PARSONS

150 Federal Street • Boston, Massachusetts 02110 • (617) 946-9400 • Fax: (617) 946-9777 • www.parsons.com

February 21, 2007

02149

154

Mr. Jesse Perez
U. S. Air Force Center for Environmental Excellence
HQ AFCEE/IWA-COR
3300 Sidney Brooks, Building 532
Brooks City-Base, TD 78235-5112

SUBJECT: Draft Proposed Plan for the Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38) at Seneca Army Depot Activity; Contract FA8903-04-D-8675, Delivery Order 0031

Dear Mr. Perez:

Parsons is pleased to submit the Draft Proposed Plan for the Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38) located at the Seneca Army Depot Activity (SEDA) in Romulus, New York.

This work was performed in accordance with the Scope of Work (SOW) for Contract No. FA8903-04-D-8675, Task Order No. 0031.

Parsons appreciates the opportunity to provide you with the Proposed Plan for this work. Should you have any questions, please do not hesitate to call me at (617) 449-1405 to discuss them.

Sincerely,

Todd Heino, P.E.
Project Manager

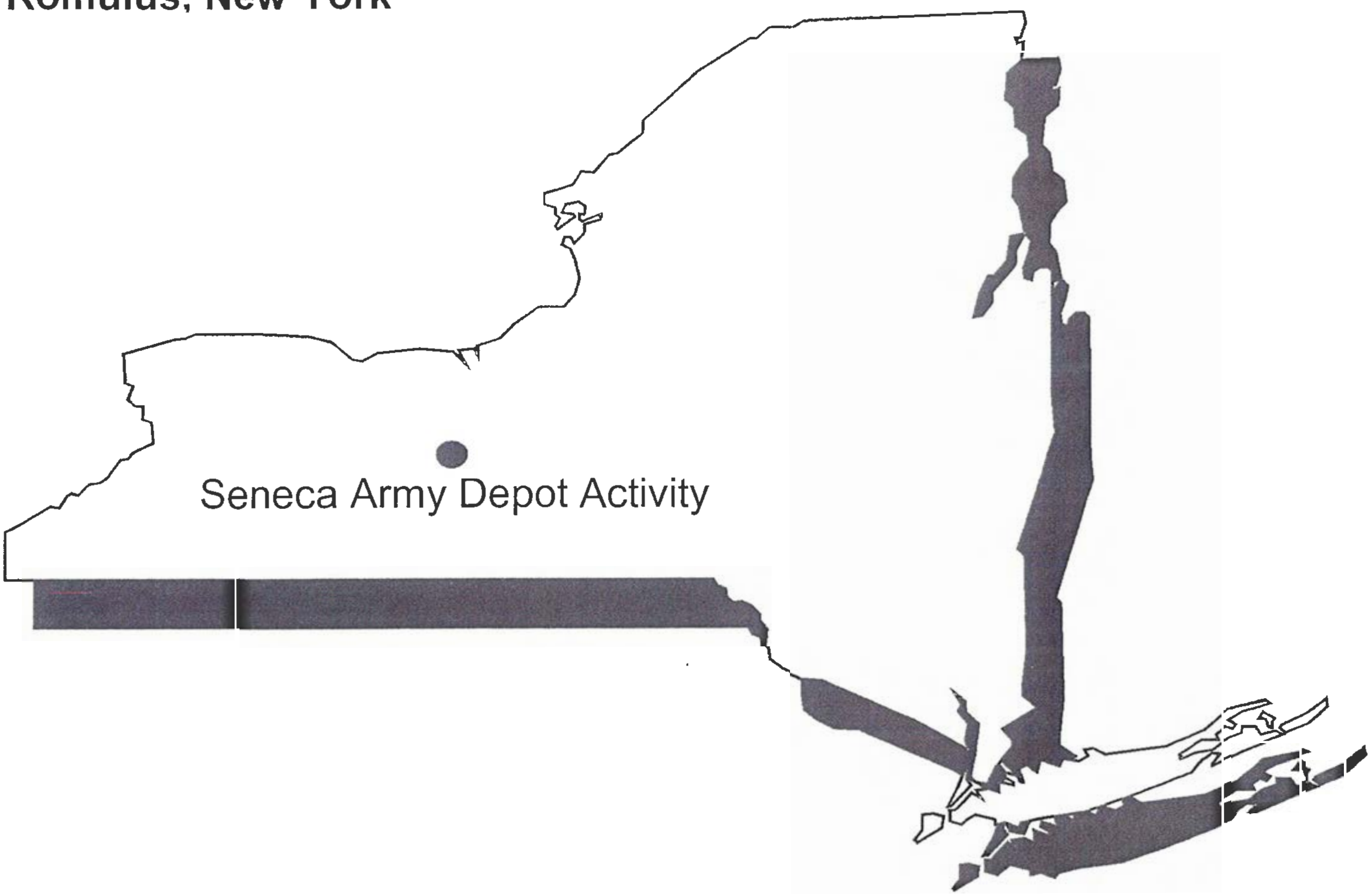
Enclosures

cc: S. Absolom, SEDA (3 paper copies, 1 electronic copy)
K. Hoddinott, USACHPPM (2 paper copies, 1 electronic copy)
C. Boes, USAEC (1 copy, electronic and paper)
T. Enroth, USACE, NY District (1copy, electronic and paper)
T. Battaglia, USACE, NY District (1 copy, electronic and paper)
Air Force email (letter only)

US Army Corps of Engineers

Air Force Center for Environmental Excellence

Seneca Army Depot Activity
Romulus, New York



DRAFT
PROPOSED PLAN

FOR THE MUNITIONS WASHOUT FACILITY (SEAD-4) AND THE BUILDING 2079 BOILER BLOWDOWN PIT (SEAD-38) SENECA ARMY DEPOT ACTIVITY

AFCEE CONTRACT NO. FA8903-04-D-8675
TASK ORDER NO. 0031
CDRL A001D

EPA SITE ID# NY0213820830
NY SITE ID# 8-50-006

PARSONS
FEBRUARY 2007

DRAFT PROPOSED PLAN
The Munitions Washout Facility (SEAD-4) and
The Building 2079 Boiler Blowdown Pit (SEAD-38)
Seneca Army Depot Activity (SEDA)
Romulus, New York

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

THE MUNITIONS WASHOUT FACILITY (SEAD-4) AND THE BUILDING 2079 BOILER BLOWDOWN PIT (SEAD-38) SENECA ARMY DEPOT ACTIVITY (SEDA) Romulus, New York

February 2007

1.0 PURPOSE OF PROPOSED PLAN

This Proposed Plan describes the alternatives considered for remediation at the Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38) located within the bounds of the former Seneca Army Depot Activity (SEDA or the Depot), in Seneca County, New York. The plan identifies the United States (U.S.) Army's preferred remedial option and documents the rationale for its preference. The Proposed Plan was developed by representatives of the U.S. Army in cooperation with the U.S. Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC). The U.S. Army is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, and Section 300.430(f) of the National Contingency Plan (NCP).

SEAD-4 and SEAD-38 were classified separately in the Solid Waste Management Unit (SWMU) Classification Report (Parsons, 1994). In this Proposed Plan, SEAD-4 and SEAD-38 are considered one operable unit (SEAD-4/38) for the purpose of remedial action due to geographical proximity (SEAD-38 is located within SEAD-4). The remedy described in this Proposed Plan is the preferred remedy for both SWMUs (hereafter collectively referred to as SEAD-4/38 or the SWMUs). The remedial options presented and summarized herein and the SEAD-4/38 characterizations are described in the SEAD-4 Remedial Investigation (RI) (Parsons, 2002a), SEAD-4 Feasibility Study (FS) (Parsons, 2005), and the SEAD-38 Action Memorandum and Decision Document (Parsons, 2002b).

Copies of the RI report, FS report, Proposed Plan, and supporting documentation are available at the following repositories:

Seneca Army Depot Activity
Building 123, P.O. Box 9
Romulus, NY 14541-0009
(607) 869-1309
Hours are Mon-Fri 8:30 am to 2:30 pm

This Proposed Plan is being provided to inform the public of the Army's preferred remedial alternative. This document is intended to solicit public comments pertaining to all the remedial options evaluated, as well as to specify the Army's preferred remedial option.

A brief description of the Army's preferred remedy for SEAD-4/38 is as follows:

- Sweep and vacuum building floors and remove debris found in abandoned Buildings 2073, 2076, 2078, 2084, and 2085;
- Demolish Building 2079;
- Excavate soil underlying drainage ditches (i.e., ditch soil) until the cleanup goal for total chromium (hereafter referred to as chromium) is achieved. This excavation will also result in the achievement of vanadium cleanup goal in the vicinity of sample location SD4-28;
- Excavate surface and subsurface soils until the cleanup goals for chromium and lead are achieved;

- Dewater the man-made lagoon and allow water to percolate into the ground at a location outside of the excavation areas.
- Once the lagoon is empty, excavate soil from the man-made lagoon until the cleanup goal for chromium is achieved;
- Remove the temporary berm along the downgradient side of man-made lagoon and allow the area of the man-made lagoon to return to its natural condition;
- Stabilize surface and subsurface soil, ditch soil, as well as building sweepings removed from the SWMUs that exceed the Toxicity Characteristic Leaching Procedure (TCLP) criteria prior to off-site disposal;
- Transport and dispose of all the excavated materials in a licensed non-hazardous off-site landfill;
- Regrade excavated soil areas and ditches as necessary; and
- Submit a Completion Report following the performance of the remedial action.

A total of approximately 25,000 cy of soil and ditch soil is expected to be excavated from SEAD-4/38 and be disposed off-site.

Table 1 presents the cleanup goals proposed for the SWMUs. The cleanup goal for chromium in the top 4 ft soil, ditch soil, and lagoon soil at SEAD-4/38 is 60 mg/Kg. The cleanup goal for lead in the top 4 ft soil at SEAD-4/38 is 167 mg/Kg. Achievement of the cleanup goals will be determined by comparing the average concentrations for the SEAD-4/38 operable unit to the cleanup goals. These cleanup goals were identified as the economic effective cleanup goals based on the sensitivity analysis conducted by Parsons. The sensitivity analysis is presented in the two letters submitted on September 30, 2004 and October 15, 2004, respectively (Appendix).

The NYSDEC TAGM value for vanadium was used as the cleanup goal for the drainage ditch hot spot located around sample location SD4-28. This cleanup goal is protective of human health and will result the concentrations at the SWMUs consistent with Seneca site-wide background.

This Proposed Plan identifies the preferred remedy for SEAD-4/38, and discusses the reasons and rationale for this preference. The Army will select a final remedy for these SWMUs only after careful consideration is given to all comments received during the public comment period, and subsequent to final consultation with the USEPA and NYSDEC.

2.0 COMMUNITY ROLE IN SELECTION PROCESS

The Army, the USEPA, and the NSYDEC rely on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each solid waste management unit. To this end, the SEAD-4 RI and FS, the SEAD-38 Action Memorandum and Decision Document, the SEAD-4 and SEAD-38 Proposed Plan, and the supporting documentation have been made available to the public for a public comment period which begins on [enter public comment period start date] and concludes on [enter public comment period end date].

Dates to remember:
MARK YOUR CALENDAR

[enter start and completion dates of public comment period]
Public comment period on RI and FS reports, Proposed Plan, and remedies considered

[enter public meeting date]
Public meeting at the [enter meeting location and time]

A public meeting will be held during the public comment period at the [meeting location] on [meeting date] at [meeting time] to present the results of the investigations and to provide public participation in the remedy selection process. During the presentation, the Army will invite the public to participate in a question and answer period, during which time the public will be allowed to ask questions or submit written comments on the Proposed Plan.

Written comments received at the public meeting will be documented in the Responsiveness Summary Section of the Record of Decision (ROD), which formalizes the selection of the remedy.

All written comments should be addressed to:

Mr. Stephen Absolom
BRAC Environmental Coordinator
Building 123, P.O. Box 9
Seneca Army Depot Activity
Romulus, NY 14541-0009

Information and data summarized within this Proposed Plan for SEAD-4 and SEAD-38 are presented and described in greater detail in the following documents:

- Feasibility Study at the Munitions Washout Facility (SEAD-4), Parsons, 2005;
- Sensitivity Analysis: Cost Effectiveness of Excavation to Meet TAGMs at Depth at SEAD-4, Seneca Army Depot Activity, Parsons, 2004a (Appendix B);
- Sensitivity Analysis: Soil Removal at SEAD-4, Seneca Army Depot Activity, Parsons, 2004b (Appendix A);
- Remedial Investigation at the Munitions Washout Facility (SEAD-4), Parsons, 2002a;
- Action Memorandum and Decision Document, Time-Critical Removal Actions, Three VOC Sites (SEADs 38, 39, and 40), Parsons, 2002b;
- Expanded Site Inspection for Seven High Priority SWMUs SEAD 4, 16, 17, 24, 25, 26, and 45, Parsons, 1995;
- SWMU Classification Report, Parsons, 1994; and
- Work Plan for CERCLA Expanded Site Inspection (ESI) of Ten Solid Waste Management Units (SWMUs), Parsons, 1993.

These documents should be reviewed and consulted. The public is encouraged to schedule a time to review the project documents at the Seneca Army Depot Activity repository (location provided below) to develop a better understanding of the SWMUs and the investigations and studies that have been conducted.

Seneca Army depot Activity
Building 123
5786 State Route 96
Romulus, New York 14541-0009

3.0 SITE BACKGROUND

The SEDA previously occupied approximately 10,600 acres of land located in the Towns of Varick and Romulus in Seneca County, New York. The former military facility was owned by the U.S. Government and operated by the Army between 1941 and approximately 2000, when the SEDA military mission ceased. The SEDA's historic military mission included receipt, storage, distribution, maintenance, and demilitarization of conventional ammunition, explosives, and special weapons.

SEDA is located in an uplands area, which forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. The elevation of the facility is approximately 600 feet above Mean Sea Level (MSL).

On July 14, 1989, the USEPA proposed the SEDA for inclusion on the National Priorities List (NPL). The USEPA recommendation was approved and finalized on August 30, 1990, when the SEDA was listed in Group 14 of the Federal Facilities portion of the NPL.

Once SEDA was listed on the NPL, the Army, the USEPA, and NYSDEC identified 57 SWMUs where historic data or information suggested, or evidence existed to support, that hazardous substances or hazardous wastes had been handled and may have been released and migrated into the environment. Each of these sites was identified in the Federal Facilities Agreement (FFA) signed by the three parties (i.e., USEPA, NYSDEC, and Army) in 1993. This list of SWMUs was subsequently expanded to include 72 sites when the Army completed the SWMU Classification Report (Parsons, 1994), which was required under the terms of the FFA. SEDA was a generator and Treatment, Storage, and Disposal Facility (TSDF) and thus, subject to regulation under the Resource Conservation and Recovery Act (RCRA). Under the RCRA permit system, corrective action is required at all SWMUs, as needed.

Remedial goals are the same for CERCLA and RCRA; thus, when the 72 units were classified in the SWMU Classification Report (Parsons, 1994), the Army recommended that they be listed either as areas requiring No Action (NA) or as Areas of Concern (AOCs). SWMUs listed as AOCs in the SWMU Classification Report (Parsons, 1994) were scheduled for further investigations based upon data and potential risks to the environment. SEAD-4 was identified as high priority AOC and SEAD-38 was identified as low priority AOC based on the SWMU Classification Report.

In 1995, SEDA was designated for closure under the Department of Defense's (DoD's) Base Realignment and Closure (BRAC) process. As part of the 1995 BRAC process, a Local Redevelopment Authority (LRA) comprised of representatives from the local community was established. A Land Reuse Plan was prepared and approved by the LRA in 1996 which designated parcels of land within the Depot for reuse into eight categories: Planned Industrial/Office Development, Warehousing, Prison, Conservation/Recreation, Institutional, Housing, Airfield/Special Events, and Federal to Federal Transfer. The area that encompasses SEAD-4/38 was determined to be "Conservation/Recreation Area". In 2005, the Seneca County Industrial Development Agency (SCIDA) revised the planned future use of property within the former Depot which added Institutional Training, Residential/Resort, Green

Energy, Development Reserve, Training Area, and Utility uses. Under this revised future use plan, SEAD-4/38 is located in the training area of the former Depot (**Figure 1**).

4.0 SITE DESCRIPTION

The Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38) are located in the southwestern portion of SEDA (**Figure 1**). SEAD-4 and SEAD-38 consist of developed and undeveloped areas surrounded by open grassland and thick brush. Several man-made drainage ditches are present at the SWMUs and most of them are approximately three feet deep. Seneca Road bisects the area running from south-southeast to north-northwest. The SEDA railroad tracks lead into the area and terminate in the vicinity of Building 2085. Eleven buildings previously existed at the SWMUs and four of the buildings have been demolished. A man-made 150-foot diameter lagoon was created for the purpose of containing wastewater. **Figure 2** presents a map of the two SWMUs and the predominant features.

The Munitions Washout Facility was active between 1948 and 1963. Operations at this facility involved the dismantling of munitions and removing the explosives by steam cleaning.

SEAD-38 is the blowdown area that once was located to the north-northwest of Building 2079, an abandoned boiler plant. The boilers discharged a total of 400 to 800 gallons of liquid per day. It is suspected that some of the discharged liquid flowed into the adjacent drainage ditch, while some may have infiltrated into the ground. It is presumed that the boiler blowdown contained water, tannins, caustic soda (sodium hydroxide), and sodium phosphate.

5.0 PREVIOUS INVESTIGATIONS AND STUDIES

It should be noted that SEAD-38 is physically located within the footprint of the area that is defined as SEAD-4. As a result, SEAD-38 characterization was conducted along with SEAD-4, during the SEAD-4 ESI, RI, and FS. Although the titles of the SEAD-4 ESI, RI, and FS reports suggest that the documents pertain specifically to SEAD-4; the information, results, analysis, and conclusions provided in these documents also relate to conditions found at SEAD-38. Similarly, the remedial action proposed in the SEAD-4 FS incorporates consideration of needed action at SEAD-38. Therefore, unless otherwise specified, the following discussion summarizing investigations and results for each media will address SEAD-4 and SEAD-38 together.

A limited sampling program was performed within the bounds of SEAD-38 in 1993 and 1994 to evaluate possible historic releases at the former boiler blowdown area. The limited sampling program included the advancement and collection of one soil boring and four surface soil samples. The collected soil samples were submitted for total petroleum hydrocarbons (TPH) analysis and the results are presented in the SEAD-38 Action Memorandum and Decision Document report (Parsons, 2002b).

The ESI conducted in 1993 and 1994 for SEAD-4 and SEAD-38 included the performance of geophysics surveys, monitoring well installation and development, and soil, ditch soil, groundwater, surface water, and sediment sampling and analyses. The results of the ESI indicated that impacts to the surface soils, ditch soils, surface water, and sediment were present at SEAD-4/38. Based on the results of the ESI, a RI Workplan was prepared and a RI was started at SEAD-4/38 in the fall of 1998. The RI field program consisted of surveys, interior building investigations, surface and subsurface soil sampling, ditch soil sampling, overburden groundwater investigations (well installation, development, aquifer testing, and sampling), surface water and sediment investigations, and an ecological investigation. Analytical data collected for SEAD-4 and SEAD-38 during the ESI and RI are presented, summarized, and discussed in the SEAD-4 RI. These data were also evaluated in a baseline human health risk assessment and a screening level ecological risk assessment, and the results of these assessments are presented in the SEAD-4 RI report.

In 2004, additional test pitting and groundwater investigations were conducted in and immediately around the area of MW4-10 to determine whether PCBs were present in the soil or the groundwater. The 2004 analytical results are presented in the SEAD-4 FS report.

Sections 5.1 through **5.6** present all the previous investigation analytical results collected from both SWMUs for the impacted mediums - building debris, soil, drainage ditch soil, groundwater, surface water, and sediment, respectively.

5.1 Building Debris

Six soil/debris samples were collected from the inside of Buildings 2073, 2076, 2078, 2079, 2084, and 2085; one from each building. The samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosives, and metals. One VOC (acetone), SVOCs including polycyclic aromatic hydrocarbons (PAHs), explosives, pesticides, PCBs, and metals were detected in the soil/debris samples. Aroclor-1254 was detected in five of the six samples and the maximum concentration (91,000 μg/Kg) was detected in the sample from Building 2073. The building debris sample results are summarized in **Table 2A**.

5.2 Soil

TPH results from the limited sampling program performed within the bounds of SEAD-38 are discussed in **Section 5.2.1**. Soil investigations were performed at SEAD-4 and SEAD-38 during the ESI (1993-1994) and RI (1998-1999) and the results are presented in the SEAD-4 RI report and summarized in **Section 5.2.2.** Soil results from the 2004 additional test pitting are presented in the SEAD-4 FS report and are summarized in **Section 5.2.3.**

5.2.1 Limited Soil Sampling Program at SEAD-38 (1993-1994)

A limited sampling program was performed within the bounds of SEAD-38 in 1993 and 1994 and included the advancement and sampling of one soil boring (SB38-1) located in the drainage ditch north-northwest of Building 2079 near the discharge end of the drainage pipe where blowdown liquids were presumably discharged from the boilers to the ditch. In addition, one surface soil sample [SS38-1, 0-2 inches below ground surface (bgs.)] was collected from the base of the drainage ditch downstream of the soil boring location. Three additional surface soil samples (SS38-2 through SS38-4, all 0-2 inches bgs.) were collected from the grassy field between Building 2079, the drainage ditch north-northwest of the building, and the drainage ditch that lies west of Building 2079.

The collected soil samples were submitted for TPH analysis and the results are presented in **Table 2B**. TPH was detected in surface soil samples SS38-2 and SS38-4 at concentrations of 104 mg/Kg and 110 mg/Kg, respectively, and surface soil samples SS38-1 and SS38-3 contained significantly higher concentrations of 1,840 mg/Kg and 1,940 mg/Kg, respectively. The detection of TPH in the soil samples suggests that a release occurred and has affected this area of the SWMU. The subsurface soil sample SB38-1 (2-4 feet bgs) contained 85 mg/Kg of TPH, indicating that the TPH impacts diminish with depth.

5.2.2 ESI (1993-1994) and RI (1998-1999) Soil Results

The soil analytical results are summarized in **Tables 2C** and **2D** for surface soil and subsurface soil, respectively.

A total of 86 surface soil samples (7 from the ESI and 79 from the RI) were collected from a depth range of 0-2 or 0-6 inches bgs. and were analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals. Seven surface soil samples were also analyzed for herbicides. Four SVOCs [benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene] were detected in 5, 11, 4, and 12 samples, respectively, out of the 86 samples with concentrations above the respective NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4046 values. The maximum detected concentrations of benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene in surface soil were 560 μg/Kg, 450 μg/Kg, 570 μg/Kg, and 130 μg/Kg, respectively. Most metals were detected in at least one soil sample at concentrations above their respective NYSDEC TAGM values. Four metals (chromium, copper, lead, and zinc) were detected in over one-third of the surface soil samples at concentrations above their respective TAGMs. The maximum detected concentrations of chromium, copper, lead, and zinc were 18,600 mg/Kg, 7,330 mg/Kg, 11,200 mg/Kg, and 2,020 mg/Kg, respectively; while their respective TAGM values are 29.6 mg/Kg, 33 mg/Kg, 24.8 mg/Kg, and 110 mg/Kg, respectively. TAGM exceedances occurred in 39 of the 86 chromium samples, 30 of the 86 copper samples, 36 of the 79 lead samples, and 29 of the 86 zinc samples.

Ten and 18 soil borings were advanced at SEAD-4/38 during the ESI and RI, respectively, to evaluate the vertical extent of impacts. Eight test pits were excavated at SEAD-4/38 during the ESI. A total of 76 subsurface soil samples were collected from depths beyond 6 inches bgs. during the ESI and RI investigations. Each of the soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals. 39 subsurface soil samples were also analyzed for herbicides. Four SVOCs [benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene] were detected in 2, 2, 2, and 1 samples, respectively, out of the 76 samples with concentrations above the respective NYSDEC TAGM values. The maximum detected concentrations of benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene in subsurface soil were 1,100 μg/Kg, 880 μg/Kg, 1,000 μg/Kg, and 48 μg/Kg, respectively. Chromium, copper, and zinc were detected in 17 out of 61, 14 out of 76, and 14 out of 76 subsurface soil samples at concentrations above their respective TAGMs. The maximum detected chromium, copper, and zinc concentrations in subsurface soil were 3,820 mg/Kg, 2,250 mg/Kg, and 1,010 mg/Kg, respectively.

In general, the detected concentrations of metals (e.g., antimony, chromium, copper, and thallium) were found to be highest in samples collected from an area located south of the lagoon, and from locations around former Building T30.

PAHs were detected in surface and subsurface soil at concentrations above their respective TAGMs and the majority of the identified exceedances were found at locations adjacent to Building 2084 and adjacent to the former building foundation near North South Baseline Road.

5.2.3 2004 Test Pitting Results

Aroclor-1260 was detected at a concentration (0.079 μg/L) below the NYSDEC GA Standard of 0.09 μg/L in one groundwater sample collected during the RI from MW4-10. As the concentration posed unacceptable risks to potential future residents, additional investigations were conducted in the area of MW4-10 in 2004, subsequent to the issuance of the SEAD-4 RI report and the Draft SEAD-4 FS report, to verify the presence/absence of a PCB source area. The Army excavated four test pits in the vicinity of MW4-10 near Building 2084 in September 2004. A total of 11 samples were collected and all samples were analyzed for PCBs. One sample (TP4-4-04) among the 11 samples was also analyzed for VOCs, SVOCs, pesticides, and metals.

The test pit sample results are summarized in **Table 2E**. PCBs were not detected in any of the 11 soil samples. No VOCs or pesticides were detected in the soil sample TP4-4-04. A total of 18 SVOCs (15 out of 18 were PAHs) were detected in TP4-4-04 and the concentrations of benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene were above the TAGM values. However, the PAH concentrations were comparable with those observed at the SWMUs during the ESI and RI. A total of 17 metals were detected in TP4-4-04 and all the concentrations were below the TAGM values.

5.3 Drainage Ditch Soil

A total of 50 ditch soil samples were collected at the depth intervals of 0-2 or 0-6 inches bgs. along the drainage ditches at SEAD-4 and SEAD-38. Each of the ditch soil samples was analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals. Six ditch soil samples were also analyzed for herbicides. Six carcinogenic PAHs [benzo (a) pyrene, benzo (a) anthracene, benzo (b) fluoranthene, benzo(k)fluoranthene, chrysene, and dibenzo(a,h)anthracene], hexachlorobenzene, phenol, and all metals except beryllium were found at concentrations above their respective NYSDEC TAGM values in one or more drainage ditch soil samples. The benzo(a)pyrene toxicity equivalent (BTE) concentrations of carcinogenic PAHs were all below 10 mg/Kg BTE. The ditch soil results are summarized in **Table 2F**.

The maximum chromium concentration (4,800 mg/Kg) was detected in the drainage ditch located to the southwest of Building T30. The highest concentrations of PAHs, PCBs (Aroclor-1254 and Aroclor-1260), and metals such as iron and vanadium were detected in the samples collected from the drainage ditch at the northern edge of the SWMUs.

5.4 Groundwater

Groundwater samples were collected during the ESI, RI, and 2004 additional investigation. **Section 5.4.1**, **Section 5.4.2**, and **Section 5.4.3** present the groundwater results from the ESI, RI, and 2004 additional investigation, respectively.

5.4.1 ESI (1993-1994) Groundwater Results

A total of five groundwater samples were collected during the ESI. The samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals. The ESI groundwater analytical results are summarized in **Table 2G**.

Diethylphthalate was detected in three out of five samples with the maximum concentration at 0.9 μg/L. No NYSDEC GA Standard or federal Maximum Contaminant Level (MCL) Standard is available for diethylphthalate. No other VOCs, SVOCs, pesticides, or PCBs were detected in any of the groundwater samples.

Six metals (i.e., antimony, beryllium, cadmium, iron, manganese, and sodium) were detected in at least one groundwater sample at concentrations that exceeded their respective NYSDEC AWQS Class GA or MCL Standards, which are the Applicable or Relevant and Appropriate Requirements (ARARs) identified for the SWMUs. In addition, aluminum and magnesium were detected in groundwater above the Standard specified in the National Secondary Drinking Water Regulation and the NYSDEC GA guidance value, respectively, both of which are TBCs for the SWMUs. Among these metals with ARAR/TBC exceedances, only beryllium and cadmium were detected above the respective maximum concentrations observed in Seneca background. Beryllium and cadmium were detected in MW4-3 at 6.3 μg/L and 5.6 μg/L, above the respective maximum Seneca background values of 2.2 μg/L and 1.45 μg/L. Beryllium and cadmium were not detected in any of the other wells during this round and were not detected in the same well (i.e., MW4-3) during the two rounds conducted in 1999, when low-flow sampling protocols were used.

