated using the 95% KM (Percentile Bootstrap) Method
b- Calculated using the 97.5% KM (Chebyshev) Method
c- Calculated using the 95% KM (Chebyshev) Method

Table 5
Secondary Screening Process - Ground Water CPC Selection
USACE Niagara - Niagara Falls, New York

Analyte	CAS Number	Frequency of Detection	Mean of Detected (ug/L)	Range of Detected(ug/L)	95% UCL (ug/L)	Max. Detect (ug/L)	EPC (ug/L)	RSL (ug/L)	CPC
Benzene	71-43-2	1/10	NA	NA	NC	1.6	1.6	0.41	Y
Naphthalene	91-20-3	2/8	8.40	3.8-13.0	NC	8.4	8.4	0.14	Y
Toluene	108-88-3	2/10	45.85	2.7-89.0	NC	89.0	89.0	2,300	N
Trichloroflorομethane	75-69-4	2/10	4.025	1.75-6.3	NC	6.3	6.3	1,300	N
2,4-Dimethylphenol	105-67-9	1/8	NA	NA	NC	3.7	3.7	730	N
4-Methylphenol	106-44-5	1/8	NA	NA	NC	44.0	44.0	NS	N
2-Methylnaphthalene	91-57-6	1/8	NA	NA	NC	16.0	16.0	150	N
Benzo(a)anthracene	56-55-3	5/8	2.416	0.44-8.3	3.653[a]	8.30	3.653	0.029	Y
Benzo(b)fluoranthene	205-99-2	2/8	4.2	1.1-7.3	7.3[a]	7.3	7.30	0.029	Y
Carbazole	86-74-8	4/8	23.690	0.41-92	35.42[b]	92.0	35.42	NS	N
Benzo(a)pyrene	50-32-8	2/8	2.925	0.95-4.9	NC	4.9	4.90	0.0029	Y
Chrysene	218-01-9	5/8	2.229	0.155-2.229	13.29[c]	2.23	2.230	2.9	N
Indeno(1,2,3-cd)pyrene	193-39-5	1/8	NA	NA	NC	0.91	0.91	0.029	Y
Phenol	108-95-2	1/8	NA	NA	NC	330	330	11,000	N
PCBs									
Aroclor 1254	11097-69-1	3/8	3.267	1.7-6.1	3.472[b]	6.1	3.47	0.034	Y
Aroclor 1260	11096-82-5	5/8	3.246	0.52-13.0	12.29[d]	13.0	12.29	0.034	Y

Notes:

ug/L - Micrograms per liter
UCL- Upper Concentration Limit
EPC - Exposure Point Concentration
RSL - Regional Screening Level (USEPA Regional Screening Level (RSL) Tables for Tap Water, June 2011)
CPC - Contaminant of Potential Concern
Y- Yes
N- No
NA- Not enough detected data available
NC- Not calculated because only one detected value.
NS- No RSL is available for the compound.
a- Calculated using the 95% KM (BCA) method
b- Calculated using the 95% KM (t) method
c- Calculated using the 99%KM (Chebyshev) method
d- Calculated using the 97.5% KM (Chebyshev) method

Table 6
Final CPC Selection
USACE Niagara - Niagara Falls, New York

Chemicals of Potential Concern	
Sub Surface Soil	Groundwater
Benzo(a)anthracene	Benzene
Dibenz(a,h)anthracene	Naphthalene
Benzo(b)fluoranthene	Benzo(a)anthracene
Benzo(a)pyrene	Benzo(b)fluoranthene
Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene
Aroclor 1254	Indeno(1,2,3-cd)pyrene
Aroclor 1260	Aroclor 1254
	Aroclor 1260

Table 7
Summary of Potential Exposure Pathways
USACE Niagara - Niagara Falls, New York

Potentially Exposed Population	Exposure Route, Medium, Exposure Point	Pathway Selected for Evaluation	Reason for Selection
Worker	Dermal exposure to sub surface soil	Yes	Future use of the Site is industrial/commerical, therefore the potential exists for future workers to come in contact with soil during excavation or construction activities.
Worker	Inhalation of sub surface soil particulates from wind	Yes	Future use of the Site is industrial/commerical, therefore the potential for land disturbance could cause future workers to come in contact with soil particulates.
Worker	Incidental ingestion of sub surface soil	Yes	Future use of the Site is industrial/commerical, therefore the potential exists for future workers to come in contact with soil during excavation or construction activities.
Worker	Accidental Ingestion of groundwater	No	Future use of the Site is industrial/commerical, and groundwater at the Site is derived from public water. In addition, incidental ingestion of exposed groundwater during construction activities would be extremely rare and sporadic.
Worker	Inhalation of volatiles through bathing and other domestic tasks; inhalation of exposed groundwater	Yes	Future use of the Site is industrial/commericial, therefore no residential water use will occur at the Site. However, exposed groundwater could occur during construction activites.
Worker	Dermal exposure to groundwater	Yes	Future use of the Site is industrial/commercial, therefore the potential exists for future workers to come in contact with the groundwater during construction activities at the Site.

Table 8
Exposure Assessment - Subsurface Soil - Dermal
USACE Niagara - Niagara Falls, New York

Dermal Contact with Chemicals in Sub Surface Soil (Adult Commercial/Industrial Worker Scenario)

Compound	EPC (mg/kg)	DA (mg/cm^2)	Absorbed Dose (mg/kg-day)	Absorption factor	Carcinogen
Benzo(a)anthracene	1.575	4.10E-08	4.72E-07	0.13	Y
Dibenz(a,h)anthracene	0.257	6.68E-09	7.71E-08	0.13	Y
Benzo(b)fluoranthene	2.052	5.34E-08	6.15E-07	0.13	Y
Benzo(a)pyrene	1.992	5.18E-08	5.97E-07	0.13	Y
Indeno(1,2,3-cd)pyrene	1.131	2.94E-08	3.39E-07	0.13	Y
Aroclor 1254	1.241	3.47E-08	4.01E-07	0.14	Y
Aroclor 1260	0.158	4.42E-09	5.10E-08	0.14	Y

Notes:

Calculated dosage is absorbed dose, not the intake dose

DA= C x CF x AF x ABS

Absorbed dose(mg/kg-day) = DA x EF x ED X EV X SA / BW X AT

Equation from RAGS Part A- Chapter 6

C = chemical concentration (EPC) mg/kg (varies per compound)

CF= Conversion factor (10E-6 kg/mg)

AF= Soil to Skin Adherence Factor (mg/cm^2), Assume 0.2 for adult worker(RAGS, Part E, Exhibit 3-5; Updated Dermal Exposure Assessment

SA = Skin surface area available for contact (cm^2/event) Assume 3,300 cm^2 for average adult (Updated Dermal Exposure Assessment Guidance)

ABS= Absorption Factor, varies per compound, use values presented in Regional Screening Level Industrial Soil Table, June 2011

EF= Exposure frequency (days per/year), assume 250 (RAGS Part E Exhibit 3-5)

ED= Exposure duration, 25 years (RAGS Part E, Exhibit 3-5)

EV= Event frequency, assume 1 (RAGS Part E, Exhibit 3-5)

BW= Body weight, assume 70kg (RAGS)

AT= Averaging Time (period over which exposure is average, days) For non-carcinogenic ED x 365 days/year; for carcinogens 70 years x 365 days/year)

EPC- Exposure Point Concentration

Table 9
Exposure Assessment - Subsurface Soil - Dermal
USACE Niagara - Niagara Falls, New York

Dermal Contact with Chemicals in Sub Surface Soil (Adult Construction Worker Scenario)

Compound	EPC (mg/kg)	DA (mg/cm^2)	Absorbed Dose (mg/kg-day)	Absorption factor	Carcinogen
Benzo(a)anthracene	1.575	6.14E-08	1.02E-08	0.13	Y
Dibenz(a,h)anthracene	0.257	1.00E-08	1.66E-09	0.13	Y
Benzo(b)fluoranthene	2.052	8.00E-08	1.33E-08	0.13	Y
Benzo(a)pyrene	1.992	7.77E-08	1.29E-08	0.13	Y
Indeno(1,2,3-cd)pyrene	1.131	4.41E-08	7.32E-09	0.13	Y
Aroclor 1254	1.241	5.21E-08	8.66E-09	0.14	Y
Aroclor 1260	0.158	6.64E-09	1.10E-09	0.14	Y

Notes:

Calculated dosage is absorbed dose, not the intake dose

DA= C x CF x AF x ABS

Absorbed dose(mg/kg-day) = DA x EF x ED X EV X SA / BW X AT

Equation from RAGS Part A- Chapter 6

C = chemical concentration (EPC) mg/kg (varies per compound)

CF= Conversion factor (10E-6 kg/mg)

AF= Soil to Skin Adherence Factor (mg/cm^2), Assume 0.3 for construction worker(RAGS, Part E, Exhibit 3-3; Activity Specific Surface Area Weighted)

SA = Skin surface area available for contact (cm^2/event) Assume 3,300 cm^2 for average adult (Updated Dermal Exposure Assessment Guidance)

ABS= Absorption Factor, varies per compound, use values presented in Regional Screening Level Industrial Soil Table, November 2011

EF= Exposure frequency (days per/year), assume 180 (Exhibit 1-2: Summary of Default Exposure Factors for Site Specific Soil Screening Evaluations, Soil Guidance USEPA 2002)

ED= Exposure duration, 0.5 years (Exhibit 1-2: Summary of Default Exposure Factors for Site Specific Soil Screening Evaluations, Soil Guidance USEPA 2002)

EV= Event frequency, assume 1 (RAGS Part E, Exhibit 3-5)

BW= Body weight, assume 70kg (RAGS)

AT= Averaging Time (period over which exposure is average, days) For non-carcinogenic ED x 365 days/year; for carcinogens 70 years x 365 days/year)

EPC- Exposure Point Concentration

Table 10
Exposure Assessment - Subsurface Soil - Inhalation
USACE Niagara - Niagara Falls, New York

Inhalation of Soil Particulates from Sub Surface Soil (Commercial/Industrial Worker)

Compound	CS (mg/m^3)	CA(ug/m^3)	Exposure concentration(ug/m^3)	Carcinogen	Molecular Weight
Benzo(a)anthracene	1.47E+01	2.15E-05	4.92E-06	Y	228.29
Dibenz(a,h)anthracene	2.93E+00	4.28E-06	9.78E-07	Y	278.35
Benzo(b)fluoranthene	2.12E+01	3.10E-05	7.08E-06	Y	252.3
Benzo(a)pyrene	2.06E+01	3.01E-05	6.87E-06	Y	252.32
Indeno(1,2,3-cd)pyrene	1.28E+01	1.87E-05	4.27E-06	Y	276.3
Aroclor 1254	1.66E+01	2.44E-05	5.57E-06	Y	328.0
Aroclor 1260	2.31E+00	3.38E-06	7.73E-07	Y	357.7

Notes:

Calculated dosage is absorbed dose, not the intake dose

EC (ug/m3) = CA x ET x EF x ED / AT

Equation from RAGS Part F- Equation 6

EC = Exposure concentration (ug/m$^{3)}$

CS= Soil concentration converted to ug/m3; varies per compound; Calculated EPC converted to ug/m$^{3\,(}$EPC X molecular weight X 0.0409)

CA= Concentration of particulates in air; CS/PEF; PEF calculated fromTable 4-5: Derivation of the PEF- Commericial/Industrial Scenario

ET = Exposure time (hours/day), Assume 8

EF= Exposure frequency (days per/year), Assume 250

ED= Exposure duration (years) , Assume 25

AT= Averaging Time (ED in years X 365 days/year X 24 hours/day)

EPC- Exposure Point Concentration

Table 11
Exposure Assessment - Subsurface Soil - Inhalation
USACE Niagara - Niagara Falls, New York

Inhalation of Soil Particulates from Sub Surface Soil (Construction Worker Scenerio)

Compound	CS (mg/m^3)	CA(ug/m^3)	Exposure concentration(ug/m^3)	Carcinogen	Molecular Weight
Benzo(a)anthracene	1.47E+01	2.15E-05	3.54E-06	Y	228.29
Dibenz(a,h)anthracene	2.93E+00	4.28E-06	7.04E-07	Y	278.35
Benzo(b)fluoranthene	2.12E+01	3.10E-05	5.10E-06	Y	252.3
Benzo(a)pyrene	2.06E+01	3.01E-05	4.95E-06	Y	252.32
Indeno(1,2,3-cd)pyrene	1.28E+01	1.87E-05	3.08E-06	Y	276.3
Aroclor 1254	1.66E+01	2.44E-05	4.01E-06	Y	328.0
Aroclor 1260	2.31E+00	3.38E-06	5.56E-07	Y	357.7

Notes:

Calculated dosage is absorbed dose, not the intake dose

EC (ug/m3) = CA x ET x EF x ED / AT

Equation from RAGS Part F- Equation 6

EC = Exposure concentration (ug/m$^{3)}$

CS= Soil concentration converted to ug/m3; varies per compound; Calculated EPC converted to ug/m$^{3\,(}$EPC X molecular weight X 0.0409)

CA= Concentration of particulates in air; CS/PEF; PEF calculated fromTable 4-5: Derivation of the PEF- Commericial/Industrial Scenario

ET = Exposure time (hours/day), Assume 8

EF= Exposure frequency (days per/year), Assume 180

ED= Exposure duration (years) , Assume 0.5

AT= Averaging Time (ED in years X 365 days/year X 24 hours/day)

EPC- Exposure Point Concentration

Table 12
Exposure Assessment - Subsurface Soil - Ingestion
USACE Niagara - Niagara Falls, New York

Incidental Ingestion of Sub Surface Soil (Commercial/Industrial Worker Scenario)

Compound	EPC (mg/kg)	Absorbed Dose (mg/kg-day)	Carcinogen
Benzo(a)anthracene	1.575	5.50E-07	Y
Dibenz(a,h)anthracene	0.257	8.98E-08	Y
Benzo(b)fluoranthene	2.052	7.17E-07	Y
Benzo(a)pyrene	1.992	6.96E-07	Y
Indeno(1,2,3-cd)pyrene	1.131	3.95E-07	Y
Aroclor 1254	1.241	4.34E-07	Y
Aroclor 1260	0.158	5.52E-08	Y

Notes:

Intake(mg/kg-day) = CS x IR x CF x FI x EF x ED / BW X AT

Equation from RAGS Part A- Chapter 6 (Exhibit 6-14)

CS = chemical concentration in soil (EPC) mg/kg (varies per compound)

IR= Ingestion rate (mg soil per day); For adults, assume 100 mg per day

CF = Conversion factor, 10^{-6} kg/mg

FI= Fraction Ingested from Contaminated Source, Pathway-specific value, Assume 100%

EF= Exposure frequency, 250 (days per/year)

ED= Exposure duration, 25 years

BW= Body weight, assume 70 kg (RAGS)

AT= Averaging Time (period over which exposure is average, days) For non-carcinogenic ED x 365 days/year; for carcinogens 70 years x 365 days/year)

EPC- Exposure Point Concentration

Table 13
Exposure Assessment - Subsurface Soil - Ingestion
USACE Niagara - Niagara Falls, New York

Incidental Ingestion of Sub Surface Soil (Construction Worker Scenario)

Compound	EPC (mg/kg)	Absorbed Dose (mg/kg-day)	Carcinogen
Benzo(a)anthracene	1.575	2.62E-08	Y
Dibenz(a,h)anthracene	0.257	4.27E-09	Y
Benzo(b)fluoranthene	2.052	3.41E-08	Y
Benzo(a)pyrene	1.992	3.31E-08	Y
Indeno(1,2,3-cd)pyrene	1.131	1.88E-08	Y
Aroclor 1254	1.241	2.06E-08	Y
Aroclor 1260	0.158	2.62E-09	Y

Notes:

Intake(mg/kg-day) = CS x IR x CF x FI x EF x ED / BW X AT

Equation from RAGS Part A- Chapter 6 (Exhibit 6-14)

CS = chemical concentration in soil (EPC) mg/kg (varies per compound)

IR= Ingestion rate (mg soil per day); For construction, assume 330 mg per day

CF = Conversion factor, 10^{-6} kg/mg

FI= Fraction Ingested from Contaminated Source, Pathway-specific value, Assume 100%

EF= Exposure frequency, 180 (days per/year)

ED= Exposure duration, 0.5 years

BW= Body weight, assume 70 kg (RAGS)

AT= Averaging Time (period over which exposure is average, days) For non-carcinogenic ED x 365 days/year; for carcinogens 70 years x 365 days/year)

EPC- Exposure Point Concentration

Table 14
Exposure Assessment - Inhalation - Groundwater
USACE Niagara - Niagara Falls, New York

Inhalation of Volatiles from Exposed Groundwater (Construction Worker)					
Compound	CW (ug/L)	CT(ug/m^3)	Exposure concentration(ug/m^3)	Volatilization Factor	Carcinogen
Benzene	1.6	1.50E+01	2.46E+00	9.35E+00	Y
Naphthalene	8.4	5.54E+01	9.11E+00	6.60E+00	N

Notes:

Calculated dosage is absorbed dose, not the intake dose

EC (ug/m3) = CT x ET x EF x ED / AT

Equation from RAGS Part F- Equation 6

EC = Exposure concentration (ug/m^3)

CW= Water concentration (EPC)

CT= Concentration of contaminant in trench; calculated from Equation 3.1: Airborne Concentration of a Contaminant in a Trench (VF x CW)

ET = Exposure time (hours/day), Assume 8

EF= Exposure frequency (days per/year), Assume 180

ED= Exposure duration (years) , Assume 0.5

AT= Averaging Time (ED in years X 365 days/year X 24 hours/day)

EPC- Exposure Point Concentration

Table 15
Exposure Assessment - Dermal - Ground Water
USACE Niagara - Niagara Falls, New York

Dermal Contact with Chemicals in Ground Water (Construction Worker Scenario)

Compound	EPC (ug/L)	CW (mg/cm^3)	FA	Kp	J_{event}	DA_{event}	Absorbed Dose	Carcinogen
Benzene	1.6	1.60E-06	1.00E+00	1.50E-02	2.90E-01	2.72E-08	4.52E-09	Y
Naphthalene	8.4	8.40E-06	1.00E+00	4.70E-02	5.60E-01	6.22E-07	1.45E-05	N
Benzo(a)anthracene	3.653	3.65E-06	1.00E+00	4.70E-01	2.03E+00	5.14E-06	8.54E-07	Y
Benzo(b)fluoranthene	7.30	7.30E-06	1.00E+00	7.00E-01	2.77E+00	1.79E-05	2.98E-06	Y
Benzo(a)pyrene	4.9	4.90E-06	1.00E+00	7.00E-01	2.69E+00	1.18E-05	1.97E-06	Y
Indeno(1,2,3-cd)pyrene	0.91	9.00E-07	6.00E-01	1.00E+00	3.78E+00	6.98E-07	1.16E-07	Y
Aroclor 1254	3.47	3.47E-06	7.00E-01	4.50E-01	7.21E+00	3.67E-07	6.09E-08	Y
Aroclor 1260	12.29	1.22E-05	5.00E-01	3.84E-01	1.33E+01	2.23E-07	3.71E-08	Y

Notes:

Calculated dosage is absorbed dose, not the intake dose

Dermally Absorbed dose(mg/kg-day) = DA_{event} x EV x ED x EF x SA / BW x AT

Equation from RAGS Part E- Chapter 3

DA_{event}= 2 x FA x Kp x CW √ [(6 x j_{event} x $t_{event)}$ / pi]

FA= Fraction absorbed water (chemical specific, obtained from RAGS Part E, Appendix B)

Kp= Dermal permeability coefficient of compound in water (chemical specific, obtained from RAGS Part E, Appendix B)

Cw= Chemical concentration in water (EPC converted to mg/cm^3)

J_{event}= Lag time per event (hr/event) Chemical specific, obtained from Appendix B

T_{event}= Event duration (hr/event) assume 0.58 (RAGS Part E Exhibit 3-2)

EV= Event frequency (events/day) assume 1 (RAGS Part E Exhibit 3-2)

EF= Exposure frequency (days per/year), assume 180 (Exhibit 1-2: Summary of Default Exposure Factors for Site Specific Soil Screening Evaluations, Soil Guidance USEPA 2002)

ED= Exposure duration, 0.5 years (Exhibit 1-2: Summary of Default Exposure Factors for Site Specific Soil Screening Evaluations, Soil Guidance USEPA 2002)

SA= Skin surface area (cm^2), assume 3,300 (RAGS Part E Exhibit 3-2)

BW= Body weight, assume 70kg (RAGS)

AT= Averaging Time (period over which exposure is average, days). For carcinogens 70 years x 365 days / year; for non-carcinogens ED X 365 days/year

EPC- Exposure Point Concentration

Table 16
Carcinogenic Risk Calculations
Subsurface Soil - Dermal
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Sub Surface Soil - Dermal (Commercial/Industrial Worker Scenario)

Compound	Absorbed Dose (mg/kg-day)	Slope Factor (mg/kg-day)	Source	Oral Absorbed Efficiency (ABSderm)	Adjusted Slope Factor (mg/kg-day)	Carcinogen	Cancer Risk
Benzo(a)anthracene	4.72E-07	7.30E-01	ECAO	1.3E-01	5.62E+00	B2	2.7E-06
Dibenz(a,h)anthracene	7.71E-08	7.30E+00	ECAO	1.3E-01	5.62E+01	B2	4.3E-06
Benzo(b)fluoranthene	6.15E-07	7.30E-01	ECAO	1.3E-01	5.62E+00	B2	3.5E-06
Benzo(a)pyrene	5.97E-07	7.30E+00	IRIS	1.3E-01	5.62E+01	B2	3.4E-05
Indeno(1,2,3-cd)pyrene	3.39E-07	7.30E-01	ECAO	1.3E-01	5.62E+00	B2	1.9E-06
Aroclor 1254	4.01E-07	2.00E+00	S	1.4E-01	1.43E+01	B2	5.7E-06
Aroclor 1260	5.10E-08	2.00E+00	S	1.4E-01	1.43E+01	B2	7.3E-07
Total Cancer Risk							**5.23E-05**

Notes:

Absorbed dose calculated in Table 8

Equations and information obtained from RAGS Part E

Cancer Risk (Absorbed dose x adjusted slope factor)

Oral Absorbed Efficiency values obtained from Exhibit 3-4, RAGS Part E

Adjusted slope factor represents the absorbed amount and not the administered; (Slope factor / ABSderm)

Standard USEPA Cancer Classification

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

IRIS= Integrated Risk Information System

ECAO= Environmental Criteria and Assessment Office

S= The User's Guide for the RSL Screening Level Table states that the upper bound slope factor of 2.0 mg/kg per day should be used.

Table 17
Carcinogenic Risk Calculations
Subsurface Soil - Dermal
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Sub Surface Soil - Dermal (Construction Worker Scenario)

Compound	Absorbed Dose (mg/kg-day)	Slope Factor (mg/kg-day)	Source	Oral Absorbed Efficiency (ABSderm)	Adjusted Slope Factor (mg/kg-day)	Carcinogen	Cancer Risk
Benzo(a)anthracene	1.02E-08	7.30E-01	ECAO	1.3E-01	5.62E+00	B2	5.7E-08
Dibenz(a,h)anthracene	1.66E-09	7.30E+00	ECAO	1.3E-01	5.62E+01	B2	9.3E-08
Benzo(b)fluoranthene	1.33E-08	7.30E-01	ECAO	1.3E-01	5.62E+00	B2	7.5E-08
Benzo(a)pyrene	1.29E-08	7.30E+00	IRIS	1.3E-01	5.62E+01	B2	7.2E-07
Indeno(1,2,3-cd)pyrene	7.32E-09	7.30E-01	ECAO	1.3E-01	5.62E+00	B2	4.1E-08
Aroclor 1254	8.66E-09	2.00E+00	S	1.4E-01	1.43E+01	B2	1.2E-07
Aroclor 1260	1.10E-09	2.00E+00	S	1.4E-01	1.43E+01	B2	1.6E-08
Total Cancer Risk							**1.13E-06**

Notes:

Absorbed dose calculated in Table 9

Equations and information obtained from RAGS Part E

Cancer Risk (Absorbed dose x adjusted slope factor)

Oral Absorbed Efficiency values obtained from Exhibit 3-4, RAGS Part E

Adjusted slope factor represents the absorbed amount and not the administered; (Slope factor / ABSderm)

Standard USEPA Cancer Classification

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

IRIS= Integrated Risk Information System

ECAO= Environmental Criteria and Assessment Office

S= The User's Guide for the RSL Screening Level Table states that the upper bound slope factor of 2.0 mg/kg per day should be used.