5.4.2 RI (1998-1999) Groundwater Results

A total of 14 groundwater samples were collected in March and April of 1999 (referred to as March/April round) and 12 groundwater samples were collected in July 1999 at SEAD-4/38 to evaluate groundwater quality. Groundwater samples were analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals. The groundwater analytical results are summarized in **Tables 2H** and **2I,** respectively, for the March/April round and the July round of sampling.

Five VOCs (acetone, benzene, ethylbenzene, toluene, and total xylenes) were each detected once, all in the same groundwater sample collected from well MW4-10 in March 1999. Concentrations reported for benzene and ethylbenzene were slightly above the NYSDEC GA Standards (2 μg/L vs. 1 μg/L and 6 μg/L vs. 5 μg/L, respectively). VOCs were not detected in any of the wells, including MW4-10, sampled in July 1999.

Six SVOCs [4-methylphenol, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, diethylphthalate, naphthalene, and phenol] and four nitroaromatic compounds (2-, 3-, and 4-, nitrotoluene and nitrobenzene) were also detected in the groundwater sample collected from well MW4-10 in March 1999. Concentrations of 4-methylphenol, 4-nitrotoluene, and nitrobenzene exceeded their respective NYSDEC GA Standards. However, with the exception of 4-methylphenol, no SVOCs or nitroaromatics were detected in MW4-10 or any other groundwater monitoring wells in the second round of groundwater sampling in July 1999. The groundwater sample collected from MW4-10 in July 1999 contained 4-methylphenol but at a concentration below its NYSDEC GA Standard.

Seven metals (i.e., antimony, chromium, iron, manganese, selenium, sodium, and thallium) were detected in at least one groundwater sample at concentrations that exceeded their respective NYSDEC AWQS Class GA or federal Maximum Contaminant Level (MCL) standards. In addition, aluminum was detected in groundwater above the Standard specified in the National Secondary Drinking Water Regulation and magnesium was detected in groundwater above the NYSDEC GA guidance value.

Among these metals with ARAR/TBC exceedances, only chromium, selenium, sodium, and thallium were detected above the respective maximum concentrations observed in Seneca background. Below summarizes a comparison of the RI groundwater results and the Seneca background for chromium, selenium, sodium, and thallium, respectively.

During the two rounds of RI sampling, chromium was detected above the maximum Seneca background once, in MW4-9 during the March/April round (260 μg/L vs. 69.4 μg/L). The turbidity of the groundwater sample was 31 Nephelometric Turbidity Units (NTU). However, the chromium concentration from the July round was 21.8 ug/L at the same well MW4-9 while the turbidity of the sample was 3.7 NTU. Therefore, the elevated chromium concentration was caused by elevated turbidity of the sample. Chromium concentrations in SEAD-4/38 are expected to be consistent with Seneca site background and the NYSDEC GA Standards based on the results of the representative samples with low turbidity.

Selenium concentrations in the groundwater samples collected from MW4-1, MW4-8, MW10, and MW4-12 in the March/April round were above the maximum Seneca background concentration (5.1 μg/L, 24 μg/L, 10.4 μg/L, and 13.4 μg/L, respectively vs. background of 3.6 μg/L). However, all selenium concentrations detected in July 1999 were consistent with Seneca background. The maximum detected concentration was 3.9 μg/L at MW4-10, comparable with the maximum Seneca background value of 3.6 μg/L.

Sodium concentrations detected in MW4-11 during both RI rounds were above the Seneca background (82,600 μg/L and 63,100 μg/L for the March/April round and the July round respectively, vs. background value of 59,400 μg/L). The turbidity observed for the July sample, 31 NTU, was the highest compared to all other samples collected during the same round.

During the two rounds of RI sampling, thallium was detected once above the Seneca background in MW4-12 during the March/April round. The detected maximum concentration at SEAD-4/38, 4.9 μg/L, was comparable with the Seneca maximum background concentration of 4.7 μg/L.

In summary, the overburden aquifer at SEAD-4/38 has low yield and caused elevated turbidity for the groundwater samples. Although sporadic exceedances of the Seneca maximum background concentrations were observed in SEAD-4/38 groundwater, the metal concentrations observed at SEAD-4/38 were generally comparable with the Seneca background data. The metal concentrations at SEAD-4/38 groundwater are expected to be consistent with background based on the results of the representative low turbidity samples.

5.4.3 2004 Additional Investigation Groundwater Results

Aroclor-1260 was detected once in well MW4-10 in July 1999, at a concentration below the NYSDEC GA Standard (0.079 μg/L vs. 0.09 μg/L). An additional round of groundwater sampling and analysis was performed at this well in June 2004 to verify the presence/absence of PCBs in the groundwater at the SWMUs. The groundwater analytical results are summarized in **Table 2J**. The 2004 analytical results indicated that PCBs were not present in the well. Based on these results, Aroclor-1260 is no longer considered present in groundwater at SEAD-4/38.

5.5 Surface Water

A total of 13 surface water samples were collected from the man-made lagoon and the drainage ditches at SEAD-4/38. The samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, explosives, and metals. The surface water results are summarized in **Table 2K**.

Acetone was the only VOC detected in surface water samples, with a maximum concentration of 4 μg/L. There is no NYSDEC Ambient Water Quality Standard (AWQS) available for acetone in Class C surface water. Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected in a single surface water sample collected from a location SW4-13 in the east-west trending drainage ditch located near the northern boundary of SEAD-4/38; none of these compounds were detected in the other surface water samples. There are no NYSDEC Class C AWQSs available for these PAHs. NYSDEC guidance values are available for benzo(a)pyrene and benzo(a)anthracene at 0.0012 μg/L and 0.03 μg/L, respectively. The benzo(a)pyrene and benzo(a)anthracene concentrations detected at SW4-13 (0.15 μg/L and 0.18μg/L, respectively) were above the guidance values.

Aluminum, cadmium, cobalt, copper, iron, lead, silver, vanadium, and zinc were detected at concentrations exceeding their respective NYSDEC AWQS Class C surface water standards in at least one surface water sample. The maximum detected concentrations compared with the AWQS values were 7,350 μg/L vs. 100 μg/L for aluminum, 11.6 μg/L vs. 1.9 μg/L for cadmium, 19.6 μg/L vs. 5 μg/L for cobalt, 97 μg/L vs. 20 μg/L for copper, 16,600 μg/L vs. 300 μg/L for iron, 117 μg/L vs. 7 μg/L for lead, 1.7 μg/L vs. 0.1 μg/L for silver, 22.5 μg/L vs. 14 μg/L for vanadium, and 492 μg/L vs. 141 μg/L for zinc. In general, the highest metal concentrations in surface water were found at locations in the east-west trending drainage ditch at the northern edge of SEAD-4/38.

5.6 Sediment

Three sediment samples were collected from the top 6 inches of the man-made lagoon bottom; the samples were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs, and metals. 4-methylphenol, 4,4'-DDE, and Aroclor-1254 were found at concentrations above the NYSDEC guidance values for sediment and the maximum detected concentrations were 0.14 mg/Kg, 0.0041 mg/Kg, and 0.28 mg/Kg, respectively. Nine metals (antimony, arsenic, chromium, copper, iron, manganese, mercury, nickel, and zinc) were detected at concentrations above the NYSDEC guidance values for sediment and the maximum detected concentrations were 50.4 mg/Kg, 8.1 mg/Kg, 3,310 mg/Kg, 2,640 mg/Kg, 29,200 mg/Kg, 569 mg/Kg, 0.16 mg/Kg, 33.4 mg/Kg, and 630 mg/Kg, respectively. The sediment results are summarized in **Table 2L**.

6.0 SUMMARY OF SEAD-4/38 RISK

A baseline risk assessment (BRA) was conducted for the combined SEAD-4 and SEAD-38 operable unit using data collected from both SWMUs during the various investigations to estimate potential human health and ecological risks that may exist if no remedial action were taken. Although an independent baseline risk assessment was not performed for SEAD-38 alone, the risk assessment results presented in the SEAD-4 RI apply to both SEAD-4 and SEAD-38 as soil, ditch soil, groundwater, and surface water samples collected from SEAD-38 and surrounding area during the combined SEAD-4/SEAD-38 SWMU investigations were included as part of the overall data set for risk assessment.

Based on this assessment, Aroclor-1254, cadmium, iron, and lead found in building debris will potentially pose significant human health risks to future indoor workers. Additional details, findings, and conclusions of the human health risk assessment are provided below in **Section 6.1**.

The screening level ecological risk assessment indicated potential risks for terrestrial receptors (short-tailed shrew, meadow vole, mourning dove, and red-tailed hawk) and aquatic receptors (great blue heron, largemouth bass, and northern leopard frog) due to the presence of chemicals found in environmental matrices at the overall operable unit (i.e., SEAD-4 and SEAD-38). Additional details, findings, and conclusions of screening level ecological risk assessment are presented below in **Section 6.2**.

6.1 Human Health Risk Assessment

The baseline human health risk assessment completed for SEAD-4 and SEAD-38 included the evaluation of the potential risks that may result in six human receptors (current on-site worker, future outdoor park worker, future indoor park worker, future construction worker, future child recreational visitor, and future resident) due to their reasonable maximum exposure to chemicals contained in the following impacted mediums at the SWMUs:

- building dust and debris,
- dusts in ambient air,
- surface, subsurface, and ditch soil,
- groundwater,
- surface water, and
- sediment.

A four-step process was used for assessing human health risks at SEAD-4/38 for a reasonable maximum exposure scenario:

- *Hazard Identification* – Identified the contaminants of potential concern based on several factors, such as toxicity, frequency of detection, and concentration.
- *Exposure Assessment* – Evaluated the pathways by which humans are potentially exposed and estimated the magnitude of potential human exposures.
- *Toxicity Assessment* – Determined the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).
- *Risk Characterization* – Summarized and combined the outputs of the exposure and toxicity assessments to provide a quantitative assessment of risks (e.g. a one-in-a-million excess cancer risk).

The following exposure pathways were considered for the identified six receptors:

1. Inhalation of dust in ambient air (current on-site worker, future outdoor park worker, future construction worker, future child recreational visitor, and future resident);
2. Inhalation of dust in indoor air (future indoor park worker);
3. Inhalation of groundwater (future child recreational visitor and future resident);
4. Ingestion of indoor dust/dirt (future indoor park worker);
5. Ingestion of on-site soils (current on-site worker, future outdoor park worker, future construction worker, future child recreational visitor, and future resident);
6. Intake of groundwater (future outdoor park worker, future indoor park worker, future child recreational visitor, and future resident);
7. Ingestion of on-site sediment (future child recreational visitor and future resident);
8. Dermal Contact to indoor dust/dirt (future indoor park worker);
9. Dermal contact to on-site soils (current on-site worker, future outdoor park worker, future construction worker, future child recreational visitor, and future resident);
10. Dermal contact to groundwater (future child recreational visitor and future resident);
11. Dermal contact to surface water (future outdoor park worker, future child recreational visitor, and future resident); and
12. Dermal contact to sediment (future outdoor park worker, future child recreational visitor, and future resident).

It should be noted that due to the change of the future land use for SEAD-4/38 (i.e., from conservation/recreation to training), some receptors evaluated during the RI (e.g., park worker and recreational visitor) no longer represent potential human receptor at the SWMUs. However, the exposure assumptions for these receptors could still be used either to represent or as an upper limit of exposure assumptions for potential future human receptors (e.g., training officer and child trespasser). Therefore, the risk assessment results can still be used to ensure no significant potential human health risks at SEAD-4/38.

Under current USEPA guidelines, the carcinogenic and non-carcinogenic effects due to exposure to site-related chemicals are considered separately. Non-carcinogenic risk for a chemical was assessed by calculation of a Hazard Quotient (HQ), which is an expression of the chronic daily intake of the chemical divided by its Reference Dose (RfD). A hazard index (HI) was then determined for each receptor/exposure route combination by summing the HQs computed for each chemical in that receptor/exposure route combination. Finally, to assess the overall potential for non-carcinogenic effects posed by more than one chemical and multiple exposure routes, the overall non-carcinogenic receptor HI is computed by summing all receptor/exposure route combination HIs considered for that receptor. Any HI at the receptor/exposure route level or at the overall level that exceeds 1.0 indicates the potential for non-carcinogenic effects to occur.

Carcinogenic risks were evaluated using a cancer slope factor (SF), which is a measure of the cancer-causing potential of a chemical. Slope factors are multiplied by daily intake estimates to generate an upper-bound estimate of excess lifetime cancer risk. According to guidance in the NCP, the target overall lifetime carcinogenic risks for determining site remediation goals should range from 10^{-6} to 10^{-4}.

It should be noted that lead, which was found in the building debris, soil, ditch soil, and sediment at SEAD-4/38, was not included in the quantitative risk assessment because a RfD is not available. Risks associated with lead exposure was evaluated by comparing the lead data to levels established by USEPA and NYSDEC as protective, based on the Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (USEPA, 1996, finalized in 2003) and the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (USEPA, 1994), which reference levels that are protective of adults and children, respectively. The results suggest that lead may pose a health risk to the future indoor park worker via exposure to the building debris. Lead in soil, ditch soil, or sediment does not pose unacceptable risks to potential receptors.

A summary of the human health risk assessment results are presented in **Table 3**. The results of the baseline risk assessment indicate that the HI is above the USEPA target of 1.0 for the future indoor park worker (HI=20), future child resident (HI=7), and future adult resident (HI=3). The total hazard index for the future indoor park worker is due (in decreasing order) to dermal contact to indoor dust/dirt and ingestion of indoor dust/dirt. The chemicals that drive the elevated risks are Aroclor-1254, iron, and cadmium in building debris. The total hazard indices for the future child resident and future adult resident are elevated primarily due to dermal contact to groundwater, intake of groundwater, soil ingestion, and sediment ingestion. The chemicals that drive the elevated risks are Aroclor-1260 in groundwater, antimony, copper, and thallium in soil, and iron in sediment/drainage ditch soil.

The cancer risk is within the target risk range of 10^{-6} to 10^{-4} for all receptors except the future indoor park worker ($3x10^{-4}$) and the future resident ($2x10^{-4}$). The elevated total cancer risk for the future indoor park worker is due primarily to the dermal contact to indoor dust/dirt. The chemical that drives the elevated risk is Aroclor-1254 in building debris. The total cancer risk for the future resident is due primarily to the dermal contact to surface water. The chemical that drive the elevated risk is benzo(a)pyrene in surface water.

Due to the risks posed by the one time detection of Aroclor-1260 in monitoring well MW4-10, an additional sampling round for PCBs was performed at MW4-10 in June 2004 to verify the presence of PCBs in groundwater. Two samples were collected from MW4-10 and the results indicated that PCBs were not present in groundwater. Therefore, Aroclor-1260 is not considered a contaminant of concern (COC) in groundwater at SEAD-4/38.

Five chemicals pose elevated risks to potential residential receptors at SEAD-4/38 (i.e., antimony, copper, and thallium in soil; iron in sediment/drainage ditch soil; and, benzo(a)pyrene in surface water); however, these chemicals do not pose unacceptable risks to the other receptors at SEAD-4/38.

On July 13, 2005, Seneca County's Economic Development Corporation (EDC) board approved SCIDA's proposed revisions to the Master Plan that changed the planned future use of the transferred land at the Depot to include subareas where the future use now would consist of Conservation, Residential/Resort, Green Energy, Development Reserve, Utility, Institutional/Training, and Training areas. With this change, the former Munitions Washout Facility now is located within the Training Area, which encompasses most of the southern portion of the former Depot. As the future use of SEAD-4/38 and the surrounding areas is consistent with light industrial activity, residential receptors are not expected at the SWMUs. As a result, antimony, copper, and thallium in soil, iron in sediment/drainage ditch soil, and benzo(a)pyrene in surface water are no longer identified as COCs for SEAD-4/38.

Further evaluation of the data indicates that should the preferred remedy be performed at the SWMUs and the cleanup goals be met, the risks to all potential receptors at the SEAD-4/38 (including the residential receptors) would be acceptable. Dermal contact with surface water will cause elevated cancer risk to potential residents due to the one time detection of benzo(a)pyrene in surface water. However, benzo(a)pyrene is only detected in one out of 13 surface soil samples and the detected concentration was below the reporting limit. As a result, benzo(a)pyrene is ruled out as a COC and it is concluded that the SWMUs will allow unrestricted use after the preferred remedy is completed.

6.2 Ecological Risk Assessment

A screening-level ecological risk assessment (SLERA) was conducted for the SWMUs. The SLERA was completed by the following steps defined in the Ecological Risk Assessment Guidance for Superfund (USEPA, 1997):

- Step 1: screening-level problem formulation and ecological effects evaluation (toxicity),
- Step 2: screening-level exposure estimate and risk calculation, and
- Step 3.2: further refinement of COCs.

Steps 1 and 2 include the following procedures, similar to the baseline human health risk assessment:

- *Characterization of the SWMUs and the Ecological Communities* — Evaluated ecological conditions, habitat, wildlife resources present in the area, and the importance of ecological resources to wildlife and to humans.
- *Exposure Assessment* — Determined contaminants of potential concern (COPCs) and exposure point concentrations, and assessed the reasonable maximum exposure. Chemical distribution of COPCs, their uptake through various pathways, and daily intakes of COPCs through environmental media were also discussed in this step.
- *Effects Assessment* — Assessed ecological effects that potentially would result from receptor exposure to the COPCs. Evaluated potential toxicity of each COPC in each medium and defined toxicity reference values (TRVs) that would be used to calculate the ecological hazard quotient based on the no observed adverse effects level (NOAEL).
- *Risk Characterization* — Integrated the results of the preceding elements of the assessment and estimated risk with respect to the assessment endpoints based on the predicted exposure to and toxicity of each COPC.

Ecological risk was then presented in terms of a hazard quotient, which was defined as the ratio of the expected daily contaminant intake to an appropriate TRV. An HQ less than one indicates that the contaminant alone is unlikely to cause adverse ecological effects.

The potential risk was calculated for terrestrial receptors (short-tailed shrew, meadow vole, mourning dove, and red-tailed hawk) and aquatic receptors (great blue heron, largemouth bass, and northern leopard frog). The COPCs in each SEAD-4/38 medium generating HQs greater than 1 are presented in **Table 4**.

For the SLERA, NOAEL toxicity values, the maximum detected COPC concentrations, and default exposure assumptions for the reasonable maximum exposure were used to calculate screening level HQs. Due to the conservative nature of these assumptions, additional evaluation was conducted to refine the contaminants of concern. The refinement of COCs streamlined the overall BRA process to determine if further evaluation was warranted. Surface water data were re-evaluated to reflect actual conditions at the SWMUs and only those samples collected from the man-made lagoon were included in the evaluation of the fish and amphibian receptors. HQs for the hawk were recalculated using a conservative estimate of the foraging factor of 10% based on an overall SEAD-4/38 size of 30 acres and a foraging range of 576 acres for the hawk. The foraging range and time factor of the great blue heron were considered in the evaluation of sediment exposure. The foraging range of the great blue heron is approximately 1.6 acres, which is twice the size of the man-made lagoon (0.7 acres). The great blue heron is a seasonal resident of New York State, spending approximately half year every year in New York. Therefore, a foraging factor of approximately 0.25 was used for the heron.

The results of the COC refinement identified chromium and lead as COCs for surface and subsurface soil (i.e., soil 0-4 ft bgs.). Chromium was identified as a COC for the ditch soils and sediment. In addition, an elevated vanadium concentration at SD4-28 raised a concern for the terrestrial ecological receptors. For surface water, only one compound (aluminum) with an HQ of 6 was calculated for the amphibian. The SLERA concluded that no further study would be required for surface water.

Cleanup goals were calculated for chromium and lead based on the cost effectiveness sensitivity analysis (Parsons, 2004a,b) and these cleanup goals (i.e., 60 mg/Kg for chromium and 167 mg/Kg for lead) are proposed for SEAD-4/38 remedial action.

7.0 SCOPE AND ROLE OF ACTION

The scope of this proposed plan is to provide adequate protection for current and future human and ecological receptors in areas previously occupied by the Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38) at SEDA.

8.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) have been developed that consist of media-specific objectives for the protection of human health and the environment. These objectives are based on available information and standards such as ARARs and the baseline risk assessment. These objectives are also based upon the current and intended future land use, which is training for SEAD-4/38. The remedial action objectives for SEAD-4/38 are as follows:

- Perform the preferred remedial action in a manner consistent with the planned future use (i.e., training) determination.
- Prevent public or other persons from direct contact with adversely impacted building debris, soils, ditch soils, and lagoon soil that may present a health risk.
- Eliminate or minimize the migration of hazardous contaminants from soil to groundwater and downgradient surface water.
- Prevent off-site migration of constituents above levels protective of public health and the environment.
- Restore soil, ditch soil, and lagoon soil to levels that are protective of public health and the environment.
- Prevent intake of groundwater containing contaminants in excess of federal and state drinking water standards or criteria, or groundwater posing a threat to public health.

Remediation goals were developed for soil and ditch soil at the overall operable unit based on the cost effectiveness sensitivity analysis (Parsons, 2004 a,b) and are summarized in **Table 1**. No COCs were identified in soil, ditch soil, or lagoon soil based on the baseline human health risk assessment. The baseline ecological risk assessment identifies chromium and lead as COCs for surface and subsurface soil, chromium as a COC for ditch soil and lagoon soil, and vanadium as a COC for ditch soil at a hot spot, sample location SD4-28.

The cleanup goal for chromium in soil and ditch soil is 60 mg/Kg. The cleanup goal for lead in soil is 167 mg/Kg. These cleanup goals are cost effective concentrations based on the sensitivity analysis and are protective of human health and the environment. The derivation of the cleanup goals for lead and chromium is presented in the two letters submitted in September and October, 2004 (Appendix).

The cleanup goal for vanadium is 150 mg/Kg, which is consistent with the NYSDEC TAGM value. As indicated in the SLERA presented in the RI report, vanadium should not be considered as a COC except in the area of SD4-28. The arithmetic average concentration of vanadium in ditch soil, excluding the hot-spot SD4-28, does not exceed two times of the Seneca background level. The NYSDEC TAGM value of 150 mg/Kg was selected as the cleanup goal for vanadium in ditch soil at the hot spot SD4-28.

The proposed cleanup goals are applicable to the top 4 feet of soil, ditch soil, and lagoon soil as deeper material is not expected to be accessible by ecological receptors. In addition, achievement of the cleanup goals will be determined by comparing the cleanup goals with the average concentrations in the respective top 4 ft mediums at SEAD-4/38. As an example, for the Army preferred remedy, soil excavation will be considered sufficient and therefore stop when post-excavation average concentrations in the top 4-ft medium at SEAD-4/38 are at or below the proposed cleanup goals.

9.0 SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost effective, comply with other statutory laws, and use permanent solutions, alternative treatment technologies, and resource recovery options to the maximum extent possible. In addition, the statute includes a preference for the treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

Three presumptive remedial alternatives were identified for the SEAD-4 and SEAD-38 SWMUs. The alternatives, along with the technologies and processes that make up each alternative, are:

- Alternative 1: No Action;
- Alternative 2: On-Site Containment (Institutional Controls/Soil Cover); and
- Alternative 3: Off-Site Disposal (Excavation/Off-Site Disposal).

Alternative 3 was selected as the preferred remedy to achieve the cleanup goals identified in **Table 1** based on its relatively low cost, technical feasibility, and overall effectiveness.

As directed by New York State Inactive Hazardous Waste Disposal Sites—Remedy Selection (6 NYCRR 375.10(b)), remediation to bring the SWMUs to pre-disposal (or unrestricted use) condition was also evaluated versus the remediation using the cleanup goals presented in **Table 1** under Alternatives 2 and 3 to weigh the advantages of restoring the SWMUs to pre-disposal conditions, versus the cost that restoring to pre-disposal conditions would incur. A full evaluation of the alternatives is presented in the SEAD-4 FS. A summary of the detailed evaluation of the alternatives is presented below.

Alternative 2 includes land use controls after the on-site capping is performed. The goals of the land use controls are to prevent the capping material that has been installed on top of the contaminated areas during the remedial action from being removed. Types of land use controls to be applied may include deed restrictions and physical controls such as signs and fences. Cost for a permanent fence and cost for a temporary fence were included for Alternative 2 and Alternative 3, respectively.

Since the completion of the SEAD-4 FS, some of the alternatives have been revised slightly and, therefore, the descriptions of the alternatives may differ from those presented in the FS. In addition, the cleanup goals and consequently the excavation volume have been revised. Therefore, the costs for the project are expected to be different from those presented in the FS. For Alternative 3, the current estimate of the cost is approximately $2.8 million, as compared to the $2.2 million in the FS. The costs presented in the FS are used in this Proposed Plan for cost comparison purposes.

9.1 Alternative 1 – No Action

Alternative 1 is the No Action alternative. This alternative allows the overall operable unit to remain as it currently is, with no further consideration given to any remedial action.

9.2 Alternative 2 – On-site Containment

Capital Cost: $1,666,790

Annual Operation and Maintenance (O&M) Cost: $44,400
Present Worth Cost for 30 Year O&M: $767,765
Construction Time: Approximately 2 months.

Alternative 2 consists of installing institutional controls (permanent fence), sweeping and vacuuming building floors, removing building debris, demolish Building 2079, excavating ditch soil and lagoon soil, placing a clean soil cover over contaminated surface and subsurface soils, disposing of excavated/removed material in an off-site landfill, and backfilling the ditches and lagoon.

Dust and debris within Buildings 2073, 2076, 2078, 2084, and 2085 will be removed, disposed of in an off-site landfill and the floors in the buildings will be swept and vacuumed clean. Building 2079 will be demolished and the building debris will be disposed of in an off-site landfill.

Ditch soil with chromium concentrations above 60 mg/Kg will be excavated and disposed of in an off-site landfill. The excavated drainage ditches will be backfilled to the original grade with clean topsoil and vegetative growth will be re-established.

Soil from the lagoon with chromium concentrations exceeding 60 mg/Kg will be excavated. The temporary berm at the end of the storm water basin will be removed after the lagoon remediation. The storm water in this area will be allowed to percolate into the ground at a location outside of the excavation areas and the lagoon will be allowed to return to its natural condition.

The excavation depth of ditch soil and lagoon soil will be determined based on the results of confirmatory sampling and analysis, but should not exceed 4 feet or beyond the upper surface of bedrock since these depths are inaccessible to ecological receptors.

Excavated building debris, ditch soil, and lagoon soil will be stockpiled and tested for the toxicity characteristic prior to disposal. Materials passing the TCLP test (i.e., those found to contain concentrations of contaminants at levels lower than established by 40CFR261.23 and 40CFR261.24) will be transported and disposed at a Subtitle D landfill. Materials exceeding the TCLP criteria will be stabilized on-site to render it non-hazardous prior to off-site disposal at the licensed landfill. Stabilization treatment requirements will be established in the remedial design. It should be noted that the TCLP criteria are not cleanup levels, rather they determine whether the soil is a hazardous waste by characteristic and define how the materials must be handled and disposed.

Alternative 2 also specifies that a soil cover will be placed over areas where concentrations of chromium and lead in surface and subsurface soil are above 60 mg/Kg or 167 mg/Kg, respectively. The soil cover applied will consist of the following, from top to bottom:

- 6 inches topsoil;
- 6 inches common fill; and
- Filter fabric (i.e. separation layer).

All excavated and covered areas will then be regraded to promote proper stormwater drainage at the SWMUs, and all areas would be revegetated to prevent erosion.

The intent of this alternative is to isolate the waste from receptors and to prevent migration of contaminants from the surface soil to surface water via soil erosion. This alternative does little to prevent potential groundwater deterioration due to the leaching of contaminants from the covered soil into the underlying aquifer.

Institutional controls will also be established as part of this remedial alternative. Fencing and signs will be installed and maintained around areas where soils are covered with the soil cap. Land use restrictions prohibiting excavation of the soil cover. Further, inspections and maintenance of the soil and vegetative covers would be established and documented.

9.3 Alternative 3 – Off-Site Disposal

Capital Cost: $2,201,990

Annual O&M Cost: NA
Present Worth Cost for 30 Year O&M: NA
Construction Time: Approximately 2 to 3 months.

Alternative 3 involves the same remediation of building debris, ditch soil, and lagoon soil as discussed in Alternative 2. Debris from Buildings 2073, 2076, 2078, 2084, and 2085 will be removed and the floors in the buildings will be swept and vacuumed clean. Building 2079 will be demolished. Ditch soil and lagoon soil containing chromium concentrations exceeding 60 mg/Kg will be excavated until the average concentration at SEAD-4/38 reaches 60 mg/kg, and temporarily staged on-site pending completion of disposal determinations. The temporary berm at the downgradient end of the lagoon will be removed after the lagoon excavation. The storm water in this area will be allowed to percolate into the ground at a location outside of the excavation areas.

For the surface and subsurface soil, Alternative 3 involves excavating soils exceeding the cleanup goals (i.e., 60 mg/Kg for chromium and 167 mg/Kg for lead) until the average concentrations at SEAD-4/38 are below the cleanup goals. The excavation area is shown in **Figure 3.**

Excavated building debris, soil, ditch soil, and lagoon soil will be stockpiled and tested for toxicity characteristic by the TCLP tests prior to being disposed. Materials passing the TCLP test will be transported and disposed of in a Subtitle D landfill. Materials that exceeds the TCLP criteria would be treated on-site to render it non-hazardous prior to off-site disposal.

Final depth of soil, ditch soil, and lagoon soil excavation will be determined based on the results of confirmatory samples, but should not exceed 4 feet or beyond the local bedrock surface.

All excavated areas will be backfilled, graded, and/or revegetated, as necessary to provide proper stormwater control. The man-made lagoon will be allowed to return to its natural condition. Clean fill, which will be tested and approved prior to use, and topsoil will be placed in excavation areas as necessary and vegetative growth will be established.

The intent of this remedial alternative is to remove the contaminated soil from the SWMUs to prevent receptors from contacting it in the future and eliminate migration of COCs to surface water and groundwater.

10.0 COMPARATIVE EVALUATION OF ALTERNATIVES

A comparative evaluation was conducted for the presumptive alternatives and the results are summarized in this section. Cleanup objectives documented in this plan are different than those identified at the time when the Final FS was prepared. The changes made to the cleanup objectives result from the sensitive analysis conducted for the SWMUs (Appendix A). While the changes in cleanup objectives do change the cost of the planned remedial action, they do not change the applicability of the evaluation of alternative completed. Each alternative was assessed against seven evaluation criteria, namely, 1) overall protectiveness of human health and the environment, 2) ARAR compliance, 3) long-term effectiveness and performance, 4) reduction of toxicity, mobility, or volume, 5) short-term effectiveness, 6) implementability, 7) cost, 8) state acceptance, and 9) community acceptance.

The results of preliminary screening and alternative evaluations are presented below.

10.1 Overall Protectiveness of Human Health and the Environment

Each alternative was assessed against the threshold criterion of overall protection of human health and the environment. The alternative must satisfy this criterion to be eligible for selection.

Alternatives 2 and 3 provide protection of human health and the environment; Alternative 1 does not. The building debris from the SWMUs would be removed and disposed off-site. Ditch soil and lagoon soil exceeding the cleanup goals would be removed from the SWMUs. Soil with concentrations above the cleanup goals would either be covered or excavated from the SWMUs. Removing or covering these materials would prevent dermal contact and ingestion, which have been identified by the BRA as the major exposure pathways for the affected mediums at SEAD-4 and SEAD-38. Alternatives 2 and 3 would each reduce risk to acceptable levels.

Removal of soils found in the drainage ditches would protect environmental receptors by preventing downgradient migration of contaminants in ditch soils to Indian Creek or Silver Creek. Alternative 3 ranks higher than Alternative 2 as contaminated surface and subsurface soil would be removed, not only to reduce direct human and ecological receptors exposure, but also to decrease any potential for migration to groundwater or surface water. Alternative 2 would decrease the potential for surface erosion and migration to nearby areas by placing a soil cover over contaminated soil. Alternative 2 is not efficient preventing migration of contaminants to groundwater.

10.2 Compliance With ARARs

Compliance with ARARs is another threshold criterion because each alternative must satisfy this requirement to be carried through the selection process. ARARs are promulgated standards that may be applicable to the SWMU cleanup process after a remedial action has been chosen for implementation.

Standards, requirements, criteria, or limitations under federal environmental or state environmental or facility siting law may be either applicable or relevant and appropriate to a specific action. The only state laws that may become ARARs are those promulgated such that they are legally enforceable and generally applicable and equivalent to or more stringent than federal laws.

There are three categories of potential ARARs and they are chemical-specific, location-specific, and action-specific. A revised list of ARARs is presented at the end of this document.

Currently NYSDEC TAGM No. 4046 values are regarded as To Be Considered (TBC) values for soil at SEAD-4/38.

There are currently no chemical specific ARARs for sediment in the State of New York; however NYSDEC guidelines for sediment are TBCs.

For surface water at SEAD-4/38, the NYSDEC Ambient Water Quality Standards (TOGS, 1.1.1, Class C Standards) are used as TBCs. Surface water is found in the man-made drainage ditches and a man-made lagoon at SEAD-4/38. The surface water in the ditches and the lagoon are not classified by NYSDEC because they are intermittent and/or not recognized as an established stream or creek. However, because the drainage ditches form the headwaters for Indian Creek or Silver Creek, the lower portion of which is designated as Class C surface water by NYSDEC, the Class C standards were used to provide a basis of comparison for the on-site chemical data. The Class C standards are not strictly applicable to the surface water in the drainage ditches and the lagoon, and thus are treated as TBCs.

For groundwater, the NYSDEC Ambient Water Quality Standards (TOGS, 1.1.1, Class GA Standards) and Drinking Water Maximum Contaminant Levels by the National Primary Drinking Water Regulations (USEPA, 2002) were identified as ARARs. Eight metals (i.e., antimony, chromium, iron, lead, manganese, selenium, sodium, and thallium) were detected in at least one groundwater sample at concentrations that exceeded the respective ARARs. In addition, aluminum was detected in groundwater above the National Secondary Drinking Water Regulation, which is non-enforceable guideline regarded as TBC for the SWMUs.

Off-site disposal would fall under RCRA requirements, which must be complied with in the remedial action. Other federal ARARs, which must be complied with, are listed at the end of this document. After an alternative is chosen, the remedial design must incorporate compliance with ARARs. The concepts of each alternative evaluated in the FS do not preclude compliance with ARARs. All alternatives have potential to fully comply with ARARs.

10.3 Long-Term Effectiveness and Permanence

The criterion of long-term effectiveness addresses the long-term protection of human health and the environment, permanence of the remedial alternative, magnitude of remaining risk, and adequacy and reliability of controls.

Alternatives 2 and 3 demonstrate long-term effectiveness because they rely on containment or/and excavation, and disposal to reduce the hazardous contaminants in soils, ditch soils, lagoon soil, and buildings at the SWMUs. Alternative 3 is the most effective in eliminating the long-term threats since excavation and removal of contaminants in soil, ditch soil, lagoon soil, and buildings will be performed. Alternative 2 is the next most effective due to the involvement of excavation and off-site disposal of building debris, ditch soils, and lagoon soil, as well as a soil cover for the affected surface and subsurface soils. The soil cover would prevent contact with the underlying soil by human and ecological receptors and reduce risk to acceptable levels. Alternative 2 has little effect in preventing groundwater deterioration by potential contaminant leaching from soil. Alternative 2 will also require future land use restrictions including prohibiting excavation and disturbance of the cover. Both Alternative 2 and Alternative 3 are considered to be technically feasible and provide effective long-term protection. Alternative 1, the no action alternative, does not provide long-term protection of human health or the environment.

The goal of Alternative 3 is to have no residual contamination in the top 4 feet soils above 167 mg/Kg for lead or above the 60 mg/Kg for chromium (**Table 1**). The goal of Alternatives 2 and 3 for ditch soil and lagoon soil is to have no residual contamination in the top 4 feet above the cleanup goal of 60 mg/Kg for chromium (**Table 1**). These cleanup goals for chromium and lead are considered to be protective of human health and the environment under the future industrial/training use scenario.

The relative rankings of the alternatives based on permanence are the same as the rankings for long-term protectiveness. Since Alternative 3 reduces the volume of the soil on-site, it is more permanent than Alternative 2, which requires soil to remain on-site. Alternative 1, the no action alternative, is not permanent because no remedial action is performed.

10.4 Reduction in Toxicity, Mobility, and Volume

The alternatives were compared with respect to the relative decreases in the toxicity, mobility, and volume of the hazardous contaminants present at the SWMUs. In summary, none of the alternatives yield great reduction in the toxicity, mobility, and volume as the alternatives rely on non-destructive technologies (no action, containment, and excavation) as the remedial action for affected mediums.

The no action alternative (Alternative 1) ranks the lowest in this category because the alternative does not effectively reduce the volume, toxicity, or mobility of the hazardous constituents at the SWMUs.

Alternatives 2 and 3 ranked higher than Alternative 1 as some contaminated material will be removed and landfilled. Once the material is landfilled, the contaminants are essentially immobile. Alternative 3 renders more reduction of mobility compared to Alternative 2 as soil, along with ditch soil, lagoon soil, and building debris, will be excavated and disposed. Alternative 2, on the other hand, decreases the mobility of the surface and subsurface soils through the placement of the soil cover, which would contain the soil and prevent migration to surface water via erosion. Further, some of the excavated/removed material from the SWMUs may be treated in order to meet the TCLP criteria prior to disposal. The treated material will be rendered non-hazardous and as a result, exhibit lower toxicity and mobility than the untreated waste.

Alternatives 2 and 3 would increase contaminated material in volume as a result of the excavation process. Alternatives 3 would have more volume increase than Alternative 2. Depending on the treatment method prior to disposal, the treated material may represent a larger volume of material than the untreated material, but the larger volume is offset by the reduction in toxicity and mobility of the treated soil.

10.5 Short-Term Effectiveness

Alternative 1 (no action) ranks highest for short-term protection of human health and the environment. The alternative does not require any construction of remedial systems and, therefore, poses the least risk to the community and on-site workers. In addition, it does not create any additional adverse environmental impacts. However, it would take longer for this alternative to achieve the remedial response action objectives than the other alternatives evaluated.

Alternative 2 does not involve a large amount of excavation and can be implemented relatively quickly, because it does not require specialized equipment or vendors. Off-site transportation of materials is limited and includes transportation of soil excavated from the drainage ditches and man-made lagoon, building debris, and materials for the cap (topsoil, common fill, and filter fabric). The latter factor can be decreased through the use of on-site borrow soils. Alternative 3 does not require additional handling for treatment or specialized equipment, but it does require more extensive excavation and off-site disposal compared with Alternative 2. The excavation and disposal can be performed efficiently and quickly.

10.6 Implementability

All of the alternatives have sufficient implementability at SEAD-4 and SEAD-38.

Alternative 1 is readily available. However, the administrative feasibility of the alternative is not considered favorable since extensive coordination with local, state, and regional agencies would be required in the attempt to support and justify no remedial actions at the SWMUs.

Alternative 2 can be constructed most easily since they involve leaving soils in place and constructing a soil cover. The construction of the soil cover involves routine earthmoving tasks, such as hauling, spreading, and compacting soils. Numerous contractors are available and qualified to perform these tasks.

Alternative 3 can also be constructed easily, though they involve more excavation, stockpiling, testing, and transportation.

For Alternatives 2 and 3, on-site stabilization may be necessary prior to disposal. In addition,. a licensed off-site landfill capable of accepting the material from the SWMUs would be needed.

10.7 Cost

Capital costs, operating costs, and administrative costs were estimated for Alternatives 1, 2, and 3 and presented in the FS report. Capital costs include those costs for professional labor, construction and equipment, field work, monitoring and testing, and treatment and disposal. Operating costs include costs for administrative and professional labor, monitoring, and utilities. Administrative costs include the costs for land use restrictions. All costs discussed are present worth estimates using a common discount rate of 5%. The capital and operating costs for Alternatives 2 and 3 are summarized in **Table 5**.

Alternative 1 (no action) is not considered to have any associated capital or operating costs. This alternative is used as a basis of comparison for the other alternatives. Alternative 2 is more expensive than Alternative 3. Alternative 3 costs $2,201,990 and Alternative 2 costs $2,434,555.

10.8 State Acceptance

State acceptance of the preferred alternative will be addressed in the ROD following review of NYSDEC comments received on the RI, the FS, and this Proposed Plan.

10.9 Community Acceptance

Community acceptance of the preferred alternative will be assessed in the ROD following review of the public comments received on the RI report, FS report, and this Proposed Plan.

11.0 PREFERRED ALTERNATIVE

Remedial action alternatives were prepared and evaluated for remediation at SEAD-4 and SEAD-38. The baseline human health risk assessment indicates that the cancer risk and non-carcinogenic risk for future indoor park workers are above acceptable levels at the SWMUs. Aroclor-1254, cadmium, iron, and lead in building debris were identified as COCs based on the baseline human health risk assessment. The baseline ecological risk assessment identified chromium and lead as COCs for surface and subsurface soil (i.e., soil 0-4 feet bgs.) and chromium as the COC for the ditch soils and sediment. In addition, an elevated vanadium concentration at SD4-28 raised concern for the terrestrial ecological receptors.

Alternatives 2 and 3 address remediating building debris, soil, ditch soil, and lagoon soil and would all be effective in reducing the human health and ecological risk as well as meeting the remedial action objectives. In summary, the goal of the remedial action is to prevent ingestion of and dermal contact with soils, ditch soils, and lagoon soil with concentrations above the cleanup goals (shown in **Table 1**), and to prevent ingestion of and dermal contact with debris that is currently inside the buildings at the SWMUs.

In comparison to Alternatives 1 and 2, Alternative 3 has the highest overall ranking. This alternative ranks high for protection of the environment, long-term effectiveness, and reduction in toxicity, mobility, and volume. Alternative 3 also provides reasonable performance in short-term effectiveness, implementability, and cost. In addition, Alternative 3 would eliminate source soils, ditch soils, lagoon soil, and building debris from further impacting the SWMUs. It is a cost-effective and readily available alternative that does not require long-term maintenance; and, the alternative can be implemented quickly to provide short-term effectiveness. Finally, it is a permanent solution that would significantly reduce the mobility of the contaminants and potential for exposure at the SWMUs.

Based on the evaluation of various options, the preferred alternative of the U.S. Army for SEAD-4 and SEAD-38 is Alternative 3 (Excavation and Off-site Disposal).

Cleanup goals to restore the SWMUs to pre-disposal conditions were considered for both Alternative 2 and Alternative 3 in order to weigh the advantages of restoring the SWMUs to pre-disposal conditions versus the cost this would incur. The goal of these alternatives is no residual contamination in soil/ditch soil and sediment above the TAGM values and

NYSDEC sediment guidance criteria, respectively. Based on the FS study, Alternative 2 with cleanup goals based on pre-disposal conditions has a total cost of over $1 million more than Alternative 2 with the cleanup goals presented in **Table 1**. Alternative 3 with cleanup goals based on pre-disposal conditions has a total cost of over $2.5 million more than Alternative 3 with the proposed cleanup goals. The alternatives with cleanup goals based on pre-disposal conditions were not selected as the preferred alternative due to the significant cost increase compared to its counterpart. Since human health and environmental risks for the intended future use, training, are acceptable under Alternatives 2 and 3, the additional health risk reductions achieved by the alternative aimed to restore the SWMUs to pre-disposal conditions do not warrant the additional project cost. In addition, Alternative 3 would result unrestricted use of the SWMUs as risks to potential residents would be within the acceptable limits after the remedy. A cost effectiveness sensitivity analysis (Parsons, 2004a,b) further demonstrated that removal to the proposed cleanup goals is the most cost effective remedy.

The elements that compose this remedy at SEAD-4 and SEAD-38 include:

- Removing the debris from abandoned buildings 2073, 2076, 2078, 2084, and 2085 and sweeping and vacuuming building floors;
- Demolishing Building 2079;
- Excavating ditch soil with chromium concentrations greater than 60 mg/Kg and soil at the hot spot SD4-28 with vanadium concentrations greater than 150 mg/Kg (**Table 1**);
- Excavating surface and subsurface soils with lead concentrations greater than 167 mg/Kg and chromium concentrations greater than 60 mg/Kg (**Table 1**) until the SEAD-4/38 average concentrations meet the cleanup goals;
- Dewater the man-made lagoon and allow water to percolate into the ground at a location outside of the excavation areas.
- Once the lagoon is empty, excavate soil from the man-made lagoon containing chromium concentrations greater than 60 mg/Kg until the chromium cleanup goal is achieved (**Table 1**);
- Removing the temporary berm at the end of the storm water control basin and allowing the man-made lagoon to return to its natural condition;
- Stabilizing soils, ditch soil, lagoon soil, and building debris and building material exceeding the TCLP criteria;
- Disposing of the excavated materials in an off-site landfill;
- Backfilling the excavated areas with clean backfill, if necessary; and
- Submitting a Completion Report after completion of the remedial action.

The excavation depth of soil, ditch soil, and lagoon soil should not exceed 4 feet or beyond the upper surface of bedrock since these depths are inaccessible to ecological receptors. A total of approximately 25,000 cy of soil, ditch soil, and lagoon soil is expected to be excavated from SEAD-4/38 and be disposed off-site.

The proposed areas of excavation for Alternative 3 are shown in **Figure 3**. **Figure 4** shows the process flow schematic for the preferred remedial option.

GLOSSARY

Acetone
A chemical that is found naturally in the environment and is also produced by industries. Low levels of acetone are normally present in the body from the breakdown of fat; the body can use it in normal processes that make sugar and fat. Acetone is a colorless liquid with a distinct smell and taste. People begin to smell acetone in air at 100 to 140 parts of acetone in a million parts of air (ppm), though some can smell it at much lower levels. Most people begin to detect the presence of acetone in water at 20 ppm. Acetone evaporates readily into the air and mixes well with water. Most acetone produced is used to make other chemicals that make plastics, fibers, and drugs. Acetone is also used to dissolve other substances.

Administrative Record
The body of documents that were considered or relied on which form the basis for the selection of a response action.

Adverse effects
Any effect resulting in anatomical, functional, or psychological impairment that may affect the performance of the whole organism.

Aluminum
Aluminum is a metal that accumulates in the environment.

Ambient Air
The encompassing air or atmosphere of the outdoor portions of a site.

Ambient Water Quality Standards (AWQS)
Standards and guidance values developed by New York State for specific classes of fresh and saline surface waters and fresh groundwaters for protection of the best uses assigned to each class.

Antimony
Antimony is a metal that accumulates in the environment.

Applicable or Relevant and Appropriate Requirements (ARARs)
As defined under CERCLA, ARARs are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limits set forth under federal or state law that specifically address problems or situations present at a CERCLA site. ARARs are major considerations in setting cleanup goals, selecting a remedy, and determining how to implement that remedy at a CERCLA site. ARARs must be attained at all CERCLA sites unless a waiver is attained. ARARs are not national cleanup standards for the Superfund program. *See also Comprehensive Environmental Response, Compensation, and Liability Act and Superfund.*

Aquifer
An aquifer is a saturated permeable geologic unit or rock formation that can store significant quantities of water and transmit the water under ordinary hydraulic gradients, possibly to wells.

Area of Concern (AOC)
Any existing or former location where hazardous substances, hazardous wastes, hazardous constituents or pollutants are or were known or suspected to have been discharged, generated, manufactured, refined, transported, stored, handled, treated, disposed, or where hazardous substances, hazardous wastes, hazardous constituents or pollutants have or may have migrated.

Arsenic
A nature element mostly in compounds with oxygen, chlorine, and sulfur (inorganic arsenic compounds). Inorganic arsenic compounds are mainly used to preserve wood. They are also used to make insecticides, weed killers, fungicides and antifouling paints. It is also used in drugs, war gases and as a homicidal and suicidal weapon. Other uses of arsenic compounds are in alloys, manufacturing of arsenic compounds (arsenic oxides) and certain glass. *See also Heavy Metal.*

Assessment endpoints
Assessment endpoints represent environmental values to be protected and generally refer to characteristics of populations and ecosystems.

Backfill
To refill (as an excavation) usually with excavated material or with clean material brought from off-site.

Base Realignment and Closure (BRAC)
A congressionally mandated process that involves closure of military bases. The goal of BRAC is to transition the former bases from military uses to civilian reuse, with the intent of minimizing the negative effects of base closure by spurring economic development and growth. The SEDA was listed as a base to be closed in October 1995.

Baseline Risk Assessment (BRA)
A baseline risk assessment is an assessment conducted before cleanup activities begin at a site to identify and evaluate the threat to human health and the environment. After remediation has been completed, the information obtained during a baseline risk assessment can be used to determine whether the cleanup levels were reached.

Baseline
A scenario or set of critical observations or data used for comparison or a control.

Bedrock
Bedrock is the rock that underlies the soil; it can be permeable or non-permeable. The underlying bedrock at the Seneca Army Depot Activity is shale. Shale is a type of rock that is formed by the consolidation of clay, mud, or silt, has a finely stratified or laminated structure, and is composed of minerals essentially unaltered since deposition.

Benzene
A colorless liquid with a sweet odor. Benzene evaporates into air very quickly and dissolves slightly in water. Benzene is highly flammable. Benzene is found in air, water, and soil. Benzene comes from both industrial and natural sources.

Benzo(a)pyrene toxicity equivalent (BTE) concentrations of carcinogenic PAHs
The benzo(a)pyrene toxicity equivalence is calculated based on the relative toxicity of the cPAHs, as cited by USEPA Integrated Risk Information System (IRIS) Database. The BTE concentration is calculated by multiplying the concentration of the seven individual cPAHs in each sample by the following factors (based on IRIS):

Benzo(a)pyrene	1
Dibenzo(a,h)anthracene	1
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Indeno(1,2,3-cd)pyrene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.01

A higher multiplier represents a greater carcinogenic health risk. The BTE concentration for each carcinogenic PAH was then summed up to get the carcinogenic PAH BTE concentration for the sample.

Cadmium
Cadmium is a heavy metal that accumulates in the environment. See also Heavy Metal.

Cancer Slope Factor
The slope factor is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used in risk assessments to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen. Slope factors for each chemical are expressed in units of inverse mg chemical per kg body weight per day of exposure.

Capital Cost
The initial cost associated with constructing a treatment remedy. The capital cost does not include the operation and maintenance of the remedy.

Carcinogen
A substance that produces cancer in an organism or increases the potential for an organism to develop cancer.

Chemical or Contaminant of Concern (COC)
Specific chemicals that are identified for evaluation in the site assessment process and that are identified to pose unacceptable risks to human health or/and the environment.

Chemical or Contaminant of Potential Concern (COPC)
Chemicals that may be hazardous to human health or the environment and identified at the site, initially from historical sources.

Chromium
A hard grey metallic element that takes a high polish, occurring principally in chromite: used in steel alloys and electroplating to increase hardness and corrosion-resistance.

Chronic
Chronic means always present or encountered. For example, the chronic daily intake is an estimate of the daily exposure of a receptor to a chemical.

Clean Water Act (CWA)
CWA is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to U.S. waters. This law gave USEPA the authority to set wastewater discharge standards on an industry-by-industry basis and to set water quality standards for all contaminants in surface waters.

Cleanup
Cleanup is the term used for actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and or the environment. The term sometimes is used interchangeably with the terms remedial action, removal action, response action, or corrective action.

Cobalt
A naturally-occurring element that has properties similar to those of iron and nickel. Cobalt is used to make alloys (mixtures of metals), colored pigments, and as a drier for paint and porcelain enamel used on steel bathroom fixtures, large appliances, and kitchenwares. Cobalt enters the environment from natural sources and from the burning of coal and oil. *See also Heavy Metal.*

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA is a federal law passed in 1980 that created a special tax those funds a trust fund, commonly known as Superfund, to be used to investigate and cleanup abandoned or uncontrolled hazardous waste sites. CERCLA required for the first time that USEPA step beyond its traditional regulatory role and provide response authority to cleanup hazardous waste sites. USEPA has primary responsibility for managing cleanup and enforcement activities authorized under CERCLA. Under the program, USEPA can pay for cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or take legal action to force parties responsible for contamination to cleanup the site or reimburse the federal government for the cost of the cleanup. *See also Superfund.*

Containment
A passive contaminant control technology, which focuses on controlling hydrologic pathways for contaminant migration.

Contaminant
A contaminant is any physical, chemical, biological, or radiological substance or matter present in any media at concentrations that may result in adverse effects on air, water, or soil.

Copper
Copper is a heavy metal that accumulates in the environment. *See also Heavy Metal.*

Department of Defense (DoD)
The federal department charged with coordinating and supervising all agencies and functions of the government relating directly to national security and the military. The DOD is the major tenant of The Pentagon, and it is divided into three major subsections—the U.S. Army, the U.S. Navy, and the U.S. Air Force.

Disposal
Disposal is the final placement or destruction of toxic, radioactive or other wastes; surplus or banned pesticides or other chemicals; polluted soils; and drums containing hazardous materials from removal actions or accidental release. Disposal may be accomplished through the use of approved secure landfills, surface impoundments, land farming, deep well injection, or ocean dumping.

Dose

1. The actual quantity of a chemical administered to an organism or to which it is exposed.
2. The amount of a substance that reaches a specific tissue (e.g. the liver).
3. The amount of a substance available for interaction with metabolic processes after crossing the outer boundary of an organism.

Downgradient
In the direction of decreasing static head (potential).

Ethylbenzene
A colorless liquid that smells like gasoline. Ethylbenzene evaporates at room temperature and burns easily. Ethylbenzene occurs naturally in coal tar and petroleum. It is also found in many products, including paints, inks, and insecticides. Gasoline contains about 2% (by weight) ethylbenzene.

Exceedance
A measured level of a compound in a medium that is greater than a defined state or federal standard.

Excess Lifetime Cancer Risk
The incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen.

Expanded Site Investigation (ESI)
An expanded site investigation typically includes media sampling and analyses. An ESI is performed following a Preliminary Site Investigation to obtain more information regarding the concentrations of pollutants at a site.

Explosive
A substance, such as trinitrotoluene, or a mixture, such as gunpowder, that is characterized by chemical stability but may be made to undergo rapid chemical change without an outside source of oxygen, whereupon it produces a large quantity of energy generally accompanied by the evolution of hot gases

Exposure Pathway
An exposure pathway is the way a chemical comes into contact with a person (i.e. by ingestion, inhalation, and dermal contact). Determining whether exposure pathways exist is an essential step in conducting a baseline risk assessment. *See also Baseline Risk Assessment.*

Exposure Point Concentration (EPC)
The value that represents a conservative estimate of the chemical concentration available from a particular medium or route of exposure.

Feasibility
A measure of whether an alternative is capable of being done or carried out successfully.

Federal Facilities Agreement (FFA) also known as the Interagency Agreement (IAG)
An agreement signed between USEPA, NYSDEC and the Army that describes the process for identifying, investigating and remediating sites at the Seneca Army Depot Activity.

GA Groundwater Standard
A water quality standard promulgated by the NYSDEC that establishes a minimum quality of a groundwater supply that could be used as a source of drinking water.

Groundwater
Groundwater is the water that flows beneath the earth's surface, possibly in an aquifer, that fills pores between such materials as sand, soil, or gravel and that often supplies water to wells and springs. See also *Aquifer*.

Habitat
The place or environment where a plant or animal naturally or normally lives and grows.

Hazard Index (HI)
The unit used to assess the overall potential for non-carcinogenic effects posed by more than one chemical. It is expressed as the sum of the hazard quotient for each individual chemical.

Hazard Quotient (HQ)
The ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level, at which no adverse health effects are likely to occur.

Hazardous Waste
A solid waste or combination of solid wastes which, because of its quantity, concentration or physical, chemical, or infectious characteristics, may a.) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or b.) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Heavy Metal
A metal whose specific gravity is approximately 5.0 or higher. Heavy metal is common hazardous waste; can damage organisms at low concentrations and tends to accumulate in the food chain.

Herbicide
A chemical pesticide designed to control or destroy plants, weeds, or grasses.

Immobile
Incapable of being moved and thereby spreading contamination.

Inorganic
Material such as sand, salt, iron, calcium salts and other mineral materials. Inorganic substances are of mineral origin, whereas organic substances are usually of animal or plant origin.

Intake
The amount of a chemical taken in by an organism.

Iron
Iron is a heavy metal that accumulates in the environment. *See also Heavy Metal.*

Landfill
A sanitary landfill is a land disposal site for non-hazardous solid wastes at which the waste is spread in layers compacted to the smallest practical volume.

Land Use Control (LUC)/Institutional Control
Any restriction or control, arising from the need to protect human health and the environment, that limits use of and/or exposure to any portion of that property, including water resources. This term encompasses "institutional controls," such as those involving real estate interests, governmental permitting, zoning, public advisories, deed notices, and other "legal" restrictions. The term may also include restrictions on access, whether achieved by means of engineered barriers such as a fence or concrete pad, or by "human" means, such as the presence of security guards. Additionally, the term may involve both affirmative measures to achieve the desired restriction (e.g., night lighting of an area) and prohibitive directives (no drilling of drinking water wells). Considered altogether, the "LUCs" for a facility, in conjunction with the base master plan, will provide a blueprint for how its property should be used in order to maintain the level of protectiveness which one or more remedial/corrective actions were designed to achieve.

Leaching
The process by which contaminants are transferred from a stabilized matrix to a liquid medium such as water or acid.

Lead
Lead is a heavy metal that is hazardous to health if breathed or swallowed. Its use in gasoline, paints, and plumbing compounds has been sharply restricted or eliminated by federal laws and regulations. See also Heavy Metal.