Table 18
Carcinogenic Risk Calculations
Subsurface Soil - Inhalation
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Sub Surface Soil - Inhalation (Commercial/Industrial Worker Scenario)

Compound	Exposure concentration(ug/m^3)	IUR(ug/m^3)$^{-1}$	Source	Carcinogen	Cancer Risk
Benzo(a)anthracene	4.92E-06	1.10E-04	CALEPA	B2	5.41E-10
Dibenz(a,h)anthracene	9.78E-07	1.20E-03	CALEPA	B2	1.17E-09
Benzo(b)fluoranthene	7.08E-06	1.10E-04	CALEPA	B2	7.79E-10
Benzo(a)pyrene	6.87E-06	1.10E-03	CALEPA	B2	7.56E-09
Indeno(1,2,3-cd)pyrene	1.10E-04	1.10E-04	CALEPA	B2	1.21E-08
Aroclor 1254	5.57E-06	5.70E-04	S	B2	3.17E-09
Aroclor 1260	7.73E-07	5.70E-04	S	B2	4.41E-10
Total Cancer Risk					**2.58E-08**

Notes:

Exposure concentration calculated in Table 10

Cancer Risk (Exposure concentration X IUR)

IUR= Slope factor for inhalation risk obtained from RSL Tables, source listed in "Source" column

Standard USEPA Cancer Classification

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

Cal EPA- California EPA

S- User's Guide to RSL Tables

Table 19
Carcinogenic Risk Calculations
Subsurface Soil - Inhalation
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Sub Surface Soil - Inhalation (Construction Worker Scenario)

Compound	Exposure concentration(ug/m^3)	IUR(ug/m^3)$^{-1}$	Source	Carcinogen	Cancer Risk
Benzo(a)anthracene	3.54E-06	1.10E-04	CALEPA	B2	3.89E-10
Dibenz(a,h)anthracene	7.04E-07	1.20E-03	CALEPA	B2	8.45E-10
Benzo(b)fluoranthene	5.10E-06	1.10E-04	CALEPA	B2	5.61E-10
Benzo(a)pyrene	4.95E-06	1.10E-03	CALEPA	B2	5.45E-09
Indeno(1,2,3-cd)pyrene	3.08E-06	1.10E-04	CALEPA	B2	3.39E-10
Aroclor 1254	4.01E-06	5.70E-04	S	B2	2.29E-09
Aroclor 1260	5.56E-07	5.70E-04	S	B2	3.17E-10
Total Cancer Risk					**1.02E-08**

Notes:

Exposure concentration calculated in Table 11

Cancer Risk (Exposure concentration X IUR)

IUR= Slope factor for inhalation risk obtained from RSL Tables, source listed in "Source" column

Standard USEPA Cancer Classification

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

Cal EPA- California EPA

S- User's Guide to RSL Tables

Table 20
Carcinogenic Risk Calculations
Subsurface Soil - Ingestion
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Sub Surface Soil - Ingestion (Commercial/Industrial Scenario)

Compound	Absorbed Dose (mg/kg-day)	Slope Factor (mg/kg-day)	Source	GI Absorption Value (ABSgi)	Absorbed Slope Factor (mg/kg-day)	Carcinogen	Cancer Risk
Benzo(a)anthracene	5.50E-07	7.30E-01	ECAO	1.0E+00	7.30E-01	B2	4.02E-07
Dibenz(a,h)anthracene	8.98E-08	7.30E+00	ECAO	1.0E+00	7.30E+00	B2	6.56E-07
Benzo(b)fluoranthene	7.17E-07	7.30E-01	ECAO	1.0E+00	7.30E-01	B2	5.23E-07
Benzo(a)pyrene	6.96E-07	7.30E+00	IRIS	1.0E+00	7.30E+00	B2	5.08E-06
Indeno(1,2,3-cd)pyrene	3.95E-07	7.30E-01	ECAO	1.0E+00	7.30E-01	B2	2.88E-07
Aroclor 1254	4.34E-07	2.00E+00	S	1.0E+00	2.00E+00	B2	8.68E-07
Aroclor 1260	5.52E-08	2.00E+00	S	1.0E+00	2.00E+00	B2	1.10E-07
Total Cancer Risk							**7.9E-06**

Notes:

Absorbed dose calculated in Table 12

Cancer Risk (Absorbed dose x adjusted slope factor)

ABSgi= GI absorption values , fraction of contaminant absorbed in GI tract obtained from RSL Tables

Absorbed slope factor represents the absorbed amount and not the administered; (Oral Slope factor / ABSgi)

Standard USEPA Cancer Classification

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

IRIS= Integrated Risk Information System

ECAO= Environmental Criteria and Assessment Office

S= The User's Guide for the RSL Screening Level Table states that the upper bound slope factor of 2.0 mg/kg per day should be used.

Table 21
Carcinogenic Risk Calculations
Subsurface Soil - Ingestion
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Sub Surface Soil - Ingestion (Construction Scenario)

Compound	Absorbed Dose (mg/kg-day)	Slope Factor (mg/kg-day)	Source	GI Absorption Value (ABSgi)	Absorbed Slope Factor (mg/kg-day)	Carcinogen	Cancer Risk
Benzo(a)anthracene	2.62E-08	7.30E-01	ECAO	1.0E+00	7.30E-01	B2	1.91E-08
Dibenz(a,h)anthracene	4.29E-09	7.30E+00	ECAO	1.0E+00	7.30E+00	B2	3.13E-08
Benzo(b)fluoranthene	3.41E-08	7.30E-01	ECAO	1.0E+00	7.30E-01	B2	2.49E-08
Benzo(a)pyrene	3.31E-08	7.30E+00	IRIS	1.0E+00	7.30E+00	B2	2.42E-07
Indeno(1,2,3-cd)pyrene	1.88E-08	7.30E-01	ECAO	1.0E+00	7.30E-01	B2	1.37E-08
Aroclor 1254	2.06E-08	2.00E+00	S	1.0E+00	2.00E+00	B2	4.12E-08
Aroclor 1260	2.62E-09	2.00E+00	S	1.0E+00	2.00E+00	B2	5.24E-09
Total Cancer Risk							**3.77E-07**

Notes:

Absorbed dose calculated in Table 13

Cancer Risk (Absorbed dose x adjusted slope factor)

ABSgi= GI absorption values , fraction of contaminant absorbed in GI tract obtained from RSL Tables

Absorbed slope factor represents the absorbed amount and not the administered; (Oral Slope factor / ABSgi)

Standard USEPA Cancer Classification

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

IRIS= Integrated Risk Information System

ECAO= Environmental Criteria and Assessment Office

S= The User's Guide for the RSL Screening Level Table states that the upper bound slope factor of 2.0 mg/kg per day should be used.

Table 22
Carcinogenic Risk Calculations
Groundwater - Inhalation - Worker
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Groundwater- Inhalation- Worker Scenario

Compound	Exposure concentration(ug/m^3)	IUR(ug/m^3)$^{-1}$	Source	Carcinogen	Cancer Risk
Benzene	2.44E+00	7.80E-06	IRIS	A	1.90E-05
Naphthalene	9.11E+00	3.40E-05	Cal EPA	C	3.10E-04
Total Cancer Risk					**3.29E-04**

Notes:

Exposure concentration calculated in Table 14

Cancer Risk (Exposure concentration x IUR)

IUR= Slope factor for inhalation risk obtained from RSL Tables, sources are listed in the "Source" column.

Standard USEPA Cancer Classification

A-Human Carcinogen: There is enough evidence to conclude that it can cause cancer in humans.

C- Possible Human Carcinogen: There is limited evidence that it can cause cancer in animals in the absence of human data, but at present it is not conclusive.

Cal EPA- California EPA

IRIS- USEPA Integrated Risk Information System

Table 23
Risk Characterization
Ground Water - Dermal
USACE Niagara - Niagara Falls, New York

Cancer Risk Calculations for Ground Water- Dermal- (Construction Worker)

Compound	Absorbed Dose (mg/kg)	Slope Factor	Source	Oral Absorbed Efficiency (ABS_{GI})	Adjusted Slope Factor (mg/kg)	Carcinogen	Cancer Risk
Benzene	4.52E-09	5.5E-02	IRIS	100%	5.50E-02	A	2.49E-10
Benzo(a)anthracene	8.54E-07	7.3E-01	ECAO	86%	NA	B2	6.23E-07
Benzo(b)fluoranthene	2.98E-06	7.3E-01	ECAO	86%	NA	B2	2.18E-06
Benzo(a)pyrene	1.97E-06	7.3E+00	IRIS	86%	NA	B2	1.44E-05
Indeno(1,2,3-cd)pyrene	1.16E-07	7.3E-01	ECAO	86%	NA	B2	8.47E-08
Aroclor 1254	6.09E-08	2.0E+00	S	74%	NA	B2	1.22E-07
Aroclor 1260	3.71E-08	2.0E+00	S	74%	NA	B2	7.42E-08
Total Cancer Risk							**1.75E-05**

Notes:

Absorbed dose calculated in Table 15

Adjusted slope factor represents the absorbed amount and not administered; (Slope factor / ABS_{GI})

Cancer Risk (Absorbed dose x adjusted slope factor)

IRIS- Integrated Risk Information System

ECAO- Environmental Criteria and Assessment Office

USEPA Carcinogen Classification

A- Human Carcinogen: There is enough evidence to conclude that it can cause cancer in humans.

B2- Probable Human Carcinogen: There is inadequate evidence that it can cause cancer in humans but at present it is far from conclusive.

Total Cancer Risk is the sum of risk for individual compounds

NA= In accordance with RAGS Part E, Exhibit 4-1, PAHs and PCBs should not be adjusted.

Table 24
Risk Characterization - Non Cancer
Ground Water - Dermal
USACE Niagara - Niagara Falls, New York

Non-Cancer Risk Calculations for Ground Water- Dermal (Construction Worker)

Compound	Absorbed Dose (mg/kg)	RfD	Source	Oral Absorbed Efficiency (ABS_{GI})	AbsorbedRfD(mg/kg)	Carcinogen	Non Cancer Risk
Naphthalene	1.45E-07	2.0E-02	IRIS	100%	2.00E-02	C	7.25E-06
Total Non-Cancer Risk							**7.25E-06**

Notes:

Absorbed dose calculated in Table 15

Adjusted slope factor represents the absorbed amount and not administered; (Reference dose oral x ABS_{GI})

Non Cancer Risk (Absorbed dose / Absorbed reference dose)

IRIS- Integrated Risk Information Systme

ECAO- Environmental Criteria and Assessment Office

USEPA Carcinogen Classification

C- Possible Human Carcinogen: There is limited evidence that it can cause cancer in animals in the absence of human data, but at present it is not conclusive.

Total Non- Cancer Risk is the sum of risk for individual compounds

Table 25
Risk Characterization - Non Cancer
Soil - Dermal
USACE Niagara - Niagara Falls, New York

Non-Cancer Risk Calculations for Ground Water- Dermal (Construction Worker)

Compound	Exposed Population	Absorbed Dose (mg/kg)	RfD	Source	Oral Absorbed Efficiency (ABS_{GI})	AbsorbedRfD(mg/kg)	Non Cancer Risk
Aroclor 1254	Commerical/Industrial Worker	4.01E-07	2.0E-05	IRIS	100%	2.00E-05	2.01E-02
Aroclor 1254	Construction Worker	8.66E-09	2.0E-05	IRIS	100%	2.00E-05	4.33E-04
Total Non-Cancer Risk							**2.01E-02**

Notes:

Absorbed dose calculated in Tables 8 and 9

Adjusted slope factor represents the absorbed amount and not administered; (Reference dose oral x ABS_{GI})

Non Cancer Risk (Absorbed dose / Absorbed reference dose)

IRIS- Integrated Risk Information Systme

Total Non- Cancer Risk is the sum of risk for individual compounds

Table 26
Risk Characterization Summary Table
USACE Niagara - Niagara Falls, New York

Media	Population	Cancer Risk	Principal Contributing Pathway
Sub Surface Soil	Commercial/Industrial Worker	5.2E-05	Dermal contact
Sub Surface Soil	Commercial/Industrial Worker	2.6E-08	Inhalation
Sub Surface Soil	Commercial/Industrial Worker	7.9E-06	Ingestion
Total Sub Surface Soil Risk- Commercial/Industrial Worker		**6.0E-05**	
Sub Surface Soil	Construction Worker	1.1E-06	Dermal contact
Sub Surface Soil	Construction Worker	1.0E-08	Inhalation
Sub Surface Soil	Construction Worker	3.8E-07	Ingestion
Total Sub Surface Soil Risk- Construction Worker		**1.5E-06**	
Groundwater	Construction Worker	1.8E-05	Dermal contact
Groundwater	Construction Worker	3.3E-04	Inhalation
Total Groundwater Risk- Worker		**3.5E-04**	

Table 27
Risk Characterization Summary Table
USACE Niagara - Niagara Falls, New York

Media	Population	Non Cancer Risk	Principal Contributing Pathway
Sub Surface Soil	Commercial/Industrial Worker	2.0E-02	Dermal contact
Total Sub Surface Soil Risk- Commercial/Industrial Worker		**2.0E-02**	
Sub Surface Soil	Construction Worker	4.3E-04	Dermal contact
Total Sub Surface Soil Risk- Construction Worker		**4.3E-04**	
Groundwater	Construction Worker	7.3E-06	Dermal contact
Total Groundwater Risk- Construction Worker		**7.3E-06**	

Table 28
Potential Sources of Uncertainty
USACE Niagara - Niagara Falls, New York

Uncertainty	Effect	Justification
Exposure point concentration	Overestimate	The 95% UCL was calculated for each compound at the Site and used as the EPC in the risk assesment calculations. In addition, for sub surface soil, the 97.5% UCL was selected for a better statistical average, which yielded even more conservative estimates.
Probability of exposure pathways	Overestimate	As a conservative estimate, the future resident was evaluated in the HHRA. The current property has non-residential use.
Exposure assumptions (frequency, duration, time)	Overestimate	Parameters selected are conservative estimates of exposure
Degradation of chemicals	Overestimate	All intake calculations and risk estimates are based on recent chemical concentrations. Concentrations will tend to decrease over time as a result of degradation.
Extrapolation of animal toxicity data to humans	Unknown	Animal studies typically involve high dose exposures, while humans are exposed to low doses in the environment
Industrial RSL are not available for groundwater	Overestimate	Residential groundwater screening levels are used in the risk assessment, since industrial groundwater levels are not available. This makes the exposure estimates much more conservative.

APPENDIX A
Soil Probe Logs

GZA GEOENVIRONMENTAL OF NEW YORK
535 WASHINGTON ST. 11TH FL.
BUFFALO, NEW YORK
ENGINEERS AND SCIENTISTS

Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 22
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/26/11
END DATE: 9/26/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Brown, fine to medium GRAVEL, some fine to coarse Sand,	Headspace result =	0
1				trace Silt, trace Brick fragments, moist.	0 ppm (0-4' bgs)	
2						
						0
3						
4						
	S-2	4-8	60	(FILL) Brown, fine to medium SAND, some Gravel, little Clay, wet.	Headspace result =	0
5					0 ppm (4-8' bgs)	
				(FILL) Brown, Silty CLAY, little fine to medium Sand, wet.		
6						
				(FILL) Brown, Silty SAND, wet.		0
7						
8						
	S-3	8-12	60		Headspace result =	0
9					0 ppm (8-12' bgs)	
10				(FILL) Brown fine SAND, trace Silt, wet.		
						0
11						
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
12						
				End of SP-22 at 12.0 feet bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes: 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK
535 WASHINGTON ST. 11TH FL.
BUFFALO, NEW YORK
ENGINEERS AND SCIENTISTS

Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 23
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/26/11
END DATE: 9/26/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Brown, fine to medium GRAVEL, some fine to coarse	Headspace result =	0
1				Sand, trace Silt, moist.	0 ppm (0-4' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-23 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes: 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK
535 WASHINGTON ST. 11TH FL.
BUFFALO, NEW YORK
ENGINEERS AND SCIENTISTS

Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 24
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/26/11
END DATE: 9/26/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA
DATUM: NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	75	(FILL) Brown, fine to medium GRAVEL, some fine to coarse	Headspace result =	0
1				Sand, trace Silt, moist.	0 ppm (0-4' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-24 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK
535 WASHINGTON ST. 11TH FL.
BUFFALO, NEW YORK
ENGINEERS AND SCIENTISTS

Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 25
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/26/11	END DATE: 9/26/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	75	(FILL) Brown, fine to medium GRAVEL, some fine to coarse Sand, little Silt, trace Clay, trace Brick fragments, moist.	Headspace result = 0 ppm (0-4' bgs)	0
1						
2						
						0
3						
4						
	S-2	4-8	50	(FILL) Grayish brown, fine SAND, some Gravel, little Silt, moist.	Headspace result = 0 ppm (4-8' bgs)	0
5						
6						
						0
7						
				Grades to:..wet.		
8						
	S-3	8-11.5	<5		Headspace result = 0 ppm (8-11.5' bgs)	0
9						
10						
						0
11						
12				Refusal at 11.5 feet bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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ENGINEERS AND SCIENTISTS

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Niagara Falls, NY

Soil Probe SP- 26
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/26/11	END DATE: 9/26/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG:	Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER:	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD:	Direct push
ROCK DRILLING METHOD:	NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Brown, fine to medium SAND and GRAVEL, some Silt, trace Clay, moist.	Headspace result = 0 ppm (0-4' bgs)	0
1						
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	100		Headspace result = 0 ppm (4-8' bgs)	0
5						
6						
						0
7						
8						
	S-3	8-12	100		Headspace result = 0 ppm (8-12' bgs)	0
9						
10						
						0
11						
12						
				End of SP-26 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Niagara Falls, NY

Soil Probe SP- 27
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/26/11 END DATE: 9/26/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	40	(FILL) Brown, fine to medium SAND and GRAVEL, trace Silt,	Headspace result =	0
1				moist.	0 ppm (0-4' bgs)	
				(FILL) Light gray, some Silt. (Crushed Concrete)		
2						
						0
3				(FILL) Brown, fine to medium SAND, some Gravel, trace Silt,		
				moist.		
4						
	S-2	4-8	100	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
				Grades to:..wet.		
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-27 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 28
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/26/11 END DATE: 9/26/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	40	(FILL) Brown, fine to medium SAND and GRAVEL, trace	Headspace result =	0
1				Silt, moist.	0 ppm (0-4' bgs)	
2						
						0
3						
				(FILL) Grades to:..gray, some Silt, wet. (Crushed Concrete)		
4						
	S-2	4-8	100	Reddish brown, Silty CLAY, trace fine to medium Sand,	Headspace result =	0
5				moist.	0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	50		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-28 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 29
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/26/11	END DATE: 9/26/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG:	Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER:	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD:	Direct push
ROCK DRILLING METHOD:	NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	50	(FILL) Brown, fine to medium GRAVEL, some fine to coarse	Headspace result =	0
1				Sand, trace Silt, moist.	0 ppm (0-4' bgs)	
2						
						0
3						
4						
	S-2	4-8	100	Reddish brown, Silty CLAY, trace fine to medium Sand,	Headspace result =	0
5				moist.	0 ppm (4-8' bgs)	
6						
				Reddish brown, Clayey SILT, trace fine to medium Sand, wet.		0
7						
				Reddish brown, Silty CLAY, trace fine to medium Sand,		
8				moist.		
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-29 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 30
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/27/11 END DATE: 9/27/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	25	(FILL) Gray, fine to medium SAND and GRAVEL, some Silt,	Headspace result =	0
1				trace Clay, moist.	0 ppm (0-4' bgs)	
2						
						0
3						
4						
	S-2	4-8	100	(FILL) Grayish brown, fine to coarse SAND, trace Gravel, trace	Headspace result =	0
5				Silt, moist.	0 ppm (4-8' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand,		
6				moist.		
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-30 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 31
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/27/11
END DATE: 9/27/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	45	(FILL) Gray, GRAVEL, some fine to medium Sand, moist.	Headspace result =	0
1					0 ppm (0-4' bgs)	
				(FILL) Brownish gray, fine to medium SAND, some Gravel, wet.		
2						
						0
3						
4				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
	S-2	4-8	90		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	90		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-31 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 22
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/26/11 END DATE: 9/26/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	40	(FILL) Dark brown, fine to medium GRAVEL, some fine to coarse	Headspace result =	0
1				Sand, trace Silt, moist.	0 ppm (0-4' bgs)	
2						
				(FILL) Grades to:..brown.		0
3						
4						
	S-2	4-8	100	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
				Reddish brown, Clayey SILT, trace fine to medium Sand, wet.		0
7						
8						
	S-3	8-12	100	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-32 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 33
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/27/11
END DATE: 9/27/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	30	(FILL) Brown, fine to medium SAND and GRAVEL, some Silt,	Headspace result =	0
1				trace Clay, moist.	0 ppm (0-4' bgs)	
2						
				Grades to:..wet.		0
3						
4						
	S-2	4-8	90	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	90		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-33 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 34
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/26/11	END DATE: 9/26/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG:	Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER:	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD:	Direct push
ROCK DRILLING METHOD:	NA

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	50	(FILL) Dark brown, fine to medium GRAVEL, some fine to coarse Sand, trace Silt, moist.	Headspace result = 0 ppm (0-4' bgs)	0
1						
2						
				(FILL) Grades to:..gray, some Silt. (Crushed Concrete)		0
3						
4				(FILL) Grades to:..wet.		
	S-2	4-8	100		Headspace result = 0 ppm (4-8' bgs)	0
5				Grayish brown to reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
6				Grades to:..reddish brown.		
						0
7						
				Reddish brown, Clayey SILT, trace fine to medium Sand, wet.		
8						
	S-3	8-12	100		Headspace result = 0 ppm (8-12' bgs)	0
9				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
10						
						0
11						
12						
				End of SP-34 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 35
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/27/11 END DATE: 9/27/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	50	(FILL) Brown, fine to medium SAND and GRAVEL, some Silt,	Headspace result =	0
1				trace Clay, moist.	0 ppm (0-4' bgs)	
				(FILL) Reddish brown, Silty CLAY, trace fine Sand, moist.		
2						
						0
3						
				(FILL) Gray, fine to medium SAND, some Gravel, wet.		
4						
	S-2	4-8	90	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	90		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-35 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 36
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/27/11 END DATE: 9/27/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

WATER LEVEL DATA

DATE	TIME	WATER	CASING

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	50	(FILL) Brown, fine to medium SAND and GRAVEL, some Silt,	Headspace result =	0
1				trace Clay, moist.	0 ppm (0-4' bgs)	
				(FILL) Brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
				(FILL) Grades to:..dark brown to black.	Slight weathered	
4				(FILL) Brown, fine to medium SAND, trace Silt, wet.	petroleum odor.	
	S-2	4-8	90	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-10	100		Headspace result =	0
9					0 ppm (8-10' bgs)	
10						
				Refusal at 10.0' bgs.		0
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 37
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/27/11
END DATE: 9/27/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA
DATUM: NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	75	(FILL) Gray, GRAVEL, some fine to medium Sand, moist.	Headspace result =	0
1				(FILL) Reddish brown, Silty CLAY, some fine to medium Sand,	0 ppm (0-4' bgs)	
				trace Gravel, moist.		
2				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
						0
3						
4						
	S-2	4-6	100		Headspace result =	0
5					0 ppm (4-6' bgs)	
6					Concrete in end	
				Refusal at 6.0' bgs.	of sample.	
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 38
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/28/11
END DATE: 9/28/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA
DATUM: NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	50	Asphalt to 0.5' bgs.	Headspace result =	0
1				(FILL) Gray, GRAVEL, some fine to medium Sand, moist.	0 ppm (0-4' bgs)	
				(FILL) Brown, fine to medium SAND and GRAVEL, some Silt,		
2				trace Clay, moist.		
						0
3						
				(FILL) Tan, fine to medium SAND, trace Silt, moist.		
4				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-38 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 39
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/28/11	END DATE: 9/28/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	40	(FILL) Brown, fine to medium SAND and GRAVEL, some Silt,	Headspace result =	0
1				trace Clay, moist.	0 ppm (0-4' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-39 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 40
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/28/11
END DATE: 9/28/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	75	(FILL) Brown, fine to medium SAND and GRAVEL, trace Silt,	Headspace result =	0
1				trace Clay, wet.	0 ppm (0-4' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	90		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	90		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-40 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 41
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/28/11 END DATE: 9/28/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	40	(FILL) Dark brown, fine to medium GRAVEL, some fine to coarse Sand, trace Silt, wet.	Headspace result = 0 ppm (0-4' bgs)	0
1						
2						0
3						
4				Dark yellowish brown, Silty CLAY, trace fine to medium Sand, moist.		
	S-2	4-8	100	Grades to:..reddish brown.	Headspace result = 0 ppm (4-8' bgs)	0
5						
6						0
7						
8						
	S-3	8-12	100	Grades to:..little fine to medium Sand, trace Gravel, wet.	Headspace result = 0 ppm (8-12' bgs)	0
9						
10				Grades to:..trace fine to medium Sand, moist.		0
11						
12						
				End of SP-41 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 42
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/27/11	END DATE: 9/27/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG:	Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER:	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD:	Direct push
ROCK DRILLING METHOD:	NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Gray, GRAVEL, some fine to medium Sand, moist.	Headspace result =	0
1				Dark brown and gray, Silty CLAY, trace fine to medium Sand,	0 ppm (0-4' bgs)	
				moist.		
2						
						0
3						
				Grades to:..light yellowish brown.		
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
				Grades to:..reddish brown, moist to wet.		
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-42 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 43
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/28/11 END DATE: 9/28/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	75	(FILL) Gray, GRAVEL, some fine to medium Sand, trace Silt, moist.	Headspace result = 0 ppm (0-4' bgs)	0
1						
				Dark yellowish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	100	Grades to:..reddish brown.	Headspace result = 0 ppm (4-8' bgs)	0
5						
6						
						0
7						
8						
	S-3	8-12	75		Headspace result = 0 ppm (8-12' bgs)	0
9						
10						
						0
11						
12						
				End of SP-43 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 44
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/28/11 END DATE: 9/28/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Gray, GRAVEL, some fine to medium Sand, trace Silt, moist.	Headspace result = 0 ppm (0-4' bgs)	0
1						
				Dark yellowish brown, Silty CLAY, trace fine to medium Sand, moist.		
2						
						0
3						
4						
	S-2	4-8	90	Grades to:..reddish brown.	Headspace result = 0 ppm (4-8' bgs)	0
5						
6						
						0
7						
8						
	S-3	8-12	100		Headspace result = 0 ppm (8-12' bgs)	0
9						
10						
						0
11						
12						
				End of SP-44 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 45
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/28/11 END DATE: 9/28/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	50	(FILL) Gray, GRAVEL, some fine to medium Sand, trace Silt,	Headspace result =	0
1				moist.	0 ppm (0-4' bgs)	
				Dark yellowish brown, Silty CLAY, trace fine to medium Sand,		
2				moist.		
						0
3						
4						
	S-2	4-8	100	Grades to:..reddish brown.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-45 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes: 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 46
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
BORING LOCATION: See Location Plan
DRILLER: Mark Janus
GROUND SURFACE ELEVATION: NA DATUM NA
START DATE: 9/27/11 END DATE: 9/27/11
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	50	Asphalt to 0.5' bgs.	Headspace result =	0
1				(FILL) Gray, GRAVEL, some fine to coarse Sand, moist.	0 ppm (0-4' bgs)	
2				(FILL) Brown, fine to coarse SAND, some Gravel, trace Silt,		
				moist.		0
3						
4						
	S-2	4-8	100	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-46 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 47
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/27/11
END DATE: 9/27/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA
DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Gray, GRAVEL, some fine to medium Sand, moist.	Headspace result =	0
1				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	0 ppm (0-4' bgs)	
2						
						0
3						
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-47 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 48
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR:	Matrix Environmental Technologies	BORING LOCATION:	See Location Plan
DRILLER:	Mark Janus	GROUND SURFACE ELEVATION:	NA DATUM NA
START DATE: 9/28/11	END DATE: 9/28/11	GZA GEOENVIRONMENTAL REPRESENTATIVE:	J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

D E P T H	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	80	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
1					0 ppm (0-4' bgs)	
2						
						0
3						
				Reddish brown, Clayey SILT, trace fine fo medium Sand, wet.		
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
6						
						0
7						
8						
	S-3	8-12	90	Reddish brown, Clayey SILT, trace fine fo medium Sand, wet.	Headspace result =	0
9					0 ppm (8-12' bgs)	
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		
10						
						0
11						
12						
				End of SP-48 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Soil Probe SP- 49
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/27/11
END DATE: 9/27/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA
DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	60	(FILL) Gray, GRAVEL, some fine to medium Sand, moist.	Headspace result =	25.5
1				(FILL) Light brown, fine SAND, trace Silt, wet.	38.6 ppm (0-4' bgs)	
				(FILL) Dark brown, Sandy SILT, trace Gravel, moist.		
2						
				Reddish brown, Silty CLAY, trace fine to medium Sand, moist.		0
3						
4						
	S-2	4-8	90		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	90		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-49 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK
535 WASHINGTON ST. 11TH FL.
BUFFALO, NEW YORK
ENGINEERS AND SCIENTISTS

Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 50
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/28/11 END DATE: 9/28/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION			SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	Sample Number	DEPTH (FT)	RECOVERY (%)			
	S-1	0-4	80	(FILL) Gray, GRAVEL, some fine to medium Sand, trace Silt,	Headspace result =	0
1				moist.	0 ppm (0-4' bgs)	
				Dark yellowish brown, Silty CLAY, trace fine to medium Sand,		
2				moist.		
						0
3						
4						
	S-2	4-8	100	Grades to:..reddish brown.	Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
8						
	S-3	8-12	100		Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-50 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK
535 WASHINGTON ST. 11TH FL.
BUFFALO, NEW YORK
ENGINEERS AND SCIENTISTS

Niagara Falls Armed Forces Reserve Center
Niagara Falls, NY

Soil Probe SP- 51
SHEET 1 OF 1
FILE No. 21.0056522.20
CHECKED BY : CZB

CONTRACTOR: Matrix Environmental Technologies
DRILLER: Mark Janus
START DATE: 9/28/11 END DATE: 9/28/11
BORING LOCATION: See Location Plan
GROUND SURFACE ELEVATION: NA DATUM NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: J. Beninati

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe 54 DT track mounted rig
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	SAMPLE INFORMATION Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	FIELD SCREENING RESULTS (ppm)
	S-1	0-4	40	Topsoil to 0.5' bgs.	Headspace result =	0
1				Dark gray, Silty CLAY, trace fine to medium Sand, moist.	0 ppm (0-4' bgs)	
2				Grades to:..reddish brown.		
						0
3						
4						
	S-2	4-8	100		Headspace result =	0
5					0 ppm (4-8' bgs)	
6						
						0
7						
				Reddish brown, Clayey SILT, trace fine fo medium Sand, wet.		
8						
	S-3	8-12	100	Reddish brown, Silty CLAY, trace fine to medium Sand, moist.	Headspace result =	0
9					0 ppm (8-12' bgs)	
10						
						0
11						
12						
				End of SP-51 at 12.0' bgs.		
13						
14						
15						
16						
17						
18						
19						
20						

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) MiniRae 2000 organic vapor meter used to field screen and headspace soil samples.
2) bgs = below ground surface.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

APPENDIX B
Photographs

Photograph 1 – Area of IRA prior to excavation as viewed from the west.

Photograph 2 – Excavation and 6” Fire Protection Main as viewed from the southeast.

Photograph 3 – Pumping of Fire Protection Main prior to removal.

Photograph 4 – Capped end of the Fire Protection Main.

Photograph 5 – Backfilled excavation as viewed from the west.

Photograph 6 – Stockpiled and covered soil as viewed from the east.

APPENDIX C
Waste Disposal Documentation

12885419

NIAGARA FALLS LANDFILL
56th Street & Niagara Falls Blvd
Niagara Falls, NY 14304 (716)282-6381

203061
ENSOL ENGINEERING
661 MAIN STREET
NIAGARA FALLS, NY 14301
Contract: 42151118910

SITE 5B	**TICKET** 459261
GRID	
WEIGHMASTER AS00067 ALBERT S	
DATE IN 8 December 2011	**TIME IN** 10:27 am
DATE OUT 8 December 2011	**TIME OUT** 10:55 am
VEHICLE PAR12	**ROLL OFF**
REFERENCE 0568945	**ORIGIN** Inbound -NY-NIAGARA

00 Gross Weight 54,940.00 lb
Tare Weight 26,140.00 lb
Net Weight 28,800.00 lb

NIAGARA FALLS ARMY RESERVE

BASE 14.40 TN

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
14.40	TN	SW-CONST DEBRIS				
1.00	LD	ENVIRONMENTAL FEE				
1.00	LD	FUEL RECOVERY FEE				

HAVE A NICE DAY

NET AMOUNT	
TENDERED	
CHANGE	
CHECK NO.	

REPUBLIC SERVICES

REV 11/09

SIGNATURE

RS-F

REPUBLIC SERVICES, INC.

Please print or type

NON-HAZARDOUS WASTE MANIFEST

0568945

1. Generator's US EPA ID Number	Manifest Document Number	2. Page 1 of

3. Generator's Name and Mailing Address
99th Regional Support Command, Niagara Falls AFRC
5231 South Scott Plaza
Fort Dix, NJ 08640
4. Phone ( )

5. Generating Location (if different)
Same
9400 Porter Road
Niagara Falls, NY 14304
6. Phone ( )

7. Transporter #1 Company Name *Pariso Trucking* FL 1 #12	8. US EPA ID Number	9. Transporter #1's Phone *716-875-6168*
10. Transporter #2 Company Name	11. US EPA ID Number	12. Transporter #2's Phone
13. Designated T/S/D Facility Name and Site Address *Allied Waste Niagara Falls NY* *5600 Niagara Falls Boulevard* *Niagara Falls, NY 14304*	14. US EPA ID Number	15. Facility's Phone *716-285-3344*

16. Waste Shipping Name and Description	17. Allied Waste Approval # and Exp. Date	18. Containers No.	18. Containers Type	19. Total Quantity	20. Unit Wt/Vol
Non Hazardous Asphalt & Gravel	*421511 18910 Exp 6 30 2012*				
a.					
b.					
c.					
d.					

21. Additional Descriptions for Materials Listed Above

22. Special Handling Instructions and Additional Information

GENERATOR

23. GENERATOR'S CERTIFICATION: I certify the materials described on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
[illegible] (99th DSC)		12	8	11

TRANSPORTER

24. Transporter #1: Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
CLIFF KACZMAREK	Cliff Kaczmarek	12	8	11

25. Transporter #2: Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

T/S/D FACILITY

26. Discrepancy Indication Space

27. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest (except as noted in Item 19)

Printed/Typed Name	Signature	Month	Day	Year
		12	8	11

TRANSPORTER #2

12885458

NIAGARA FALLS LANDFILL
56th Street & Niagara Falls Blvd
Niagara Falls, NY 14304 (716)282-6381

203061
ENSOL ENGINEERING
661 MAIN STREET
NIAGARA FALLS, NY 14301
Contract: 42151118910

SITE 5B	**TICKET** 459300	**GRID**
A500067 ALBERT S	**WEIGHMASTER**	
DATE IN 8 December 2011		**TIME IN** 11:58 am
DATE OUT 8 December 2011		**TIME OUT** 12:20 pm
VEHICLE FAR12		**ROLL OFF**
REFERENCE 0568946	**ORIGIN** Inbound -NY-NIAGARA	

00 Gross Weight 37,980.00 lb
Tare Weight 26,100.00 lb
Net Weight 11,880.00 lb

NIAGARA FALLS ARMY RESERVE

BASE 5.94 TN

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
5.94	TN	SW-CONST DEBRIS				
1.00	LD	ENVIRONMENTAL FEE				
1.00	LD	FUEL RECOVERY FEE				

HAVE A NICE DAY

NET AMOUNT
TENDERED
CHANGE
CHECK NO.

REPUBLIC SERVICES

REV 11/09

SIGNATURE

RS-F

REPUBLIC SERVICES, INC.

NON-HAZARDOUS WASTE MANIFEST

0568946

Please print or type.

1. Generator's US EPA ID Number
Manifest Document Number
2. Page 1 of

3. Generator's Name and Mailing Address
99th Regional Support Command, Niagara Falls AFRC
5231 South Scott Plaza
Fort Dix, NJ 08640
4. Phone ( )

5. Generating Location (if different)
Same
9400 Porter Road
Niagara Falls, NY 14304
6. Phone ( )

7. Transporter #1 Company Name
Pariso Trucking PLI #12
8. US EPA ID Number
9. Transporter #1's Phone
716-875-6168

10. Transporter #2 Company Name
11. US EPA ID Number
12. Transporter #2's Phone

13. Designated T/S/D Facility Name and Site Address
Allied Waste Niagara Falls NY
5600 Niagara Falls Boulevard
Niagara Falls, NY 14304
14. US EPA ID Number
15. Facility's Phone
716-285-3344

GENERATOR

16. Waste Shipping Name and Description	17. Allied Waste Approval # and Exp. Date	18. Containers		19. Total Quantity	20. Unit Wt/Vol
		No.	Type		
Non Hazardous Asphalt & Gravel	421511 18910 Exp 6 30 2012				
a.					
b.					
c.					
d.					

21. Additional Descriptions for Materials Listed Above

22. Special Handling Instructions and Additional Information

23. **GENERATOR'S CERTIFICATION:** I certify the materials described on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name [illegible]
Signature
Month 12 Day 8 Year 11

TRANSPORTER

24. **Transporter #1:** Acknowledgement of Receipt of Materials
Printed/Typed Name CLIFF KACZMAREK
Signature Cliff Kaczmarek
Month 12 Day 8 Year 11

25. **Transporter #2:** Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

T/S/D FACILITY

26. Discrepancy Indication Space

27. **Facility Owner or Operator:** Certification of receipt of waste materials covered by this manifest (except as noted in Item 19)
Printed/Typed Name
Signature
Month 12 Day 15 Year 11

TRANSPORTER #2

APPENDIX D

Clean Fill Documentation

SEVEN SPRINGS GRAVEL PRODUCTS, LLC
8479 Seven Springs Road
Batavia, New York 14020

Telephone (585) 343-4336

No. 76874

CUSTOMER Pariso Logistic

BILLING ADDRESS

CITY | STATE | ZIP

DESTINATION ADDRESS

PRODUCT DESCRIPTION Sc. Clay fill | CU. YARDS

C.O.D.'S ONLY

PRODUCT COST $ × 21.82 TONS = $

FREIGHT CHG. $ × TONS = $

OTHER:

SUBTOTAL

TAX

TOTAL $

DATE:
GROSS:
TARE:
NET:

GROSS 72140 lb
TARE 28500 lb
NET 43640 lb
03:42AM 09/29/2011

CUSTOMER SIGNATURE

DRIVER SIGNATURE | TRUCK NO. 1

WEIGHMASTER SIGNATURE Karen | LICENSE # 180112

Seven Springs Gravel Products, LLC shall not be held liable for any loss after acceptance of a load.

SEVEN SPRINGS GRAVEL PRODUCTS, LLC
8479 Seven Springs Road
Batavia, New York 14020

Telephone (585) 343-4336

No. 76880

CUSTOMER Pariso Logistic

BILLING ADDRESS

CITY | STATE | ZIP

DESTINATION ADDRESS

PRODUCT DESCRIPTION Sc. Clay fill | CU. YARDS

C.O.D.'S ONLY

PRODUCT COST $ × 19.20 TONS = $

FREIGHT CHG. $ × TONS = $

OTHER:

SUBTOTAL

TAX

TOTAL $

DATE:
GROSS:
TARE:
NET:

GROSS 64600 lb
TARE 26200 lb
NET 38400 lb
12:37PM 09/29/2011

CUSTOMER SIGNATURE

DRIVER SIGNATURE | TRUCK NO. 2

WEIGHMASTER SIGNATURE Karen | LICENSE # 180112

Seven Springs Gravel Products, LLC shall not be held liable for any loss after acceptance of a load.

p. 1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Facility DEC ID 8-1844-00020

PERMIT
Under the Environmental Conservation Law (ECL)

Permittee and Facility Information

Permit Issued To:	**Facility:**
SEVEN SPRINGS GRAVEL PRODUCTS	SEVEN SPRINGS GRAVEL PRODUCTS
8479 SEVEN SPRINGS RD	8472 SEVEN SPRINGS RD
BATAVIA, NY 14020	BATAVIA, NY 14020
(716) 343-4336	

Facility Location: in STAFFORD in GENESEE COUNTY
Facility Principal Reference Point: NYTM-E: 244.8 NYTM-N: 4765.6
Latitude: 43°00'00.8" Longitude: 78°07'51.1"
Project Location: East of Seven Springs Road, 3,300 ft. south of Rt 33
Authorized Activity:

Permit to mine unconsolidated material from a 30-acre permit term area, within a 30-acre Life of Mine. Approved operations include screening and crushing.

Permit Authorizations

Mined Land Reclamation - Under Article 23, Title 27
Permit ID 8-1844-00020/00001 (Mined Land ID 80276)
Renewal Effective Date: 10/13/2006 Expiration Date: 10/12/2011

NYSDEC Approval

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, and all conditions included as part of this permit.

Permit Administrator: JOHN L COLE, Deputy Regional Permit Administrator
Address: NYSDEC REGION 8 HEADQUARTERS
6274 EAST AVON-LIMA RD
AVON, NY 14414

Authorized Signature: John L Cole Date 10/12/2006

Distribution List

Minerals
TOWN OF BATAVIA
Thomas Giles

Permit Components

MINED LAND RECLAMATION PERMIT CONDITIONS

GENERAL CONDITIONS, APPLY TO ALL AUTHORIZED PERMITS

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Permit Attachments

Permit Sign

MINED LAND RECLAMATION PERMIT CONDITIONS

1. **Conformance With Plans** All activities authorized by this permit must be in strict conformance with the approved plans submitted by the applicant or applicant's agent as part of the permit application. Such plans were approved by Joseph G. Bucci Jr., Mined Land Reclamation Specialist 1, on August 31, 2006 and consist of the following items: see Conformance with Plans - Addenda

2. **Conformance with Plans - Addenda**

- Mining Permit Application dated January 24, 2006.
- Organizational Report Form dated February 7, 2005.
- Environmental Assessment Forms received September 9, 1987, February 19, 1998, September 14, 1999 and January 24, 2006.
- Mined Land Use Plan Renewal and Modification dated December 2005.
- Mining Plan Map dated December 2005.
- Reclamation Plan Map dated December 2005.
- Cross Sections dated December 2005.

- Mining and Reclamation Plan narratives dated September 8, 1998 with revisions received December 14, 1998 and September 14, 1999, including Appendix B (Pollution Prevention Plan), "Standard and Specifications for Dust Control" and Grassed Waterway Construction Details.
- December 18, 2000 Amendment - Mining permit term area and mining phases.
- September 14, 1999 letter from P. Bauter to M. Migliore.
- December 31, 1998 letter from P. Bauter to S. Army.
- December 14, 1998 letter from P. Bauter to S. Army.

3. **Post Sign and Permit** The enclosed permit and permit sign must be conspicuously posted in a publicly accessible location at the project site. They must be visible, legible and protected from the elements at all times.

4. **Strip and Stockpile Soils for Reclamation** Prior to the excavation of previously undisturbed areas, topsoil and overburden shall be stripped, stockpiled separately, and used for reclamation of mined areas. These stockpiles shall be seeded to establish a vegetative cover within 30 days, or as soon as practicable following their construction. The permittee shall locate all overburden stockpiles within the permitted area of the approved Life of Mine. Sufficient quantities of topsoil must be retained on the site for use in reclamation, unless prior approval is granted by the department.

5. **No Unpermitted Discharge Outside Limits of Mine** There shall be no natural swales or channels or constructed features such as ditches, pipes, etc., that are capable of discharging waters to any offsite areas or to any areas outside the limits of the Life of Mine except those explicitly described and shown in the narrative and graphic portions of the approved Mined Land Use Plan. All silt laden water and storm water generated on, or running across, the site shall be retained within the approved project area. The permittee must comply with all applicable State Pollutant Discharge Elimination System (SPDES) permit requirements and provide necessary notifications for off-site point source discharges.

6. **Fueling of Equipment and Reporting of Spills** Fueling of equipment shall be controlled to prevent spillage. Any spillage of fuels, waste oils, other petroleum products or hazardous materials shall be reported to the department's Spill Hotline number (1-800-457-7362) within 2 hours. The permittee shall retain the department's Spill Response number for immediate access in the permittee's office and at the mine site.

7. **File Termination Notice** If the permittee decides to discontinue operation, a termination notice must be filed 60 days prior to the scheduled temporary or permanent cessation of mining.

8. **No Deviation From Approved Plan** The permittee shall not deviate or depart from the approved mined land use plan without approval by the department of an alteration or modification thereto.

9. Archaeological or Structural Remains If any archaeological or structural remains are encountered during excavation, the permittee must immediately cease, or cause to cease, all work in the area of the remains and notify

Regional Permit Administrator
NYSDEC REGION 8 HEADQUARTERS
6274 EAST AVON-LIMA RD
AVON, NY14414

Work shall not resume until written permission to do so has been received from the department.

10. Bond, Surety to Remain in Force Any required reclamation bond or other surety, in an amount determined by the department, shall be maintained in full force and effect. Such a bond or other surety shall not be terminated until the reclamation of the mined area is approved by the department in writing.

11. Maintain Area Markers for Permit Term The permittee shall provide permanent markers such as stakes, posts or other devices acceptable to the Department to identify and delineate the permit area, as outlined on the approved Mining Plan Map. These markers are to be installed prior to the start of mining and shall be maintained for the duration of the permit term.

12. Minimum 25 ft. Separation from Property Line No mining activity of any kind, including clearing and grubbing, shall occur within 25 feet of any adjacent property line or right-of-way. When mining is conducted lower than the adjacent property, the distance from the floor of the mine to the nearest property line shall be no closer than 25 feet plus1½ times the depth of the excavation, except where otherwise noted in the approved Mined Land Use Plan.

13. Mining Operation Periods All mining, reclamation and associated activities (including but not limited to: excavating, grading, processing operations, stockpiling operations, haulage operations, and maintenance operations) shall be limited to the following times: Monday through Friday 7 a.m. to 7 p.m., Saturdays 7 a.m. to 5 p.m. Operation of the mine is prohibited on Sundays and legal holidays.

14. Dust Control Water or other approved dust palliatives must be applied to haulageways and other parts of the mine, as often as necessary, to prevent visible dust from leaving the mine property.

GENERAL CONDITIONS - Apply to ALL Authorized Permits:

1. Facility Inspection by The Department The permitted site or facility, including relevant records, is subject to inspection at reasonable hours and intervals by an authorized representative of the Department of Environmental Conservation (the Department) to determine whether the permittee is complying with this permit and the ECL. Such representative may order the work suspended pursuant to ECL 71- 0301 and SAPA 401(3).

The permittee shall provide a person to accompany the Department's representative during an inspection to the permit area when requested by the Department.

A copy of this permit, including all referenced maps, drawings and special conditions, must be available for inspection by the Department at all times at the project site or facility. Failure to produce a copy of the permit upon request by a Department representative is a violation of this permit.

2. **Relationship of this Permit to Other Department Orders and Determinations** Unless expressly provided for by the Department, issuance of this permit does not modify, supersede or rescind any order or determination previously issued by the Department or any of the terms, conditions or requirements contained in such order or determination.

3. **Applications For Permit Renewals, Modifications or Transfers** The permittee must submit a separate written application to the Department for permit renewal, modification or transfer of this permit. Such application must include any forms or supplemental information the Department requires. Any renewal, modification or transfer granted by the Department must be in writing. Submission of applications for permit renewal, modification or transfer are to be submitted to:

Regional Permit Administrator
NYSDEC REGION 8 HEADQUARTERS
6274 EAST AVON-LIMA RD
AVON, NY14414

4. **Submission of Renewal Application** The permittee must submit a renewal application at least 30 days before permit expiration for the following permit authorizations: Mined Land Reclamation.

5. **Permit Modifications, Suspensions and Revocations by the Department** The Department reserves the right to modify, suspend or revoke this permit. The grounds for modification, suspension or revocation include:

a. materially false or inaccurate statements in the permit application or supporting papers;

b. failure by the permittee to comply with any terms or conditions of the permit;

c. exceeding the scope of the project as described in the permit application;

d. newly discovered material information or a material change in environmental conditions, relevant technology or applicable law or regulations since the issuance of the existing permit;

e. noncompliance with previously issued permit conditions, orders of the commissioner, any provisions of the Environmental Conservation Law or regulations of the Department related to the permitted activity.

6. **Permit Transfer** Permits are transferrable unless specifically prohibited by statute, regulation or another permit condition. Applications for permit transfer should be submitted prior to actual transfer of ownership.

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Item A: Permittee Accepts Legal Responsibility and Agrees to Indemnification
The permittee, excepting state or federal agencies, expressly agrees to indemnify and hold harmless the Department of Environmental Conservation of the State of New York, its representatives, employees, and agents ("DEC") for all claims, suits, actions, and damages, to the extent attributable to the permittee's acts or omissions in connection with the permittee's undertaking of activities in connection with, or operation and maintenance of, the facility or facilities authorized by the permit whether in

compliance or not in compliance with the terms and conditions of the permit. This indemnification does not extend to any claims, suits, actions, or damages to the extent attributable to DEC's own negligent or intentional acts or omissions, or to any claims, suits, or actions naming the DEC and arising under Article 78 of the New York Civil Practice Laws and Rules or any citizen suit or civil rights provision under federal or state laws.

Item B: Permittee's Contractors to Comply with Permit
The permittee is responsible for informing its independent contractors, employees, agents and assigns of their responsibility to comply with this permit, including all special conditions while acting as the permittee's agent with respect to the permitted activities, and such persons shall be subject to the same sanctions for violations of the Environmental Conservation Law as those prescribed for the permittee.

Item C: Permittee Responsible for Obtaining Other Required Permits
The permittee is responsible for obtaining any other permits, approvals, lands, easements and rights-of-way that may be required to carry out the activities that are authorized by this permit.

Item D: No Right to Trespass or Interfere with Riparian Rights
This permit does not convey to the permittee any right to trespass upon the lands or interfere with the riparian rights of others in order to perform the permitted work nor does it authorize the impairment of any rights, title, or interest in real or personal property held or vested in a person not a party to the permit.

P 327888

JOB# 25638

CARMEN M. PARISO, INC.
3649 River Road
Tonawanda, NY 14150
OFFICE 875-6168
FAX 875-4121

CUSTOMER MATRIX
DATE 10/19/09

LOAD LOCATION SEVEN SPRINGS
DUMP LOCATION PORTER AVE

HIRED TRUCK COMPANY
TRUCK #/DRIVER 1141 / Mary

☑ DUMP TRUCK SERVICE
☐ DUMP TRAILER SERVICE
☐ OTHER

MATERIAL HAULED Clay Fill

JOB START ____________
JOB FINISH ____________
TRAVEL TIME ____________
☐ LUNCH ☐ NO LUNCH
TOTAL ____________

LD #	TICKET #	WEIGHT	WAIT TIME ON JOB IN - OUT	REMARKS SPECIFY: ON "HOLD" @ PLANT, TOLLS, DUMP LOCATIONS, ETC.
1		19.32	-	
2		22.70	-	
3				
4			-	
5			-	
6			-	
7				
8			-	
9			-	
10				
11				
12			-	2 GI TOLLS
13			-	
14			-	
15			-	

OUR RESPONSIBILITY ENDS AT THE CURB

CUSTOMER'S SIGNATURE: ____________________

RETURN THIS ORIGINAL TO PARISO

P 304718

CARMEN M. PARISO, INC.
3649 River Road
Tonawanda, NY 14150
OFFICE 875-6168 FAX 875-4121

JOB# 25638

CUSTOMER: MATRIX
DATE: 10/14/09
LOAD LOCATION: Seven Springs
DUMP LOCATION: Porter [illegible]/N. Falls
HIRED TRUCK COMPANY:
TRUCK #/DRIVER: 238 LORI H.