Manganese
Manganese is metal that accumulates in the environment.

Maximum Contaminant Level (MCL)
Established under the Safe Drinking Water Act as concentrations of pollutants considered protective for drinking water.

Mean Sea Level (MSL)
A tidal datum. The arithmetic mean of hourly heights observed over the National Tidal Datum Epoch. Shorter series are specified in the name; e.g., monthly mean sea level and yearly mean sea level.

Medium
A medium is a specific environment (air, water, or soil) that is the subject of regulatory concern and activities.

Mercury
Mercury is a heavy metal that can accumulate in the environment and is highly toxic if breathed or swallowed. Mercury is found in thermometers, measuring devices, pharmaceutical and agricultural chemicals, chemical manufacturing, and electrical equipment. See also *Heavy Metal.*

4-methylphenol
Also called p-cresol. Three types of closely related cresols exist: ortho-cresol (o-cresol), meta-cresol (m-cresol), and para-cresol (p-cresol). Cresols can be either solid or liquid, depending on how pure they are; pure cresols are solid, while mixtures tend to be liquid. Cresols do not evaporate quickly from water, but in rivers and lakes, they can be removed quickly by bacteria. Dissolved cresols can pass through soil into underground water sources. 4-methylphenol is used largely in the formulation of antioxidants and in the fragrance and dye industries. Mixed cresols are used as disinfectants, preservatives, and wood preservatives. Mixed cresols may be found in ambient air; sources are car exhaust, electrical power plants, municipal solid waste incinerators, oil refineries, and cigarettes. People in areas where heated with coal, oil, or wood may be exposed to mixed cresols in the air. Some foods also contain mixed cresols.

Migration
Migration is the movement of contaminants from the source of contamination to contact with human populations or the environment. A migration pathway is a potential path or route that contaminants take. Migration pathways include air, surface water, groundwater, and land surface. The existence and identification of all potential migration pathways must be considered during assessment and characterization of a waste site.

Mobility
The ability of a contaminant to move throughout the affected media or to other media, thereby spreading the contamination.

Monitoring Well
A monitoring well is a well drilled at a specific location on or off a hazardous waste site at which groundwater can be sampled at selected depths and studied to determine the direction of groundwater flow and the types and quantities of contaminants present in the groundwater.

National Contingency Plan (NCP)
The NCP, formally the National Oil and Hazardous Substances Contingency Plan, is the major regulatory framework that guides the Superfund response effort. The NCP is a comprehensive body of regulations that outlines a step-by-step process for implementing Superfund responses and defines the roles and responsibilities of USEPA, other federal agencies, states, private parties, and the communities in response to situations in which hazardous substances are released into the environment. *See also Superfund.*

National Priorities List (NPL)
The NPL is USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response under Superfund. Inclusion of a site on the list is based primarily on the score the site receives under the Hazard Ranking System. Money from Superfund can be used for cleanup only at sites that are on the NPL. USEPA is required to update the NPL at least once a year. *See also Superfund.*

New York State Department of Environmental Conservation (NYSDEC)
The state regulatory agency responsible for enforcing the rules and regulations of New York. Representatives from the headquarters in Albany and Region 8 are involved in the review and oversight of the environmental work being conducted at the Seneca Army Depot Activity.

Nickel
A very abundant element found primarily combined with oxygen or sulfur in the environment. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as catalysts for chemical reactions. Much of the nickel in the environment is found with soil and sediments because nickel attaches to particles that

contain iron or manganese, which are often present in soil and sediments. Nickel does not appear to collect in fish, plants, or animals used for food. *See also Heavy Metal.*

Nitrobenzene
An oily yellow liquid with an almond-like odor. Nitrobenzene may be pale yellow-brown in appearance. Nitrobenzene is produced in large quantities for industrial use. Approximately 98% of the nitrobenzene produced in the United States is used to manufacture a chemical known as aniline. Nitrobenzene is also used to produce lubricating oils. A very small amount of nitrobenzene is used in the manufacture of dyes, drugs, pesticides, and synthetic rubber.

4-Nitrotoluene
2-, 3- and 4-Nitrotoluenes are produced commercially, as a mixture, by nitration of toluene. 4-Nitrotoluene is used mainly to produce intermediates in the production of colourants. It is also used in much smaller quantities in the production of agricultural, pharmaceutical and rubber chemicals.

No Action
Determination made by USEPA following a preliminary assessment that a site does not pose a significant risk and so requires no further activity under CERCLA.

No Observable Adverse Effect Level (NOAEL)
An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered as adverse, or as precurors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects.

Non-Carcinogen
A substance, which produces systemic effects, or general effects, to the body of an organism. These effects are generally not cancer related.

Operable Unit (OU)
A grouping of sites into one larger entity. Sites can be grouped into an operable unit due to geographical proximity to each other, similar chemical hazards or for other reasons. The SEAD-4 and SEAD-38 sites are considered one operable unit for the purposes of remedial action.

Operation and Maintenance (O&M)
O&M refers to the activities conducted at a site, following remedial actions, to ensure that the cleanup methods are working properly. O&M activities are conducted to maintain the effectiveness of the remedy and to ensure that no new threat to human health or the environment arises. Under the Superfund program, the state or PRP assumes responsibility for O&M, which may include such activities as groundwater and air monitoring, inspection and maintenance of the treatment equipment remaining on-site, and maintenance of any security measures or institutional controls.

Organic Chemical or Compound
An organic chemical or compound is a substance produced by animals or plants that contains mainly carbon, hydrogen, and oxygen.

Overburden
The geologic material overlying bedrock.

Pesticide
A pesticide is a substance or mixture of substances intended to prevent or mitigate infestation by, or destroy or repel, any pest. Pesticides can accumulate in the food chain and or contaminate the environment if misused.

Polychlorinated Biphenyl (PCB)
PCBs are a group of toxic, persistent chemicals, produced by chlorination of biphenyl, that once were used in high voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes. Further sale or use of PCBs was banned in 1979. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor. For example, the name Aroclor 1254 means that the mixture contains approximately 54% chlorine by weight, as indicated by the second two digits in the name.

Polycyclic Aromatic Hydrocarbon (PAH)
A PAH is a chemical compound that contains more than one fused benzene ring. They are commonly found in petroleum fuels, coal products, and tar.

Pre-disposal conditions
Conditions present at a site before activities that caused the current environmental contamination took place.

Present Worth Cost
The equivalent future worth of money at the present time. By discounting all costs to a common base year, the costs for different remedial action alternatives can to be compared on the basis of a single figure for each alternative. This is a calculated value that requires the length of time that an activity would be performed and the interest rate. For example, the cost of the long-term operation and maintenance of a remedy is provided in terms of the present worth.

Proposed Plan
The first step in the remedy selection process. The Proposed Plan provides information supporting the decisions of how the preferred alternative was selected. It summarizes the RI and FS process and how the alternatives comply with the requirements of the NCP and CERCLA. The Proposed Plan is provided to the public for comment. The responses to the Proposed Plan comments are provided in the ROD.

Reasonable Maximum Exposure (RME)
The highest exposure that could reasonably be expected to occur for a given exposure pathway at a site. It is intended to account for both uncertainty in the contaminant concentration and variability in the exposure parameters.

Receptor
A human or animal, or group of humans or animals, that has the potential to be adversely affected by exposure to chemicals present in the environment.

Record of Decision (ROD)
A ROD is a legal, technical, and public document that explains which cleanup alternative will be used at a Superfund NPL site. The ROD is based on information and technical analysis generated during the remedial investigation and feasibility study and consideration of public comments and community concerns. *See also Remedial Investigation and Feasilbility Study.*

Reference Dose (RfD)
The reference dose is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime.

Release
A release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substance, as defined under RCRA. See also Resource Conservation and Recovery Act.

Remedial Action
The actual construction or implementation phase of a state Superfund site cleanup that follows remedial design. See also remedial design (RD).

Remedial Action Objectives (RAO)
Media specific objectives designed to be protective of human health and the environment.

Remedial Design (RD)
An engineering phase that follows remedial investigation/feasibility study and includes development of engineering drawings and specifications for site cleanup. See also remedial investigation (RI), and remedial action (RA).

Remedial Investigation (RI) and Feasibility Study (FS)
The RI and FS is the step in the Superfund cleanup process that is conducted to gather sufficient information to support the selection of a site remedy that will reduce or eliminate the risks associated with contamination at the site. The RI involves site characterization through collection of data and information necessary to characterize the nature and extent of contamination at the site. The RI also determines whether the contamination presents a significant risk to human health or the environment. The FS focuses on the development of specific response alternatives for addressing contamination at a site.

Resource Conservation and Recovery Act (RCRA)
RCRA is a federal law enacted in 1976 that established a regulatory system to track hazardous substances from their generation to their disposal. The law requires the use of safe and secure procedures in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

Screening-Level Ecological Risk Assessment (SLERA)
A screening risk assessment conducted to eliminate chemicals of concern (COCs) that do not pose an ecological risk and to calculate protective concentration levels (PCLs) for those COCs that do pose an unacceptable risk to selected ecological receptors.

Sediment Criteria
Technical guidance provided by NYSDEC, the Division of Fish and Wildlife, that describes allowable sediment quality for a variety of chemicals. The values provided in this document have been adopted as screening levels for comparison to site data. Exceedances of these values provide that basis for further evaluation and decision making.

Selenium
Selenium is a metal that accumulates in the environment.

Semivolatile Organic Compound (SVOC)
Organic compounds that volatilize slowly at standard temperature (20 degrees C and 1 atm pressure).

Seneca Army Depot Activity (SEDA)
An approximately 10,600-acre military facility, constructed in 1941, located in central New York, responsible for storage and management of military commodities, including munitions. The depot is undergoing closure and ceased military operations in 2000. Environmental cleanup activities will continue until all sites have been addressed.

Seneca County Industrial Development Agency (SCIDA)
A public benefit corporation created in 1973 by an act of the New York State Legislature. The agency's primary purpose is to promote private sector commercial and industrial development, and advance the job opportunities and economic welfare of the people of Seneca County. A 7-member board of directors governs the SCIDA. The Board is appointed by the Seneca County Board of Supervisors. Professional staff manages the day-to-day operations of the SCIDA.

Significant Threat
The term refers to the level of contamination that a state would consider significant enough to warrant an action. The thresholds vary from state to state.

Silver
A rare element but occurs naturally in the environment as a soft, "silver" colored metal It also occurs in powdery white (silver nitrate and silver chloride) or dark-gray to black compounds (silver sulfide and silver oxide). Silver could be found at hazardous waste sites in the form of these compounds mixed with soil and/or water.

Sodium
Sodium is a metal that accumulates in the environment.

Soil Boring
Soil boring is a process by which a soil sample is extracted from the ground for chemical, biological, and analytical testing to determine the level of contamination present.

Soil Erosion
The process by which soil wears away by the action of water, wind, or glacial ice.

Solid Waste Management Unit (SWMU)
A SWMU is a RCRA term used to describe a contiguous area of land on or in which a solid waste, including hazardous waste, was managed. This includes areas containing landfills, tanks, land treatment areas, and spills, or any areas where waste materials were handled. Identification of all SWMUs at SEDA was performed as part of the RCRA Part B Permit Application process.

Stabilization
Stabilization is the process of removing wastewater from a waste or changing it chemically to make the waste less permeable and susceptible to transport by water. Stabilization technologies can immobilize many heavy metals, certain radionuclides, and selected organic compounds, while decreasing the surface area and permeability of many types of sludge, contaminated soils, and solid wastes.

Stockpile
To place or store in a pile.

Subsurface
Underground; beneath the surface.

Subtitle D Landfill
A non-hazardous municipal solid waste landfill. See also *Landfill.*

Superfund
Superfund is the trust fund that provides for the cleanup of hazardous substances released into the environment, regardless of fault. The Superfund was established under CERCLA and subsequent amendments to CERCLA. The term Superfund also is used to refer to cleanup programs designed and conducted under CERCLA and its subsequent amendments. See also *Comprehensive Environmental Response, Compensation, and Liability Act.*

Surface Water
Surface water is all water naturally open to the atmosphere, such as rivers, lakes, reservoirs, streams, and seas.

Surface Water Standards - Class C
Standards and guidance values have been developed for specific classes of fresh and saline surface waters for protection of the best uses assigned to each class. In New York, Class C waters are defined as waters used for fishing. These waters should be suitable for fish propagation and survival and for primary and secondary contact recreation.

Technical Administrative Guidance Memorandum (TAGM)
TAGMs are technical guidance publications provided by NYSDEC that describe various processes and procedures recommended by NYSDEC for the investigation and remediation of hazardous waste sites. One TAGM, No. 4046, provides guideline values for soil cleanup limits at waste sites.

Thallium
A sparsely but widely distributed poisonous metallic element that resembles lead in physical properties and is used chiefly in the form of compounds in photoelectric cells or as a pesticide.

Threshold Criteria
Criteria against which a remedial alternative is evaluated to determine if it would be further considered as an option for a given site. Screening is performed by whether the alternative would pass or fail the threshold factor. The threshold factors are overall protection of human health and the environment and ARAR compliance.

Toluene
A clear, colorless liquid with a distinctive smell. Toluene is added to gasoline along with benzene and tolueneylene. Toluene occurs naturally in crude oil and in the tolu tree. It is produced in the process of making gasoline and other fuels from crude oil, in making coke from coal, and as a by-product in the manufacture of styrene. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

Topsoil
Surface soil usually including the organic layer in which plants have most of their roots.

Total Petroleum Hydrocarbons (TPH)
Measure of the concentration or mass of petroleum hydrocarbon constituents present in a given amount of soil or water. The word "total" is a misnomer--few, if any, of the procedures for quantifying hydrocarbons can measure all of them in a given sample. Volatile ones are usually lost in the process and not quantified and non-petroleum hydrocarbons sometimes appear in the analysis.

Toxicity Characteristic Leaching Procedure (TCLP)
The TCLP is a testing procedure used to identify the toxicity of wastes and is the most commonly used test for degree of mobilization offered by a solidification and stabilization process. Under this procedure, a waste is subjected to a process designed to model the leaching effects that would occur if the waste were disposed of in a RCRA Subtitle D municipal landfill. *See also Solidification and Stabilization.*

Toxicity Reference Value (TRV)
In the ecological risk assessment, toxicity reference value reflecting dietary NOAELs (the level of exposure at which no adverse effects have been demonstrated) were used for risk characterization.

Toxicity
Toxicity is a quantification of the degree of danger posed by a substance to animal or plant life.

Treatment, Storage, and Disposal Facility (TSDF)
Site where a hazardous substance is treated, stored, or disposed of. TSDFs are regulated by USEPA and states under RCRA.

United States Environmental Protection Agency (USEPA)
The federal regulatory agency responsible for enforcing the rules and regulations pertaining to the environment of the United States. Representatives from the USEPA Region 2, which includes New York State, are involved in the review and oversight of the environmental work being conducted at the Seneca Army Depot Activity.

Vanadium
A silvery-white, ductile metal resistant to corrosion; used in alloy steels and as an x-ray target.

Volatile Organic Compound (VOC)
A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. Examples of VOCs include trichloroethane, trichloroethylene, and BTEX. These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

Volume
The quantity of a contaminated media.

Wastewater
Wastewater is spent or used water from an individual home, a community, a farm, or an industry that contains dissolved or suspended matter.

Xylenes
There are three forms of xylene in which the methyl groups vary on the benzene ring: meta-xylene, ortho-xylene, and para-xylene (m-, o-, and p-xylene). The term total xylenes refers to all three isomers of xylene (m-, o-, and p-xylene). Mixed xylene is a mixture of the three isomers and usually also contains 6-15% ethylbenzene. Xylene is primarily a synthetic chemical. Chemical industries produce xylene from petroleum. Xylene also occurs naturally in petroleum and coal tar and is formed during forest fires, to a small extent. It is a colorless, flammable liquid with a sweet odor.

Zinc
Zinc is a heavy metal that accumulates in the environment. *See also Heavy Metal*

ARAR LIST

Potential Chemical-Specific ARARs and TBCs

There are currently no chemical specific ARARs for soil in the State of New York. Cleanup levels for chemical hazardous contaminants in soil have been developed by the State of New York as TAGMs under 3HWR-92-4045. The NYSDEC TAGM manual for cleanup levels for soils is #HWR-94-4046 and has been used as guidance for this remedial action. The soil concentrations provided in the TAGM 4046 are not promulgated standards, and therefore are not ARARs, but rather are TBC guidelines for SEDA.

Groundwater at the sites is classified by NYSDEC as Class GA. As a result, the groundwater quality standards for a Class GA groundwater are potential ARARs for the sites. In addition, the Drinking Water Maximum Contaminant Levels by the National Primary Drinking Water Regulations (USEPA, 2002) were identified as relevant and appropriate requirements.

Surface water at SEAD-4 is found in drainage ditches that surround the site. The surface water in these ditches has not been classified by NYSDEC since these ditches are not recognized as an established stream or creek. However, because the drainage ditches near SEAD-4 form the headwaters for Indian Creek or Silver Creek, the lower portion of which is designated as Class C surface water by NYSDEC, the Class C standards were used to provide a basis of comparison for the on-site surface water chemical data. The Class C standards are not strictly applicable to the surface water in the drainage ditches found on the sites and thus are treated as TBCs.

Sediment results were compared to the most conservative New York State guidelines for sediment, including: New York State lowest effect level (NYS LEL), New York State human health bioaccumulation criteria (NYS HHB), New York State benthic aquatic life acute and chronic toxicity criteria (NYS BALAT and NYS BALCT, respectively), and New York State wildlife bioaccumulation criteria (NYS WB). These sediment criteria are not ARARs, but rather TBCs because they are not promulgated standards.

Potential Federal Location-Specific ARARs

- Executive Orders 11593, Floodplain Management (May 24, 1977), and 11990, Protection of Wetlands (May 24, 1977).
- National Historic Preservation Act (16 USC 470) Section 106 and 110(f), and the associated regulations (*i.e.*, 36 CFR part 800) (requires Federal agencies to identify all affected properties on or eligible for the National Register of Historic Places and consult with the State Historic Preservation Office and Advisory Council on Historic Presentation).
- RCRA Location and 100-year Floodplains Requirements (40 CFR 264.18(b)).
- Clean Water Act, section 404, and Rivers and Harbor Act, section 10 (requirements for dredge and fill activities) and the associated regulations (*i.e.*, (40 CFR part 230).
- Wetlands Construction and Management Procedures (40 CFR part 6, Appendix A).
- Fish and Wildlife Coordination Act of 1934 (16 USC 661).
- Wilderness Act of 1964 (16 USC 1131 - 1136).

Potential New York Location-Specific ARARs

- New York State Freshwater Wetlands Law (New York Environmental Conservation Law (ECL) articles 24 and 71).
- New York State Freshwater Wetlands Permit and Classification Requirements (6 NYCRR 663 and 664).
- New York State Floodplain Management Act, ECL, article 36, and Floodplain Management regulations (6 NYCRR part 500).
- New York State Inactive Hazardous Waste Disposal Sites—Remedy Selection (6 NYCRR 375.10(b)("goal of the program for a specific site is to restore that site to pre-disposal conditions, to the extent feasible and authorized by law.").
- New York State Flood Hazard Area Construction Standards.

Potential Federal Action-Specific ARARs

- RCRA subtitle C, Hazardous Waste Treatment Facility Design and Operating Standards for Treatment and Disposal systems, (*i.e.*, landfill, incinerators, tanks, containers, etc.) (*i.e.*, 40 CFR part 264); RCRA section 3004(o), 42 USC 6924(o) (RCRA statutory minimum technology requirements.)
- RCRA, Closure and Post-Closure Standards (40 CFR 264, subpart G).
- RCRA Groundwater Monitoring and Protection Standards (40 CFR 264.92 and 264.97 – 264.99).
- RCRA Generator Requirements for Manifesting Waste for Off-site Disposal (40 CFR part 262, subpart B).
- RCRA Transporter Requirements for Off-Site Disposal (40 CFR part 263).
- RCRA, Subtitle D, Non-Hazardous Waste Management Standards (40 CFR part 257).
- RCRA Land Disposal Restrictions (40 CFR part 268) (on and off-site disposal of excavated soil).
- CWA--NPDES Permitting Requirements for Discharge of Treatment System Effluent (40 CFR parts 122-125).
- CWA--Effluent Guidelines for Organic Chemicals, Plastics and Synthetic Fibers (discharge limits) (40 CFR part 414).
- CWA--Discharge to POTW—general Pretreatment regulations (40 CFR part 403).

- DOT Rules for Hazardous Materials Transport (49 CFR part 107, and 171.1-171.500).
- OSHA Standards for Hazardous Waste Operations and Emergency Response, 29 CFR 1910.120, and procedures for General Construction Activities (29 CFR parts 1910 and 1926).
- RCRA Air Emission Standards for Process Vents, Equipment Leaks, and Tanks, Surface Impoundments, and Containers (40 CFR part 264, subparts AA, BB, and CC.)

Potential New York Action-Specific ARARs

- New York State Pollution Discharge Elimination System (SPDES) Permit Requirements (Standards for Stormwater Runoff, Surface Water, and Groundwater Discharges (6 NYCRR 750-757)).
- New York State Hazardous Waste Regulations—identification, generators, transportation, treatment/storage/disposal, land disposal restrictions, and minimum technology requirements (6 NYCRR 370-376)
- New York State Solid Waste Management and Siting Restrictions (6 NYCRR 360-361).
- New York State Hazardous Waste Generator and Transporter Requirements for Manifesting Waste for Off-Site Disposal (6 NYCRR 364 and 372).
- New York State Inactive Hazardous Waste Disposal Sites—Remedy Selection (6 NYCRR 375.10(b)("At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by hazardous waste disposed at the site through the proper application of scientific and engineering principles.").
- New York State Inactive Hazardous Waste Disposal Sites--Interim Remedial Measures (IRMs) (6 NYCRR 375-1.3(n) and 375.1.11)

REFERENCES

New York State Department of Environmental Conservation (NYSDEC). 2006. Superfund and Brownfield Law and Regulation 6 NYCRR Part 375 Subpart 375-1 – General Remedial Program Requirements. June.

New York State Department of Environmental Conservation (NYSDEC). 1998 with updates. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Division of Water Technical and Operational Guidance Series 1.1.1.

New York State Department of Environmental Conservation (NYSDEC). 1994. Technical and Administrative Guidance Memorandum (TAGM): Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites, October 1994.

New York State Department of Environmental Conservation (NYSDEC). 1993 with 1998 and 1999 updates. Technical Guidance for Screening Contaminated Sediments.

Parsons. 2005. Final Feasibility Study at the Munitions Washout Facility (SEAD-4). March.

Parsons. 2004a. Sensitivity Analysis: Cost Effectiveness of Excavation to Meet TAGMs at Depth at SEAD-4, Seneca Army Depot Activity. October.

Parsons. 2004b. Sensitivity Analysis: Soil Removal at SEAD-4, Seneca Army Depot Activity. September.

Parsons. 2002a Final Remedial Investigation Report at the Munitions Washout Facility (SEAD-4). January.

Parsons. 2002b Final Action Memorandum and Decision Document, Time-Critical Removal Actions, Three VOC SITES (SEADs 38, 39, & 40). August.

Parsons. 1995. Final Expanded Site Inspection, Seven High Priority SWMU's, SEAD 4, 16, 17, 24, 25, 26, and 45. December.

Parsons. 1994. Final SWMU Classification Report.

Parsons. 1993. Work Plan for CERCLA Expanded Site Inspection (ESI) of Ten Solid Waste Management Units (SWMUs). January.

United States Environmental Protection Agency (USEPA). 2003. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. January.

United States Environmental Protection Agency (USEPA). 2002. List of Drinking Water Contaminants & MCLs. EPA816-F-02-013. July.

United States Environmental Protection Agency (USEPA). 1997. Ecological Risk Assessment Guidance for Superfund. EPA 540-R-97-006. June.

United States Environmental Protection Agency (USEPA). 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Office of Solid Waste and Emergency Response. OSWER Directive #9355.4-12. August.

TABLE 1
CLEANUP GOALS FOR SEAD-4 AND SEAD-38 SOIL, DITCH SOIL, AND SEDIMENT FOR INDUSTRIAL USE
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

Compounds	Soil Cleanup Goal [1] (mg/kg)	Drainage Ditch and Man-Made Lagoon Cleanup Goal [1] (mg/kg)	Cleanup Goal for Drainage Ditch Hot Spot SD4-28 [2] (mg/kg)
Chromium (total)	60	60	--
Lead	167	--	--
Vanadium	--	--	150

Notes:
1. Cleanup goals for soil, ditch soil, and sediment are applicable to the top 4 feet of soil, ditch soil, and sediment as the deeper material is not considered accessible by ecological receptors.
The cleanup goals were selected based on a sensitivity analysis presented in a letter submitted by Parsons in October 15, 2004.
The sensitivity analysis and the cleanup goals were approved by the USEPA and NYSDEC.
2. NYSDEC TAGM value for vanadium was used as the cleanup goal for the drainage ditch hot spot located around sample location SD4-28.
This cleanup goal is protective of human health and will result the concentrations at the site consistent with Seneca site-wide background.

Table 2A
Summary Statistics for SEAD-4/38 Building Debris Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNITS	MAXIMUM	FREQUENCY OF DETECTION	NUMBER OF DETECTS	NUMBER OF ANALYSES
Volatile Organic Compounds					
Acetone	UG/KG	40	100%	6	6
Semivolatile Organic Compounds					
2,4-Dinitrotoluene	UG/KG	360	33%	2	6
2-Methylnaphthalene	UG/KG	1500	33%	2	6
Acenaphthene	UG/KG	1400	67%	4	6
Anthracene	UG/KG	690	83%	5	6
Benzo(a)anthracene	UG/KG	5200	83%	5	6
Benzo(a)pyrene	UG/KG	8500	100%	6	6
Benzo(b)fluoranthene	UG/KG	11000	100%	6	6
Benzo(ghi)perylene	UG/KG	8700	100%	6	6
Benzo(k)fluoranthene	UG/KG	8300	50%	3	6
Bis(2-Ethylhexyl)phthalate	UG/KG	890000	100%	6	6
Butylbenzylphthalate	UG/KG	1600	50%	3	6
Carbazole	UG/KG	5800	67%	4	6
Chrysene	UG/KG	13000	100%	6	6
Di-n-butylphthalate	UG/KG	32000	100%	6	6
Dibenz(a,h)anthracene	UG/KG	3000	67%	4	6
Dibenzofuran	UG/KG	1500	33%	2	6
Diethyl phthalate	UG/KG	130	33%	2	6
Fluoranthene	UG/KG	25000	100%	6	6
Fluorene	UG/KG	760	50%	3	6
Indeno(1,2,3-cd)pyrene	UG/KG	7500	83%	5	6
N-Nitrosodiphenylamine	UG/KG	66	17%	1	6
Naphthalene	UG/KG	1300	50%	3	6
Pentachlorophenol	UG/KG	4900	33%	2	6
Phenanthrene	UG/KG	23000	100%	6	6
Pyrene	UG/KG	25000	100%	6	6
Explosives					
1,3-Dinitrobenzene	UG/KG	180	33%	2	6
2,4,6-Trinitrotoluene	UG/KG	260	17%	1	6
2,4-Dinitrotoluene	UG/KG	1900	50%	3	6
2-amino-4,6-Dinitrotoluene	UG/KG	320	33%	2	6
4-amino-2,6-Dinitrotoluene	UG/KG	300	17%	1	6
RDX	UG/KG	200	17%	1	6
Tetryl	UG/KG	820	17%	1	6

Table 2A
Summary Statistics for SEAD-4/38 Building Debris Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNITS	MAXIMUM	FREQUENCY OF DETECTION	NUMBER OF DETECTS	NUMBER OF ANALYSES
Pesticides/PCBs					
4,4'-DDD	UG/KG	35	67%	4	6
4,4'-DDE	UG/KG	1200	100%	6	6
4,4'-DDT	UG/KG	5600	100%	6	6
Alpha-Chlordane	UG/KG	780	67%	4	6
Aroclor-1254	UG/KG	91000	83%	5	6
Aroclor-1260	UG/KG	3100	67%	4	6
Beta-BHC	UG/KG	31	17%	1	6
Dieldrin	UG/KG	1100	83%	5	6
Endosulfan I	UG/KG	160	33%	2	6
Endosulfan II	UG/KG	30	33%	2	6
Endosulfan sulfate	UG/KG	200	33%	2	6
Endrin	UG/KG	320	50%	3	6
Endrin aldehyde	UG/KG	390	83%	5	6
Endrin ketone	UG/KG	370	50%	3	6
Gamma-Chlordane	UG/KG	95	83%	5	6
Heptachlor	UG/KG	34	17%	1	6
Heptachlor epoxide	UG/KG	360	83%	5	6
Methoxychlor	UG/KG	390	50%	3	6
Metals					
Aluminum	MG/KG	6110	100%	6	6
Antimony	MG/KG	26.1	100%	6	6
Arsenic	MG/KG	33.6	100%	6	6
Barium	MG/KG	3560	100%	6	6
Beryllium	MG/KG	0.46	33%	2	6
Cadmium	MG/KG	132	83%	5	6
Calcium	MG/KG	253000	100%	6	6
Chromium	MG/KG	1840	100%	6	6
Cobalt	MG/KG	37.1	100%	6	6
Copper	MG/KG	1220	100%	6	6
Cyanide	MG/KG	28.7	67%	4	6
Iron	MG/KG	362000	100%	6	6
Lead	MG/KG	12000	100%	6	6
Magnesium	MG/KG	17600	100%	6	6
Manganese	MG/KG	1630	100%	6	6
Mercury	MG/KG	62.8	100%	6	6
Nickel	MG/KG	1330	100%	6	6
Potassium	MG/KG	3750	100%	6	6
Silver	MG/KG	0.57	100%	6	6
Sodium	MG/KG	1530	100%	6	6
Thallium	MG/KG	7	83%	5	6
Vanadium	MG/KG	948	100%	6	6
Zinc	MG/KG	6100	100%	6	6

Note:
This table presents results for analytes that were detected at least once in the building debris samples.