☒ DUMP TRUCK SERVICE
☐ DUMP TRAILER SERVICE
☐ OTHER
MATERIAL HAULED: Clay Fill

JOB START: 7:30 —
JOB FINISH:
TRAVEL TIME: —
☐ LUNCH ☐ NO LUNCH
TOTAL: —

LD #	TICKET #	WEIGHT	WAIT TIME ON JOB IN - OUT	REMARKS SPECIFY: ON "HOLD" @ PLANT, TOLLS, DUMP LOCATIONS, ETC.
①	209327	23.06	8:15-8:20	
②	209352	19.90	-	
③	209370	20.66		
4			-	
5			-	
6			-	
7			-	
8			-	
9			-	
10			-	
11			-	
12			-	
13			-	
14			-	
15			-	

OUR RESPONSIBILITY ENDS AT THE CURB

CUSTOMER'S SIGNATURE:

RETURN THIS ORIGINAL TO PARISO

APPENDIX E
Analytical Result Summary Tables

Table 2

DRAFT - Soil Analytical Testing Results Summary
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Unrestricted Soil Cleanup Objectives	Restricted Commmercial Soil Cleanup Objectives	SP-22-2-4 Result	SP-22-10-12 Result	SP-23-2-4 Result	SP-23-6-8 Result	SP-24-2-4 Result	SP-24-8-10 Result	SP-25-2-4 Result	SP-25-6-8 Result	SP-26-1-3 Result	SP-26-6-8 Result	SP-27-2-4 Result	SP-27-6-8 Result	SP-28-1-3 Result	SP-28-6-8 Result	SP-29-1-3 Result	SP-29-6-8 Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)																		
Acetone	50	*500,000*	<	7.1 J	60	22 J	28 J	<	<	<	27 J	6.7 J	<	<	<	9.7 J	7.3 J	<
Methylcyclohexane	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Tetrachloroethene	1,300	*150,000*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Methylene Chloride	50	*500,000*	4.9 J	5.6 J	4.8 J	5.1 J	5.1 J	3.9 J	5.1 J	5.6 J	4.6 J	4.8 J	4.9 J	5.0 J	4.7 J	5.8 J	7.8	5.6 J
2-Butanone (MEK)	100,000	*NV*	<	<	7.5 J	<	<	<	<	<	<	<	<	<	<	<	<	<
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)																		
Naphthalene	12,000	*500,000*	<	51 J	<	<	<	<	<	<	<	<	<	<	<	<	<	<
2-Methylnaphthalene	410 [9]	*NV*	<	12 J	<	<	<	<	<	<	<	<	<	<	<	<	<	<
4-Methylphenol	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Acenaphthylene	100,000	*500,000*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	32 J
Acenaphthene	20,000	*500,000*	<	68 J	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Fluorene	30,000	*500,000*	<	96 J	<	<	<	<	<	<	<	<	<	<	<	<	<	33 J
Phenanthrene	100,000	*500,000*	500 J	210 J	<	<	<	<	5100 J	3300 J	<	<	83 J	<	15 J	18 J	1800 J	360
Anthracene	100,000	*500,000*	<	97 J	<	<	<	<	1300 J	<	<	<	<	<	<	<	<	97 J
Fluoranthene	100,000	*500,000*	830 J	250	<	<	<	<	7100 J	7000 J	16 J	<	80 J	<	36 J	77 J	3100 J	570
Pyrene	100,000	*500,000*	590 J	160 J	<	<	<	<	4900 J	6100 J	11 J	<	40 J	<	25 J	57 J	2000 J	350
Benzo(a)anthracene	1,000	*5,600*	650 J	110 J	12 J	<	21 J	<	3600 J	5600 J	14 J	<	37 J	<	27 J	46 J	1700 J	210 J
Dibenzo(a,h)anthracene	330	*560*	<	14 J	<	<	30 J	<	**630 J**	**1200 J**	<	<	10 J	<	<	12 J	<	29 J
Dibenzofuran	7,000	*NV*	<	31 J	<	<	<	<	<	<	<	<	<	<	<	<	<	19 J
Diethyl phthalate	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Di-n-octyl phthalate	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Di-n-butyl phthalate	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Bis(2-ethylhexyl)phthalate	50,000 [9]	*NV*	<	<	<	88 J	<	<	<	<	<	<	<	<	<	<	<	<
Carbazole	NV	*NV*	<	17 J	<	<	<	<	<	<	<	<	<	<	<	<	<	15 J
Chrysene	1,000	*56,000*	670 JB	100 JB	11 JB	<	29 JB	<	3500 JB	5400 JB	14 JB	<	45 JB	<	25 JB	47 JB	2300 JB	200 J
Benzo(b)fluoranthene	1,000	*5,600*	590 J	91 J	16 J	11 J	<	11 J	4100 J	5600 J	19 J	12 J	59 J	15 J	40 J	72 J	3500 J	210 J
Benzo(k)fluoranthene	800	*56,000*	420 J	64 J	13 J	11 J	<	13 J	1700 J	3100 J	16 J	12 J	27 J	9.1 J	19 J	35 J	1700 J	110 J
Biphenyl	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzo(a)pyrene	1,000	*1,000*	550 J	90 J	13 J	9.5 J	<	<	**3200 J**	**5800 J**	15 J	9.9 J	39 J	<	26 J	54 J	**2900 J**	160 J
Indeno(1,2,3-cd)pyrene	500	*5,600*	280 J	32 J	<	<	30 J	<	1200 J	2100 J	9.3 J	8.8 J	23 J	<	16 J	27 J	1400 J	86 J
Benzo(g,h,i)perylene	100,000	*500,000*	310 J	33 J	<	<	35 J	<	1400 J	2500 J	<	9.8 J	26 J	<	15 J	28 J	1800 J	91 J
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)																		
Aroclor 1254	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aroclor 1260	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	1,100	<	320	<
Total PCBs	100*	*1,000**	<	<	<	<	<	<	<	<	<	<	<	<	1,100	<	320	<

Notes:
1. Compounds detected in one or more samples are presented on this table. Refer to Attachment C for list of all compounds included in analysis.
2. Analytical testing completed by Test America Laboratories.
3. ug/kg = part per billion; mg/kg = parts per million
4. < indicates compound was not detected above method detection limits.
5. B = Compound was found in the blank and sample.
6. J = Result is less than the reporting limit but greater or equal to the method detection limit and the concentration is an approximate value.
7. NV = no value.
8. NT = not tested.
9. Shading indicates value exceeds Unrestricted Use Soil Cleanup Objectives.
10. **Bold** indicates value exceeds Restricted Commercial Use Soil Cleanup Objectives.
11. A duplicate sample (DUP-1) was collected at soil probe location SP-34, 6 to 8 feet. Values shown are the higher of the two analytical results.
12. *Soil cleanup objective is for the sum of the Aroclor compound concentrations detected (Total PCBs).
13. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6: Unrestricted Use Soil Cleanup Objectives and the Supplemetal Soil Cleanup Objectives (SSCOs) are from NYSDEC Final Commissioners Policy, CP-51, Dated October 21, 2010.

Parameter	Unrestricted Soil Cleanup Objectives	Restricted Commmercial Soil Cleanup Objectives	SP-30-1-3 Result	SP-30-10-12 Result	SP-31-1-3 Result	SP-31-8-10 Result	SP-32-2-4 Result	SP-32-8-10 Result	SP-33-0-2 Result	SP-33-8-10 Result	SP-34-2-4 Result	SP-34-6-8 Result	SP-35-1-3 Result	SP-35-6-8 Result	SP-36-1-3 Result	SP-36-8-10 Result	SP-37-1-3 Result	SP-37-4-6 Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)																		
Acetone	50	*500,000*	12 J	<	<	<	<	30	<	<	<	6.7 J	<	<	27 J	17 J	19 J	29 J
Methylcyclohexane	NV	*NV*	3.0 J	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Tetrachloroethene	1,300	*150,000*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Methylene Chloride	50	*500,000*	3.8 JB	2.9 JB	4.3 JB	3.2 JB	5.6 J	5.2 J	<	<	6.9	5.9 J	<	<	2.9 JB	<	2.9 J	<
2-Butanone (MEK)	100,000	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	5.2 J	<	<	<
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)																		
Naphthalene	12,000	*500,000*	17 J	<	7.7 J	<	<	<	<	<	33 J	<	<	<	5.7 J	<	45 J	<
2-Methylnaphthalene	410 [9]	*NV*	9.3 J	<	<	<	<	<	52 J	<	38 J	<	<	<	4.1 J	<	28 J	<
4-Methylphenol	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Acenaphthylene	100,000	*500,000*	22 J	<	15 J	<	<	<	68 J	<	<	<	<	<	9.0 J	<	9.8 J	<
Acenaphthene	20,000	*500,000*	25 J	<	3.0 J	<	<	<	<	<	<	<	<	<	4.3 J	<	160 J	<
Fluorene	30,000	*500,000*	26 J	<	<	<	<	<	<	<	<	<	<	<	12 J	<	320	<
Phenanthrene	100,000	*500,000*	320 B	8.8 JB	96 JB	6.6 JB	88 J	<	190 JB	<	120 J	<	7.7 JB	<	89 JB	4.5 JB	2,400 B	10 JB
Anthracene	100,000	*500,000*	52 J	<	28 J	<	22 J	<	88 J	<	<	<	<	<	22 J	<	690	<
Fluoranthene	100,000	*500,000*	630 B	17 JB	250 B	13 JB	180 J	<	560 JB	5.5 JB	140 J	<	27 JB	7.9 JB	130 JB	5.8 JB	2,700 B	17 JB
Pyrene	100,000	*500,000*	430 B	12 JB	170 JB	11 JB	120 J	<	440 JB	4.9 JB	89 J	<	20 JB	6.0 JB	98 JB	5.1 JB	1,700 B	9.8 JB
Benzo(a)anthracene	1,000	*5,600*	260 B	14 JB	150 JB	15 JB	97 J	11 J	330 JB	9.1 JB	66 J	15 J	23 JB	8.9 JB	55 JB	9.4 JB	950 B	13 JB
Dibenzo(a,h)anthracene	330	*560*	<	<	<	<	20 J	<	<	<	13 J	<	<	<	<	<	64 J	<
Dibenzofuran	7,000	*NV*	16 J	<	6.4 J	<	<	<	28 J	<	24 J	<	<	<	6.1 J	<	190 J	<
Diethyl phthalate	NV	*NV*	14 JB	12 JB	16 JB	11 JB	<	<	<	9.8 JB	<	<	11 JB	7.4 JB	13 JB	12 JB	7.9 JB	10 JB
Di-n-octyl phthalate	NV	*NV*	32 J	32 J	38 J	30 J	<	<	310 J	31 J	<	<	30 J	28 J	<	31 J	31 J	<
Di-n-butyl phthalate	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	380	<
Bis(2-ethylhexyl)phthalate	50,000 [9]	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Carbazole	NV	*NV*	53 J	4.1 J	14 J	3.7 J	<	<	74 J	3.6 J	<	<	3.6 J	<	14 J	4.4 J	230	<
Chrysene	1,000	*56,000*	290 B	17 JB	140 JB	14 JB	110 JB	10 JB	380 JB	7.9 JB	78 J	14 JB	24 JB	10 JB	62 JB	9.6 JB	940 B	9.7 JB
Benzo(b)fluoranthene	1,000	*5,600*	440 B	18 JB	190 JB	20 JB	140 J	14 J	740 JB	12 JB	81 J	16 J	46 JB	20 JB	97 JB	8.8 JB	1,200 B	18 JB
Benzo(k)fluoranthene	800	*56,000*	180 JB	16 JB	82 JB	15 JB	64 J	13 J	360 JB	10 JB	40 J	14 J	24 JB	11 JB	43 JB	8.1 JB	620 B	16 JB
Biphenyl	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	17 J	<
Benzo(a)pyrene	1,000	*1,000*	290 B	15 JB	130 JB	15 JB	98 J	14 J	490 JB	7.0 JB	59 J	14 J	30 JB	11 JB	63 JB	7.3 JB	920 B	11 JB
Indeno(1,2,3-cd)pyrene	500	*5,600*	120 JB	10 JB	56 JB	10 JB	45 J	<	210 JB	7.6 JB	38 J	<	17 JB	7.4 JB	30 JB	6.2 JB	270 B	9.0 JB
Benzo(g,h,i)perylene	100,000	*500,000*	120 JB	7.8 JB	57 JB	11 JB	52 J	<	400 JB	8.8 JB	52 J	<	19 JB	6.9 JB	32 JB	6.0 JB	290 B	7.9 JB
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)																		
Aroclor 1254	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aroclor 1260	NV	*NV*	150 J	<	<	<	410	<	940	<	<	<	<	<	<	<	<	<
Total PCBs	100*	*1,000**	150	<	<	<	410	<	940	<	<	<	<	<	<	<	<	<

Notes:

1. Compounds detected in one or more samples are presented on this table. Refe
2. Analytical testing completed by Test America Laboratories.
3. ug/kg = part per billion; mg/kg = parts per million
4. < indicates compound was not detected above method detection limits.
5. B = Compound was found in the blank and sample.
6. J = Result is less than the reporting limit but greater or equal to the method de
7. NV = no value.
8. NT = not tested.
9. Shading indicates value exceeds Unrestricted Use Soil Cleanup Objectives.
10. **Bold** indicates value exceeds Restricted Commercial Use Soil Cleanup Obje
11. A duplicate sample (DUP-1) was collected at soil probe location SP-34, 6 tc
12. *Soil cleanup objective is for the sum of the Aroclor compound concentratic
13. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6
    CP-51, Dated October 21, 2010.

Parameter	Unrestricted Soil Cleanup Objectives	Restricted Commmercial Soil Cleanup Objectives	SP-41-1-3 Result	SP-41-6-8 Result	SP-47-1-3 Result	SP-47-6-8 Result	SP-50-1-3 Result	SP-50-6-8 Result	SP-51-1-3 Result	SP-51-6-8 Result	EX-NORTH Result	EX-SOUTH Result	EX-EAST Result	EX-WEST Result	EX-FLOOR Result	OUTFALL 004 Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)																
Acetone	50	*500,000*	NT	NT	NT	NT	NT	NT	NT	NT	44	17 J	17 J	29	<	<
Methylcyclohexane	NV	*NV*	NT	NT	NT	NT	NT	NT	NT	NT	<	<	<	<	<	<
Tetrachloroethene	1,300	*150,000*	NT	NT	NT	NT	NT	NT	NT	NT	2.4 JB	2.4 JB	2 JB	1.8 JB	2 JB	<
Methylene Chloride	50	*500,000*	NT	NT	NT	NT	NT	NT	NT	NT	<	<	<	<	<	<
2-Butanone (MEK)	100,000	*NV*	NT	NT	NT	NT	NT	NT	NT	NT	<	<	<	<	<	<
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)																
Naphthalene	12,000	*500,000*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	390 J
2-Methylnaphthalene	410[9]	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	460 J
4-Methylphenol	NV	*NV*	17 J	<	NT	NT	<	<	<	<	<	<	<	<	<	<
Acenaphthylene	100,000	*500,000*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	180 J
Acenaphthene	20,000	*500,000*	<	<	NT	NT	21 J	<	<	<	<	<	<	<	<	4,500
Fluorene	30,000	*500,000*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	5,400
Phenanthrene	100,000	*500,000*	<	<	NT	NT	750 J	160 J	<	<	<	<	<	<	85 J	56,000 B
Anthracene	100,000	*500,000*	<	<	NT	NT	160 J	<	<	<	<	<	<	<	41 J	19,000
Fluoranthene	100,000	*500,000*	<	<	NT	NT	1,000 J	260 J	<	19 J	<	18 J	<	<	580	190,000
Pyrene	100,000	*500,000*	<	<	NT	NT	740 J	200 J	<	<	<	18 J	<	<	550	160,000
Benzo(a)anthracene	1,000	*5,600*	<	21 J	NT	NT	410 J	140 J	<	<	<	26 J	<	<	320	**120,000**
Dibenzo(a,h)anthracene	330	*560*	<	19 JB	NT	NT	<	<	<	<	<	20 J	<	<	47 J	<
Dibenzofuran	7,000	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	2,400 J
Diethyl phthalate	NV	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	<
Di-n-octyl phthalate	NV	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	<
Di-n-butyl phthalate	NV	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	<
Bis(2-ethylhexyl)phthalate	50,000[9]	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	<
Carbazole	NV	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	8,600
Chrysene	1,000	*56,000*	<	24 J	NT	NT	390 J	120 J	<	<	<	15 J	<	<	290	**120,000**
Benzo(b)fluoranthene	1,000	*5,600*	<	24 J	NT	NT	420 J	150 J	<	<	4.8 J	32 J	<	<	290	**120,000**
Benzo(k)fluoranthene	800	*56,000*	<	29 J	NT	NT	280 J	89 J	<	<	4.2 J	22 J	<	<	170 J	49,000 B
Biphenyl	NV	*NV*	<	<	NT	NT	<	<	<	<	<	<	<	<	<	<
Benzo(a)pyrene	1,000	*1,000*	<	17 J	NT	NT	380 J	130 J	<	<	<	28 J	<	<	270	**82,000 B**
Indeno(1,2,3-cd)pyrene	500	*5,600*	<	19 JB	NT	NT	230 JB	93 JB	<	<	<	26 J	<	<	130 J	**28,000 B**
Benzo(g,h,i)perylene	100,000	*500,000*	<	15 JB	NT	NT	230 JB	97 JB	<	17 JB	<	27 J	<	<	140 J	29,000 B
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)																
Aroclor 1254	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	70 J	<
Aroclor 1260	NV	*NV*	<	<	<	<	<	<	<	<	<	<	<	<	<	210
Total PCBs	100*	*1,000**	<	<	<	<	<	<	<	<	<	<	<	<	70	210

Notes:
1. Compounds detected in one or more samples are presented on this table. Refe
2. Analytical testing completed by Test America Laboratories.
3. ug/kg = part per billion; mg/kg = parts per million
4. < indicates compound was not detected above method detection limits.
5. B = Compound was found in the blank and sample.
6. J = Result is less than the reporting limit but greater or equal to the method de
7. NV = no value.
8. NT = not tested.
9. Shading indicates value exceeds Unrestricted Use Soil Cleanup Objectives.
10. **Bold** indicates value exceeds Restricted Commercial Use Soil Cleanup Obje
11. A duplicate sample (DUP-1) was collected at soil probe location SP-34, 6 tc
12. *Soil cleanup objective is for the sum of the Aroclor compound concentratic
13. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6
CP-51, Dated October 21, 2010.

Table 3

DRAFT - Water Analytical Testing Results Summary
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Class GA Criteria	SP-22-110926	SP-25-110926	SP-30-110927	SP-32-110926	SP-34-110926	SP-36-110927	SP-42-110927	SP-49-110927
Volatile Organic Compounds - EPA Method 8260 TCL (ug/L)									
2-Butanone (MEK)	50	<	<	<	<	<	<	3.8 J	<
Acetone	50	<	5.8 J	<	3.0 J	3.8 J	6.6 J	23	<
Benzene	1	<	<	<	<	<	<	<	1.6
Carbon disulfide	NV	0.32 J	<	<	<	<	<	<	<
Cyclohexane	NV	<	<	<	<	<	<	<	0.95 J
Ethylbenzene	5	<	<	<	<	<	<	<	1.3
Methylcyclohexane	NV	<	<	<	<	<	<	<	1.1
Methylene chloride	5	<	<	<	<	<	<	<	<
Toluene	5	<	<	<	<	<	<	<	2.7
Trichloroethene	5	<	<	<	0.58 J	<	<	<	<
Trichlorofluoromethane	5	6.3	<	<	<	<	<	<	<
Total Xylenes	5	<	<	<	<	<	<	<	1.8 J
Semi-Volatile Organic Compounds - EPA Method 8270 (ug/L)									
2,4-Dimethylphenol	1	<	<	<	<	<	<	NS	NS
2-Methylnaphthalene	NV	<	<	<	<	<	<	NS	NS
4-Methylphenol	1	<	<	<	<	<	<	NS	NS
Acenaphthene	20	3.3 J	<	<	<	<	<	NS	NS
Anthracene	50	0.91 J	0.43 J	<	<	<	<	NS	NS
Benzo [a] anthracene	0.002*	0.49 J	0.85 J	<	<	0.44 J	<	NS	NS
Benzo [a] pyrene	ND	<	0.95 J	<	<	<	<	NS	NS
Benzo [b] fluoranthene	0.002*	<	1.1 J	<	<	<	<	NS	NS
Benzo(g,h,i)perylene	NV	<	0.79 J	<	<	<	<	NS	NS
Carbazole	5	1.9 J	0.41 J	<	<	<	<	NS	NS
Chrysene	0.002*	0.39 J	0.77 J	<	<	0.43 J	<	NS	NS
Dibenzofuran	NV	1.2 J	<	<	<	<	<	NS	NS
Diethyl phthalate	50	4.0 J	<	<	<	<	<	NS	NS
Di-n-butyl-phthalate	NV	0.5 JB	0.46 JB	<	0.47 JB	0.44 JB	0.74 J	NS	NS
Dibenz(a,h)anthracene	NV	<	0.67 J	<	<	<	<	NS	NS
Fluoranthene	50	1.7 J	1.2 J	0.45 J	<	0.90 J	<	NS	NS
Fluorene	50	2.8 J	<	<	<	<	<	NS	NS
Indeno(1,2,3-cd)pyrene	0.002	<	0.91 J	<	<	<	<	NS	NS
Naphthalene	10 *	3.8 J	<	<	<	<	<	NS	NS
Phenanthrene	50 *	3.7 J	0.59 J	<	<	0.44 J	<	NS	NS
Pyrene	50	1.5 J	1.2 J	<	<	0.99 J	<	NS	NS
PCBs - EPA Method 8082 (ug/L)									
Aroclor 1254	NV	<	<	<	2	<	<	NS	NS
Aroclor 1260	NV	<	<	0.77	1	<	13	NS	NS
Total PCBs	0.09 [11]	0.0	0.0	0.77	3.0	0.0	13.0	NS	NS

Notes:
1. Compounds detected in one or more samples are presented on this table.
2. Analytical testing completed by Test America Laboratories.
3. NYSDEC Class GA criteria obtained from Division of Water Technical and Operational Guidance Series (TOGS 1.1.1), June 1998, dated October 1993, revised June 1998, January 1999 errata sheet and April 2000 addendum.
4. ug/L = part per billion (ppb); mg/L = part per million (ppm)
5. Shading indicates values exceeding NYSDEC Class GA groundwater criteria.
6. Class GA criteria shown is for total xylene concentration.
7. < = compound was not detected.
8. * indicates a Guidance Value instead of a Standard Value.
9. NV = no value.
10. ND = non-detectable concentration by approved analytical methods.
11. Groundwater criteria is for the sum of the Aroclor compound concentrations detected (Total PCBs).

Table 2
Soil Analytical Testing Results Summary
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Unrestricted Use Soil Cleanup Objectives	Restricted Residential Soil Cleanup Objectives	Restricted Commercial Soil Cleanup Objectives	SP-1-5-7 12/06/2010 Result	SP-2-6-8 12/06/2010 Result	SP-3-4-6 12/06/2010 Result	SP-4-2-4 12/06/2010 Result	SP-5-2-4 12/06/2010 Result	SP-6-2-4 12/06/2010 Result	SP-7-4-6 12/06/2010 Result	SP-8-4-6 12/06/2010 Result	SP-8 (DUP-1) 12/06/2010 Result	SP-9-2-4 12/06/2010 Result	SP-10-2-4 12/06/2010 Result	SP-11-2-4 12/06/2010 Result	SP-12-6-10 12/06/2010 Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)																
Acetone	50	**100,000**	*500,000*	7.1	ND	31	38	70	120	38	38	49	100	45	48	44
Methylene Chloride	50	**100,000**	*500,000*	25	12	32	29	35	31	31	30	20	27	24	38	25
Toluene	700	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1,000	**41,000**	*390,000*	ND	31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.3
Xylenes, total	260	**100,000**	*500,000*	ND	23	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	15
Isopropylbenzene	2,300	**NV**	*NV*	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5
Methylcyclohexane	NV	**NV**	*NV*	ND	66	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	3,900	**100,000**	*500,000*	ND	42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8,400	**52,000**	*190,000*	ND	29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9
4-Isopropyltoluene	10,000 ^{11}	**NV**	*NV*	ND	7.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3,600	**52,000**	*190,000*	1.4	130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11
sec-Butylbenzene	11,000	**100,000**	*500,000*	ND	5.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	100,000	**NV**	*NV*	ND	ND	ND	ND	16	28	ND	ND	ND	27	8.9	ND	ND
n-Butylbenzene	12,000	**NV**	*NV*	ND	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12,000	**100,000**	*500,000*	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	230
Total VOCs	NV	**NV**	*NV*	33.5	392.8	66.2	67.0	121.0	179.0	69.0	68.0	69.0	154.0	77.9	86.0	335
Total VOC TICs	NV	**NV**	*NV*	41.1	2140	14	11	17	14	12	12	8.1	12	10	14	51
Semi-Volatile Organic Compounds - EPA Method 8270 (ug/kg)																
Naphthalene	12,000	**100,000**	*500,000*	ND	410	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	690
2-Methylnaphthalene	410 ^{11}	**NV**	*NV*	ND	410	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20,000	**100,000**	*500,000*	ND	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	30,000	**100,000**	*500,000*	17	39	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100,000	**100,000**	*500,000*	48	170	ND	ND	ND	66	ND	ND	ND	ND	ND	25	33
Anthracene	100,000	**100,000**	*500,000*	ND	50	ND	ND	ND	22	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100,000	**100,000**	*500,000*	51	210	ND	ND	ND	190	ND	ND	ND	ND	22	33	33
Pyrene	100,000	**100,000**	*500,000*	46	180	ND	ND	ND	130	ND	ND	ND	ND	14	24	23
Benzo(a)anthracene	1,000	**1,000**	*5,600*	20	91	ND	ND	ND	89	ND	ND	ND	ND	ND	16	18
Dibenzo(a,h)anthracene	330	**330**	*560*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	50000 ^{11}	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	ND	ND	ND
Carbazole	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1,000	**3,900**	*56,000*	27	94	ND	ND	ND	78	ND	ND	ND	ND	ND	ND	17
Benzo(b)fluoranthene	1,000	**1,000**	*5,600*	34	110	ND	ND	ND	120	ND	ND	ND	ND	13	14	ND
Benzo(k)fluoranthene	800	**3,900**	*56,000*	12	39	ND	ND	ND	37	ND	ND	ND	ND	ND	ND	ND
Biphenyl	NV	**NV**	*NV*	ND	32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1,000	**1,000**	*1,000*	23	85	ND	ND	ND	85	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	**500**	*5,600*	19	38	ND	ND	ND	40	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	100,000	**100,000**	*500,000*	26	51	ND	ND	ND	50	ND	ND	ND	ND	ND	ND	ND
Total SVOCs	NV	**NV**	*NV*	323	2,034	ND	ND	ND	907	ND	ND	ND	100	49	112	814
Total SVOC TICs	NV	**NV**	*NV*	1,550	19,150	ND	ND	3,000	7,350	ND	ND	ND	ND	220	1600	690
TAL Metals - EPA Method SW 846 (mg/kg)																
Aluminum	NV	**NV**	*NV*	2,290	2,460	17,600	21,200	27,600	21,000	20,500	17,400	15,300	23,500	9,870	13,600	ND
Antimony	NV	**NV**	*NV*	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND
Arsenic	13	**16**	*16*	2.0	4.8	6.4	2.8	7.1	5.7	7.6	5.7	3.7	3.4	1.9	2.1	4.8
Barium	350	**400**	*400*	11.6	14	105	151	171	130	179	41.2	89.4	106	71.9	84.2	152
Beryllium	7.2	**590**	*590*	0.115	0.105	0.950	1.39	1.95	1.14	1.12	0.903	0.771	1.15	0.456	0.583	1.27
Cadmium	2.5	**9.3**	*9.3*	0.186	0.169	0.221	0.109	0.156	0.251	0.185	0.182	0.151	0.153	0.157	0.169	0.146
Calcium	NV	**NV**	*NV*	95,000	78,300	16,800	2,020	2,090	5,850	10,700	49,300	44,100	1,570	3,040	4,300	18,900
Chromium	30	**180**	*1,500*	3.45	7.12	23.5	27.6	38	29.8	29.5	24.1	22.0	30.8	11.2	15	29.8
Cobalt	30 ^{11}	**NV**	*NV*	2.03	1.96	13.8	11.5	26.8	14.6	18.2	14.3	14.3	23.1	2.4	3.28	19.3
Copper	50	**270**	*270*	8.7	6.1	23.1	21.6	34.3	22.4	33	24.7	21.1	30.7	7.1	7.3	30.4
Iron	2000 ^{11}	**NV**	*NV*	5,690	5,360	26,800	31,900	44,600	37,900	35,300	29,300	25,100	31,600	8,600	16,100	34,500
Lead	63	**400**	*1,000*	8	6.3	13.4	15	14.9	17.8	14.4	9.7	8.0	7.5	11.7	8.5	16.6
Magnesium	NV	**NV**	*NV*	50,500	31,200	10,500	8,210	9,580	8,000	14,800	14,000	12,200	8,100	2,130	2,850	10,800
Manganese	1,600	**2,000**	*10,000*	298	222	291	186	476	266	**2,470**	475	587	432	84	162	782
Mercury	0.18	**0.81**	*2.8*	ND	ND	0.0132	0.0423	0.0451	0.0492	0.0341	ND	0.0100	0.0218	0.0685	0.0703	0.0394
Nickel	30	**310**	*310*	5.24	5.04	33.7	33.2	48.8	34.3	42.4	34.6	33.3	37.7	9.53	11.5	42.8
Potassium	NV	**NV**	*NV*	485	659	1,600	1,770	2,450	2,040	1,980	2,260	2,240	1,700	1,240	1,460	2,180
Selenium	3.9	**180**	*1,500.0*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	NV	**NV**	*NV*	151	134	136	298	347	141	294	322	278	150	111	112	341
Vanadium	100 ^{11}	**NV**	*NV*	6.11	5.96	29.7	33.9	47.4	39.6	38.7	32.1	26.8	32.3	9.58	12.5	38.1
Zinc	109	**10,000**	*10,000*	44.6	30.6	62.3	72	100	84.5	69.5	61.7	56.6	74	30.1	35.9	72.1
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)																
Aroclor 1248	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	51	ND
Aroclor 1254	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	29	ND	ND	ND	ND	25	ND
Total PCBs	100*	**1000***	*1,000**	ND	ND	ND	ND	ND	ND	29	ND	ND	ND	ND	76	ND

Table 2
Soil Analytical Testing Results Summary
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Unrestricted Use Soil Cleanup Objectives	Restricted Residential Soil Cleanup Objectives	Restricted Commercial Soil Cleanup Objectives	SP-13-0-2 12/07/2010 Result	SP-14-2-4 12/07/2010 Result	SP-15-0-4 12/07/2010 Result	SP-16-0-2 12/07/2010 Result	SP-17-4-8 12/07/2010 Result	SP-17 (DUP-2) 12/07/2010 Result	SP-18-0-4 12/07/2010 Result	SP-19-0-4 12/07/2010 Result	SP-20-0-4 12/07/2010 Result	SP-21-0-4 12/07/2010 Result	TP-1-0-4* 12/07/2010 Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)														
Acetone	50	**100,000**	*500,000*	10	19	19	ND	52	69	11	340	29	13	7.6
Methylene Chloride	50	**100,000**	*500,000*	5.9	5.2	6.6	4.6	5.9	4.1	7.8	5.4	4.1	4.7	4.6
Toluene	700	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND
Ethylbenzene	1,000	**41,000**	*390,000*	ND	ND	ND	ND	ND	ND	ND	1.9	2.6	ND	ND
Xylenes, total	260	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	5.2	8.3	ND	ND
Isopropylbenzene	2,300	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	3,900	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8,400	**52,000**	*190,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	10,000 [11]	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3,600	**52,000**	*190,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	11,000	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	100,000	**NV**	*NV*	ND	ND	ND	ND	ND	7.1	ND	ND	ND	ND	ND
n-Butylbenzene	12,000	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12,000	**100,000**	*500,000*	ND	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	NV	**NV**	*NV*	15.9	25.5	25.6	4.6	57.9	80.2	18.8	352.5	45.6	17.7	12.2
Total VOC TICs	NV	**NV**	*NV*	10	8.9	9.8	8.6	12	8.4	9.5	8.1	7.1	7.3	6.5
Semi-Volatile Organic Compounds - EPA Method 8270 (ug/kg)														
Naphthalene	12,000	**100,000**	*500,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	410 [11]	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	**100,000**	*500,000*	ND	32	ND	ND	ND	ND	ND	ND	ND	ND	3,000
Acenaphthene	20,000	**100,000**	*500,000*	ND	22	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	30,000	**100,000**	*500,000*	ND	47	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100,000	**100,000**	*500,000*	ND	330	ND	ND	ND	ND	660	1,100	ND	ND	5,400
Anthracene	100,000	**100,000**	*500,000*	ND	92	ND	ND	ND	ND	160	200	ND	ND	1,900
Fluoranthene	100,000	**100,000**	*500,000*	1,300	510	ND	ND	27	25	800	1,600	ND	ND	16,000
Pyrene	100,000	**100,000**	*500,000*	1,200	480	14	ND	25	23	800	1,400	ND	ND	15,000
Benzo(a)anthracene	1,000	**1,000**	*5,600*	960	290	ND	ND	16	19	420	790	ND	ND	***10,000***
Dibenzo(a,h)anthracene	330	**330**	*560*	ND	38	ND	ND	ND	ND	ND	ND	ND	ND	***2,300***
Bis(2-ethylhexyl)phthalate	50000 [11]	**NV**	*NV*	6,600	170	150	ND	160	160	1,500	1,800	1,300	7,500	ND
Carbazole	NV	**NV**	*NV*	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1,000	**3,900**	*56,000*	690	230	ND	ND	ND	ND	420	690	ND	ND	**9,700**
Benzo(b)fluoranthene	1,000	**1,000**	*5,600*	**1,000**	260	ND	ND	16	ND	450	740	ND	ND	***14,000***
Benzo(k)fluoranthene	800	**3,900**	*56,000*	ND	110	ND	ND	ND	ND	ND	ND	ND	ND	**6,500**
Biphenyl	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1,000	**1,000**	*1,000*	960	250	ND	ND	ND	15	390	680	ND	ND	***14,000***
Indeno(1,2,3-cd)pyrene	500	**500**	*5,600*	ND	110	ND	ND	ND	ND	210	320	ND	ND	***8,800***
Benzo(g,h,i)perylene	100,000	**100,000**	*500,000*	730	120	ND	ND	ND	ND	280	380	ND	ND	12,000
Total SVOCs	NV	**NV**	*NV*	13,440	3,115	164	ND	244	242	6,090	9,700	1,300	7,500	118,600
Total SVOC TICs	NV	**NV**	*NV*	ND	ND	580	9,400	ND	ND	ND	ND	ND	ND	7,600
TAL Metals - EPA Method SW 846 (mg/kg)														
Aluminum	NV	**NV**	*NV*	10,700	24,000	32,100	15,500	17,400	15,800	11,400	13,200	15,100	9,810	9,970
Antimony	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	13	**16**	*16*	6.0	6.5	2.4	6.1	6.3	2.7	8.1	6.8	5.0	6.1	4.1
Barium	350	**400**	*400*	98.6	194	249	107	***418***	168	104	133	90.3	81.3	153
Beryllium	7.2	**590**	*590*	1.38	4.71	8.21	1.96	0.926	0.800	1.38	0.81	1.27	0.637	1.23
Cadmium	2.5	**9.3**	*9.3*	0.48	0.353	0.061	0.216	0.152	0.114	0.554	0.25	0.168	0.791	0.800
Calcium	NV	**NV**	*NV*	168,000	203,000	268,000	225,000	50,700	49,500	173,000	157,000	44,000	138,000	116,000
Chromium	30	**180**	*1,500*	**682**	**379**	31.4	**1,040**	24.2	22.3	**797**	**969**	119	**720**	165
Cobalt	30 [11]	**NV**	*NV*	3.73	6.41	2.44	3.47	16.2	13.6	5.63	5.83	10.4	11.8	4.68
Copper	50	**270**	*270*	9.5	25.4	4.8	11	24.9	18.5	108	45.3	16	19.5	13
Iron	2000 [11]	**NV**	*NV*	6,750	24,700	4,360	4,140	31,000	23,800	22,200	10,900	16,200	20,900	11,200
Lead	63	**400**	*1,000*	27.3	18.3	3.6	11.2	9.5	8.5	42.4	17	7.8	31.5	39.4
Magnesium	NV	**NV**	*NV*	62,800	20,900	8,020	46,400	11,500	11,500	52,600	45,200	9,010	44,900	39,600
Manganese	1,600	**2,000**	*10,000*	1,090	**2,670**	**3,450**	1,130	722	576	**4,150**	1,230	845	679	771
Mercury	0.18	**0.81**	*2.8*	0.0205	0.0452	ND	ND	0.0109	ND	ND	0.0163	0.0146	0.0259	0.124
Nickel	30	**310**	*310*	13.8	20.7	1.66	19.8	35.8	32.0	41.7	29.9	25.1	32.6	12.8
Potassium	NV	**NV**	*NV*	874	1,650	2,440	635	2,420	2,790	722	885	1,710	716	1,210
Selenium	3.9	**180**	*1,500.0*	ND	1.4	2.1	ND	ND	ND	ND	ND	ND	ND	0.7
Sodium	NV	**NV**	*NV*	328	690	930	616.0	271	290	329	443	154	289	254
Vanadium	100 [11]	**NV**	*NV*	17.1	22.3	5.64	25.7	32.3	26.9	23.4	29.8	22.1	26.7	15.3
Zinc	109	**10,000**	*10,000*	79.2	36.8	0.6	30.5	55	52	124	40.5	43.9	170	124
Polychlorinated Biphenyls - EPA Method 8082 (ug/kg)														
Aroclor 1248	NV	**NV**	*NV*	ND	ND	ND	ND	ND	ND	ND	620	ND	ND	ND
Aroclor 1254	NV	**NV**	*NV*	1,700	230	9.8	1,400	21	15	1800	540	65	650	700
Aroclor 1260	NV	**NV**	*NV*	840	67	ND	1,600	ND	ND	760	190	40	410	210
Total PCBs	100*	**1000***	*1,000**	***2,540***	297	9.8	***3,000***	21	15	***2,560***	***1,350***	105	***1,060***	910

Table 2
Soil Analytical Testing Results Summary
Niagara Falls Armed Foreces Reserve Center
Niagara Falls, New York

Notes:

1. Compounds detected in one or more samples are presented on this table.
2. Analytical testing completed by Test America Laboratories.
3. ug/kg = micrograms per kilogram; mg/kg = milligrams per kilogram
4. ND indicates compound was not detected above method detection limits.
5. NV = no value.
6. Shading indicates value exceeds Unrestricted Use Soil Cleanup Objectives.
7. **Bold** indicates value exceeds the Restricted Residential Soil Cleanup Objectives.
8. *Italics* indicates value exceeds the Restricted Commercial Soil Cleanup Objectives.
9. A duplicate sample (DUP-1) was collected at soil probe location SP-8. Values shown are the higher of the two analytical results.
10. *Soil cleanup objective is for the sum of the Aroclor compound concentrations detected (Total PCBs).
11. Soil cleanup objective used is from NYSDEC Final Commissioners Policy, CP-51, dated October 21, 2010.

Table 3

Water Analytical Testing Results Summary
Niagara Falls Armed Forces Reserve Center
Niagara Falls, New York

Parameter	Class GA Criteria	West Pipe End Water	TP-12-Water
Volatile Organic Compounds - EPA Method 8260 TCL (ug/L)			
2-Butanone (MEK)	50	2.7	ND
Acetone	50	18	ND
cis-1,2-Dichloroethene	5	0.99	ND
Trichloroethene	5	4.1	ND
Vinyl Chloride	2	1.9	ND
Toluene	5	13	ND
Xylenes (total)	5[6]	2.5	ND
Naphthalene	10	89	ND
Total VOCs	NV	132.19	ND
Total VOC TICs	NV	37.9	415
Semi-Volatile Organic Compounds - EPA Method 8270 (ug/L)			
2,4-Dimethylphenol	1	3.7	ND
2-Methylnaphthalene	NV	16	ND
4-Methylphenol	1	44	ND
Acenaphthene	20	9.8	ND
Anthracene	50	6.8	ND
Benzo [a] anthracene	0.002*	2	8.3
Benzo [a] pyrene	ND	ND	4.9
Benzo [b] fluoranthene	0.002*	ND	7.3
Carbazole	5	92	ND
Chrysene	0.002*	ND	9.4
Dibenzofuran	NV	17	ND
Fluoranthene	50	10	20
Fluorene	50	27	ND
Naphthalene	10 *	87	ND
Phenanthrene	50 *	49	ND
Phenol	1	330	ND
Total SVOCs	NV	694.3	49.9
Total SVOC TICs	NV	985	18,790
PCBs - EPA Method 8082 (ug/L)			
Aroclor 1254	NV	6.1	1.7
Aroclor 1260	NV	0.94	0.72
Total PCBs	0.09[11]	7.04	2.42
Dissolved Metals - EPA Method SW 846 (mg/L)			
Aluminum	NV	0.529	0.621
Barium	1	0.0278	0.0173
Calcium	NV	62.8	74.7
Chromium	0.05	0.0706	0.215
Copper	0.2	ND	0.0025
Iron	0.3	0.031	ND
Magnesium	35*	0.154	ND
Manganese	0.3	0.0018	0.0004
Nickel	0.1	0.0067	0.0015
Potassium	NV	21	3.03
Sodium	20	12.3	2.7
Vanadium	NV	0.0044	0.0104
Zinc	2*	0.0137	0.0042

Notes:
1. Compounds detected in one or more samples are presented on this table.
2. Analytical testing completed by Test America Laboratories.
3. NYSDEC Class GA criteria obtained from Division of Water Technical and Operational Guidance Series (TOGS 1.1.1), June 1998, dated October 1993, revised June 1998, January 1999 errata sheet and April 2000 addendum.
4. ug/L = micrograms per liter; mg/L = miligrams per liter
5. Shading indicates values exceeding NYSDEC Class GA groundwater criteria.
6. Class GA criteria shown is for total xylene concentration.
7. ND = compound was not detected.
8. * indicates a Guidance Value instead of a Standard Value.
9. NV = no value.
10. ND = non-detectable concentration by approved analytical methods.
11. Groundwater criteria is for the sum of the Aroclor compound concentrations detected (Total PCBs).

Table 2
Post Excavation Soil Results - September 2009
9400 Porter Road
Niagara Falls, New York

Sample Location Laboratory Sample ID Sample Date Sample Depth (ft bgs)	Maximum Contaminant Level	CS-1 RSI0550-01 9/16/2009 1.0-1.25	CS-2 RSI0550-02 9/16/2009 1.0-1.25	CS-3 RSI0550-03 9/16/2009 1.0-1.25	CS-4 RSI0550-04 9/16/2009 1.0-1.25	CS-5 RSI0550-05 9/16/2009 1.0-1.25	CS-6 RSI0550-06 9/16/2009 1.0-1.25	CS-6 (DUP) RSI0550-11 9/16/2009 1.0-1.25	CS-7 RSI0550-07 9/16/2009 1.0-1.25
PCBs (mg/kg) EPA Method 8082	1.0	0.33	0.27	0.17	0.39	**14**	**18**	**12**	**14**

Sample Location Laboratory Sample ID Sample Date Sample Depth (ft)	Maximum Contaminant Level	CS-8 RSI0550-08 9/16/2009 1.0-1.25	CS-9 RSI0550-09 9/16/2009 1.0-1.25	CS-10 RSI0550-10 9/16/2009 1.0-1.25
PCBs (mg/kg) EPA Method 8082	1.0	**4.8**	**1.9**	0.33

Notes:

Samples detected at levels exceeding the Maximum Contaminant Level are shown in bold and underlined [**thus**].

mg/kg	Milligrams per kilogram
ND	Non-detect

Sampling Information:
Samples were collected in 8 oz glass containers.
Samples were placed in iced coolers at approximately 4^{o}C.

Table 3
Post-Excavation Soil Results - October 2009
9400 Porter Road
Niagara Falls, New York

Sample Location Laboratory Sample ID Sample Date Sample Depth (ft bgs)	Maximum Contaminant Level	CS-11 RSJ0561-01 10/8/2009 2.0-2.25	CS-12 RSJ0561-02 10/8/2009 2.0-2.25	CS-13 RSJ0561-03 10/8/2009 2.0-2.25	CS-14 RSJ0561-04 10/8/2009 2.0-2.25	CS-14(DUP) RSJ0561-06 10/8/2009 2.0-2.25	CS-15 RSJ0561-05 10/8/2009 2.0-2.25
PCBs (mg/kg) EPA Method 8082	1.0	0.170	0.022	0.800	0.006 J	0.016 J	0.007 J

Notes:

mg/kg	Milligrams per kilogram
ND	Non-detect
J	Analyte detected at a level less than the Reporting Limit and greater than the Method Detection Limit.

Sampling Information:
Samples were collected in 8 oz glass containers.
Samples were placed in iced coolers at approximately 4^{o}C.

APPENDIX F

Pro UCL 4.0 Software Outputs

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Benzene	D_Benzene	Naphthaler	D_Naphtha	Toluene	D_Toluene	Trichloroflu	D_Trichlorc	2,4-Dimeth	D_2,4-Dim	4-Methylph	D_4-Methy	2-Methlyna	D_2-Methly	Benzo(a)ar	D_Benzo(a	Benzo(b)flu
2	0.205	0	3.8	1	0.255	0	6.3	1	0.255	0	0.18	0	0.305	0	0.49	1	0.17
3	0.205	0	0.385	0	0.255	0	0.44	0	0.255	0	0.18	0	0.305	0	0.85	1	1.1
4	0.205	0	0.375	0	0.255	0	0.44	0	0.25	0	0.18	0	0.295	0	0.18	0	0.17
5	0.205	0	0.375	0	0.255	0	0.44	0	0.25	0	0.18	0	0.295	0	0.18	0	0.17
6	0.205	0	0.36	0	0.255	0	0.44	0	0.24	0	0.17	0	0.285	0	0.44	1	0.16
7	0.205	0	0.36	0	0.255	0	0.44	0	0.235	0	0.17	0	0.285	0	0.17	0	0.16
8	0.205	0	13	1	0.255	0	0.44	0	3.7	1	44	1	16	1	2	1	0.8
9	1.6	1	0.85	0	2.7	1	0.44	0	2.4	0	1.75	0	2.9	0	8.3	1	7.3
10	0.205	0			89	1	0.44	0									
11	0.8	0			1	0	1.75	1									

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1	D_Benzo(b	Benzo(a)py	D_Benzo(a	Carbazole	D_Carbazo	Chrysene	D_Chrysen	Indeno(1,2,	D_Indeno(	Phenol	D_Phenol	Aroclor 125	D_Aroclor	Aroclor 126	D_Aroclor 1260	
2	0	0.235	0	1.9	1	0.39	1	0.235	0	0.195	0	0.12	0	0.12	0	
3	1	0.95	1	0.41	1	0.77	1	0.91	1	0.195	0	0.12	0	0.12	0	
4	0	0.235	0	0.15	0	0.165	0	0.235	0	0.195	0	0.125	0	0.77	1	
5	0	0.235	0	0.15	0	0.165	0	0.235	0	0.195	0	2	1	1	1	
6	0	0.225	0	0.43	1	0.43	1	0.225	0	0.185	0	0.12	0	0.12	0	
7	0	0.22	0	0.14	0	0.155	1	0.22	0	0.185	0	0.12	0	13	1	
8	0	1.1	0	92	1	0.8	0	1.1	0	330	1	6.1	1	0.94	1	
9	1	4.9	1	1.45	0	9.4	1	2.25	0	1.9	0	1.7	1	0.52	1	
10																
11																

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Acetone	D_Acetone	Benzo(a)ar	D_Benzo(a	Dibenzo(a,	D_Dibenzo	Chrysene	D_Chrysen	Benzo(b)flu	D_Benzo(b	Benzo(k)flu	D_Benzo(k	Benzo(a)py	D_Benzo(a	Indeno(1,2	D_Indeno(	Aroclor 125	D_Aroclor	Aroclor 126	D_Aroclor	PE Aroclor
2	0.0055	0	0.65	1	0.052	0	0.67	1	0.59	1	0.42	1	0.55	1	0.28	1	0.051	0	0.11	0	0.33
3	0.0071	1	0.11	1	0.014	1	0.1	1	0.091	1	0.064	1	0.09	1	0.032	1	0.056	0	0.12	0	0.27
4	0.06	1	0.012	1	0.00269	0	0.011	1	0.016	1	0.013	1	0.013	1	0.0061	0	0.056	0	0.12	0	0.17
5	0.022	1	0.00175	0	0.0012	0	0.001	0	0.011	1	0.011	1	0.0095	1	0.0028	0	0.052	0	0.12	0	0.39
6	0.028	1	0.021	1	0.03	1	0.029	1	0.002	0	0.0011	0	0.00245	0	0.03	1	0.048	0	0.11	0	14
7	0.0025	0	0.00175	0	0.0012	0	0.001	0	0.011	1	0.013	1	0.0024	0	0.00275	0	0.048	0	0.11	0	15
8	0.0023	0	3.6	1	0.63	1	3.5	1	4.1	1	1.7	1	3.2	1	1.2	1	0.022	0	0.048	0	14
9	0.00245	0	5.6	1	1.2	1	5.4	1	5.6	1	3.1	1	5.8	1	2.1	1	0.023	0	0.05	0	4.8
10	0.027	1	0.014	1	0.0012	0	0.014	1	0.019	1	0.016	1	0.015	1	0.0093	1	0.0225	0	0.05	0	1.9
11	0.0067	1	0.0017	0	0.00175	0	0.001	0	0.012	1	0.012	1	0.0098	1	0.0088	1	0.026	0	0.06	0	0.33
12	0.0027	0	0.037	1	0.01	1	0.045	1	0.059	1	0.027	1	0.039	1	0.023	1	0.0285	0	0.065	0	0.17
13	0.00255	0	0.00185	0	0.00125	0	0.00105	0	0.015	1	0.0091	1	0.00255	0	0.00295	0	0.0235	0	0.055	0	0.022
14	0.0025	0	0.027	1	0.0012	0	0.025	1	0.04	1	0.019	1	0.026	1	0.016	1	0.0235	0	1.1	1	0.8
15	0.0097	1	0.046	1	0.012	1	0.047	1	0.072	1	0.035	1	0.054	1	0.027	1	0.0255	0	0.055	0	0.011
16	0.0073	1	1.7	1	0.13	0	2.3	1	3.5	1	1.7	1	2.9	1	1.4	1	0.027	0	0.32	1	0.007
17	0.00245	0	0.21	1	0.029	1	0.2	1	0.21	1	0.11	1	0.16	1	0.086	1	0.0275	0	0.06	0	
18	0.012	1	0.26	1	0.0015	0	0.29	1	0.44	1	0.18	1	0.29	1	0.12	1	0.024	0	0.15	1	
19	0.00245	0	0.014	1	0.00115	0	0.017	1	0.018	1	0.016	1	0.015	1	0.01	1	0.0245	0	0.055	0	
20	0.00225	0	0.15	1	0.0013	0	0.14	1	0.19	1	0.082	1	0.13	1	0.056	1	0.0285	0	0.065	0	
21	0.00235	0	0.015	1	0.0011	0	0.014	1	0.02	1	0.015	1	0.015	1	0.01	1	0.022	0	0.049	0	
22	0.0028	0	0.097	1	0.02	1	0.11	1	0.14	1	0.064	1	0.098	1	0.045	1	0.0275	0	0.41	1	
23	0.03	1	0.011	1	0.00115	0	0.01	1	0.014	1	0.013	1	0.014	1	0.0027	0	0.023	0	0.05	0	
24	0.00235	0	0.33	1	0.0011	0	0.38	1	0.74	1	0.36	1	0.49	1	0.21	1	0.027	0	0.94	1	
25	0.00245	0	0.0091	1	0.00115	0	0.0079	1	0.012	1	0.01	1	0.007	1	0.0076	1	0.022	0	0.049	0	
26	0.0029	0	0.066	1	0.013	1	0.078	1	0.081	1	0.04	1	0.059	1	0.038	1	0.029	0	0.065	0	
27	0.0067	1	0.015	1	0.0012	0	0.014	1	0.016	1	0.014	1	0.014	1	0.0029	0	0.0225	0	0.05	0	
28	0.0245	0	0.023	1	0.00115	0	0.024	1	0.046	1	0.024	1	0.03	1	0.017	1	0.0285	0	0.065	0	
29	0.0023	0	0.0089	1	0.0011	0	0.01	1	0.02	1	0.011	1	0.011	1	0.0074	1	0.024	0	0.055	0	
30	0.027	1	0.055	1	0.00115	0	0.062	1	0.097	1	0.043	1	0.063	1	0.03	1	0.0285	0	0.065	0	
31	0.017	1	0.0094	1	0.00105	0	0.0096	1	0.0088	1	0.0081	1	0.0073	1	0.0062	1	0.0224	0	0.0495	0	
32	0.019	1	0.95	1	0.064	1	0.94	1	1.2	1	0.62	1	0.92	1	0.27	1	0.0265	0	0.06	0	
33	0.029	1	0.013	1	0.0013	0	0.0097	1	0.018	1	0.016	1	0.011	1	0.009	1	0.0265	0	0.06	0	
34	0.044	1	0.0018	0	0.00125	0	0.00105	0	0.00205	0	0.00115	0	0.00255	0	0.0029	0	0.0305	0	0.065	0	
35	0.017	1	0.021	1	0.019	1	0.024	1	0.024	1	0.029	1	0.017	1	0.019	1	0.0285	0	0.065	0	
36	0.029	1	0.41	1	0.0065	0	0.39	1	0.42	1	0.28	1	0.38	1	0.23	1	0.0275	0	0.06	0	
37	0.00245	0	0.14	1	0.006	0	0.12	1	0.15	1	0.089	1	0.13	1	0.093	1	0.028	0	0.06	0	
38	0.0024	0	0.00175	0	0.0012	0	0.001	0	0.002	0	0.0011	0	0.00245	0	0.00285	0	0.028	0	0.06	0	
39	0.0071	1	0.0018	0	0.00125	0	0.00105	0	0.00205	0	0.00115	0	0.00255	0	0.0029	0	0.0295	0	0.065	0	
40	0.00255	0	0.0018	0	0.0012	0	0.00105	0	0.0048	1	0.0042	1	0.0025	0	0.00285	0	0.029	0	0.065	0	
41	0.0155	0	0.026	1	0.02	1	0.015	1	0.032	1	0.022	1	0.028	1	0.026	1	0.03	0	0.065	0	
42	0.038	1	0.00175	0	0.0012	0	0.001	0	0.00195	0	0.0011	0	0.00245	0	0.0028	0	0.059	0	0.065	0	
43	0.07	1	0.00175	0	0.0012	0	0.001	0	0.00195	0	0.0011	0	0.00245	0	0.0028	0	0.0305	0	0.065	0	
44	0.12	1	0.32	1	0.047	1	0.29	1	0.29	1	0.17	1	0.27	1	0.13	1	0.0245	0	0.055	0	
45	0.038	1	0.01	0	0.0011	0	0.0135	0	0.034	1	0.012	1	0.0115	0	0.0098	0	0.026	0	0.055	0	
46	0.0435	1	0.0455	0	0.0012	0	0.047	0	0.11	1	0.039	1	0.0425	0	0.019	0	0.07	1	0.11	1	
47	0.1	1	0.0019	0	0.0013	0	0.0011	0	0.00215	0	0.0012	0	0.00265	0	0.00305	0	0.00195	0	0.0043	0	
48	0.045	1	0.0185	0	0.0125	0	0.0105	0	0.0205	0	0.0115	0	0.0255	0	0.0295	0	0.00215	0	0.0047	0	
49	0.048	1	0.024	0	0.0165	0	0.014	0	0.027	0	0.0155	0	0.0335	0	0.0385	0	0.00235	0	0.005	0	
50	0.044	1	0.089	1	0.00135	0	0.078	1	0.12	1	0.037	1	0.085	1	0.04	1	0.0022	0	0.00475	0	
51	0.01	1	0.0018	0	0.00125	0	0.00105	0	0.002	0	0.00115	0	0.0025	0	0.0029	0	0.0029	0	0.0065	0	
52	0.019	1	0.001675	0	0.00115	0	0.005025	0	0.0019	0	0.001075	0	0.002375	0	0.0027	0	0.00235	0	0.0065	0	
53	0.0019	1	0.00185	0	0.00125	0	0.00105	0	0.00205	0	0.00115	0	0.00255	0	0.00295	0	0.00225	0	0.029	1	
54	0.0029	0	0.0018	0	0.0022	0	0.00105	0	0.013	1	0.00115	0	0.0025	0	0.00285	0	0.002025	0	0.00445	0	
55	0.0605	1	0.16	1	0.0013	0	0.0011	0	0.014	1	0.0024	1	0.0026	0	0.003	0	0.0022	0	0.0049	0	
56	0.011	1	0.018	1	0.00135	0	0.017	1	0.0045	1	0.0025	1	0.00275	0	0.00315	0	0.00215	0	0.0048	0	
57	0.34	1	0.96	1	0.055	0	0.69	1	1	1	0.055	0	0.96	1	0.135	0	0.051	1	0.025	1	
58	0.029	1	0.29	1	0.038	1	0.23	1	0.26	1	0.11	1	0.25	1	0.11	1	0.0024	0	0.0065	0	
59	0.013	1	0.0034	1	0.00115	0	0.001	0	0.0019	0	0.0011	0	0.00235	0	0.0027	0	1.7	1	0.84	1	
60	0.0076	1	0.1	0	0.07	0	0.06	0	0.14	0	0.075	0	0.14	0	0.16	0	0.23	1	0.067	1	
61			0.0175	1	0.001225	0	0.001025	0	0.0155	1	0.001125	0	0.0025	0	0.00285	0	0.0098	1	0.00455	0	
62			0.42	1	0.012	0	0.42	1	0.45	1	0.0115	0	0.39	1	0.21	1	1.4	1	1.6	1	
63			0.79	1	0.0145	0	0.69	1	0.74	1	0.0135	0	0.68	1	0.32	1	0.018	1	0.004825	0	
64			0.0155	0	0.0105	0	0.009	0	0.0175	0	0.01	0	0.022	0	0.025	0	1.8	1	0.76	1	
65			0.095	0	0.065	0	0.055	0	0.105	0	0.06	0	0.135	0	0.155	0	0.54	1	0.19	1	
66			10	1	2.3	1	9.7	1	14	1	6.5	1	14	1	8.8	1	0.065	1	0.04	1	
67																	0.65	1	0.41	1	
68																	0.7	1	0.21	1	
69																					
70																					
71																					
72																					
73																					
74																					
75																					
76																					
77																					
78																					
79																					
80																					
81																					
82																					
83																					