TABLE 2B
SEAD-38 SURFACE AND SUBSURFACE SOIL TPH ANALYSIS RESULTS
PROPOSED PLAN FOR SEAD-4 AND SEAD-38
SENECA ARMY DEPOT ACTIVITY

Analyte	Matrix Location Depth (ft) Date Sample ID Laboratory ID Units	Maximum Result	NYSDEC TAGM #4046 Value [1]	Number Above TAGM #4046 Value	Soil SEAD-38 0-0.2 12/17/1993 SS38-1 207135	Soil SEAD-38 0-0.2 12/17/1993 SS38-2 207136	Soil SEAD-38 0-0.2 12/17/1993 SS38-3 207137	Soil SEAD-38 0-0.2 12/17/1993 SS38-4 207138	Soil SEAD-38 2-4 1/9/1994 SB38-1 208176
Total Petroleum Hydrocarbons	mg/Kg	1940	NA	NA	1840	104	1940	110	85
pH	standard units	8.93	NA	NA	7.36	7.46	7.47	7.4	8.93
Total Solids	% W/W	88.8	NA	NA	60.2	79.8	80.1	86	88.8

Note:
1. The New York State Department of Environmental Conservation's Technical and Administrative Guidance Memorandum HWR-94-4046 (or TAGM #4046) does not contain guidance values for these analyses.
NA = Not Applicable

Table 2C
Summary Statistics for SEAD-4 /38 Surface Soil Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNITS	MAXIMUM	FREQUENCY OF DETECTION	NYSDEC TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Volatile Organic Compounds							
1,1-Dichloroethane	UG/KG	2	2%	200	0	2	86
1,2-Dichloroethene (total)	UG/KG	4	3%		0	3	86
Acetone	UG/KG	140	31%	200	0	27	86
Benzene	UG/KG	1	1%	60	0	1	86
Methyl butyl ketone	UG/KG	9	1%		0	1	86
Methylene chloride	UG/KG	3	1%	100	0	1	86
Toluene	UG/KG	14	29%	1500	0	25	86
Trichloroethene	UG/KG	3	3%	700	0	3	86
Semivolatile Organic Compounds							
2-Methylnaphthalene	UG/KG	35	16%	36400	0	14	86
Acenaphthene	UG/KG	78	9%	50000	0	8	86
Acenaphthylene	UG/KG	32	9%	41000	0	8	86
Anthracene	UG/KG	110	17%	50000	0	15	86
Benzo(a)anthracene	UG/KG	560	83%	224	5	71	86
Benzo(a)pyrene	UG/KG	450	80%	61	11	69	86
Benzo(b)fluoranthene	UG/KG	890	80%	1100	0	69	86
Benzo(ghi)perylene	UG/KG	310	55%	50000	0	47	86
Benzo(k)fluoranthene	UG/KG	510	50%	1100	0	43	86
Bis(2-Ethylhexyl)phthalate	UG/KG	13000	59%	50000	0	51	86
Butylbenzylphthalate	UG/KG	12000	12%	50000	0	10	86
Carbazole	UG/KG	120	22%		0	19	86
Chrysene	UG/KG	570	86%	400	4	74	86
Di-n-butylphthalate	UG/KG	220	44%	8100	0	38	86
Di-n-octylphthalate	UG/KG	44	8%	50000	0	7	86
Dibenz(a,h)anthracene	UG/KG	130	22%	14	12	19	86
Dibenzofuran	UG/KG	58	16%	6200	0	14	86
Diethyl phthalate	UG/KG	22	16%	7100	0	14	86
Fluoranthene	UG/KG	1100	93%	50000	0	80	86
Fluorene	UG/KG	74	6%	50000	0	5	86
Indeno(1,2,3-cd)pyrene	UG/KG	320	53%	3200	0	46	86
N-Nitrosodiphenylamine	UG/KG	19	1%		0	1	86
Naphthalene	UG/KG	74	13%	13000	0	11	86
Phenanthrene	UG/KG	640	87%	50000	0	75	86
Phenol	UG/KG	17	2%	30	0	2	86
Pyrene	UG/KG	990	88%	50000	0	76	86
Explosives							
1,3,5-Trinitrobenzene	UG/KG	120	1%		0	1	86
2,4,6-Trinitrotoluene	UG/KG	72	1%		0	1	86
2,4-Dinitrotoluene	UG/KG	330	2%		0	2	86
2-amino-4,6-Dinitrotoluene	UG/KG	90	1%		0	1	86
4-Nitrotoluene	UG/KG	390	1%		0	1	79

Table 2C
Summary Statistics for SEAD-4 /38 Surface Soil Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNITS	MAXIMUM	FREQUENCY OF DETECTION	NYSDEC TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Pesticides/PCBs							
4,4'-DDD	UG/KG	190	23%	2900	0	20	86
4,4'-DDE	UG/KG	160	31%	2100	0	27	86
4,4'-DDT	UG/KG	760	34%	2100	0	29	86
Aldrin	UG/KG	2.2	1%	41	0	1	86
Alpha-BHC	UG/KG	2.4	6%	110	0	5	86
Alpha-Chlordane	UG/KG	4.9	9%		0	8	86
Total PCBs	UG/KG	360	27%	1000	0	23	86
Aroclor-1254	UG/KG	310	26%	10000	0	22	86
Aroclor-1260	UG/KG	110	3%	10000	0	3	86
Beta-BHC	UG/KG	7.6	12%	200	0	10	86
Dieldrin	UG/KG	7.4	6%	44	0	5	86
Endosulfan I	UG/KG	1.7	5%	900	0	4	86
Endosulfan II	UG/KG	5.2	3%	900	0	3	86
Endosulfan sulfate	UG/KG	3.8	1%	1000	0	1	86
Endrin	UG/KG	27	3%	100	0	3	86
Endrin aldehyde	UG/KG	20	12%		0	10	86
Endrin ketone	UG/KG	4.2	3%		0	3	86
Gamma-Chlordane	UG/KG	7.4	9%	540	0	8	86
Heptachlor	UG/KG	4.2	3%	100	0	3	86
Heptachlor epoxide	UG/KG	3.6	5%	20	0	4	86
Metals							
Aluminum	MG/KG	18800	100%	19300 *	0	86	86
Antimony	MG/KG	148	74%	5.9 *	16	34	46
Arsenic	MG/KG	14.6	100%	8.2 *	5	86	86
Barium	MG/KG	278	100%	300	0	86	86
Beryllium	MG/KG	1.8	100%	1.1 *	1	86	86
Cadmium	MG/KG	2.3	13%	2.3 *	1	11	86
Calcium	MG/KG	196000	100%	121000 *	4	86	86
Chromium	MG/KG	18600	100%	29.6 *	39	86	86
Chromium, Hexavalent	MG/KG	14.7	27%		0	4	15
Cobalt	MG/KG	19.9	100%	30	0	86	86
Copper	MG/KG	7330	100%	33 *	30	86	86
Cyanide	MG/KG	0.87	2%	0.35	2	2	86
Iron	MG/KG	64600	100%	36500 *	2	86	86
Lead	MG/KG	11200	100%	24.8 *	36	79	79
Magnesium	MG/KG	35300	100%	21500 *	1	86	86
Manganese	MG/KG	1540	100%	1060 *	4	86	86
Mercury	MG/KG	1.2	52%	0.1	16	45	86
Nickel	MG/KG	228	100%	49 *	1	86	86
Potassium	MG/KG	2340	100%	2380 *	0	86	86
Selenium	MG/KG	3.4	23%	2	1	20	86
Silver	MG/KG	1.7	6%	0.75 *	1	5	86
Sodium	MG/KG	1270	34%	172 *	3	29	86
Thallium	MG/KG	5.4	22%	0.7 *	17	19	85
Vanadium	MG/KG	1250	100%	150	1	86	86
Zinc	MG/KG	2020	100%	110 *	29	86	86
Others							
Nitrate/Nitrite	MG/KG	8.06	100%			63	63

Notes:
This table presents results for analytes that were detected at least once in the surface soil (0-6 inches bgs.) samples.
'* The soil criteria for these inorganics are 95th percentile site background values.

Table 2D
Summary Statistics for SEAD-4 /38 Subsurface Soil Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Volatile Organic Compounds							
Acetone	UG/KG	31	9%	200	0	7	76
Chloroform	UG/KG	15	8%	300	0	6	76
Ethyl benzene	UG/KG	1	1%	5500	0	1	76
Methylene chloride	UG/KG	2	3%	100	0	2	76
Toluene	UG/KG	13	28%	1500	0	21	76
Total Xylenes	UG/KG	8	4%	1200	0	3	76
Semivolatile Organic Compounds							
2-Methylnaphthalene	UG/KG	260	4%	36400	0	3	76
Acenaphthene	UG/KG	88	3%	50000	0	2	76
Acenaphthylene	UG/KG	170	4%	41000	0	3	76
Anthracene	UG/KG	340	4%	50000	0	3	76
Benzo(a)anthracene	UG/KG	1100	7%	224	2	5	76
Benzo(a)pyrene	UG/KG	880	8%	61	2	6	76
Benzo(b)fluoranthene	UG/KG	730	9%	1100	0	7	76
Benzo(ghi)perylene	UG/KG	270	3%	50000	0	2	76
Benzo(k)fluoranthene	UG/KG	890	5%	1100	0	4	76
Bis(2-Ethylhexyl)phthalate	UG/KG	2000	11%	50000	0	8	76
Butylbenzylphthalate	UG/KG	120	1%	50000	0	1	76
Carbazole	UG/KG	160	1%		0	1	76
Chrysene	UG/KG	1000	11%	400	2	8	76
Di-n-butylphthalate	UG/KG	63	24%	8100	0	18	76
Di-n-octylphthalate	UG/KG	37	21%	50000	0	16	76
Dibenz(a,h)anthracene	UG/KG	48	1%	14	1	1	76
Dibenzofuran	UG/KG	33	1%	6200	0	1	76
Fluoranthene	UG/KG	2400	11%	50000	0	8	76
Fluorene	UG/KG	330	4%	50000	0	3	76
Indeno(1,2,3-cd)pyrene	UG/KG	260	3%	3200	0	2	76
Naphthalene	UG/KG	130	3%	13000	0	2	76
Phenanthrene	UG/KG	1400	8%	50000	0	6	76
Pyrene	UG/KG	1800	9%	50000	0	7	76
Nitroaromatics							
Tetryl	UG/KG	67	1%		0	1	76

Table 2D
Summary Statistics for SEAD-4 /38 Subsurface Soil Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Pesticides/PCBs							
4,4'-DDE	UG/KG	21	4%	2100	0	3	76
4,4'-DDT	UG/KG	2.9	1%	2100	0	1	76
Aldrin	UG/KG	8.2	1%	41	0	1	76
Alpha-Chlordane	UG/KG	10	1%		0	1	76
Total PCBs	UG/KG	1600	7%	10000	0	5	76
Aroclor-1248	UG/KG	27	1%		0	1	76
Aroclor-1254	UG/KG	1600	5%	10000	0	4	76
Beta-BHC	UG/KG	1.4	1%	200	0	1	76
Delta-BHC	UG/KG	5.9	1%	300	0	1	76
Endosulfan I	UG/KG	11	1%	900	0	1	76
Endrin	UG/KG	34	1%	100	0	1	76
Endrin aldehyde	UG/KG	3.7	1%		0	1	76
Herbicides							
Dicamba	UG/KG	23	3%		0	1	39
Metals							
Aluminum	MG/KG	21000	100%	19300 *	4	76	76
Antimony	MG/KG	57.8	30%	5.9 *	10	21	69
Arsenic	MG/KG	21.5	100%	8.2 *	4	76	76
Barium	MG/KG	133	100%	300	0	76	76
Beryllium	MG/KG	1	99%	1.1 *	0	75	76
Cadmium	MG/KG	1.5	4%	2.3 *	0	3	71
Calcium	MG/KG	102000	100%	121000 *	0	76	76
Chromium	MG/KG	3820	100%	29.6 *	17	61	61
Cobalt	MG/KG	29.1	100%	30	0	76	76
Copper	MG/KG	2250	100%	33 *	14	76	76
Iron	MG/KG	40900	100%	36500 *	7	76	76
Lead	MG/KG	251	100%	24.8 *	6	76	76
Magnesium	MG/KG	32000	100%	21500 *	3	76	76
Manganese	MG/KG	2100	100%	1060 *	5	59	59
Mercury	MG/KG	0.12	45%	0.1	1	34	76
Nickel	MG/KG	62.3	100%	49 *	9	76	76
Potassium	MG/KG	2490	100%	2380 *	2	76	76
Selenium	MG/KG	0.86	33%	2	0	25	76
Silver	MG/KG	1.2	8%	0.75 *	4	6	76
Sodium	MG/KG	134	61%	172 *	0	46	76
Vanadium	MG/KG	31	100%	150	0	76	76
Zinc	MG/KG	1010	100%	110 *	14	76	76
Others							
Nitrate/Nitrite	MG/KG	2.7	100%			37	37

Notes:
The table presents results for analytes that were detected at least once in the subsurface soil (>6 inches bgs.) samples.
'* The soil criteria for these inorganics are 95th percentile site background values.

Table 2E
Summary Statistics for SEAD-4/38 2004 Test Pit Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Semivolatile Organic Compounds							
1,1'-Biphenyl	UG/KG	530	100%		0	1	1
2-Methylnaphthalene	UG/KG	5800	100%	36400	0	1	1
Anthracene	UG/KG	160	100%	50000	0	1	1
Benzo(a)anthracene	UG/KG	940	100%	224	1	1	1
Benzo(a)pyrene	UG/KG	980	100%	61	1	1	1
Benzo(b)fluoranthene	UG/KG	2000	100%	1100	1	1	1
Benzo(ghi)perylene	UG/KG	450	100%	50000	0	1	1
Benzo(k)fluoranthene	UG/KG	560	100%	1100	0	1	1
Carbazole	UG/KG	200	100%		0	1	1
Chrysene	UG/KG	1300	100%	400	1	1	1
Dibenz(a,h)anthracene	UG/KG	87	100%	14	1	1	1
Dibenzofuran	UG/KG	1100	100%	6200	0	1	1
Fluoranthene	UG/KG	1200	100%	50000	0	1	1
Fluorene	UG/KG	150	100%	50000	0	1	1
Indeno(1,2,3-cd)pyrene	UG/KG	740	100%	3200	0	1	1
Naphthalene	UG/KG	5500	100%	13000	0	1	1
Phenanthrene	UG/KG	1500	100%	50000	0	1	1
Pyrene	UG/KG	940	100%	50000	0	1	1
Metals							
Aluminum	MG/KG	8780	100%	19300	0	1	1
Antimony	MG/KG	1.2	100%	5.9	0	1	1
Arsenic	MG/KG	3.2	100%	8.2	0	1	1
Barium	MG/KG	67.1	100%	300	0	1	1
Beryllium	MG/KG	0.71	100%	1.1	0	1	1
Calcium	MG/KG	5190	100%	121000	0	1	1
Chromium	MG/KG	15.7	100%	29.6	0	1	1
Cobalt	MG/KG	7.3	100%	30	0	1	1
Copper	MG/KG	12.4	100%	33	0	1	1
Iron	MG/KG	15900	100%	36500	0	1	1
Lead	MG/KG	18.3	100%	24.8	0	1	1
Magnesium	MG/KG	3410	100%	21500	0	1	1
Manganese	MG/KG	350	100%	1060	0	1	1
Nickel	MG/KG	20.7	100%	49	0	1	1
Potassium	MG/KG	646	100%	2380	0	1	1
Vanadium	MG/KG	18.8	100%	150	0	1	1
Zinc	MG/KG	51.6	100%	110	0	1	1

Notes:
This table presents results for analytes that were detected at least once in the 2004 test pit samples.
* The soil criteria for these inorganics are 95th percentile SEDA site background values.

Table 2F
Summary Statistics for SEAD-4/38 Ditch Soil Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	MAX	FREQUENCY	NYSDEC TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Volatiles Organic Compounds							
Acetone	UG/KG	180	24%	200	0	12	50
Carbon disulfide	UG/KG	18	6%	2700	0	3	50
Chloroform	UG/KG	14	4%	300	0	2	50
Methylene chloride	UG/KG	11	6%	100	0	3	50
Styrene	UG/KG	3	4%		0	2	48
Toluene	UG/KG	42	10%	1500	0	5	50
Total Xylenes	UG/KG	7	4%	1200	0	2	48
Semivolatile Organic Compounds							
1,4-Dichlorobenzene	UG/KG	73	2%	8500	0	1	50
2-Methylnaphthalene	UG/KG	31	8%	36400	0	4	50
4-Methylphenol	UG/KG	23	10%	900	0	5	50
Acenaphthene	UG/KG	610	16%	50000	0	8	50
Acenaphthylene	UG/KG	130	16%	41000	0	8	50
Anthracene	UG/KG	1700	44%	50000	0	22	50
Benzo(a)anthracene	UG/KG	5900	88%	224	11	44	50
Benzo(a)pyrene	UG/KG	5100	88%	61	19	44	50
Benzo(b)fluoranthene	UG/KG	4800	92%	1100	3	46	50
Benzo(ghi)perylene	UG/KG	3200	80%	50000	0	40	50
Benzo(k)fluoranthene	UG/KG	5700	67%	1100	2	20	30
Bis(2-Ethylhexyl)phthalate	UG/KG	42000	46%	50000	0	23	50
Butylbenzylphthalate	UG/KG	16	10%	50000	0	5	50
Carbazole	UG/KG	500	36%		0	18	50
Chrysene	UG/KG	6200	94%	400	8	47	50
Di-n-butylphthalate	UG/KG	250	52%	8100	0	26	50
Di-n-octylphthalate	UG/KG	12	4%	50000	0	2	50
Dibenz(a,h)anthracene	UG/KG	1200	52%	14	17	26	50
Dibenzofuran	UG/KG	230	18%	6200	0	9	50
Diethyl phthalate	UG/KG	17	4%	7100	0	2	50
Fluoranthene	UG/KG	16000	96%	50000	0	48	50
Fluorene	UG/KG	660	18%	50000	0	9	50
Hexachlorobenzene	UG/KG	840	4%	410	1	2	50
Indeno(1,2,3-cd)pyrene	UG/KG	3100	76%	3200	0	38	50
N-Nitrosodiphenylamine	UG/KG	760	2%		0	1	50
Naphthalene	UG/KG	13	12%	13000	0	6	50
Phenanthrene	UG/KG	7900	92%	50000	0	46	50
Phenol	UG/KG	210	8%	30	4	4	50
Pyrene	UG/KG	12000	96%	50000	0	48	50
Nitroaromatics							
2-Nitrotoluene	UG/KG	450	2%		0	1	44
2-amino-4,6-Dinitrotoluene	UG/KG	200	2%		0	1	50

Table 2F
Summary Statistics for SEAD-4/38 Ditch Soil Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	MAX	FREQUENCY	NYSDEC TAGM	NUMBER ABOVE TAGM	NUMBER OF DETECTS	NUMBER OF ANALYSES
Pesticides/PCBs							
4,4'-DDD	UG/KG	90	26%	2900	0	13	50
4,4'-DDE	UG/KG	86	36%	2100	0	18	50
4,4'-DDT	UG/KG	45	32%	2100	0	16	50
Aldrin	UG/KG	2.8	6%	41	0	3	50
Alpha-Chlordane	UG/KG	44	16%		0	8	50
Aroclor-1254	UG/KG	580	48%	10000	0	24	50
Aroclor-1260	UG/KG	250	18%	10000	0	9	50
Beta-BHC	UG/KG	3.3	8%	200	0	4	50
Dieldrin	UG/KG	18	8%	44	0	4	50
Endosulfan I	UG/KG	1.9	2%	900	0	1	50
Endosulfan II	UG/KG	6.8	4%	900	0	2	50
Endosulfan sulfate	UG/KG	12	8%	1000	0	4	50
Endrin aldehyde	UG/KG	15	10%		0	5	50
Endrin ketone	UG/KG	62	6%		0	3	50
Gamma-Chlordane	UG/KG	40	20%	540	0	10	50
Heptachlor	UG/KG	2.4	2%	100	0	1	50
Heptachlor epoxide	UG/KG	10	12%	20	0	6	50
Methoxychlor	UG/KG	68	4%		0	2	50
Metals							
Aluminum	MG/KG	22100	100%	19300	3	50	50
Antimony	MG/KG	82.7	68%	5.9	14	27	40
Arsenic	MG/KG	37.7	98%	8.2	8	49	50
Barium	MG/KG	488	100%	300	3	50	50
Beryllium	MG/KG	1.1	100%	1.1	2	50	50
Cadmium	MG/KG	34.1	54%	2.3	13	27	50
Calcium	MG/KG	140000	100%	121000	3	50	50
Chromium	MG/KG	4800	100%	29.6	22	50	50
Cobalt	MG/KG	28.4	100%	30	0	50	50
Copper	MG/KG	988	100%	33	32	50	50
Iron	MG/KG	87900	100%	36500	8	50	50
Lead	MG/KG	374	100%	24.8	39	47	47
Magnesium	MG/KG	27900	100%	21500	1	50	50
Manganese	MG/KG	5480	100%	1060	10	50	50
Mercury	MG/KG	2.4	60%	0.1	21	30	50
Nickel	MG/KG	453	100%	49	13	50	50
Potassium	MG/KG	3460	100%	2380	9	50	50
Selenium	MG/KG	6.1	48%	2	7	24	50
Silver	MG/KG	1.7	50%	0.75	10	25	50
Sodium	MG/KG	1370	68%	172	15	34	50
Vanadium	MG/KG	1140	100%	150	1	50	50
Zinc	MG/KG	1150	100%	110	39	50	50

Notes:
The soil criteria for the inorganics are the 95th percentile site background values or the TAGMs.
Four samples collected from Indian Creek outside SEAD-4 (SD4-49 through 52) were not included.
This table presents results for analytes that were detected at least once in the ditch soil samples.

Table 2G
Summary Statistics for SEAD-4/38 Groundwater Samples Collected in 1994
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	NUMBER OF ANALYSES	NUMBER OF DETECTS	FREQUENCY OF DETECTION	SEAD-4/38 MAXIMUM	COMPARISON TO SENECA BACKGROUND		COMPARISON TO ARAR & TBC VALUES		
						SENECA BACKGROUND MAXIMUM	NUMBER ABOVE SENECA MAXIMUM	GROUNDWATER CRITERIA	CRITERIA SOURCE	NUMBER ABOVE CRITERIA
Semivolatile Organic Compounds										
Diethylphthalate	UG/L	5	3	60%	0.9					
Metals										
Aluminum	UG/L	5	4	80%	1240	42400	0	50	EPA SEC MCL	4
Antimony	UG/L	5	2	40%	39.3	52.7	0	3	NYS GA	2
Arsenic	UG/L	5	2	40%	2.2	10	0	10	EPA MCL	0
Barium	UG/L	5	5	100%	46.7	337	0	1000	NYS GA	0
Beryllium	UG/L	5	1	20%	6.3	2.2	1	4	EPA MCL	1
Cadmium	UG/L	5	1	20%	5.6	1.45	1	5	NYS GA, EPA MCL	1
Calcium	UG/L	5	5	100%	147000	181000	0			
Chromium	UG/L	5	2	40%	21.3	69.4	0	50	NYS GA	0
Cobalt	UG/L	5	3	60%	8.2	34.6	0			
Copper	UG/L	5	2	40%	37.6	32.5	1	200	NYS GA	0
Iron	UG/L	5	5	100%	2270	69400	0	300	NYS GA	4
Lead	UG/L	5	3	60%	2.2	34.8	0	15	EPA MCL	0
Magnesium	UG/L	5	5	100%	57600	58200	0	35000	NYS GA Guidance	1
Manganese	UG/L	5	5	100%	477	1120	0	300	NYS GA	2
Mercury	UG/L	5	2	40%	0.04	0.1	0	0.7	NYS GA	0
Nickel	UG/L	5	2	40%	6.4	99.8	0	100	NYS GA	0
Potassium	UG/L	5	5	100%	7380	10200	0			
Selenium	UG/L	5	3	60%	2.1	3.6	0	10	NYS GA	0
Silver	UG/L	5	1	20%	6.7	4.5	1	50	NYS GA	0
Sodium	UG/L	5	5	100%	31100	59400	0	20000	NYS GA	1
Vanadium	UG/L	5	2	40%	7.7	4.7	1			
Zinc	UG/L	5	5	100%	95	143	0	2000	NYS GA Guidance	0

Notes:
All samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. This table presents results for analytes that were detected at least once in the groundwater samples.
Only detects were included for groundwater criteria exceedance evaluation.

Table 2H
Summary Statistics for SEAD-4/38 Groundwater Samples Collected in March and April 1999
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

						COMPARISON TO SENECA		COMPARISON TO ARAR & TBC VALUES		
ANALYTE	UNIT	NUMBER OF ANALYSES	NUMBER OF DETECTS	FREQUENCY OF DETECTION	SEAD-4/38 MAXIMUM	SENECA BACKGROUND MAXIMUM	NUMBER ABOVE SENECA MAXIMUM	GROUNDWATER CRITERIA	CRITERIA SOURCE	NUMBER ABOVE CRITERIA
Volatile Organic Compounds										
Acetone	UG/L	14	1	7%	8					
Benzene	UG/L	14	1	7%	2			1	NYS GA	1
Ethyl benzene	UG/L	14	1	7%	6			5	NYS GA	1
Toluene	UG/L	14	1	7%	0.4			5	NYS GA	0
Total Xylenes	UG/L	14	1	7%	4			5	NYS GA	0
Semivolatile Organic Compounds										
4-Methylphenol	UG/L	14	1	7%	2.2			1	NYS GA	1
Bis(2-Ethylhexyl)phthalate	UG/L	14	1	7%	1.1			5	NYS GA	0
Di-n-butylphthalate	UG/L	14	1	7%	0.15			50	NYS GA	0
Diethyl phthalate	UG/L	14	2	14%	0.072					0
Naphthalene	UG/L	14	1	7%	2.2					0
Phenol	UG/L	14	1	7%	0.4			1	NYS GA	0
Nitroaromatics										
2-Nitrotoluene	UG/L	14	1	7%	0.87			5	NYS GA	0
3-Nitrotoluene	UG/L	14	1	7%	2.6			5	NYS GA	0
4-Nitrotoluene	UG/L	14	1	7%	10			5	NYS GA	1
Nitrobenzene	UG/L	14	1	7%	0.89			0.4	NYS GA	1
Pesticides/PCBs										
Aldrin	UG/L	14	1	7%	0.0036			0	NYS GA	1
Alpha-BHC	UG/L	14	1	7%	0.0028			0.01	NYS GA	0
Gamma-Chlordane	UG/L	14	1	7%	0.0054			0.05	NYS GA	0
Heptachlor	UG/L	14	1	7%	0.0038			0.04	NYS GA	0
Metals										
Aluminum	UG/L	13	12	92%	2430	42400	0	50	EPA SEC. MCL	11
Antimony	UG/L	13	5	38%	13.8	52.7	0	3	NYS GA	3
Barium	UG/L	13	13	100%	53.8	337	0	1000	NYS GA	0
Beryllium	UG/L	13	2	15%	0.26	2.2	0	4	EPA MCL	0
Calcium	UG/L	13	13	100%	134000	181000	0			
Chromium	UG/L	13	8	62%	260	69.4	1	50	NYS GA	1
Cobalt	UG/L	13	1	8%	1.5	34.6	0			

Table 2H
Summary Statistics for SEAD-4/38 Groundwater Samples Collected in March and April 1999
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

						COMPARISON TO SENECA		COMPARISON TO ARAR & TBC VALUES		
ANALYTE	UNIT	NUMBER OF ANALYSES	NUMBER OF DETECTS	FREQUENCY OF DETECTION	SEAD-4/38 MAXIMUM	SENECA BACKGROUND MAXIMUM	NUMBER ABOVE SENECA MAXIMUM	GROUNDWATER CRITERIA	CRITERIA SOURCE	NUMBER ABOVE CRITERIA
Copper	UG/L	13	2	15%	4.3	32.5	0	200	NYS GA	0
Iron	UG/L	13	11	85%	2310	69400	0	300	NYS GA	4
Magnesium	UG/L	13	13	100%	51700	58200	0	35000	NYS GA Guidance	2
Manganese	UG/L	13	11	85%	378	1120	0	300	NYS GA	1
Nickel	UG/L	13	8	62%	6	99.8	0	100	NYS GA	0
Potassium	UG/L	13	13	100%	4570	10200	0			
Selenium	UG/L	13	6	46%	24	3.6	4	10	NYS GA	3
Silver	UG/L	13	3	23%	1.2	4.5	0	50	NYS GA	0
Sodium	UG/L	13	13	100%	82600	59400	1	20000	NYS GA	3
Thallium	UG/L	13	3	23%	4.9	4.7	1	2	EPA MCL	3
Vanadium	UG/L	13	5	38%	4.3	70.8	0			
Zinc	UG/L	13	13	100%	82.8	143	0	2000	NYS GA Guidance	0
Others										
Nitrate/Nitrite	MG/L	4	4	100%	0.09			10	NYS GA	0

Notes:
This table presents results for analytes that were detected at least once in the groundwater samples.
Only detects were included for groundwater criteria exceedance evaluation.

Table 2I
Summary Statistics for SEAD-4/38 Groundwater Samples Collected in July 1999
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	NUMBER OF ANALYSES	NUMBER OF DETECTS	FREQUENCY OF DETECTION	MAXIMUM	COMPARISON TO SENECA: SENECA BACKGROUND MAXIMUM	COMPARISON TO SENECA: NUMBER ABOVE SENECA MAXIMUM	COMPARISON TO ARAR & TBC VALUES: GROUNDWATER CRITERIA	CRITERIA SOURCE	NUMBER ABOVE TAGM
Semivolatile Organic Compounds										
4-Methylphenol	UG/L	11	1	9%	0.53			1	NYS GA	0
Pesticides/PCBs										
Aroclor-1260	UG/L	11	1	9%	0.079			0.09	NYS GA	0
Delta-BHC	UG/L	11	1	9%	0.0041			0.04	NYS GA	0
Heptachlor	UG/L	11	1	9%	0.0056			0.04	NYS GA	0
Metals										
Aluminum	UG/L	12	11	92%	3820	42400	0	50	EPA SEC. MCL	10
Arsenic	UG/L	12	3	25%	6.5	10	0	10	EPA MCL	0
Barium	UG/L	12	12	100%	121	337	0	1000	NYS GA	0
Cadmium	UG/L	12	1	8%	0.55	1.45	1	5	NYS GA, EPA MCL	0
Calcium	UG/L	12	12	100%	128000	181000	0			
Chromium	UG/L	12	8	67%	21.8	69.4	0	50	NYS GA	0
Cobalt	UG/L	12	1	8%	3.9	34.6	0			
Copper	UG/L	12	5	42%	10.2	32.5	1	200	NYS GA	0
Iron	UG/L	12	11	92%	6900	69400	0	300	NYS GA	7
Lead	UG/L	12	1	8%	1	34.8	0	15	EPA MCL	0
Magnesium	UG/L	12	12	100%	49000	58200	0	35000	NYS GA Guidance	1
Manganese	UG/L	12	12	100%	855	1120	0	300	NYS GA	2
Nickel	UG/L	12	2	17%	9.9	99.8	0	100	NYS GA	0
Potassium	UG/L	12	12	100%	14400	10200	1			
Selenium	UG/L	12	2	17%	3.9	3.6	1	10	NYS GA	0
Silver	UG/L	12	1	8%	2.5	4.5	0	50	NYS GA	0
Sodium	UG/L	12	12	100%	63100	59400	1	20000	NYS GA	3
Vanadium	UG/L	12	2	17%	11.4	70.8	0			
Zinc	UG/L	12	8	67%	81.1	143	0	2000	NYS GA Guidance	0
Others										
Nitrate/Nitrite	MG/L	5	5	100%	0.15			10	NYS GA	0

Note:
The table presents results for analytes that were detected at least once in groundwater samples. Only detects were included for groundwater criteria exceedance evaluation.

Table 2J
SEAD-4/38 Groundwater PCB Data - June 2004
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

							Facility	SEAD-4	SEAD-4
							Location ID	MW4-10	MW4-10
							Matrix	GW	GW
							Sample ID	42043	42044
							Sample Date	6/9/2004	6/9/2004
							QC Code	SA	SA
							Study ID	PCB resamp	PCB resamp
Parameter	**Units**	**Maximum Value**	**Frequency of Detection**	**Criteria Level**	**Number of Exceedances**	**Number of Times Detected**	**Number of Samples Collected**	Value (Q)	Value (Q)
Aroclor-1016	UG/L	0	0%	0.09	0	0	2	1 U	1 U
Aroclor-1221	UG/L	0	0%	0.09	0	0	2	1 U	1 U
Aroclor-1232	UG/L	0	0%	0.09	0	0	2	1 U	1 U
Aroclor-1242	UG/L	0	0%	0.09	0	0	2	1 U	1 U
Aroclor-1248	UG/L	0	0%	0.09	0	0	2	1 U	1 U
Aroclor-1254	UG/L	0	0%	0.09	0	0	2	1 U	1 U
Aroclor-1260	UG/L	0	0%	0.09	0	0	2	1 U	1 U

Notes:
This table presents all analytical results.
The method detection limit for each analysis was less than 0.060 ug/L and the reporting limit was 1.0 ug/L.
The criteria level of 0.09 ug/L is the GA Standard.
U = Compound was not detected

Table 2K
Summary Statistics for SEAD-4 /38 Surface Water Samples
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNIT	MAXIMUM	FREQUENCY OF DETECTION	NYS CLASS C	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF ANALYSES
Volatile Organic Compounds							
Acetone	UG/L	4	31%		0	4	13
Semivolatile Organic Compounds							
Anthracene	UG/L	0.068	8%		0	1	13
Benzo(a)anthracene	UG/L	0.18	8%		0	1	13
Benzo(a)pyrene	UG/L	0.15	8%		0	1	13
Benzo(b)fluoranthene	UG/L	0.15	8%		0	1	13
Benzo(ghi)perylene	UG/L	0.073	8%		0	1	13
Benzo(k)fluoranthene	UG/L	0.16	8%		0	1	13
Bis(2-Ethylhexyl)phthalate	UG/L	0.22	23%	0.6	0	3	13
Butylbenzylphthalate	UG/L	0.076	8%		0	1	13
Carbazole	UG/L	0.054	8%		0	1	13
Chrysene	UG/L	0.18	8%		0	1	13
Fluoranthene	UG/L	0.41	15%		0	2	13
Indeno(1,2,3-cd)pyrene	UG/L	0.069	8%		0	1	13
Phenanthrene	UG/L	0.35	8%		0	1	13
Pyrene	UG/L	0.25	15%		0	2	13
Explosives							
1,3-Dinitrobenzene	UG/L	0.07	8%		0	1	13
Pesticides/PCBs							
Alpha-Chlordane	UG/L	0.0077	8%		0	1	13
Beta-BHC	UG/L	0.0041	8%		0	1	13
Gamma-Chlordane	UG/L	0.0064	8%		0	1	13
Metals							
Aluminum	UG/L	7350	100%	100	7	13	13
Antimony	UG/L	6.6	38%		0	5	13
Arsenic	UG/L	4.2	8%	150	0	1	13
Barium	UG/L	213	100%		0	13	13
Cadmium	UG/L	11.6	46%	1.9	1	6	13
Calcium	UG/L	159000	100%		0	13	13
Chromium	UG/L	44.8	31%	347	0	4	13
Cobalt	UG/L	19.6	8%	5	1	1	13
Copper	UG/L	97	77%	20	4	10	13
Iron	UG/L	16600	100%	300	7	13	13
Lead	UG/L	117	31%	7.2	2	4	13
Magnesium	UG/L	32700	100%		0	13	13
Manganese	UG/L	2350	100%		0	13	13
Nickel	UG/L	32.6	15%	154	0	2	13
Potassium	UG/L	4790	100%		0	13	13
Silver	UG/L	1.7	15%	0.1	2	2	13
Sodium	UG/L	36200	100%		0	13	13
Thallium	UG/L	2.4	8%	8	0	1	13
Vanadium	UG/L	22.5	31%	14	1	4	13
Zinc	UG/L	492	100%	141	1	13	13
Others							
Nitrate/Nitrite	MG/L	0.25	100%			9	9

Note:
This table presents results for analytes that were detected at least once in the surface water samples.

Table 2L
Summary Statistics for SEAD-4 Sediment Samples in Lagoon
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

ANALYTE	UNITS	MAX	FREQUENCY OF DETECTION	NYS CRITERIA[1]	SOURCE OF CRITERIA[2]	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF ANALYSES
Volatile Organic Compounds								
Acetone	UG/KG	210	67%			0	2	3
Carbon disulfide	UG/KG	12	67%			0	2	3
Methyl ethyl ketone	UG/KG	49	33%			0	1	3
Semivolatile Organic Compounds								
4-Methylphenol	UG/KG	140	33%	20	NYS Chronic	1	1	3
Di-n-octylphthalate	UG/KG	46	33%			0	1	3
Fluoranthene	UG/KG	31	33%	39887	NYS Chronic	0	1	3
Fluorene	UG/KG	29	33%	313	NYS Chronic	0	1	3
N-Nitrosodipropylamine	UG/KG	410	33%			0	1	3
Pyrene	UG/KG	26	33%	37580	NYS Chronic	0	1	3
Nitroaromatics								
4-amino-2,6-Dinitrotoluene	UG/KG	140	33%			0	1	3
Pesticides/PCBs								
4,4'-DDE	UG/KG	4.1	33%	0.39	NYDEC HHB	1	1	3
Aroclor-1254	UG/KG	280	67%	0.031	NYDEC HHB	2	2	3
Endrin aldehyde	UG/KG	3	33%			0	1	3
Herbicides								
2,4,5-T	UG/KG	21	33%			0	1	3
Metals								
Aluminum	MG/KG	17500	100%			0	3	3
Antimony	MG/KG	50.4	67%	2	NYS LEL	2	2	3
Arsenic	MG/KG	8.1	100%	6	NYS LEL	2	3	3
Barium	MG/KG	102	100%			0	3	3
Beryllium	MG/KG	0.65	100%			0	3	3
Calcium	MG/KG	68100	100%			0	3	3
Chromium	MG/KG	3310	100%	26	NYS LEL	3	3	3
Cobalt	MG/KG	14.1	100%			0	3	3
Copper	MG/KG	2640	100%	16	NYS LEL	3	3	3
Iron	MG/KG	29200	100%	20000	NYS LEL	3	3	3
Lead	MG/KG	18.6	100%	31	NYS LEL	0	3	3
Magnesium	MG/KG	7630	100%			0	3	3
Manganese	MG/KG	569	100%	460	NYS LEL	1	3	3
Mercury	MG/KG	0.16	100%	0.15	NYS LEL	1	3	3
Nickel	MG/KG	33.4	100%	16	NYS LEL	3	3	3
Potassium	MG/KG	2760	100%			0	3	3
Sodium	MG/KG	207	100%			0	3	3
Vanadium	MG/KG	28.2	100%			0	3	3
Zinc	MG/KG	630	100%	120	NYS LEL	3	3	3

Notes:

(1) Criteria calculated using a TOC of 3.91%. This is a site wide TOC value.

(2) NYSDEC HHB = NYSDEC Human Health Bioaccumulation Criteria
NYS Chronic = NYSDEC Benthic Aquatic Life Chronic Toxicity Criteria
NYDEC W/H = NYSDEC Wildlife/Human Bioaccumulation Criteria
NYS LEL = NYSDEC Lowest Effect Level

(3) This table presents results for analytes that were detected at least once in the sediment samples.
MAX = Maximum

TABLE 3
SUMMARY OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
REASONABLE MAXIMUM EXPOSURE (RME)
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	Inhalation of Dust in Ambient Air	5E-05	2E-08
	Ingestion of Soil	5E-03	5E-08
	Dermal Contact to Soil	1E-03	1E-08
	TOTAL RECEPTOR RISK (Nc & Car)	**6E-03**	**8E-08**
FUTURE OUTDOOR PARK WORKER	Inhalation of Dust in Ambient Air	3E-04	1E-07
	Ingestion of Soil	4E-02	4E-07
	Dermal Contact to Soil	9E-03	1E-07
	Intake of Groundwater	5E-02	8E-07
	Dermal Contact to Surface Water	4E-03	9E-06
	Dermal Contact to Sediment	3E-03	2E-08
	TOTAL RECEPTOR RISK (Nc & Car)	**1E-01**	**1E-05**
FUTURE INDOOR PARK WORKER	Inhalation of Dust in Indoor Air	1E-01	5E-07
	Ingestion of Indoor Dust/Dirt	5E+00	9E-05
	Dermal Contact to Indoor Dust/Dirt	2E+01	3E-04
	Intake of Groundwater	5E-02	8E-07
	TOTAL RECEPTOR RISK (Nc & Car)	**2E+01**	**3E-04**
FUTURE CONSTRUCTION WORKER	Inhalation of Dust in Ambient Air	6E-03	1E-07
	Ingestion of Soil	2E-01	1E-07
	Dermal Contact to Soil	1E-02	6E-09
	TOTAL RECEPTOR RISK (Nc & Car)	**2E-01**	**3E-07**
FUTURE RECREATIONAL VISITOR (CHILD)	Inhalation of Dust Ambient Air	1E-04	1E-08
	Ingestion of Soil	3E-02	6E-08
	Dermal Contact to Soil	1E-03	4E-09
	Inhalation of Groundwater	6E-04	2E-09
	Intake of Ground Water	2E-02	6E-08
	Dermal Contact to Ground Water	2E-01	6E-07
	Dermal Contact to Surface Water	2E-02	6E-06
	Dermal Contact to Sediment	1E-02	1E-08
	Ingestion of Sediment	6E-02	4E-07
	TOTAL RECEPTOR RISK (Nc & Car)	**4E-01**	**7E-06**

TABLE 3
SUMMARY OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
REASONABLE MAXIMUM EXPOSURE (RME)
Proposed Plan for SEAD-4 and SEAD-38
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	ADULT HAZARD INDEX	CHILD HAZARD INDEX	LIFETIME CANCER RISK
FUTURE RESIDENT	Inhalation of Dust in Ambient Air	2E-03	3E-03	1E-06
	Ingestion of Soil	8E-02	8E-01	3E-06
	Dermal Contact to Soil	2E-02	3E-02	4E-07
	Inhalation of Groundwater	5E-03	2E-02	2E-07
	Intake of Groundwater	2E-01	5E-01	5E-06
	Dermal Contact to Groundwater	3E+00 **	6E+00 **	6E-05
	Dermal Contact to Surface Water	4E-02	5E-02	1E-04 ***
	Ingestion of Sediment	4E-02	4E-01	4E-06
	Dermal Contact to Sediment	3E-02	3E-02	2E-07
	TOTAL RECEPTOR RISK (Nc & Car)	**3E+00**	**7E+00**	**2E-04**

Notes:
** Risk via this route are driven by Aroclor-1260. The reader is cautioned that these values grossly overestimate the risk due to low frequency of detection and excessive conservatism in the dermal absorption model for highly lipophilic compounds, such as PCBs. See SEAD-4 RI Section 6.5 for further discussion.
***Risk via this route are driven by PAHs. The reader is cautioned that these values grossly overestimate the risk due to low frequency of detection and excessive conservatism in the dermal absorption model for highly lipophilic compounds, such as PAHs. See SEAD-4 RI Section 6.5 for further discussion.

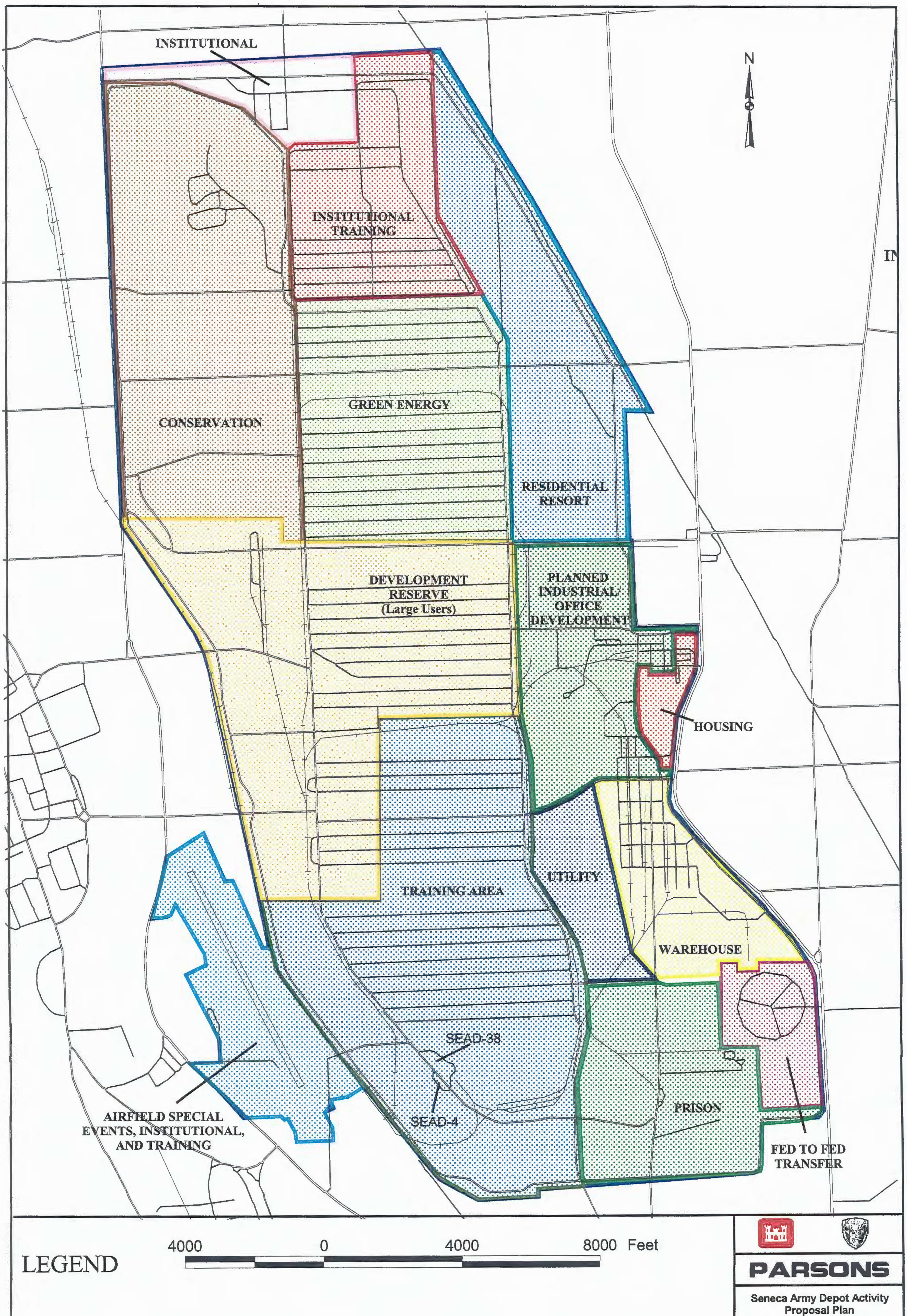
Table 4
Ecological COPCs with HQs > 1
Proposed Plan for SEAD-4/38
Seneca Army Depot Activity

Surface and Subsurface Soil (0-4 ft bgs.) COPCs with HQs>1	
Benzo(a)pyrene	Bis(2-ethylhexyl)phthalate
Di-n-octylphthalate	Total PCBs
4,4'-DDT	Antimony
Chromium	Chromium VI
Copper	Lead
Mercury	Thallium
Ditch soil COPCs with HQs>1	
benzo(a)pyrene	bis(2-ethylhexyl)phthalate
Aroclor-1254	Aroclor-1260
Antimony	Chromium
Chromium VI	Copper
Lead	Mercury
Vanadium	Zinc
Sediment COPCs with HQs>1	
Aluminum	Chromium
Zinc	
Surface Water COPCs with HQs>1	
Aluminum	Cadmium
Cobalt	Copper
Iron	Manganese
Vanadium	Zinc

Table 5
Cost Estimate Summary
Proposed Plan for SEAD-4/38
Seneca Army Depot Activity

	ALTERNATIVE 2 On-site Containment		ALTERNATIVE 3 Excavation/Off-site Disposal	
Soil Remedial Action Goals	**Alternative 2: Ecological Protection (7)**	**Alternative 2P: Pre-Disposal Conditions(8)**	**Alternative 3: Ecological Protection (7)**	**Alternative 3P: Pre-Disposal Conditions(8)**
Owner Costs of:				
Remedial Design	$492,120	$492,120	$423,050	$423,050
Mobilization/Demobilization	$22,350	$22,350	$22,350	$22,350
Sampling and Testing	$61,930	$92,900	$99,920	$199,180
Site Work	$221,060	$221,060	$169,150	$169,150
Well Installation	$5,420	$5,420	--	--
Case 1 (Removal of Soil/Debris from Buildings)	$31,200	$31,200	$31,200	$31,200
Case 2 (Ecological Protection - Soil)	$190,620	--	$814,230	--
Case 3 ("Pre-disposal" conditions - Soil)	--	$1,164,430	--	$3,274,750
Case 4 (Sediment in Lagoon)	$557,990	$557,990	$557,990	$557,990
Cases 5 and 6 (Semi-annual groundwater and surface water monitoring)	$84,100	$84,100	$84,100	$84,100
Owners Cost Total (1) and (2)	$1,666,790	$2,671,570	$2,201,990	$4,761,770
Annual O&M Costs (3)	$5,000	$6,000	NA	NA
Annual Post Remediation Monitoring Costs (4)	$39,400	$39,400	NA	NA
Present Worth O&M and Monitoring Cost (30 year) (5)	$767,765	$785,057	NA	NA
Total Evaluated Price (6)	$2,434,555	$3,456,627	$2,201,990	$4,761,770

NOTES:
1. Cost to Owner is the sum of the Cost to Prime (Contractor) plus prime contractor Indirect Cost. Also known as the bid amount or construction contract cost.
2. Cost to Prime (Contractor) is the sum of the direct costs plus any sales tax, subcontractor markups, and adjust pricing that have been applied in the project.
3. Annual Costs are costs that will occur yearly due to activities such as maintenance or monitoring.
4. Post Remediation Monitoring consists of semi-annual groundwater monitoring.
5. Present Worth Cost is based on a 4% interest rate over the number of years specified above.
6. Total Evaluated Price is the sum of the Project Cost and Present Worth Cost.
7. Soil remediated to ecological cleanup values. Soil in ditches considered as soils. Sediment in lagoon remediated to NYSDEC Sediment Criteria.
8. Pre-disposal conditions are metals and semi-volatiles to to TAGM values. Sediment in ditches and lagoon remediated to NYSDEC Sediment Criteria.



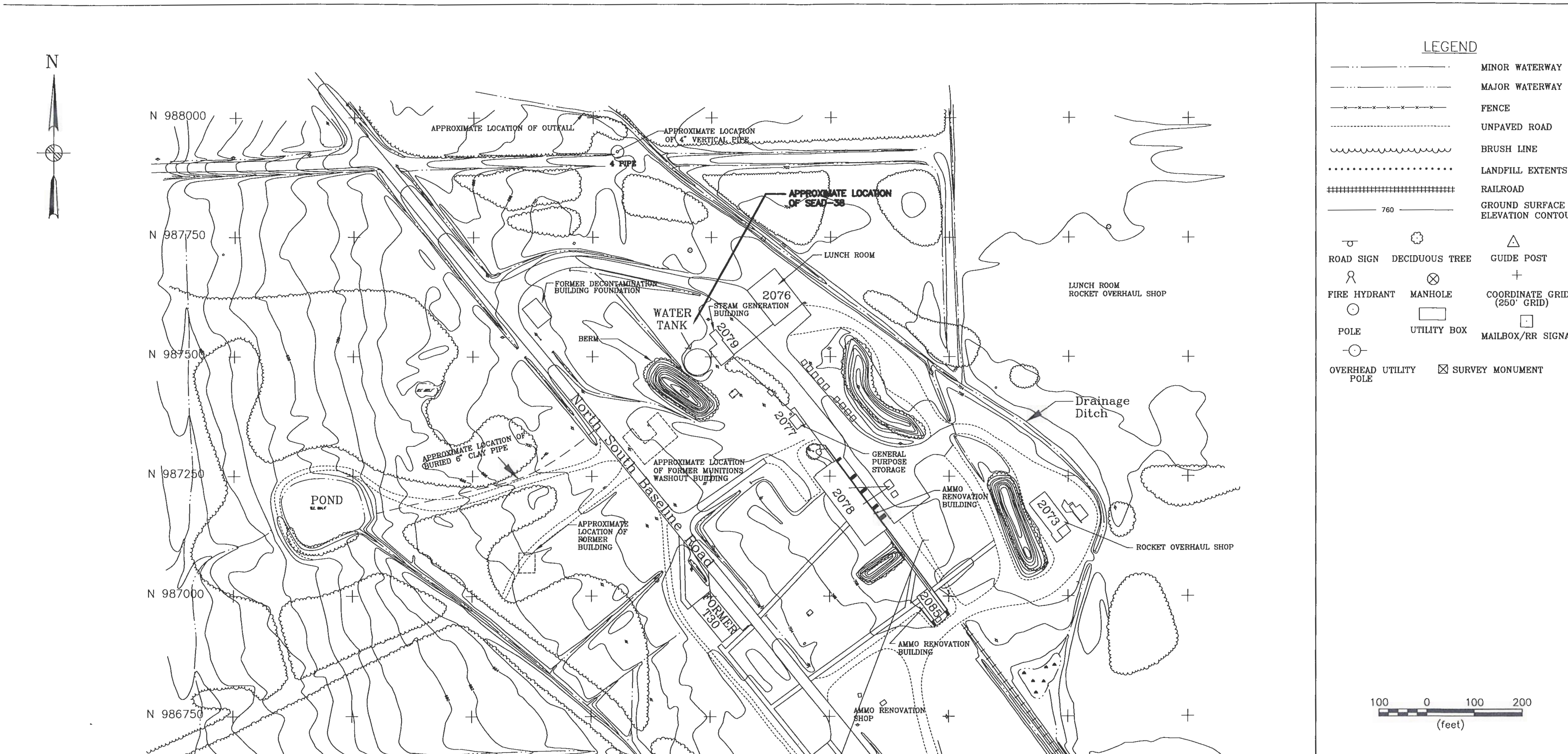
PARSONS

Seneca Army Depot Activity
Proposal Plan
SEAD-4 and SEAD-38

Figure 1
Future Land Use and
Site Locations

February 2007

O:\Seneca\PBC II\s-4_n_s-38_landuses.apr\Figure 1 - Land Use & Site Locations



PARSONS

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
PROPOSED PLAN FOR
SEAD-4 AND SEAD-38

DEPT. ENVIRONMENTAL ENGINEERING	Dwg. No.