	V	W	X	Y	Z	AA	AB	AC	AD
1	D_PE Aroc	PE Aroclor	D_PE Aroc	Combined	D_Combin	Combined	D_ Combined Aroclor 1260		
2	1	0.0022	0	0.051	0	0.11	0		
3	1	0.00215	0	0.056	0	0.12	0		
4	1	0.0022	0	0.056	0	0.12	0		
5	1	0.002	0	0.052	0	0.12	0		
6	1	0.115	0	0.048	0	0.11	0		
7	1	0.125	0	0.048	0	0.11	0		
8	1	0.11	0	0.022	0	0.048	0		
9	1	0.1	0	0.023	0	0.05	0		
10	1	0.0105	0	0.0225	0	0.05	0		
11	1	0.00215	0	0.026	0	0.06	0		
12	1	0.00225	0	0.0285	0	0.065	0		
13	1	0.0022	0	0.0235	0	0.055	0		
14	1	0.011	0	0.0235	0	1.1	1		
15	1	0.002225	0	0.0255	0	0.055	0		
16	1	0.00225	0	0.027	0	0.32	1		
17				0.0275	0	0.06	0		
18				0.024	0	0.15	1		
19				0.0245	0	0.055	0		
20				0.0285	0	0.065	0		
21				0.022	0	0.049	0		
22				0.0275	0	0.41	1		
23				0.023	0	0.05	0		
24				0.027	0	0.94	1		
25				0.022	0	0.049	0		
26				0.029	0	0.065	0		
27				0.0225	0	0.05	0		
28				0.0285	0	0.065	0		
29				0.024	0	0.055	0		
30				0.0285	0	0.065	0		
31				0.0224	0	0.0495	0		
32				0.0265	0	0.06	0		
33				0.0265	0	0.06	0		
34				0.0305	0	0.065	0		
35				0.0285	0	0.065	0		
36				0.0275	0	0.06	0		
37				0.028	0	0.06	0		
38				0.028	0	0.06	0		
39				0.0295	0	0.065	0		
40				0.029	0	0.065	0		
41				0.03	0	0.065	0		
42				0.059	0	0.065	0		
43				0.0305	0	0.065	0		
44				0.0245	0	0.055	0		
45				0.026	0	0.055	0		
46				0.07	1	0.11	1		
47				0.00195	0	0.0043	0		
48				0.00215	0	0.0047	0		
49				0.00235	0	0.005	0		
50				0.0022	0	0.00475	0		
51				0.0029	0	0.0065	0		
52				0.00235	0	0.0065	0		
53				0.00225	0	0.029	1		
54				0.002025	0	0.00445	0		
55				0.0022	0	0.0049	0		
56				0.00215	0	0.0048	0		
57				0.051	1	0.025	1		
58				0.0024	0	0.0065	0		
59				1.7	1	0.84	1		
60				0.23	1	0.067	1		
61				0.0098	1	0.00455	0		
62				1.4	1	1.6	1		
63				0.018	1	0.004825	0		
64				1.8	1	0.76	1		
65				0.54	1	0.19	1		
66				0.065	1	0.04	1		
67				0.65	1	0.41	1		
68				0.7	1	0.21	1		
69				0.33	1	0.0022	0		
70				0.27	1	0.00215	0		
71				0.17	1	0.0022	0		
72				0.39	1	0.002	0		
73				14	1	0.115	0		
74				15	1	0.125	0		
75				14	1	0.11	0		
76				4.8	1	0.1	0		
77				1.9	1	0.0105	0		
78				0.33	1	0.00215	0		
79				0.17	1	0.00225	0		
80				0.022	1	0.0022	0		
81				0.8	1	0.011	0		
82				0.011	1	0.002225	0		
83				0.007	1	0.00225	0		

	A	B	C	D	E	F	G	H	I	J	K	L
1				**General UCL Statistics for Data Sets with Non-Detects**								
2	**User Selected Options**											
3	From File			P:\projects\USACE-Louisville, KY.773\773-04\HHRA\Pro UCL Software Outputs\Groundwater Input.wst								
4	Full Precision			OFF								
5	Confidence Coefficient			95%								
6	Number of Bootstrap Operations			2000								
7												
8												
9	**Benzene**											
10												
11	**General Statistics**											
12	Number of Valid Observations					8	Number of Distinct Observations					2
13												
14	**Raw Statistics**						**Log-transformed Statistics**					
15	Minimum					0.205	Minimum of Log Data					-1.585
16	Maximum					1.6	Maximum of Log Data					0.47
17	Mean					0.379	Mean of log Data					-1.328
18	Median					0.205	SD of log Data					0.726
19	SD					0.493						
20	Coefficient of Variation					1.3						
21	Skewness					2.828						
22												
23												
24	**Warning: There are only 2 Distinct Values in this data**											
25	**There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.**											
26	**Those methods will return a 'N/A' value on your output display!**											
27												
28	**It is necessary to have 4 or more Distinct Values to compute bootstrap methods.**											
29	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
30	**It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.**											
31												
32	**Relevant UCL Statistics**											
33	**Normal Distribution Test**						**Lognormal Distribution Test**					
34	Shapiro Wilk Test Statistic					0.419	Shapiro Wilk Test Statistic					0.419
35	Shapiro Wilk Critical Value					0.818	Shapiro Wilk Critical Value					0.818
36	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
37												
38	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
39	95% Student's-t UCL					0.71	95% H-UCL					0.743
40	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL					0.71
41	95% Adjusted-CLT UCL (Chen-1995)					0.853	97.5% Chebyshev (MVUE) UCL					0.874
42	95% Modified-t UCL (Johnson-1978)					0.739	99% Chebyshev (MVUE) UCL					1.195
43												
44	**Gamma Distribution Test**						**Data Distribution**					
45	k star (bias corrected)					1.046	**Data do not follow a Discernable Distribution (0.05)**					
46	Theta Star					0.363						
47	MLE of Mean					0.379						
48	MLE of Standard Deviation					0.371						
49	nu star					16.73						
50	Approximate Chi Square Value (.05)					8.479	**Nonparametric Statistics**					

	A	B	C	D	E	F	G	H	I	J	K	L
51	Adjusted Level of Significance					0.0195	95% CLT UCL					0.666
52	Adjusted Chi Square Value					7.045	95% Jackknife UCL					N/A
53							95% Standard Bootstrap UCL					N/A
54	Anderson-Darling Test Statistic					2.546	95% Bootstrap-t UCL					N/A
55	Anderson-Darling 5% Critical Value					0.728	95% Hall's Bootstrap UCL					N/A
56	Kolmogorov-Smirnov Test Statistic					0.534	95% Percentile Bootstrap UCL					N/A
57	Kolmogorov-Smirnov 5% Critical Value					0.299	95% BCA Bootstrap UCL					N/A
58	**Data not Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					1.139
59							97.5% Chebyshev(Mean, Sd) UCL					1.468
60	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					2.114
61	95% Approximate Gamma UCL					0.749						
62	95% Adjusted Gamma UCL					0.901						
63												
64	**Potential UCL to Use**						Use 95% Chebyshev (Mean, Sd) UCL					1.139
65												
66	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
67	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
68	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
69												

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Number of Valid Data	8	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
		Percent Non-Detects	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzene was not processed!

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Number of Valid Data	8	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
		Percent Non-Detects	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzene was not processed!

	A	B	C	D	E	F	G	H	I	J	K	L
1				**General UCL Statistics for Data Sets with Non-Detects**								
2	**User Selected Options**											
3	From File			P:\projects\USACE-Louisville, KY.773\773-04\HHRA\Pro UCL Software Outputs\Subsurface Input.wst								
4	Full Precision			OFF								
5	Confidence Coefficient			95%								
6	Number of Bootstrap Operations			2000								
7												
8												
9	**Combined Aroclor 1254**											
10												
11	**General Statistics**											
12	Number of Valid Data					82	Number of Detected Data					27
13	Number of Distinct Detected Data					24	Number of Non-Detect Data					55
14							Percent Non-Detects					67.07%
15												
16	**Raw Statistics**						**Log-transformed Statistics**					
17	Minimum Detected					0.007	Minimum Detected					-4.962
18	Maximum Detected					15	Maximum Detected					2.708
19	Mean of Detected					2.201	Mean of Detected					-1.102
20	SD of Detected					4.486	SD of Detected					2.208
21	Minimum Non-Detect					0.00195	Minimum Non-Detect					-6.24
22	Maximum Non-Detect					0.059	Maximum Non-Detect					-2.83
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					61
25	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					21
26	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					74.39%
27												
28	**UCL Statistics**											
29	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
30	Shapiro Wilk Test Statistic					0.517	Shapiro Wilk Test Statistic					0.962
31	5% Shapiro Wilk Critical Value					0.923	5% Shapiro Wilk Critical Value					0.923
32	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
33												
34	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
35	DL/2 Substitution Method						DL/2 Substitution Method					
36	Mean					0.733	Mean					-3.543
37	SD					2.744	SD					2.298
38	95% DL/2 (t) UCL					1.237	95% H-Stat (DL/2) UCL					1.054
39												
40	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
41	**MLE yields a negative mean**						Mean in Log Scale					-5.086
42							SD in Log Scale					3.279
43							Mean in Original Scale					0.726
44							SD in Original Scale					2.746
45							95% t UCL					1.231
46							95% Percentile Bootstrap UCL					1.262
47							95% BCA Bootstrap UCL					1.445
48												
49	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
50	k star (bias corrected)					0.34	**Data Follow Appr. Gamma Distribution at 5% Significance Level**					

	A	B	C	D	E	F	G	H	I	J	K	L
51	Theta Star					6.473						
52	nu star					18.36						
53												
54	A-D Test Statistic					1.138	**Nonparametric Statistics**					
55	5% A-D Critical Value					0.841	Kaplan-Meier (KM) Method					
56	K-S Test Statistic					0.841	Mean					0.731
57	5% K-S Critical Value					0.181	SD					2.728
58	**Data follow Appr. Gamma Distribution at 5% Significance Level**						SE of Mean					0.307
59							95% KM (t) UCL					1.241
60	**Assuming Gamma Distribution**						95% KM (z) UCL					1.236
61	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					1.234
62	Minimum					0.007	95% KM (bootstrap t) UCL					1.488
63	Maximum					15	95% KM (BCA) UCL					1.307
64	Mean					2.257	95% KM (Percentile Bootstrap) UCL					1.259
65	Median					2.3	95% KM (Chebyshev) UCL					2.069
66	SD					2.548	97.5% KM (Chebyshev) UCL					2.648
67	k star					0.905	99% KM (Chebyshev) UCL					3.785
68	Theta star					2.496						
69	Nu star					148.3	**Potential UCLs to Use**					
70	AppChi2					121.2	95% KM (t) UCL					1.241
71	95% Gamma Approximate UCL					2.763						
72	95% Adjusted Gamma UCL					2.773						
73	**Note: DL/2 is not a recommended method.**											
74												
75	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
76	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
77	**For additional insight, the user may want to consult a statistician.**											
78												
79												
80	**Combined Aroclor 1260**											
81												
82	**General Statistics**											
83	Number of Valid Data					82	Number of Detected Data					16
84	Number of Distinct Detected Data					15	Number of Non-Detect Data					66
85							Percent Non-Detects					80.49%
86												
87	**Raw Statistics**						**Log-transformed Statistics**					
88	Minimum Detected					0.025	Minimum Detected					-3.689
89	Maximum Detected					1.6	Maximum Detected					0.47
90	Mean of Detected					0.45	Mean of Detected					-1.459
91	SD of Detected					0.466	SD of Detected					1.333
92	Minimum Non-Detect					0.002	Minimum Non-Detect					-6.215
93	Maximum Non-Detect					0.125	Maximum Non-Detect					-2.079
94												
95	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					71
96	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					11
97	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					86.59%
98												
99	**UCL Statistics**											
100	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					

	A	B	C	D	E	F	G	H	I	J	K	L
101	Shapiro Wilk Test Statistic					0.847	Shapiro Wilk Test Statistic					0.946
102	5% Shapiro Wilk Critical Value					0.887	5% Shapiro Wilk Critical Value					0.887
103	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
104												
105	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
106	DL/2 Substitution Method						DL/2 Substitution Method					
107	Mean					0.107	Mean					-3.809
108	SD					0.263	SD					1.822
109	95% DL/2 (t) UCL					0.156	95% H-Stat (DL/2) UCL					0.22
110												
111	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
112	**MLE yields a negative mean**						Mean in Log Scale					-5.312
113							SD in Log Scale					2.353
114							Mean in Original Scale					0.0915
115							SD in Original Scale					0.268
116							95% t UCL					0.141
117							95% Percentile Bootstrap UCL					0.144
118							95% BCA Bootstrap UCL					0.153
119												
120	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
121	k star (bias corrected)					0.762	**Data appear Gamma Distributed at 5% Significance Level**					
122	Theta Star					0.591						
123	nu star					24.38						
124												
125	A-D Test Statistic					0.261	**Nonparametric Statistics**					
126	5% A-D Critical Value					0.768	Kaplan-Meier (KM) Method					
127	K-S Test Statistic					0.768	Mean					0.108
128	5% K-S Critical Value					0.222	SD					0.261
129	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.0298
130							95% KM (t) UCL					0.158
131	**Assuming Gamma Distribution**						95% KM (z) UCL					0.157
132	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.154
133	Minimum					0.025	95% KM (bootstrap t) UCL					0.169
134	Maximum					1.6	95% KM (BCA) UCL					0.181
135	Mean					0.453	95% KM (Percentile Bootstrap) UCL					0.167
136	Median					0.45	95% KM (Chebyshev) UCL					0.238
137	SD					0.201	97.5% KM (Chebyshev) UCL					0.294
138	k star					3.884	99% KM (Chebyshev) UCL					0.404
139	Theta star					0.117						
140	Nu star					636.9	**Potential UCLs to Use**					
141	AppChi2					579.4	95% KM (t) UCL					0.158
142	95% Gamma Approximate UCL					0.498						
143	95% Adjusted Gamma UCL					0.499						
144	**Note: DL/2 is not a recommended method.**											
145												
146	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
147	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
148	**For additional insight, the user may want to consult a statistician.**											
149												

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	P:\projects\USACE-Louisville, KY.773\773-04\HHRA\Pro UCL Software Outputs\Subsurface Input.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acetone

General Statistics			
Number of Valid Data	59	Number of Detected Data	37
Number of Distinct Detected Data	28	Number of Non-Detect Data	22
		Percent Non-Detects	37.29%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0019	Minimum Detected	-6.266
Maximum Detected	0.34	Maximum Detected	-1.079
Mean of Detected	0.039	Mean of Detected	-3.761
SD of Detected	0.057	SD of Detected	0.998
Minimum Non-Detect	0.00225	Minimum Non-Detect	-6.097
Maximum Non-Detect	0.0245	Maximum Non-Detect	-3.709
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	39
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	20
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	66.10%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.53	Shapiro Wilk Test Statistic	0.981
5% Shapiro Wilk Critical Value	0.936	5% Shapiro Wilk Critical Value	0.936
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0253	Mean	-4.768
SD	0.0484	SD	1.58
95% DL/2 (t) UCL	0.0358	95% H-Stat (DL/2) UCL	0.0582
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-4.553
		SD in Log Scale	1.323
		Mean in Original Scale	0.0256
		SD in Original Scale	0.0483
		95% t UCL	0.0361
		95% Percentile Bootstrap UCL	0.0368
		95% BCA Bootstrap UCL	0.0433
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.032	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	

	A	B	C	D	E	F	G	H	I	J	K	L
51	Theta Star					0.0378						
52	nu star					76.36						
53												
54	A-D Test Statistic					0.888	**Nonparametric Statistics**					
55	5% A-D Critical Value					0.775	Kaplan-Meier (KM) Method					
56	K-S Test Statistic					0.775	Mean					0.0253
57	5% K-S Critical Value					0.149	SD					0.048
58	**Data follow Appr. Gamma Distribution at 5% Significance Level**						SE of Mean					0.00634
59							95% KM (t) UCL					0.0359
60	**Assuming Gamma Distribution**						95% KM (z) UCL					0.0357
61	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.0347
62	Minimum					1E-12	95% KM (bootstrap t) UCL					0.0459
63	Maximum					0.34	95% KM (BCA) UCL					0.0397
64	Mean					0.0301	95% KM (Percentile Bootstrap) UCL					0.037
65	Median					0.022	95% KM (Chebyshev) UCL					0.0529
66	SD					0.0471	97.5% KM (Chebyshev) UCL					0.0649
67	k star					0.23	99% KM (Chebyshev) UCL					0.0883
68	Theta star					0.131						
69	Nu star					27.11	**Potential UCLs to Use**					
70	AppChi2					16.24	95% KM (Percentile Bootstrap) UCL					0.037
71	95% Gamma Approximate UCL					0.0503						
72	95% Adjusted Gamma UCL					0.0509						
73	**Note: DL/2 is not a recommended method.**											
74												
75	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
76	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
77	**For additional insight, the user may want to consult a statistician.**											
78												
79												
80	**Benzo(a)anthracene**											
81												
82	**General Statistics**											
83	Number of Valid Data					65	Number of Detected Data					43
84	Number of Distinct Detected Data					40	Number of Non-Detect Data					22
85							Percent Non-Detects					33.85%
86												
87	**Raw Statistics**						**Log-transformed Statistics**					
88	Minimum Detected					0.0034	Minimum Detected					-5.684
89	Maximum Detected					10	Maximum Detected					2.303
90	Mean of Detected					0.645	Mean of Detected					-2.431
91	SD of Detected					1.78	SD of Detected					1.959
92	Minimum Non-Detect					0.00168	Minimum Non-Detect					-6.392
93	Maximum Non-Detect					0.1	Maximum Non-Detect					-2.303
94												
95	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					46
96	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					19
97	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					70.77%
98												
99	**UCL Statistics**											
100	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					

	A	B	C	D	E	F	G	H	I	J	K	L
101	Shapiro Wilk Test Statistic					0.407	Shapiro Wilk Test Statistic					0.941
102	5% Shapiro Wilk Critical Value					0.943	5% Shapiro Wilk Critical Value					0.943
103	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
104												
105	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
106	DL/2 Substitution Method						DL/2 Substitution Method					
107	Mean					0.429	Mean					-3.677
108	SD					1.474	SD					2.508
109	95% DL/2 (t) UCL					0.734	95% H-Stat (DL/2) UCL					1.614
110												
111	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
112	**MLE yields a negative mean**						Mean in Log Scale					-3.831
113							SD in Log Scale					2.601
114							Mean in Original Scale					0.427
115							SD in Original Scale					1.474
116							95% t UCL					0.732
117							95% Percentile Bootstrap UCL					0.743
118							95% BCA Bootstrap UCL					0.919
119												
120	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
121	k star (bias corrected)					0.331	**Data do not follow a Discernable Distribution (0.05)**					
122	Theta Star					1.947						
123	nu star					28.48						
124												
125	A-D Test Statistic					3.03	**Nonparametric Statistics**					
126	5% A-D Critical Value					0.851	Kaplan-Meier (KM) Method					
127	K-S Test Statistic					0.851	Mean					0.428
128	5% K-S Critical Value					0.146	SD					1.462
129	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.184
130							95% KM (t) UCL					0.735
131	**Assuming Gamma Distribution**						95% KM (z) UCL					0.73
132	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.732
133	Minimum					1E-12	95% KM (bootstrap t) UCL					1.162
134	Maximum					10	95% KM (BCA) UCL					0.779
135	Mean					0.431	95% KM (Percentile Bootstrap) UCL					0.746
136	Median					0.018	95% KM (Chebyshev) UCL					1.228
137	SD					1.473	97.5% KM (Chebyshev) UCL					1.575
138	k star					0.0974	99% KM (Chebyshev) UCL					2.255
139	Theta star					4.428						
140	Nu star					12.66	**Potential UCLs to Use**					
141	AppChi2					5.668	97.5% KM (Chebyshev) UCL					1.575
142	95% Gamma Approximate UCL					0.964						
143	95% Adjusted Gamma UCL					0.982						
144	**Note: DL/2 is not a recommended method.**											
145												
146	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
147	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
148	**For additional insight, the user may want to consult a statistician.**											
149												
150												

	A	B	C	D	E	F	G	H	I	J	K	L
151	Dibenzo(a,h)anthracene											
152												
153	General Statistics											
154	Number of Valid Data					65	Number of Detected Data					15
155	Number of Distinct Detected Data					14	Number of Non-Detect Data					50
156							Percent Non-Detects					76.92%
157												
158	Raw Statistics						Log-transformed Statistics					
159	Minimum Detected					0.01	Minimum Detected					-4.605
160	Maximum Detected					2.3	Maximum Detected					0.833
161	Mean of Detected					0.296	Mean of Detected					-3
162	SD of Detected					0.645	SD of Detected					1.743
163	Minimum Non-Detect					0.00105	Minimum Non-Detect					-6.859
164	Maximum Non-Detect					0.13	Maximum Non-Detect					-2.04
165												
166	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					62
167	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					3
168	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					95.38%
169												
170	UCL Statistics											
171	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
172	Shapiro Wilk Test Statistic					0.521	Shapiro Wilk Test Statistic					0.783
173	5% Shapiro Wilk Critical Value					0.881	5% Shapiro Wilk Critical Value					0.881
174	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
175												
176	Assuming Normal Distribution						Assuming Lognormal Distribution					
177	DL/2 Substitution Method						DL/2 Substitution Method					
178	Mean					0.0722	Mean					-5.821
179	SD					0.326	SD					2.122
180	95% DL/2 (t) UCL					0.14	95% H-Stat (DL/2) UCL					0.0645
181												
182	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
183	MLE yields a negative mean						Mean in Log Scale					-7.403
184							SD in Log Scale					2.912
185							Mean in Original Scale					0.0687
186							SD in Original Scale					0.327
187							95% t UCL					0.136
188							95% Percentile Bootstrap UCL					0.146
189							95% BCA Bootstrap UCL					0.185
190												
191	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
192	k star (bias corrected)					0.343	Data do not follow a Discernable Distribution (0.05)					
193	Theta Star					0.864						
194	nu star					10.29						
195												
196	A-D Test Statistic					2.264	Nonparametric Statistics					
197	5% A-D Critical Value					0.82	Kaplan-Meier (KM) Method					
198	K-S Test Statistic					0.82	Mean					0.0763
199	5% K-S Critical Value					0.238	SD					0.323
200	Data not Gamma Distributed at 5% Significance Level						SE of Mean					0.0414

	A	B	C	D	E	F	G	H	I	J	K	L
201											95% KM (t) UCL	0.145
202	**Assuming Gamma Distribution**										95% KM (z) UCL	0.144
203					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.142
204					Minimum	1E-12					95% KM (bootstrap t) UCL	1.606
205					Maximum	2.3					95% KM (BCA) UCL	0.157
206					Mean	0.284					95% KM (Percentile Bootstrap) UCL	0.156
207					Median	0.294					95% KM (Chebyshev) UCL	0.257
208					SD	0.326					97.5% KM (Chebyshev) UCL	0.335
209					k star	0.251					99% KM (Chebyshev) UCL	0.488
210					Theta star	1.13						
211					Nu star	32.64	**Potential UCLs to Use**					
212					AppChi2	20.58					95% KM (Chebyshev) UCL	0.257
213					95% Gamma Approximate UCL	0.45						
214					95% Adjusted Gamma UCL	0.455						
215	**Note: DL/2 is not a recommended method.**											
216												
217	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
218	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
219	**For additional insight, the user may want to consult a statistician.**											
220												
221												
222	**Chrysene**											
223												
224	**General Statistics**											
225					Number of Valid Data	65					Number of Detected Data	40
226					Number of Distinct Detected Data	32					Number of Non-Detect Data	25
227											Percent Non-Detects	38.46%
228												
229	**Raw Statistics**						**Log-transformed Statistics**					
230					Minimum Detected	0.0079					Minimum Detected	-4.841
231					Maximum Detected	9.7					Maximum Detected	2.272
232					Mean of Detected	0.678					Mean of Detected	-2.345
233					SD of Detected	1.794					SD of Detected	1.948
234					Minimum Non-Detect	0.001					Minimum Non-Detect	-6.908
235					Maximum Non-Detect	0.06					Maximum Non-Detect	-2.813
236												
237	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	43
238	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	22
239	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	66.15%
240												
241	**UCL Statistics**											
242	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
243					Shapiro Wilk Test Statistic	0.426					Shapiro Wilk Test Statistic	0.922
244					5% Shapiro Wilk Critical Value	0.94					5% Shapiro Wilk Critical Value	0.94
245	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
246												
247	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
248					DL/2 Substitution Method						DL/2 Substitution Method	
249					Mean	0.419					Mean	-3.999
250					SD	1.439					SD	2.75