FIGURE 2

SEAD-4 MUNITIONS WASHOUT FACILITY & SEAD-38 THE BLDG. 2079 BOILER BLOWDOWN PIT LOCATION MAP

SCALE 1" = 200'	DATE SEPTEMBER 2006

o:/seneca/sead-4/Figure3.mxd

LEGEND

• Sample Location

EXCAVATION DEPTH TO 1 FOOT

EXCAVATION DEPTH TO 4 FEET

N W E S

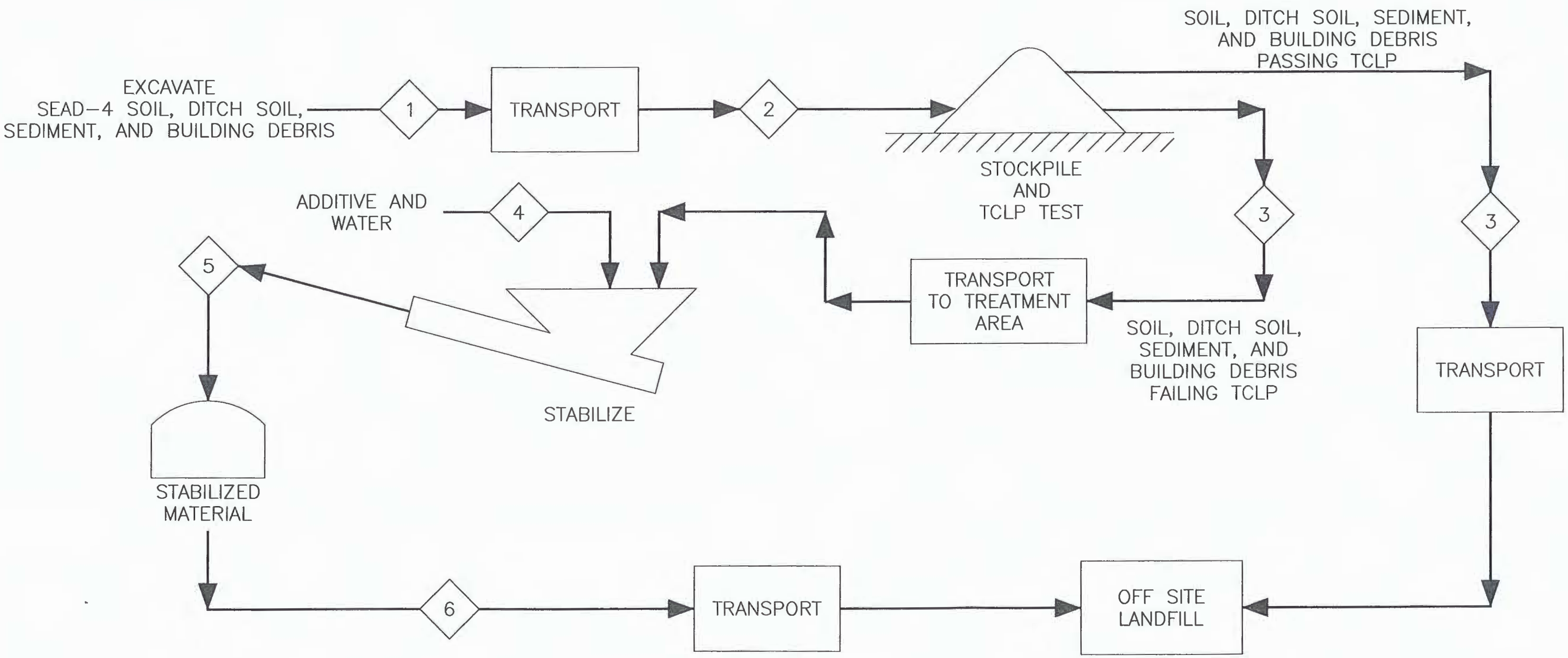
100 50 0 100 200 300 Feet

PARSONS

SENECA ARMY DEPOT ACTIVITY
SEAD-4

Figure 3
Approximate Area of Excavation for Proposed Cleanup Goals (Cr=60mg/kg , Pb=167mg/kg)

1 = 200'	February 2007



PARSONS

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
PROPOSED PLAN FOR
SEAD-4 AND SEAD-38

DEPT. ENVIRONMENTAL ENGINEERING	Dwg. No.

FIGURE 4
ALTERNATIVE 3
GENERALIZED PROCESS FLOW SCHEMATIC

SCALE N.T.S.	DATE SEPTEMBER 2006

APPENDICES

A. SOIL CLEANUP GOAL SENSITIVITY ANALYSIS

- Sensitivity Analysis
- Table
- Figures

B. COST EFFECTIVENESS OF EXCAVATION TO MEET TAGMS AT DEPTH

- Cost Effectiveness of Excavation to Meet TAGMs at Depth at SEAD-4
- Figures

C. NYSDEC Approval Letter of Sensitivity Analysis, dated January 26, 2005

APPENDIX A

SOIL CLEANUP GOAL SENSITIVITY ANALYSIS

- Sensitivity Analysis
- Table
- Figures

PARSONS

MEMORANDUM

TO:	Scott Bradley, USACE - Huntsville Julio Vazquez, USEPA Joe White, NYSDEC Steve Absolom, SEDA Tom Enroth, USACE – NY District Chris Boes, AEC Keith Hoddinott, USACHPPM	**DATE:**	September 30, 2004
FROM:	Todd Heino, Parsons	**COPIES:**	**file**
SUBJECT:	Sensitivity Analysis: Soil Removal at SEAD-4, Seneca Army Depot Activity		

Purpose

At a recent BCT meeting, the Army was asked to perform a sensitivity (or "knee of the curve") analysis of remediation costs versus contaminant mass removed for SEAD-4 at Seneca Army Depot in Romulus, New York. The overall goal of the analysis is to determine the economic effectiveness of various excavation plans based on a comparison of cost to volume of soil removed associated with each cleanup goal scenario. This analysis assesses the mass of contaminant in soils, namely lead (Pb) and chromium (Cr), removed for various metal cleanup goals. Five cleanup goal criteria were assessed, and volumes of excavation and associated masses of contaminant removed were determined for each criterion. This information was plotted on a graph in order to determine which criteria offered the most *bang for the buck.*

Five scenarios were developed:

A: Cr > 30 mg/Kg; Pb > 167 mg/Kg
B: Cr > 30 mg/Kg; Pb > 30 mg/Kg
C: Cr > 60 mg/Kg; Pb > 400 mg/Kg
D: Cr > 324 mg/Kg; Pb > 167 mg/Kg
E: Cr > 324 mg/Kg; Pb > 400 mg/Kg

It should be noted that a scenario excavating soils that exceed TAGMs for any individual metal was considered; however it was eliminated from further evaluation since it would involve excavating all soils at SEAD-4 and beyond.

Delineation of excavation area

For each cleanup goal scenario, the bounds of excavation of soils (surface soil, subsurface soil, ditch soil, and sediment) were delineated in one of two ways:

1. The limit of excavation extended to the nearest sample meeting the cleanup goal, or

2. If an area was not entirely bounded, the limit of excavation extended 100 feet beyond the location of the last soil sample not meeting the cleanup goal.

For each criteria, a map noting the excavation area correponding to the cleanup goal scenario was created using the GIS mapping program ArcView, and ArcView generated an excavation volume based on the map. These figures depicting the approximate area of excavation for scenarios A, B, C, D, and E are presented as **Figures A, B, C, D**, and **E**, respectively. The depth of excavation was based on the depth required to meet cleanup goals based on existing results. If a sample at depth was vertically unbounded, the excavation was extended approximately 1 foot downward from the last sample.

Determination of mass of soil and contaminants and cost of removal

Using the excavation volume, the following calculation was performed to determine the mass of soil that would be excavated and the mass of contaminant that would be excavated under each scenario:

volume (cy) x 1.5 tons/cy x 2000 lbs/ton x 0.454 kg/lb x Cr concentration (mg/Kg) = Cr mass (mg)

Average concentrations of a contaminant for each scenario were calculated by including all of the samples within the excavation area for the scenario (including perimeter samples).

The cost of soil removal was calculated assuming that excavation, disposal, and backfilling costs $100/cy for non-hazardous material, and $200/cy for hazardous material. It was assumed that 25% of the soil excavated under the least conservative scenario, Scenario E, would be hazardous, which accounts for 3239 cy of soil. For all other scenarios, costs were calculated by assuming 3239 cy of soil required hazardous disposal and the remainder was non-hazardous.

In order to assess the effectiveness of each excavation scenario, the cost of soil excavation and disposal was related to the percent of chromium and lead removed, shown in **Figures 1** and **2**, respectively. The percent of contaminant removed was calculated by comparing the mass of lead and chromium removed under a cleanup scenario compared to the mass of lead and chromium removed under Scenario B. Accordingly, under Scenario B, 100% of the lead and chromium mass above TAGMs was excavated. **Table 1** provides a summary of the mass of soil removed, the percent of contaminant removed, and the cost of each scenario.

Results

In a sensitivity analysis, the most effective scenario for cost vs. mass removed is determined by a change in the slope from principally horizontal to a vertical slope. The results show that the shape of the curve changes at the data point for Scenario A (Cr > 60 ppm, Pb > 167 ppm), which would remove 93% chromium and 70% lead (by mass) at a cost of $2.6 million. Scenario B results in the removal of 100% of contaminants; however, the cost increases by 100% (from $2.6

million to $5.2 million). Since the remaining chromium from Scenario A to B is mostly due to levels of chromium and lead close to background, the additional cost of $2.6 million is not warranted.

Recommendations

1. Based on the sensitivity analysis, the Army recommends cleanup goals from Scenario A (Cr > 60 mg/Kg, Pb > 167 mg/Kg);
2. No excavation will extend beyond the horizontal limits shown for this scenario (see **Figure A**). No horizontal cleanup verification will be performed beyond these limits.
3. Cleanup verification testing will be performed to determine the final vertical limits. The cleanup goals for Scenario A will be used since these goals are used to determine the horizontal limits.
4. In areas where the final horizontal limit is not well-defined, the Army will conduct additional sampling to determine where Scenario A cleanup goals are met, "the clean edge".
5. Once NYSDEC's approval is received, Parsons will incorporate this information, results from the additional groundwater testing, and results from the test pitting into the FS and submit the document as final.

The Army recognizes that NYSDEC may request that vertical sampling achieve cleanup goals of TAGMs (Cr = 30 ppm, Pb = 30 ppm). The Army does not believe that this cleanup level is appropriate. The Scenario A cleanup goals are

- protective of human health and the environment;
- reasonably similar to background concentrations, particularly for chromium; and
- remaining soils exceeding the TAGM values found during cleanup verification testing will be covered with backfill.

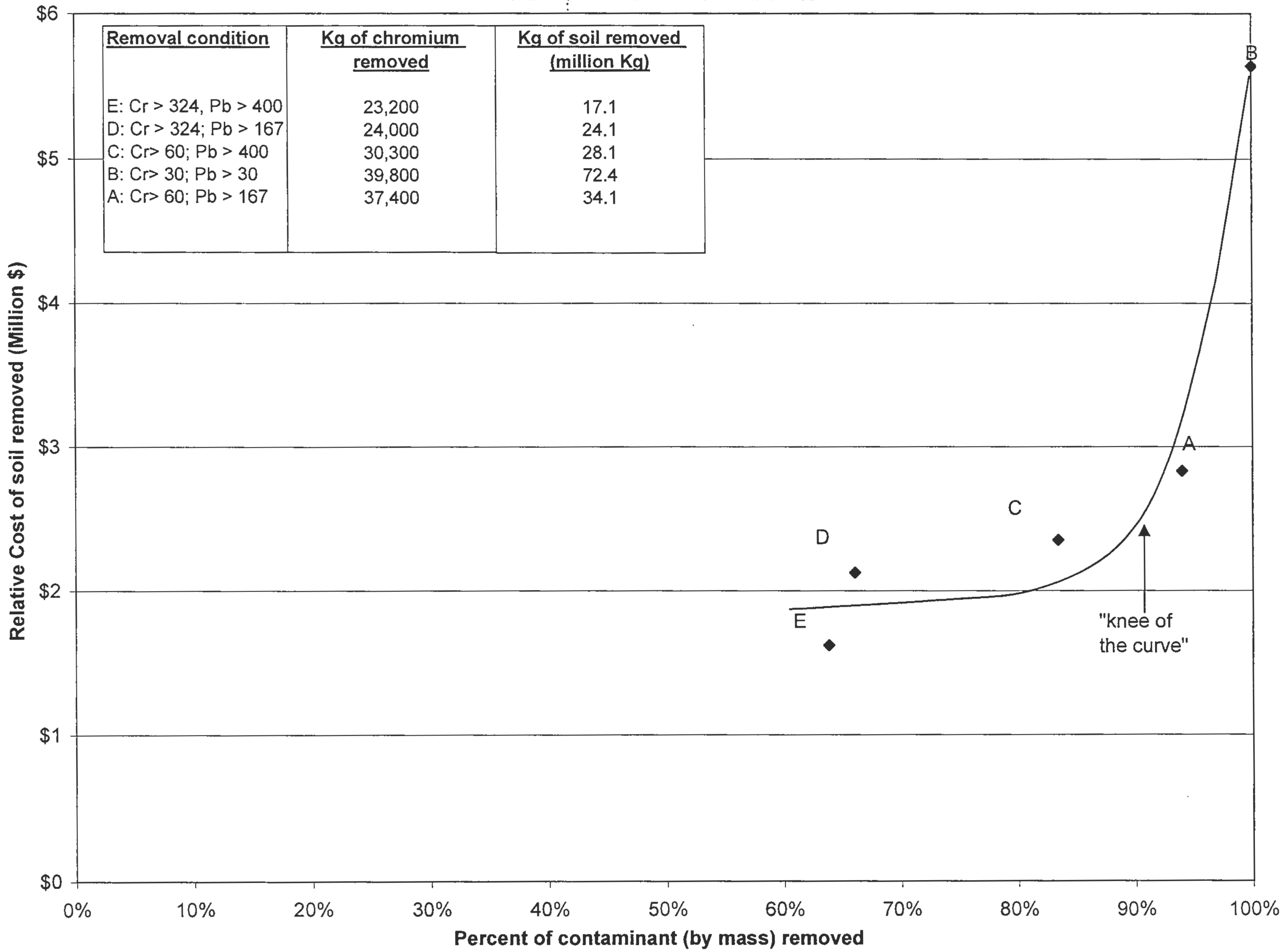
Parsons appreciates your consideration of this recommendation. If you have any questions, please do not hesitate to call me at (617) 457-7905 to discuss further.

Table D-1
Summary of Sensitivity Analysis Results
SEAD-4 Feasibility Study
Seneca Army Depot Activity

	Volume (cy)	Mass of soil (million Kg)	Relative Cost ($mill)	Mass of Cr (Kg)	% Chromium removed	Mass of Pb (Kg)	% Lead removed
Scenario E	12,955	17.1	1.6	23,200	63.8%	3,700	57.7%
Scenario D	18,020	24.5	2.1	24,000	66.0%	4,500	70.3%
Scenario C	20,276	28.1	2.4	30,300	83.4%	4,100	64.3%
Scenario B	53,128	72.4	5.6	39,800	100.0%	6,400	100.0%
Scenario A	25,049	34.1	2.8	37,400	94.0%	5,100	72.5%

Notes:
A: Cr > 60 Pb > 167
B: Cr> 30; Pb > 30
C: Cr> 60; Pb > 400
D: Cr > 324; Pb > 167
E: Cr > 324, Pb > 400

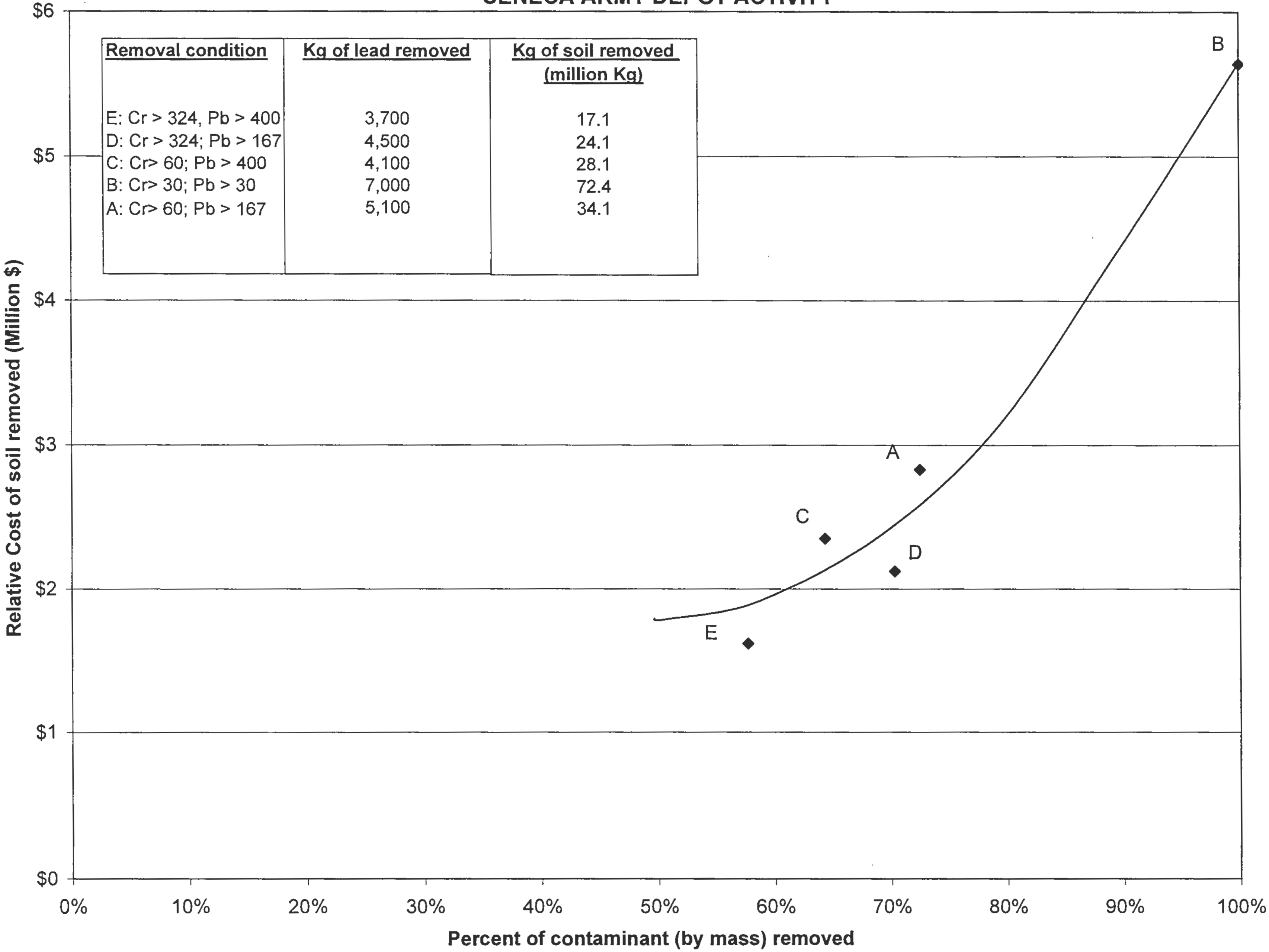
Figure D-1
Relative Cost for Chromium Mass Removal at SEAD-4
SEAD-4 Feasibility Study
SENECA ARMY DEPOT ACTIVITY



Removal condition	Kg of chromium removed	Kg of soil removed (million Kg)
E: Cr > 324, Pb > 400	23,200	17.1
D: Cr > 324; Pb > 167	24,000	24.1
C: Cr> 60; Pb > 400	30,300	28.1
B: Cr> 30; Pb > 30	39,800	72.4
A: Cr> 60; Pb > 167	37,400	34.1

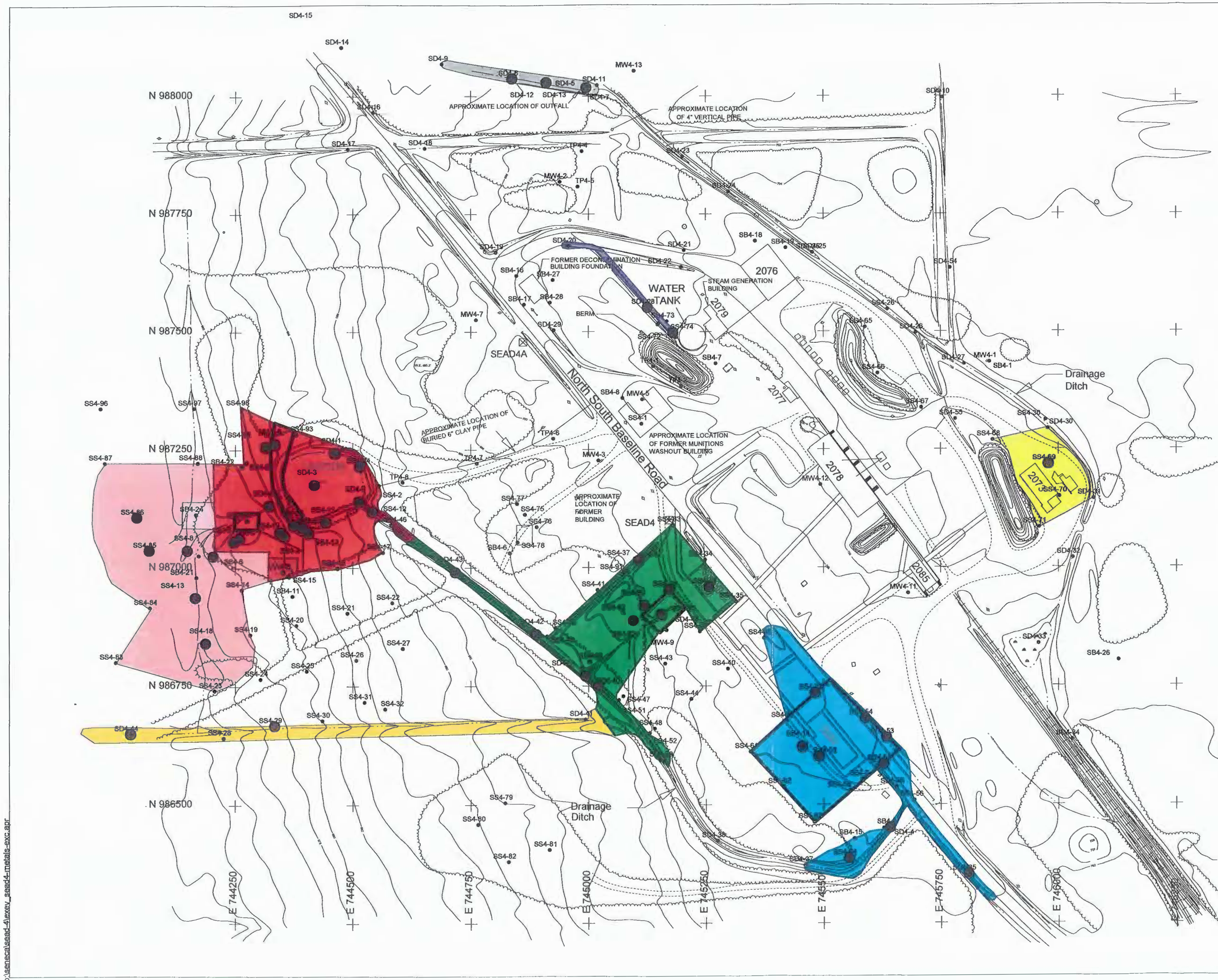
P:\PIT\Projects\SENECA\SEAD4\FS\revised Exc Area_May2004\sensitivity anal Rev 2 Nov04\Knee of Curve Nov04.xls-Fig D-1

Figure D-2
Relative Cost for Lead Mass Removal at SEAD-4
SEAD-4 Feasibility Study
SENECA ARMY DEPOT ACTIVITY



Removal condition	Kg of lead removed	Kg of soil removed (million Kg)
E: Cr > 324, Pb > 400	3,700	17.1
D: Cr > 324; Pb > 167	4,500	24.1
C: Cr> 60; Pb > 400	4,100	28.1
B: Cr> 30; Pb > 30	7,000	72.4
A: Cr> 60; Pb > 167	5,100	34.1

P:\PIT\Projects\SENECA\SEAD4\FS\revised Exc Area_May2004\sensitivity anal Rev 2 Nov04\Knee of Curve Nov04.xls-Fig D-2



LEGEND

Cr and Pb Concentration (ppm)

- • Cr < 60 and Pb < 167
- ● Cr > 60 or Pb > 167

Section 1	1 ft cut = 4,338 cy
Section 1B	10 ft cut = 946 cy
Section 2	1 ft cut = 3,038 cy
Section 2B	4 ft cut = 1,265 cy
Section 2C	8 ft cut = 809 cy
Section 3	1 ft cut = 2760 cy
Section 3B	7 ft cut = 950 cy
Section 4	4 ft cut = 7046 cy
Section 4B	1 ft cut = 1288 cy
Section 5	1 ft cut = 1206 cy
Section 6	1 ft cut = 148 cy
Section 7	1 ft cut = 942 cy
Section 8	1 ft cut = 312 cy

Total volume to be removed 25,049 cy

N

100 0 100 200 300 Feet

PARSONS

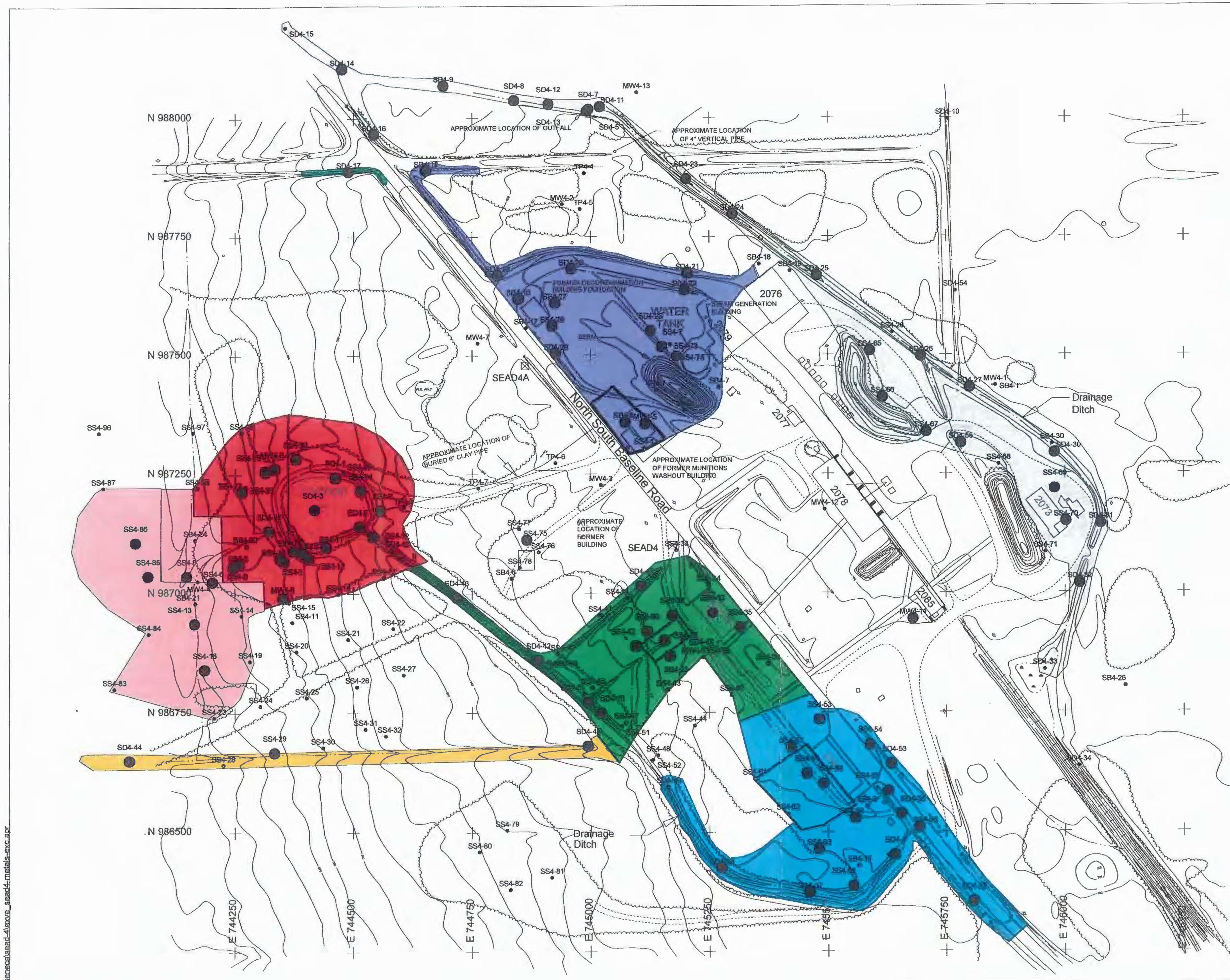
SENECA ARMY DEPOT ACTIVITY

SEAD-4
FEASIBILITY STUDY

Figure A
Approximate Area of Excavation for Criteria - A
Cr > 60, Pb > 167

1" = 200' | FEBRUARY 2005

o:\seneca\sead-4\exv_sead4-metals-exc.apr



LEGEND

Cr and Pb Concentration (ppm)

- Cr < 30 and Pb < 30
- Cr > 30 or Pb > 30

Section 1	1 ft cut = 3967 cy
Section 1B	10 ft cut = 7922 cy
Section 2	1 ft cut = 3067 cy
Section 2B	7 ft cut = 468 cy
Section 2C	4 ft cut = 384 cy
Section 2D	9 ft cut = 8208 cy
Section 3	1 ft cut = 4261 cy
Section 3B	7 ft cut = 1218 cy
Section 4	1 ft cut = 5138 cy
Section 4B	4 ft cut = 2960 cy
Section 5	1 ft cut = 1206 cy
Section 6	1 ft cut = 5226 cy
Section 6A	7 ft cut = 2670 cy
Section 7	1 ft cut = 6340 cy
Section 8	1 ft cut = 93 cy