	A	B	C	D	E	F	G	H	I	J	K	L
251					95% DL/2 (t) UCL	0.717					95% H-Stat (DL/2) UCL	2.669
252												
253					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
254	**MLE yields a negative mean**										Mean in Log Scale	-4.07
255											SD in Log Scale	2.755
256											Mean in Original Scale	0.418
257											SD in Original Scale	1.439
258											95% t UCL	0.716
259											95% Percentile Bootstrap UCL	0.732
260											95% BCA Bootstrap UCL	0.873
261												
262	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
263					k star (bias corrected)	0.335	**Data do not follow a Discernable Distribution (0.05)**					
264					Theta Star	2.022						
265					nu star	26.83						
266												
267					A-D Test Statistic	2.812	**Nonparametric Statistics**					
268					5% A-D Critical Value	0.848					Kaplan-Meier (KM) Method	
269					K-S Test Statistic	0.848					Mean	0.421
270					5% K-S Critical Value	0.151					SD	1.427
271	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	0.179
272											95% KM (t) UCL	0.72
273	**Assuming Gamma Distribution**										95% KM (z) UCL	0.715
274					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.718
275					Minimum	0.0079					95% KM (bootstrap t) UCL	1.287
276					Maximum	9.7					95% KM (BCA) UCL	0.724
277					Mean	0.498					95% KM (Percentile Bootstrap) UCL	0.729
278					Median	0.147					95% KM (Chebyshev) UCL	1.202
279					SD	1.421					97.5% KM (Chebyshev) UCL	1.54
280					k star	0.451					99% KM (Chebyshev) UCL	2.204
281					Theta star	1.104						
282					Nu star	58.63	**Potential UCLs to Use**					
283					AppChi2	42.03					97.5% KM (Chebyshev) UCL	1.54
284					95% Gamma Approximate UCL	0.695						
285					95% Adjusted Gamma UCL	0.7						
286	**Note: DL/2 is not a recommended method.**											
287												
288	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
289	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
290	**For additional insight, the user may want to consult a statistician.**											
291												
292												
293	**Benzo(b)fluoranthene**											
294												
295	**General Statistics**											
296					Number of Valid Data	65					Number of Detected Data	49
297					Number of Distinct Detected Data	42					Number of Non-Detect Data	16
298											Percent Non-Detects	24.62%
299												
300	**Raw Statistics**						**Log-transformed Statistics**					

	A	B	C	D	E	F	G	H	I	J	K	L
301	Minimum Detected					0.0045	Minimum Detected					-5.404
302	Maximum Detected					14	Maximum Detected					2.639
303	Mean of Detected					0.716	Mean of Detected					-2.503
304	SD of Detected					2.218	SD of Detected					1.973
305	Minimum Non-Detect					0.0019	Minimum Non-Detect					-6.266
306	Maximum Non-Detect					0.14	Maximum Non-Detect					-1.966
307												
308	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					47
309	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					18
310	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					72.31%
311												
312	**UCL Statistics**											
313	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
314	Shapiro Wilk Test Statistic					0.365	Shapiro Wilk Test Statistic					0.923
315	5% Shapiro Wilk Critical Value					0.947	5% Shapiro Wilk Critical Value					0.947
316	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
317												
318	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
319	DL/2 Substitution Method						DL/2 Substitution Method					
320	Mean					0.542	Mean					-3.352
321	SD					1.945	SD					2.393
322	95% DL/2 (t) UCL					0.945	95% H-Stat (DL/2) UCL					1.608
323												
324	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
325	**MLE yields a negative mean**						Mean in Log Scale					-3.441
326							SD in Log Scale					2.438
327							Mean in Original Scale					0.541
328							SD in Original Scale					1.945
329							95% t UCL					0.943
330							95% Percentile Bootstrap UCL					0.963
331							95% BCA Bootstrap UCL					1.194
332												
333	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
334	k star (bias corrected)					0.31	**Data do not follow a Discernable Distribution (0.05)**					
335	Theta Star					2.313						
336	nu star					30.35						
337												
338	A-D Test Statistic					4.198	**Nonparametric Statistics**					
339	5% A-D Critical Value					0.859	Kaplan-Meier (KM) Method					
340	K-S Test Statistic					0.859	Mean					0.542
341	5% K-S Critical Value					0.137	SD					1.93
342	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.242
343							95% KM (t) UCL					0.945
344	**Assuming Gamma Distribution**						95% KM (z) UCL					0.94
345	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.944
346	Minimum					1E-12	95% KM (bootstrap t) UCL					1.573
347	Maximum					14	95% KM (BCA) UCL					1.001
348	Mean					0.541	95% KM (Percentile Bootstrap) UCL					0.996
349	Median					0.02	95% KM (Chebyshev) UCL					1.596
350	SD					1.945	97.5% KM (Chebyshev) UCL					2.052

	A	B	C	D	E	F	G	H	I	J	K	L
351	k star					0.115	99% KM (Chebyshev) UCL					2.948
352	Theta star					4.717						
353	Nu star					14.91	**Potential UCLs to Use**					
354	AppChi2					7.201	97.5% KM (Chebyshev) UCL					2.052
355	95% Gamma Approximate UCL					1.121						
356	95% Adjusted Gamma UCL					1.14						
357	**Note: DL/2 is not a recommended method.**											
358												
359	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
360	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
361	**For additional insight, the user may want to consult a statistician.**											
362												
363												
364	**Benzo(k)fluoranthene**											
365												
366	**General Statistics**											
367	Number of Valid Data					65	Number of Detected Data					44
368	Number of Distinct Detected Data					35	Number of Non-Detect Data					21
369							Percent Non-Detects					32.31%
370												
371	**Raw Statistics**						**Log-transformed Statistics**					
372	Minimum Detected					0.0024	Minimum Detected					-6.032
373	Maximum Detected					6.5	Maximum Detected					1.872
374	Mean of Detected					0.365	Mean of Detected					-3.095
375	SD of Detected					1.107	SD of Detected					1.839
376	Minimum Non-Detect					0.00108	Minimum Non-Detect					-6.835
377	Maximum Non-Detect					0.075	Maximum Non-Detect					-2.59
378												
379	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					51
380	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					14
381	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					78.46%
382												
383	**UCL Statistics**											
384	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
385	Shapiro Wilk Test Statistic					0.375	Shapiro Wilk Test Statistic					0.916
386	5% Shapiro Wilk Critical Value					0.944	5% Shapiro Wilk Critical Value					0.944
387	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
388												
389	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
390	DL/2 Substitution Method						DL/2 Substitution Method					
391	Mean					0.249	Mean					-4.143
392	SD					0.923	SD					2.321
393	95% DL/2 (t) UCL					0.44	95% H-Stat (DL/2) UCL					0.596
394												
395	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
396	**MLE yields a negative mean**						Mean in Log Scale					-4.287
397							SD in Log Scale					2.373
398							Mean in Original Scale					0.248
399							SD in Original Scale					0.923
400							95% t UCL					0.439

	A	B	C	D	E	F	G	H	I	J	K	L
401											95% Percentile Bootstrap UCL	0.455
402											95% BCA Bootstrap UCL	0.587
403												
404	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
405					k star (bias corrected)	0.319	**Data do not follow a Discernable Distribution (0.05)**					
406					Theta Star	1.145						
407					nu star	28.05						
408												
409					A-D Test Statistic	4.782	**Nonparametric Statistics**					
410					5% A-D Critical Value	0.855					Kaplan-Meier (KM) Method	
411					K-S Test Statistic	0.855					Mean	0.249
412					5% K-S Critical Value	0.144					SD	0.916
413	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	0.115
414											95% KM (t) UCL	0.44
415	**Assuming Gamma Distribution**										95% KM (z) UCL	0.438
416					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.44
417					Minimum	1E-12					95% KM (bootstrap t) UCL	0.871
418					Maximum	6.5					95% KM (BCA) UCL	0.475
419					Mean	0.252					95% KM (Percentile Bootstrap) UCL	0.443
420					Median	0.015					95% KM (Chebyshev) UCL	0.749
421					SD	0.922					97.5% KM (Chebyshev) UCL	0.966
422					k star	0.102					99% KM (Chebyshev) UCL	1.392
423					Theta star	2.464						
424					Nu star	13.27	**Potential UCLs to Use**					
425					AppChi2	6.075					97.5% KM (Chebyshev) UCL	0.966
426					95% Gamma Approximate UCL	0.55						
427					95% Adjusted Gamma UCL	0.56						
428	**Note: DL/2 is not a recommended method.**											
429												
430	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
431	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
432	**For additional insight, the user may want to consult a statistician.**											
433												
434												
435	Benzo(a)pyrene											
436												
437	**General Statistics**											
438					Number of Valid Data	65					Number of Detected Data	40
439					Number of Distinct Detected Data	35					Number of Non-Detect Data	25
440											Percent Non-Detects	38.46%
441												
442	**Raw Statistics**						**Log-transformed Statistics**					
443					Minimum Detected	0.007					Minimum Detected	-4.962
444					Maximum Detected	14					Maximum Detected	2.639
445					Mean of Detected	0.806					Mean of Detected	-2.359
446					SD of Detected	2.406					SD of Detected	2.009
447					Minimum Non-Detect	0.00235					Minimum Non-Detect	-6.053
448					Maximum Non-Detect	0.14					Maximum Non-Detect	-1.966
449												
450	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	50

	A	B	C	D	E	F	G	H	I	J	K	L
451	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					15
452	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					76.92%
453												
454	**UCL Statistics**											
455	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
456	Shapiro Wilk Test Statistic					0.376	Shapiro Wilk Test Statistic					0.926
457	5% Shapiro Wilk Critical Value					0.94	5% Shapiro Wilk Critical Value					0.94
458	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
459												
460	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
461	DL/2 Substitution Method						DL/2 Substitution Method					
462	Mean					0.499	Mean					-3.723
463	SD					1.918	SD					2.484
464	95% DL/2 (t) UCL					0.896	95% H-Stat (DL/2) UCL					1.436
465												
466	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
467	**MLE yields a negative mean**						Mean in Log Scale					-4.035
468							SD in Log Scale					2.724
469							Mean in Original Scale					0.497
470							SD in Original Scale					1.919
471							95% t UCL					0.894
472							95% Percentile Bootstrap UCL					0.907
473							95% BCA Bootstrap UCL					1.169
474												
475	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
476	k star (bias corrected)					0.311	**Data do not follow a Discernable Distribution (0.05)**					
477	Theta Star					2.588						
478	nu star					24.91						
479												
480	A-D Test Statistic					3.091	**Nonparametric Statistics**					
481	5% A-D Critical Value					0.854	Kaplan-Meier (KM) Method					
482	K-S Test Statistic					0.854	Mean					0.499
483	5% K-S Critical Value					0.151	SD					1.903
484	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.239
485							95% KM (t) UCL					0.898
486	**Assuming Gamma Distribution**						95% KM (z) UCL					0.893
487	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.896
488	Minimum					0.007	95% KM (bootstrap t) UCL					1.774
489	Maximum					14	95% KM (BCA) UCL					0.948
490	Mean					0.68	95% KM (Percentile Bootstrap) UCL					0.919
491	Median					0.394	95% KM (Chebyshev) UCL					1.541
492	SD					1.886	97.5% KM (Chebyshev) UCL					1.992
493	k star					0.461	99% KM (Chebyshev) UCL					2.878
494	Theta star					1.475						
495	Nu star					59.9	**Potential UCLs to Use**					
496	AppChi2					43.1	97.5% KM (Chebyshev) UCL					1.992
497	95% Gamma Approximate UCL					0.944						
498	95% Adjusted Gamma UCL					0.952						
499	**Note: DL/2 is not a recommended method.**											
500												

	A	B	C	D	E	F	G	H	I	J	K	L
501	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
502	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
503	**For additional insight, the user may want to consult a statistician.**											
504												
505												
506	**Indeno(1,2,3-cd)pyrene**											
507												
508	**General Statistics**											
509	Number of Valid Data					65	Number of Detected Data					36
510	Number of Distinct Detected Data					33	Number of Non-Detect Data					29
511							Percent Non-Detects					44.62%
512												
513	**Raw Statistics**						**Log-transformed Statistics**					
514	Minimum Detected					0.0062	Minimum Detected					-5.083
515	Maximum Detected					8.8	Maximum Detected					2.175
516	Mean of Detected					0.445	Mean of Detected					-2.789
517	SD of Detected					1.498	SD of Detected					1.775
518	Minimum Non-Detect					0.0027	Minimum Non-Detect					-5.915
519	Maximum Non-Detect					0.16	Maximum Non-Detect					-1.833
520												
521	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					55
522	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					10
523	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					84.62%
524												
525	**UCL Statistics**											
526	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
527	Shapiro Wilk Test Statistic					0.318	Shapiro Wilk Test Statistic					0.923
528	5% Shapiro Wilk Critical Value					0.935	5% Shapiro Wilk Critical Value					0.935
529	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
530												
531	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
532	DL/2 Substitution Method						DL/2 Substitution Method					
533	Mean					0.251	Mean					-4.115
534	SD					1.129	SD					2.178
535	95% DL/2 (t) UCL					0.485	95% H-Stat (DL/2) UCL					0.414
536												
537	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
538	**MLE yields a negative mean**						Mean in Log Scale					-4.541
539							SD in Log Scale					2.448
540							Mean in Original Scale					0.247
541							SD in Original Scale					1.13
542							95% t UCL					0.481
543							95% Percentile Bootstrap UCL					0.517
544							95% BCA Bootstrap UCL					0.695
545												
546	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
547	k star (bias corrected)					0.331	**Data do not follow a Discernable Distribution (0.05)**					
548	Theta Star					1.344						
549	nu star					23.84						
550												

	A	B	C	D	E	F	G	H	I	J	K	L
551	A-D Test Statistic					3.5	**Nonparametric Statistics**					
552	5% A-D Critical Value					0.848	Kaplan-Meier (KM) Method					
553	K-S Test Statistic					0.848	Mean					0.25
554	5% K-S Critical Value					0.158	SD					1.121
555	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.141
556							95% KM (t) UCL					0.486
557	**Assuming Gamma Distribution**						95% KM (z) UCL					0.482
558	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.484
559	Minimum					0.0062	95% KM (bootstrap t) UCL					1.318
560	Maximum					8.8	95% KM (BCA) UCL					0.555
561	Mean					0.403	95% KM (Percentile Bootstrap) UCL					0.509
562	Median					0.293	95% KM (Chebyshev) UCL					0.865
563	SD					1.11	97.5% KM (Chebyshev) UCL					1.131
564	k star					0.546	99% KM (Chebyshev) UCL					1.653
565	Theta star					0.738						
566	Nu star					71.04	**Potential UCLs to Use**					
567	AppChi2					52.64	97.5% KM (Chebyshev) UCL					1.131
568	95% Gamma Approximate UCL					0.544						
569	95% Adjusted Gamma UCL					0.548						
570	**Note: DL/2 is not a recommended method.**											
571												
572	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
573	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
574	**For additional insight, the user may want to consult a statistician.**											
575												

APPENDIX G

ATSDR ToxFAQs^{TM}

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BENZENE

CAS # 71-43-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,000 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

❏ Industrial processes are the main source of benzene in the environment.
❏ Benzene can pass into the air from water and soil.
❏ It reacts with other chemicals in the air and breaks down within a few days.
❏ Benzene in the air can attach to rain or snow and be carried back down to the ground.
❏ It breaks down more slowly in water and soil, and can pass through the soil into underground water.
❏ Benzene does not build up in plants or animals.

How might I be exposed to benzene?

❏ Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
❏ Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
❏ Air around hazardous waste sites or gas stations will contain higher levels of benzene.
❏ Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries, but we do not know for certain that benzene caused the effects. It is not known whether benzene will affect fertility in men.

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the blood-forming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ August 2005

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

- Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.
- Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.
- Naphthalene can become weakly attached to soil or pass through soil into underground water.
- In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.
- Naphthalene does not accumulate in the flesh of animals or fish that you might eat.
- 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

- Breathing low levels in outdoor air.
- Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- Drinking water from contaminated wells.
- Touching fabrics that are treated with moth repellents containing naphthalene.
- Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❑ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❑ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❑ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❑ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

AGENCY FOR TOXIC SUBSTANCES
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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

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- ☐ Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCHLORINATED BIPHENYLS

Division of Toxicology ToxFAQs™ February 2001

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

❑ PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

❑ PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

❑ PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.

❑ PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

❑ Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.

❑ Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.

❑ Breathing air near hazardous waste sites and drinking contaminated well water.

❑ In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risk of exposure to PCBs?

❑ You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

❑ Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

❑ Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

❑ If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX H

Capital Costs

Table I-1
Cost Estimate Summary
Alternative 1: No Further Action

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	No Further Action		
TOTAL		$ -	$ -

Net Present Worth

Capital Costs	$ -
Net Present Value of O&M Costs	$ -
TOTAL NET PRESENT WORTH =	$ -

Notes:

1.) Refer to the attached pages for descriptions of the cost estimate assumptions.
2.) Present Worth of O&M costs were calculated for a 5-year duration, using a 3% return on investment.
3.) Total costs are rounded to the nearest $1,000.

ASSUMPTIONS:

1) No further action would be required at the Site.

Table I-2
Cost Estimate Summary
Alternative 2: Implementation of Site Mangement Plan

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	Develop Site Management Plan	$ 11,000	
2	Annual Inspection to verify institutional & engineering controls	$ -	$ 800
3	Annual Certification Report	$ -	$ 2,000
		$ -	
TOTAL		$ 11,000	$ 2,800

Subtotal	$ 11,000
Contingency/Administration Cost (20%)	$ 2,200
Net Present Worth	
Capital Costs	$ 13,200
Net Present Value of Annual O&M Costs	$ 70,000
TOTAL NET PRESENT WORTH =	$ 83,200

Notes:
1.) Refer to the attached pages for cost estimate assumptions.
2) Total costs are rounded to the nearest $1,000.

ASSUMPTIONS:
1) Site Manangement Plan (SMP) to be developed based on NYSDEC template.
2) SMP and its requirements will need to be implemented for 30 yrs.
3) Institutional and engineering controls to be covered by SMP include soil and groundwater.
4) Inspection and certification requirements are to be conducted by third engineering firm.
5) One annual inspection to be completed to fulfill requirement of SMP that the institutional and engineering controls implemented remain in place and effective.
6) One annual Periodic Review Report will be submitted annually.
7) Costs associated with annual inspection and Periodic Review Report are considered to the O&M costs assiciated with the implementation of the SMP.
8) Contingency/Administration cost to cover costs inccured by the facility as part of implementation of the SMP.

ESTIMATED INSTALLATION COSTS - Implementation of a Site Management Plan

NO.	ITEM	ESTIMATED QUANTITY	UNIT (EA, LF, LS)	UNIT PRICE	ESTIMATED COST
1	SMP Development (average labor cost per hour)	90	HR	$100.	$9,000
2	Preproduction, shipping and communication costs	1	LS	$1,000.	$1,000
3	Project Management Time	8	HR	$125.	$1,000

SUBTOTAL INSTALLATION COSTS:	$11,000
TOTAL INSTALLATION COST	**$11,000**

ESTIMATED ANNUAL O & M COSTS

NO.	ITEM	ESTIMATED QUANTITY	UNIT (EA, LF, LS)	UNIT PRICE	ESTIMATED COST
1	Annual inspection to verify institutional and engineering controls are in place				
	and effective.	8	hours	$100.	$800
2	Annual Periodic Review Report preparation.	1	lump sum	$2,000.	$2,000

SUBTOTAL O & M COSTS:		$2,800
CONTINGENCY COSTS	20.0%	$560
TOTAL O & M COSTS:		**$3,360**

ADDITIONAL COMMENTS

*

*

GZA	Computed By
*	Checked By
*	Approved By

ESTIMATED NET PRESENT VALUE

ITEM	COST
CAPITAL COST	$11,000
5-YEAR NPV	$25,991
10-YEAR NPV	$38,359
30-YEAR NPV	$69,659

NPV RATES:

6.00%	DISCOUNT RATE
2.00%	INFLATION RATE

Table I-3
Cost Estimate Summary
Alternative 3: Soil & Groundwater Removal and Off-Site Disposal

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	Waste Characteristic Coordination, Sampling and Analysis	$6,000	$ -
2	Soil Excavation, Off-Site Disposal and Backfilling Activities	$ 248,000	$ -
3	Groundwater Containerization, Sampling and Disposal	$ 15,000	$ -
4	Excavation Field Oversight and Management	$ 18,000	$ -
5	Final Reporting	$ 5,000	$ -
TOTAL		$ -	$ -

Net Present Worth

Capital Costs	$292,000
15% Contingency Cost	$43,800
Net Present Worth of Annual O&M Costs	$ -
TOTAL NET PRESENT WORTH =	$335,800

Notes:

1) Refer to the attached pages for descriptions and details of the cost estimate.
2) Total costs are rounded to the nearest $1,000.
3) Estimated unit rates based on RS Means 2011 - Site Work & Landscape Cost Data unless otherwise noted.
4) City location factor of 0.982 applied to RS Means 2011 unit rates for Niagara Falls, New York.

ASSUMPTIONS:

1) Assumed area of excavation totals about 20,500 square feet (sf).
2) Excavation will include soil from approximately 0 to 4 feet bgs with total estimated volume of 3,034 cubic yards (cy).
3) Excavator with 2 cy bucket will directly load non-hazardous soil into dump trucks for delivery to disposal facility.
4) Disposal facility for non-hazardous soil within 15 mile of site for 25 cy capacity trucks for 2.5 hr round trip travel.
5) Clean structural fill source located within 5 miles of site. Backfill will be placed directly into excavation.
6) 105 hp dozer and vibratory roller to spread and compact structural fill in 12-inch lifts.
7) Approximately 4 days to excavate soil and 3 days to backfill and compact.
8) Field oversight done at 8-hrs per day and project management at about 15% of field oversight time.
9) Groundwater volume of about 92,000 gallons containerized in 5 approximate 20,000 gallon frac-tanks.
10) Containerized groundwater to be discharged into City of Niagara Falls sanitary sewer after authorization.
11) Frac-tank daily rental rate includes costs for delivery, pick up and clean out.
12) Waste charicteristic unit rates include coordination, soil sample collection, field oversight and laboratory analysis
13) Up to 20 soil samples collected for confirmatory analysis including VOCs, SVOCs, PCBs and metals.

ESTIMATED INSTALLATION COSTS - Soil & Groundwater Removal and Off-Site Disposal

NO.	ITEM	ESTIMATED QUANTITY	UNIT (EA, LF, LS)	UNIT PRICE	ESTIMATED COST
1	Mobilization / Demobilization of heavy machinery (RSM 01 54 36 0020)	6	Ea	$228.81	$1,373
2	Excavation and direct load with 2 cy bucket (RSM 31 23 16.42 0260 plus 15%)	3034	CY	$2.02	$6,129
3	Transportation to disposal facility (average of RSM 02 81 20 1260 & 1270)	1830	Mile	$5.35	$9,791
4	Non-hazardous soil disposal (Engineering Judgment and Knowledge of local costs)	3034	CY	$42.	$127,428
5	Imported clean structural fill (RSM 31 05 16.10 0600 and 0900)	3034	CY	$32.75	$99,364
6	Bulldozer to spread structural fill (RSM 31 23 23.14 3000)	3034	CY	$0.95	$2,882
7	Compaction with vibratory roller and 3 passes (RSM 31 23 23.23 5080)	3034	CY	$0.37	$1,123
8	Waste characteristic analysis (4 total samples based on engineering judgment)	4	Ea	$1,500.	$6,000
9	Confirmatory soil sampling for VOCs, SVOCs, PCBs, metals	20	Ea	$400.	$8,000
10	Field oversight labor (based on 8-hr day)	64	Hr	$80.	$5,120
11	Project Management (assume 15% of field staff)	9.5	Hr	$125.	$1,188
12	Equipment, shipping, communication, misc.	8	Day	$400.	$3,200
13	20,000 gallon Frac-tank rental assume 5 total for 14 days	70	Day	$100.	$7,000
14	Groundwater analysis of Frac-tank	5	Ea	$500.	$2,500
15	Permit, coordination, equipment, labor to discharge groundwater to sanitary sewer	5	Ea	$1,000.	$5,000
16	Final Report for Soil and groundwater off-site disposal	1	Ea	$5,000.	$5,000

SUBTOTAL INSTALLATION COSTS: $291,098

TOTAL INSTALLATION COST **$291,098**

ESTIMATED ANNUAL O & M COSTS

NO.	ITEM	ESTIMATED QUANTITY	UNIT (EA, LF, LS)	UNIT PRICE	ESTIMATED COST

SUBTOTAL O & M COSTS: $0

CONTINGENCY COSTS 20.0% $0

TOTAL O & M COSTS: **$0**

ADDITIONAL COMMENTS

*

*

GZA	Computed By
*	Checked By
*	Approved By

ESTIMATED NET PRESENT VALUE

ITEM	COST
CAPITAL COST	$291,098
5-YEAR NPV	$291,098
10-YEAR NPV	$291,098
30-YEAR NPV	$291,098

NPV RATES:

6.00%	DISCOUNT RATE
2.00%	INFLATION RATE

Project Niagara Falls Armed Forces Reserve Center
File No. 21.0056522.20
Location Niagara Falls, NY
Date 12/7/11
By D. TROY
Subject Soil and Groundwater Removal & Off-Site Disposal
Checked 12/7/11
By CZB
Based on Previous soil/water analytical results
Revised
By

Assume Excavation to include soils from 0-4 Ft BGS in Area shown on Fig —
Assume Soils are not Hazardous and can be directly loaded into Dump trucks for delivery to disposal Facility (Assume 10-15 miles). No stockpiling will be required

Assume backfill material delivered and directly placed into excavation — No stockpiling
Soils placed in 12-inch lifts spread with Dozer and compacted with 10-ton Roller

Assume No Asphalt pavement after Excavation/Backfilling. No utilities to be encountered/repaired

Assume waste characteristic sampling at frequency of ONE per 2500 ton of soil

Area 1 = 145' × 65' = 9425 ft^2
Area 2 = 195' × 50' = 9750 ft^2
Area 3 = ½ × 35' × 75' = 1312.5 ft^2

Assume 0-4 ft soil removed from EXCAVATION

$V_1 = (9425\,ft^2 \times 4\,ft)/27\,ft^3/cy) = 1396$ cy

$V_2 = (9750\,ft^2 \times 4\,ft)/27 = 1444$ cy

$V_3 = (1312.5\,ft^2 \times 4\,ft)/27 = 194$ cy

Total Volume = 3034 cy

Convert to tonnage $3034\,cy \left(\frac{1.6\,ton}{cy}\right) \approx \underline{\underline{4850\,ton}}$

Following Costs are BASED ON RS MEANS 2011 - SITE WORK AND LANDSCAPE COST DATA.
NIAGARA FALLS LOCATION FACTOR = 98.2 %

EXCAVATOR: Assume 2cy bucket, track mounted excavator. Excavated Soil Placed directly into Dump trucks for transport to disposal Facility

MOB/DEMOB 01 54 36 0020 \$233/MOB   \$233 × 2 × 0.982 = \$457.61 ✓

SAY \$ 460

Excavation: 31 23 16.42 0260   \$1.76/cy × 3034cy × 0.982 × 1.15

31 23 16.42 0020 (Add 15% for direct load into trucks)   = \$ 6030 ✓

Means estimate 165 cy/hr = Assume 100 cy/hr to directly load. (Engineering judgment)

Capacity = $3034\,cy \frac{hr}{100\,cy} = \frac{30.4\,hr}{8\,hr}$ day = 3.8 day — SAY 4 day to Excavate.

Project

File No.

Location

Date

By

Subject

Checked

By

Based on

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By

WASTE SOIL TRANSPORTATION / DISPOSAL

Assume soil is NON Hazardous and can be disposed @ municipal or C/D Landfill

Transportation: Assume truckload = 25 cy or 18 tons

Value ranges between 02 81 20 1260 and 1270 = $3.85/mile to $7.05/mile

Assume average ∴ (3.85 + 7.05)/2 = $5.45/mile

Assume disposal facility within 15 miles.

Total yards: 3034/25 = 122 trucks x $5.45/mile x 15 mile/truck x 0.982 = $9793.9

(Assumes 30 trucks per day with ONE Excavator)

= SAY $9800

Disposal RSMEANS 02 65 10 2050/2055 range between $140 + $440/cy

Assume soil is NON Hazardous and can be used as daily cover @ landfill

BASED ON Engineering Judgement and Knowledge of Area assume $55/cy ∴ $55/cy x 3034 cy = $166870

SAY 167,000

CLEAN IMPORTED BACKFILL

Assume clean imported Select structural fill to be placed/compacted in EXCAVATION
Assume Quarry Source within 5-10 miles of site

RSMEANS 31 05 16.10 0600 $28.50/cy

$28.50/cy x 0.982 x 3034 cy = $84912.56

Add $4.87/5 mile haul ∴ Assume 3034 x $4.87 x 0.982 ≈ $14509.6

SAY: Additional $

SAY 99,422
TOTAL

Project
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By

Compaction of Backfill soils.

Assume imported clean fill dumped directly into Excavation. Fill spread with Dozer to 12-inch lifts, compacted with 10-TON Vibratory Roller.

DOZER – Assume 105 HP. Place in 14" loose lifts – on
Structural Backfill = 31 23 23.14 3000 – 50 ft sand and gravel

$0.97 L.C.Y ∴ $0.97/cy × 0.982 × 3034 cy = $2890

Daily output = 1350 Lcy/day ∴ 3034 cy / 1350 Lcy = 2.24 day

Assume 3 days to spread

Say $3000

Compaction: Assume smooth drum roller – 3 passes minimum 12" lifts

31 23 23.23 5080 = $0.38/Ecy × 0.982 × 3034 = $1132

3500 ECY/day

Assume 3 days due to dozer requirements.

WASTE CHARACTERISTIC SAMPLING

Assume full suit of analysis including TCLP VOCs/SVOCs/metals
Total PCB's ≈ $1500/sample

Assume 1 sample @ 500 cy, ie 1000 cy v 1/25

SAY 4 samples total = 1500X4 = $6000

Mobilization For DOZER / Compactor ~ $233 × 4 × 0.982 = $915

SAY $1000

Project
File No.
Location
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By
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OVERSIGHT FOR EXCAVATION OF SOIL.

Assume Excavate ≈ 100 cy/hr ∴ $\frac{3034\,\text{cy}}{100\,\text{cy/hr}} \times \frac{1\,\text{day}}{8\,\text{hr}} = 3.8$ Days SAY **4 Days**

Assume R/T Soil disposal time = 2.5 hrs

$\frac{3034\,\text{cy}}{4\,\text{days}} = 758\,\frac{\text{cy}}{\text{day}}\ \frac{\text{Truck}}{25\,\text{cy}} = 30\,\frac{\text{trucks}}{\text{day}} \therefore 30^{\text{truck}}/2.5\,\text{hr}$ = 12 trucks needed/Day

Dozer capacity = 1350 LCY/day ∴ 3034/1350 = 2.25 days SAY 3 days.

Compactor — SAY 3 days due to capacity of Dozer.

Labor Oversight – Assume 4 + 3 = 7 days total @ 8 hr/day = 56 hrs ✓

P.M oversight = 15% Field Staff ≈ 8 hrs ✓

Equipment includes OVM, Dust monitor, PPE, shipping etc = \$200/day ✓

Confirmatory Sampling

Project
File No.
Location
Date
By
Subject
Checked
By
Based on
Revised
By

GROUNDWATER COLLECTION / SAMPLING AND DISPOSAL.

Based on previous field investigations:
Assume Eastern half of Excavation will encounter ground water from 2-4 Ft BGS.
western portion of excavation will have minimal g.w infiltration to 4 Ft BGS.

To account for infiltration of G.W from areas outside of Excavation areas assume total volume of G.W as follows.

Excavation Area × 2 Ft × 0.3 (porosity) =

$20{,}500 \text{ ft}^2 \times 2 \text{ ft} \times 0.3 = 12300 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{\text{cf}} \approx 92{,}000$ gallons

Assume Containerize in Frac tank, sample and dispose to N.F sanitary Sewer.
Assume G.W will be able to be discharged to sanitary for a fee.

Baker tank approx 20,000 gallons ∴ Assume 5 tanks required

Sampling each tank about $500 ∴ $2500 cost for analysis

Assume $100 / day Frac tank rental - Assume 2 weeks for 5 tanks

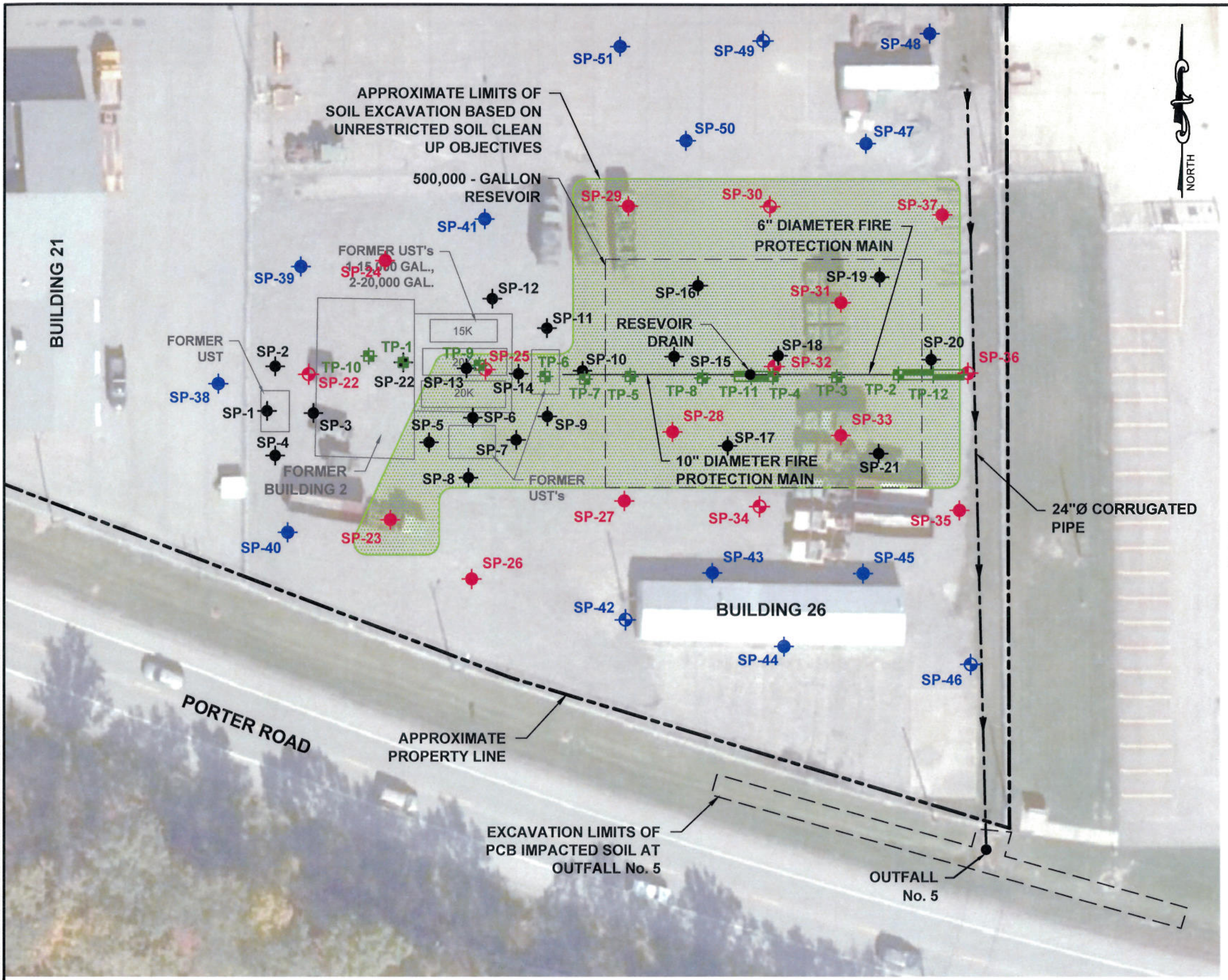
14 days × 5 × $100/day = $7,000

Assume $2000 for coordination, permit, equipment for discharge of containerized g.w into Niagara Falls Sanitary Sewer.

TOTAL G.W costs:

	$7,000
+	2500
+	2000
	11500

Assume $12,000



LEGEND:

SP-19	APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE COMPLETED ON DECEMBER 6 & 7, 2010 (21 LOCATIONS)
TP-3	APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT COMPLETED ON DECEMBER 7 & 8, 2010 (12 LOCATIONS)
TP-1 SP-22	APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE SP-22 CONVERTED TO TEST PIT, TP-1 DUE TO SUBSURFACE REFUSAL FOLLOWING SEVERAL ATTEMPTS COMPLETED ON DECEMBER 7, 2010.
SP-26	APPROXIMATE LOCATION AND DESIGNATION OF PRIMARY SOIL PROBE COMPLETED IN SEPTEMBER 2011 (10 LOCATIONS)
SP-34	APPROXIMATE LOCATION AND DESIGNATION OF PRIMARY SOIL PROBE COMPLETED IN SEPTEMBER 2011 WITH TEMPORARY PIEZOMETER INSTALLED (6 LOCATIONS)
SP-40	APPROXIMATE LOCATION AND DESIGNATION OF SECONDARY SOIL PROBE COMPLETED IN SEPTEMBER 2011 (11 LOCATIONS)
SP-42	APPROXIMATE LOCATION AND DESIGNATION OF SECONDARY SOIL PROBE COMPLETED IN SEPTEMBER 2011 WITH TEMPORARY PIEZOMETER INSTALLED (3 LOCATIONS)
🟩	APPROXIMATE LIMITS OF SOIL EXCAVATION BASED ON UNRESTRICTED SOIL CLEAN UP OBJECTIVES

NOTES:

1. BASE MAP ADAPTED FROM AN AERIAL PHOTOGRAPH DOWNLOADED FROM http://www.bing.com/maps/, AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

0 20 40 80
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

NIAGARA FALLS AFRC
9400 PORTER ROAD
NIAGARA FALLS, NEW YORK
REMEDIAL INVESTIGATION AND INTERIM REMEDIAL ACTION

ALTERNATIVE 3
SOIL AND GROUNDWATER REMOVAL
AND OFF-SITE DISPOSAL

PREPARED BY: GZA GeoEnvironmental of N.Y. Engineers and Scientists 535 WASHINGTON STREET 11th FLOOR BUFFALO, NEW YORK 14203 (716) 685-2300		PREPARED FOR: PARS ENVIRONMENTAL, INC	
PROJ MGR: CZB	REVIEWED BY:	CHECKED BY:	FIGURE
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	4
DATE NOVEMBER 2011	PROJECT NO. 21.0056522.20	REVISION NO.	

APPENDIX I

PUBLIC NOTICE AD PROOF

THE BUFFALO NEWS

-Ad Proof-

This is the proof of your ad scheduled to run on the dates indicated below.

Please confirm placement prior to deadline, by contacting your account rep at (716) 849-5535.

Date:	**08/17/11**
Account #:	**525230**
Company Name:	**PARS Environmental Incc**
Contact:	
Address:	**500 Horizon Dr. Suite 540** **Robbinsville, NJ 08691**
Telephone:	**(609) 890-7277**
Fax:	

Ad ID:	747761
Start:	08/21/11
Stop:	08/21/11
Total Cost:	$380.92
# of Lines:	39
# of Inserts:	1.07
Ad Class:	750
Account Rep:	Marcy Lombardo
Phone #	(716) 849-5535
Email:	mlombardo@buffnews.com

Run Dates:
Buffalo News (P1) 08/21/11
Web-BuffNews/Buffalo.com (P6)
08/21/11

Ad proof

NOTICE OF 30-DAY PERIOD FOR PUBLIC COMMENT

The Department of the Army has initiated a Remedial Investigation at the Niagara Falls Armed Forces Reserve Center, 9400 Porter Road, Niagara Falls, NY. In compliance with Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act, the Army has prepared a document repository for public review and comment at the Niagara Falls Public Library 1425 Main Street, Niagara Falls, NY 14305, 716-286-4894.

Written comments shall be received and considered until September 23, 2011, and should be directed to: Ms. Laura Dell'Olio via e-mail, laura.dellolio@usar.army.mil or at the following address: 99th RSC-DPW-ENV, 5231 South Scott Plaza, Joint Base McGuire-Dix-Lakehurst, NJ, 08640.

THE BUFFALO NEWS

-Affidavit-

Lisa Stephan-Kozlowski of the City of Buffalo, New York, being duly sworn, deposes and says that he/she is Principal Clerk of THE BUFFALO NEWS INC., Publisher of THE BUFFALO NEWS, a newspaper published in said city, that the notice of which the annexed printed slip taken from said newspaper is a copy, was inserted and published therein **1** times, the first insertion being on **08/21/2011** and the last insertion being on **08/21/2011**

Lisa Stephan-Kozlowski

Dates Ad Ran:

Buffalo News (P1) 08/21/11

Sworn to before me this 25th day of, August 2011

Shukriyyah Hawkins

Notary Public, Erie County, New York

SHUKRIYYAH HAWKINS
Notary Public, State of New York
Qualified in Erie County
My Commission Expires 9/30/13

ust
.),

M-7PM*
F
AM-6PM*
FF
12PM-5PM*
OFF
3 @ 10AM
UCTION!
ds of Rugs in
s, Styles, and
Traditional, Con-
rary, Transitional,
ual, Hand Knotted,
ers, Braided, TONS
Samples, Artwork,
illows, Pads, Acces-
ries **& So Much More!**
Everything MUST GO!
Note: All Fixtures, including (6) Galt Electric Rug Displays (20 Arms Each), Nourison & Masland Displays, Racks, Pallet Racking, Rolling Ladders, etc. to be sold at auction.

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General

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General

Restaurant Equipment AUCTION! Former Santora's Location
600 Delaware St,
Tonawanda, NY
Wed. Aug. 24 @ 10AM

Restaurant Equipment: Walk In Cooler, Mini Walk In Freezer, (2) Pizza Ovens, Range Guard System, (2) Hoods, Refrigerator, Sub Units, Two Burner Flat Grill Oven, Chargrill, Pitco Fryers, 2 Dr. Keg Cooler, Warming Box, Warmers, Grease Trap, Microwave, 3 Bay Sink, Slicer, Stainless Prep Stands & Work Tables, Scale, Shelves, Tray Racks, (6) Bar Stools, (7) Sect. of Booth, **Office Equipment:** LG & Dynex Flat Screen TVs, Camera System, Credit Card Machine, Slip Printers, Phones & a KSU, Hanging Lights, Signs, Décor **& SO MUCH MORE! See web for more info!**

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Notices

NOTICE OF 30-DAY PERIOD FOR PUBLIC COMMENT

The Department of the Army has initiated a Remedial Investigation at the Niagara Falls Armed Forces Reserve Center, 9400 Porter Road, Niagara Falls, NY. In compliance with Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act, the Army has prepared a document repository for public review and comment at the Niagara Falls Public Library 1425 Main Street, Niagara Falls, NY 14305, 716-286-4894.

Written comments shall be received and considered until September 23, 2011, and should be directed to: Ms. Laura Dell'Olio via e-mail, laura.dellolio@usar.army.mil or at the following address: 99th RSC-DPW-ENV, 5231 South Scott Plaza, Joint Base McGuire-Dix-Lakehurst, NJ, 08640.

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E	A	G	A	N	■	F	A	V	O	R	■	P	R	I	Z	E	■	O	M	A	H	A
E	R	O	D	E	■	A	N	I	M	A	■	P	A	D	R	E	■	F	O	X	E	S
S	T	R	E	A	M	L	I	N	E	S	■	A	H	E	A	D	O	F	T	I	M	E
■	■	■	T	R	I	L	L	S	■	P	A	L	M	S	■	B	O	S	E	■	■	■
G	E	M	S	■	T	E	A	■	■	■	X	L	S	■	F	E	N	■	S	U	B	S
R	T	E	■	P	E	N	■	L	A	C	E	■	■	R	O	D	A	N	■	C	E	P
E	N	A	M	O	R	■	C	O	M	A	■	S	T	I	R	S	■	O	G	L	E	R
G	A	L	A	S	■	E	A	T	I	N	■	C	U	T	E	■	R	O	M	A	N	Y
■	■	■	C	H	A	G	R	I	N	■	R	E	B	A	■	■	E	S	A	■	■	■
K	O	B	E	■	N	A	H	■	O	N	E	N	E	S	S	■	D	E	N	N	E	D
G	N	U	■	D	O	D	O	■	■	I	C	I	■	■	E	M	T	S	■	W	O	E
B	A	Z	A	A	R	■	P	E	A	C	O	C	K	■	Q	U	A	■	M	T	N	S
■	■	■	U	M	A	■	■	G	W	E	N	■	L	O	U	N	G	E	R	■	■	■
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L	A	V	A	S	■	M	E	S	S	Y	■	I	N	T	L	■	M	E	D	I	U	M
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■	■	■	E	T	A	L	■	C	U	R	I	A	■	V	I	D	E	O	S	■	■	■
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O	R	E	O	S	■	A	T	A	L	E	■	R	O	I	L	S	■	A	G	I	L	E
S	N	O	R	T	■	G	O	R	E	N	■	I	N	L	E	T	■	R	E	L	I	C
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APPENDIX J
NYSDEC COMMENTS

From:	Dellolio, Laura A CTR CTR USAR 99TH RRC -NA- <laura.dellolio@usar.army.mil>
Sent:	Tuesday, September 06, 2011 9:36 AM
To:	Michael Moore; Tom Dobinson
Subject:	FW: sampling and analysis plan for Niagara Falls AFRC (UNCLASSIFIED)
Signed By:	laura.dellolio@usar.army.mil
Follow Up Flag:	Follow up
Flag Status:	Flagged

Classification: UNCLASSIFIED
Caveats: NONE

Here's the official comments from the State. I don't see anything eye raising.

Thank you,
Laura Dell'Olio
609-562-7661

-----Original Message-----
From: Chek Ng [mailto:cbng@gw.dec.state.ny.us]
Sent: Friday, September 02, 2011 4:34 PM
To: Dellolio, Laura A CTR CTR USAR 99TH RRC -NA-
Subject: Re: sampling and analysis plan for Niagara Falls AFRC (UNCLASSIFIED)

Laura,

It was nice meeting you as well. I am including the following comments for the sake of completeness. In the case where this plan will not be revised, please make a note of the comment and add it in the investigation report. Please feel free to forward this to GZA (Consultant). A copy of this email has been made into the permanent electronic record in the State.

a) Page 7, Section 3.2: It is mentioned that the depth of soil borings will be based on field observations. From the meeting, it was my understanding that the soil boring will be done until the water table, which could vary from location to location due to a perched groundwater table.

b) Page 16, Section 6.2.2: Please add that the MS/MSD duplicates wil be collected at a frequency of 5% (1 in 20 samples).

c) Page 17, Section 7.2: The State's Part 375 Soil Cleanup Guidance separates out commercial and industrial use. As such, the COPCs need to be compared to either commercial OR industrial standards. From my discussion, it seems that the end use will most likely be industrial, so the contamination numbers should be compared to industrial use.

d) As mentioned in your email below, Outfall 4 sediment will be sampled for VOCs, SVOCs, metals, and PCB. Please also mention in the final report that the Outfalls 1, 2 and 3 will not be sampled due to accessibility issues caused by the Cayuga Creek and the outfall's position beneath the river water line.

e) Analysis of soil in the report should also mentioned that there are fill material that was brought from the nearby quarry into the site which may caused high readings for certain metals in the soil. This should nullify any concerns for the high metal content in the soil.

Regards,

Chek Beng Ng, P.E.
Environmental Engineer 2
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 11th Floor
Albany NY 12233-7015
Phone: (518) 402-9620
Fax: (518) 402-9627>>> "Dellolio, Laura A CTR CTR USAR 99TH RRC -NA-" <laura.dellolio@usar.army.mil> 9/1/2011 10:44 AM >>>
Classification: UNCLASSIFIED
Caveats: NONE

Hello Chek,

Good to make your acquaintance last week.

I was wondering if you were going to be providing formal comments to the work plan. We have added a sediment sample for outfall 4 to the workplan for analysis of VOCs, SVOCs, metals, and PCBS. Were there any other comments?

Thank you,

Laura Dell'Olio
Installation Restoration Program Coordinator

99th RSC, DPW Environmental Division
Contractor, PB&A Inc.
609-562-7661 (office)
919-270-7376 (cell)

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Classification: UNCLASSIFIED
Caveats: NONE

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Caveats: NONE

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A, 11th Floor
625 Broadway, Albany, New York 12233-7015
Phone: (518) 402-9625 • **Fax:** (518) 402-9627
Website: www.dec.ny.gov

Joe Martens
Commissioner

March 23, 2012

Mr. Michael Moore, CPG
Senior Project Manager
PARS Environmental, Inc.
500 Horizon Drive, Suite 540
Robbinsville, NJ 08691

Re: Remedial Investigation/Interim Remedial Action Report and Human Health Risk Assessment Report for Niagara Falls Armed Forces Reserve Center (Site ID: 932152)

Dear Mr. Moore:

The New York State Department of Environmental Conservation and the New York State Department of Health (State) is in receipt of the above report dated January 24, 2012.

Technical and editorial comments are provided in the attachment to this letter, and should be addressed prior to the final issuance of this document.

Please contact me at (518) 402-9620 or cbng@gw.dec.state.ny.us. should you have any questions.

Sincerely yours,

Ng Chek Beng

Mr. Chek Beng Ng, P.E.
Environmental Engineer 2
Remedial Bureau A, Section C

Attachment

cc: J. Swartwout, DEC
L. Dellolio, USAR
N. Freeman, DOH

COMMENTS FOR THE REMEDIAL INVESTIGATION/INTERIM REMEDIAL ACTION REPORT AND HUMAN HEALTH RISK ASSESSMENT NIAGARA FALLS ARMED FORCES RESERVE CENTER (SITE ID: 932152)

1. Page 5, Section 2.7: Were any surface and/or subsurface soil samples taken from Outfall No. 5? If so, please state what was detected, and the concentrations of chemicals observed that was above the Part 375 Unrestricted and Commercial Cleanup Levels.

2. Page 5, Section 2.7: At the end of the second and third paragraphs, please state what were the 'low' and 'detectable' levels of PCB. A range of values and the detected concentrations would suffice.

3. Page 6, Last Paragraph: From previous conversation, it was thought that the fill material was brought in from a nearby quarry? It would be helpful to state the origin of the fill in this paragraph. Also, if the site was NOT used for any activities that would cause any kind of metal contamination (i.e. metal fabrication or machining), it would helpful to state the fact here.

4. Figure 5: It is suggested that a 'spider map' be created to show the detected soil and groundwater concentrations on the Figure themselves, pointing to the location where they were detected. Bolded numbers could be used to indicate exceedance above Commercial Cleanup Levels for ease of viewing and interpretation.

5. In the Tables section (or in the corresponding text), please elaborate what the sample designations. For instance, SP-22-10-12 means soil boring at location SP-22 from 10 inches to 12 inches below ground surface?

6. Page 24, Section 7.6.2: It should be mentioned that since the facility is fenced in, trespassing into the property is limited to only building personnel and not the general public.

7. Page 45, Section 9.1.1: The document indicates that SVOC's detected in the drainage swale near Outfall 4 are commonly found in ditches that receive storm water runoff from asphalt paved surfaces. It should be confirmed that Outfall 4 only receives surface water from the AFRC parking lot and that no other discharges (i.e. floor drains in existing building) are contributing to the outflow of Outfall 4.

4/9/2012
Response to NYSDEC and DOH comments from letter dated March 23, 2012.

1. Add statement that post-excavation samples from Outfall No. 2 and the drainage swale were below the Maximum Contaminant Level of 1 mg/kg, which was established by NYSDEC.

2. Added detected PCB concentrations to report.

3. Add statement to report about the suspected origin of the fill material.

4. Adding tables to the figures showing detected soil and groundwater contaminants will result in figures that are cluttered because of the close proximately of the boring locations.

5. A description of the sample designations is included in Table 1. Also, added a sentence to Section 3.1.1 regarding sample designations.

6. Added a sentence to Section 7.6.2 about the property being secured by a fence and locked gates.

7. Added a sentence to Section 9.1.1 about storm water runoff to Outfall No. 4.