Total volume to be removed 53,129 cy

N

100 0 100 200 300 Feet

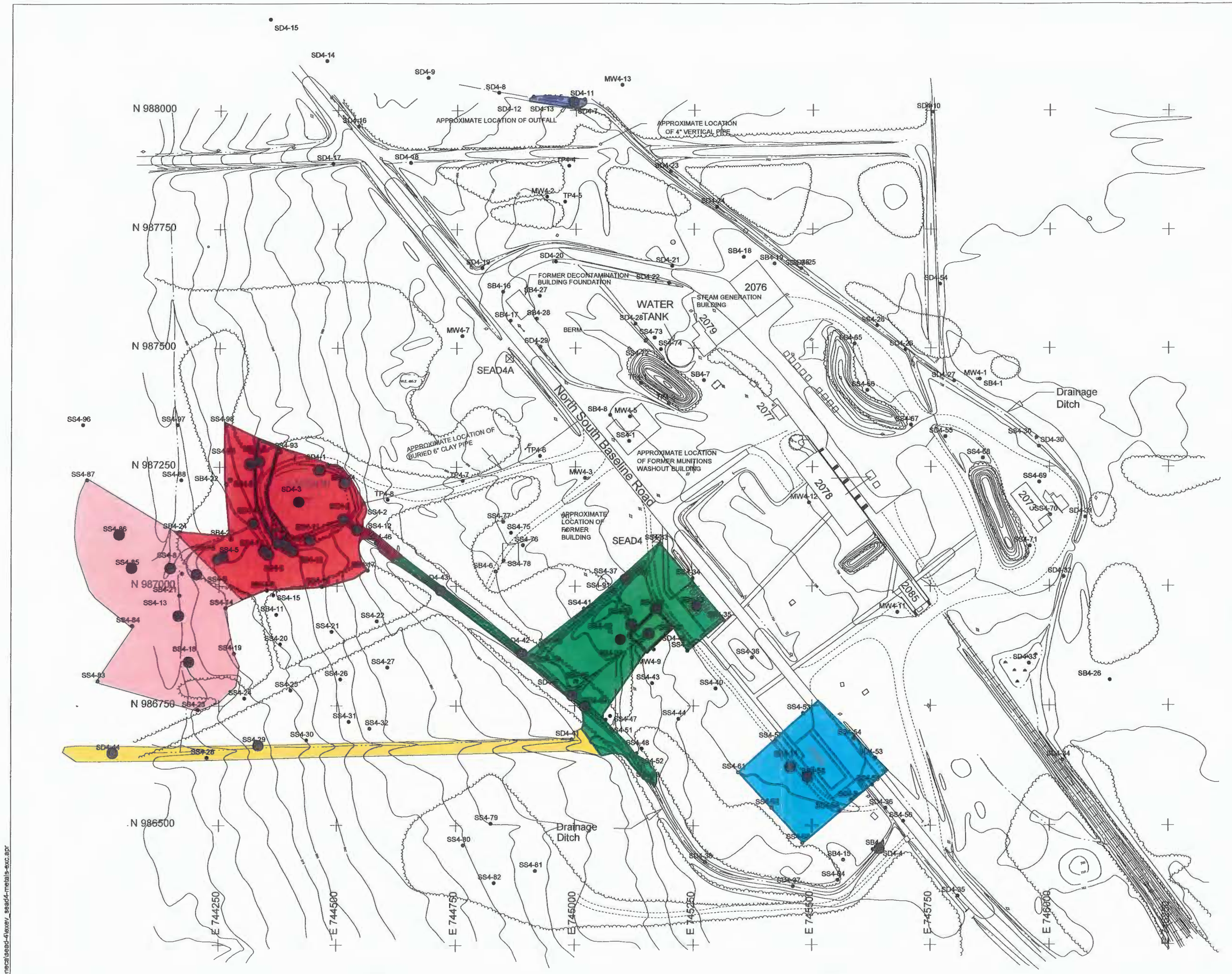
PARSONS

SENECA ARMY DEPOT ACTIVITY

SEAD-4 FEASIBILITY STUDY

Figure B
Approximate Area of Excavation for Criteria - B
Cr > 30, Pb > 30

1" = 200' | FEBRUARY 2005



LEGEND

Cr and Pb Concentration (ppm)

- Cr < 60 and Pb < 400
- Cr > 60 or Pb > 400

Section 1	1 ft cut = 3793 cy
Section 2	1 ft cut = 3000 cy
Section 2B	4 ft cut = 1041 cy
Section 3	1 ft cut = 2760 cy
Section 3B	7 ft cut = 950 cy
Section 4	4 ft cut = 7046 cy
Section 5	1 ft cut = 1206 cy
Section 6	1 ft cut = 82 cy
Section 7	1 ft cut = 398 cy

Total volume to be removed 20,276 cy

N

100 0 100 200 300 Feet

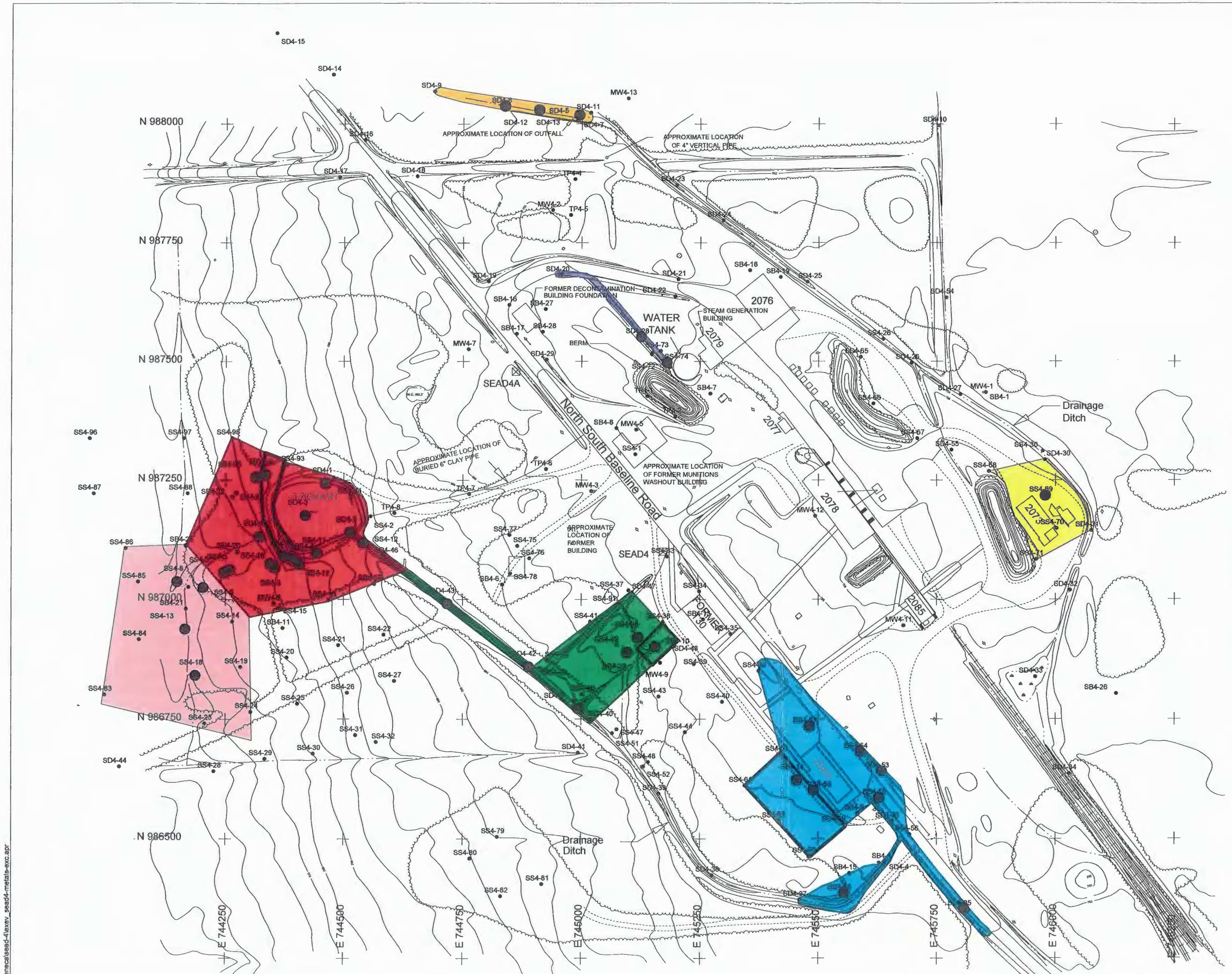
PARSONS

SENECA ARMY DEPOT ACTIVITY

SEAD-4
FEASIBILITY STUDY

Figure C
Approximate Area of Excavation
for Criteria - C
Cr > 60, Pb > 400

1" = 200' | FEBRUARY 2005



LEGEND

Cr and Pb Concentration (ppm)

- Cr < 324 and Pb < 167
- Cr > 324 or Pb > 167

Section 1	1 ft cut = 3594 cy
Section 2	1 ft cut = 3869 cy
Section 2B	4 ft cut = 1041 cy
Section 3	1 ft cut = 1740 cy
Section 3B	7 ft cut = 950 cy
Section 4	4 ft cut = 3080 cy
Section 4B	1 ft cut = 2344 cy
Section 5	1 ft cut = 312 cy
Section 6	1 ft cut = 148 cy
Section 7	1 ft cut = 942 cy

Total volume to be removed 18,020 cy

N

100 0 100 200 300 Feet

PARSONS

SENECA ARMY DEPOT ACTIVITY

SEAD-4 FEASIBILITY STUDY

Figure D
Approximate Area of Excavation for Criteria - D
Cr > 324, Pb > 167

1" = 200' | FEBRUARY 2005

o:\seneca\sead-4\exev_sead4-metals-exc.apr

LEGEND

Cr and Pb Concentration (ppm)

- Cr < 324 and Pb < 400
- Cr > 324 or Pb > 400

Section 1	1 ft cut = 3594 cy
Section 2	1 ft cut = 3869 cy
Section 2B	4 ft cut = 1041 cy
Section 3	1 ft cut = 1740 cy
Section 3B	7 ft cut = 950 cy
Section 4	1 ft cut = 1761 cy

Total volume to be removed 12,955 cy

N

100 0 100 200 300 Feet

PARSONS

SENECA ARMY DEPOT ACTIVITY

SEAD-4
FEASIBILITY STUDY

Figure E
Approximate Area of Excavation
for Criteria - E
Cr > 324, Pb > 400

1" = 200'

FEBRUARY 2005

o:\seneca\sead-4\exev_sead4-metals-exc.apr

APPENDIX B

COST EFFECTIVENESS OF EXCAVATION TO MEET TAGMS AT DEPTH

- Cost Effectiveness of Excavation to Meet TAGMs at Depth at SEAD-4
- Figures

PARSONS

MEMORANDUM

TO:	Scott Bradley, USACE - Huntsville Julio Vazquez, USEPA Joe White, NYSDEC Steve Absolom, SEDA Tom Enroth, USACE – NY District Chris Boes, AEC Keith Hoddinott, USACHPPM	**DATE:**	October 15, 2004
FROM:	Todd Heino, Parsons	**COPIES:**	**file**
SUBJECT:	Sensitivity Analysis: Cost Effectiveness of Excavation to Meet TAGMs at Depth at SEAD-4, Seneca Army Depot Activity		

The Army submitted a sensitivity analysis of the cleanup goals vs. contaminant mass removed for SEAD-4 at Seneca Army Depot on September 30, 2004. Parsons recommended that Scenario A be used to establish cleanup goals for the site. The cleanup goals were 60 mg/Kg and 167 mg/Kg for chromium and lead, respectively. NYSDEC responded that these cleanup goals were acceptable for the horizontal limits, however, the vertical limits should be the TAGM values.

The Army recommended that a similar sensitivity analysis be performed to determine if excavation of soils to meet TAGMs at depth was cost-effective. The results of this analysis are provided in this letter and attached figures/tables.

Since the submission of the sensitivity analysis on September 30, 2004, minor revisions have been made to correct for an error in the depth of excavation. As a result, the recommended scenario, Scenario A' (Cr > 167 mg/Kg, Pb > 30 mg/Kg), would excavate 25,000 cy of soil at a cost of $2.8 million, while removing 94% chromium and 72.5 % lead, by mass. The revised scenario B' would excavate 53,100 cy of soil at a cost of $5.6 million. These minor revisions do not affect the outcome of the sensitivity analysis presented in the past.

In support of the new analysis, a figure showing the excavation area for Scenario A' was revised by changing the depth of excavation based on TAGM levels (Scenario A' TAGM), where data was available, shown in **Figure A**. The cost of excavating Scenario A' to a depth to meet TAGMs is $4.4 million and the percent chromium and lead removed is 96.5% and 78.7%, respectively. This additional excavation would remove 2% more chromium (94% to 96%) than the original Scenario A' at a cost increase of 57% ($2.8 million to $4.4 million).

There is significant uncertainty with this analysis. Many of the soil sampling results show that excavation at depth to meet TAGMs is unbounded. Ten samples collected from the greatest depth interval at a specified sample location exceeded the TAGM values for chromium and for lead. Additionally, subsurface soil samples were not collected from most of the areas below the locations of contaminated surface soil or sediment samples. Due to a lack of analytical data at depth, there is great uncertainty in determining the depth of excavation required to achieve TAGMs. In order to account for this risk, the cost of excavating an additional foot was assessed (Scenario A' TAGM+1) and determined that an additional $1.7 million per vertical foot would be added to the base cost of $4.4 million. Therefore, vertical excavation to meet TAGMs could increase to $6.1 million or more.

The costs of these alternatives and the percent removal of chromium (by mass) are shown on a curve on **Figure 1** and summarized in **Table 1**. The curve illustrates that the percent mass removed is barely increasing while the cost of the removal action is increasing dramatically. The cost of excavating down to a depth to conservatively meet TAGMs, Scenario A' TAGMs+1, ($6.1 million) is over twice as much as the cost of excavating using Scenario A' cleanup goals ($2.8 million).

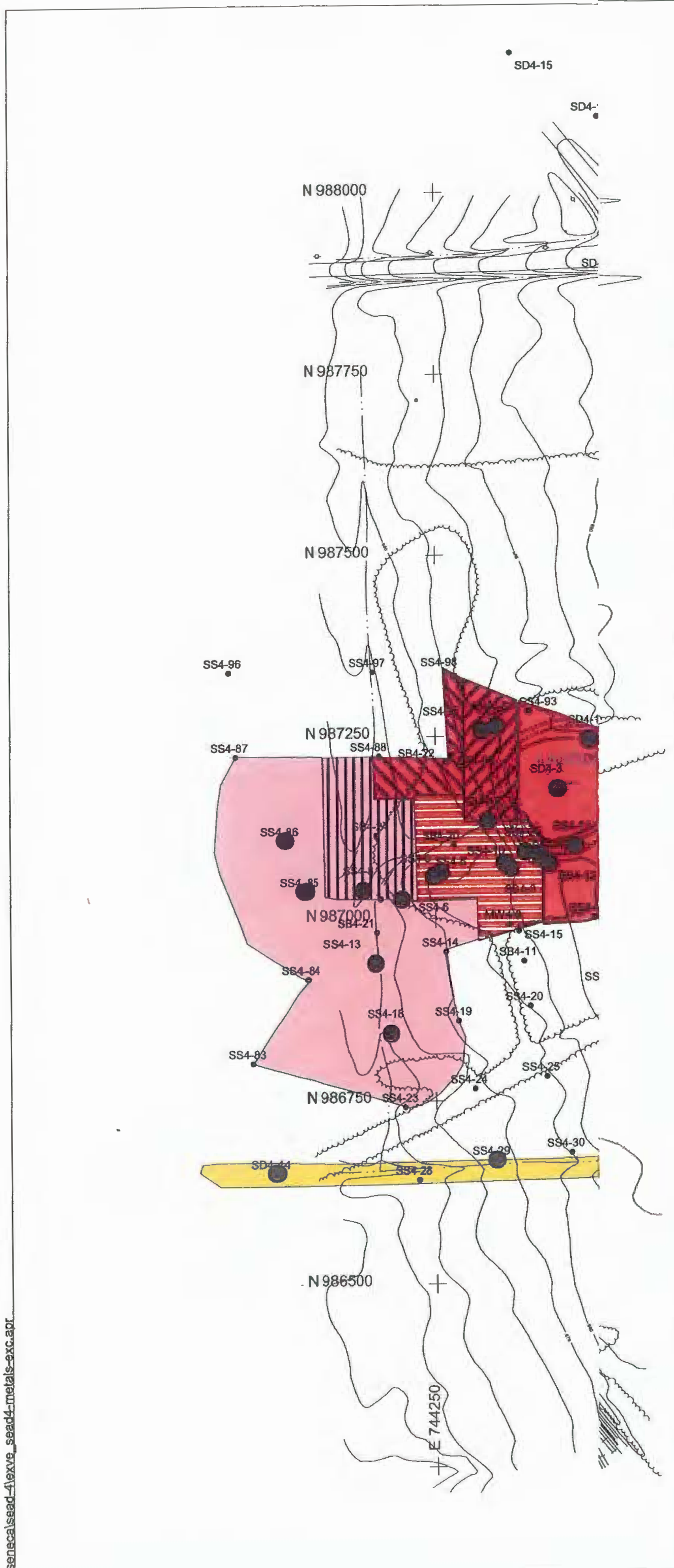
Based on these results, the Army proposes using Scenario A' for cleanup goals to determine the vertical and horizontal limits of excavation. There would be a disproportioned cost compared to the mass of contaminant removed to excavate at depth to TAGM. Additionally, the uncertainty of the depths required to achieve TAGMs could significantly add to this imbalance. These conclusions are also relevant to the removal of lead, as shown in **Figure 2**.

If you have any questions, please do not hesitate to call me at (617) 457-7905 to discuss further.

Table 1
Summary of Excavation Scenarios to Meet TAGMs at Depth
SEAD-4
Seneca Army Depot Activity

	Volume (cy)	Cost ($mill)	Mass of Chromium (Kg)	% Chromium removed	Mass of Lead (Kg)	% Lead removed
A (Original Scenario A presented at BCT meeting) [1]	22,496	$2.57	33,630	92.5%	4,439	69.4%
A' (Revised Scenario A to correct previous minor error)	25,049	$2.83	37,446	94.0%	5,082	72.5%
A' TAGM (A' modified to excavate to depths delineated by TAGMs)	41,064	$4.43	38,428	96.5%	5,518	78.7%
A' TAGM+1 (A' TAGM plus excavating an additional foot)	57,535	$6.08	39,437	99.0%	5,967	85.1%
B' (Revised Scenario B to correct previous minor error) [1]	53,128	$5.64	39,841	100%	7,010	100%

Notes:
1. Included as a point of reference.



LEGEND

Cr and Pb Concentration (ppm)

- • Cr < 60 and Pb < 167
- ● Cr > 60 or Pb > 167

Pink	Section 1 — 1 ft cut = 3604 cy
Pink with vertical lines	Section 1B — 10 ft cut = 8023 cy
Red	Section 2 — 1 ft cut = 1752 cy
Red hatched	Section 2B — 7 ft cut = 2528 cy
Red hatched	Section 2C — 4 ft cut = 1975 cy
Dark red lined	Section 2D — 9 ft cut = 8319 cy
Green	Section 3 — 1 ft cut = 2702 cy
Green outlined	Section 3B — 7 ft cut = 1219 cy
Blue	Section 4 — 1 ft cut = 1288 cy
Blue outlined	Section 4B — 4 ft cut = 7046 cy
Yellow	Section 5 — 1 ft cut = 1206 cy
Light blue	Section 6 — 1 ft cut = 148 cy
Yellow	Section 7 — 1 ft cut = 942 cy
Grey	Section 8 — 1 ft cut = 312 cy

Total volume to be removed 41064 cy

N

100 0 100 200 300 Feet

PARSONS

SENECA ARMY DEPOT ACTIVITY

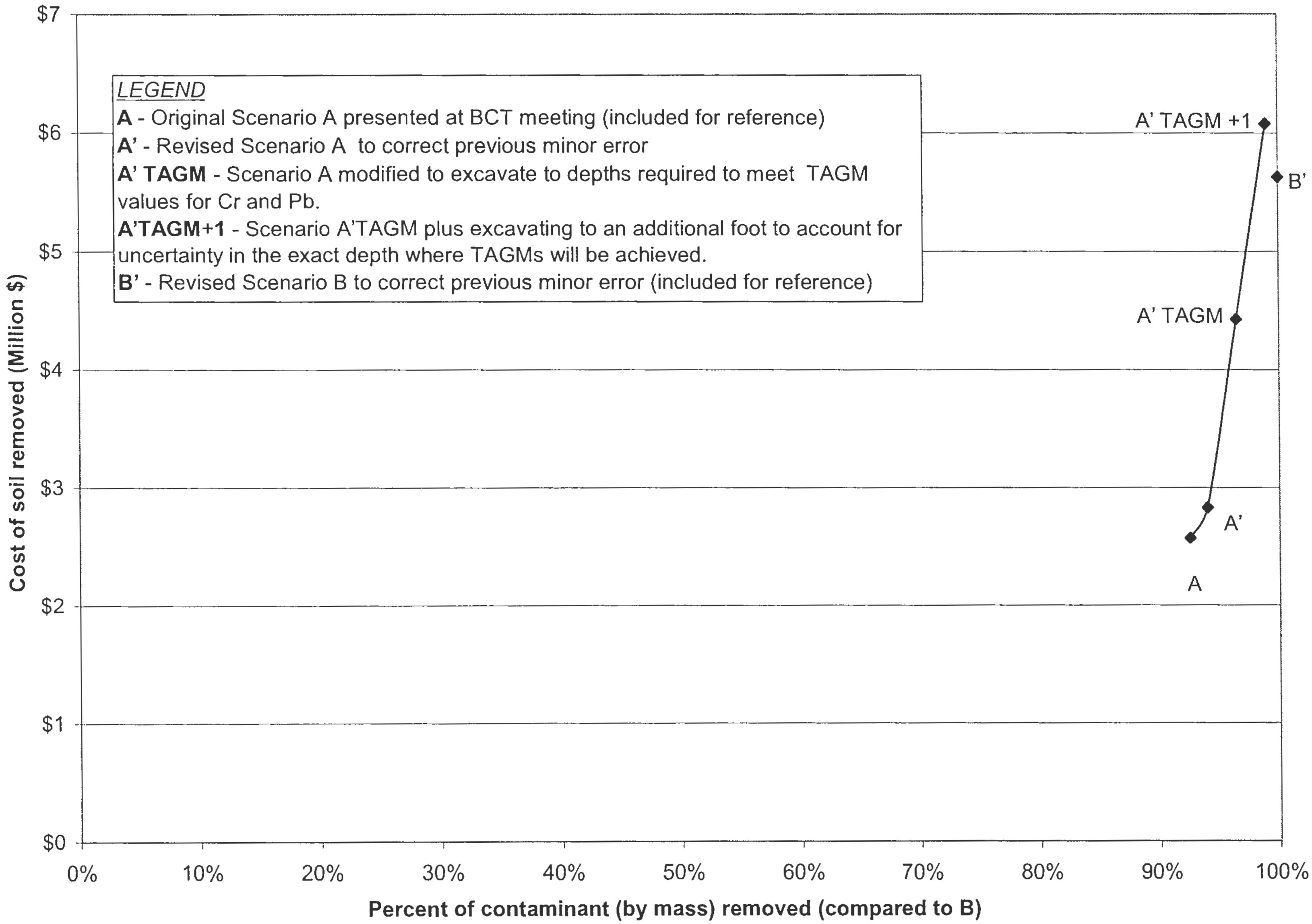
SEAD-4

**Figure A (Depth Delineated by TAGM)
Approximate Area of Excavation
for Criteria - A
Cr > 60, Pb > 167**

1" = 200'	AUGUST 2004

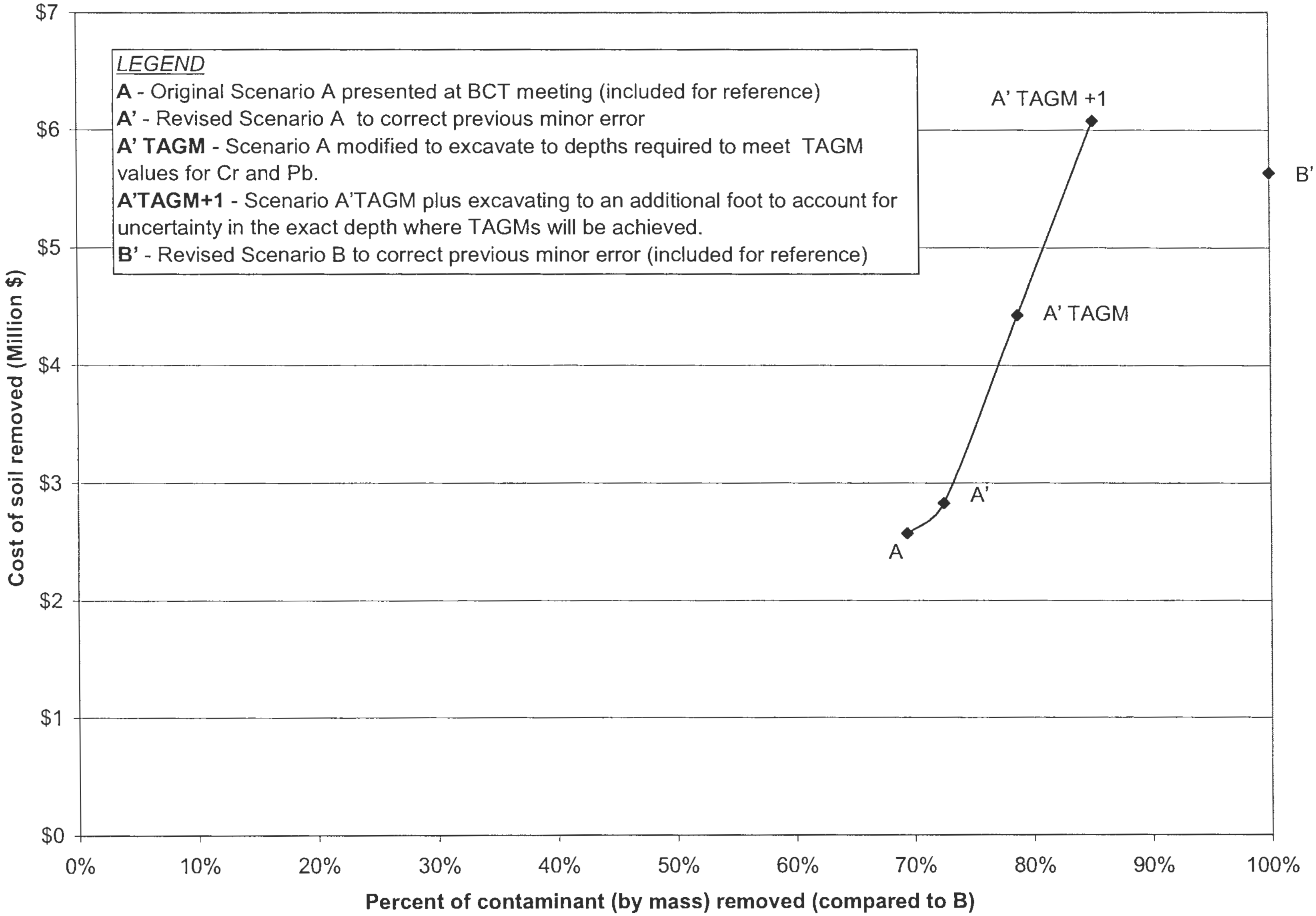
o:\seneca\sead-4\exve_sead4-metals-exc.apr

Figure 1
Cost for Chromium Mass Removal to Meet TAGMs at Depth at SEAD-4



P:\PIT\Projects\SENECA\SEAD4\FS\revised Exc Area_May2004\average concentrations\rev calcs oct04\extra depth calc.xls-Cr %B curve

Figure 2
Cost for Lead Mass Removal to Meet TAGMs at Depth at SEAD-4



P:\PIT\Projects\SENECA\SEAD4\FS\revised Exc Area_May2004\average concentrations\rev calcs oct04\extra depth calc.xls-Pb %B curve

APPENDIX C

NYSDEC Approval Letter of Sensitivity Analysis, dated January 26, 2005

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D, 12th Floor
625 Broadway, Albany, New York 12233-7013
Phone: (518) 402-9814 • **FAX:** (518) 402-9020
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

January 26, 2005

Mr. Stephen Absolom
Chief, Engineering and Environmental Division
Seneca Army Depot Activity (SEDA)
5786 State Route 96
Romulus, NY 14541-5001

Re: NYS Inactive Hazardous Waste Disposal Site No. 8-50-006
Sensitivity Analysis SEAD 4

Dear Mr. Absolom:

The "Knee of the Curve" sensitivity analysis for SEAD 4 outlined in Parsons Briefing Presentation of September 21, 2004 and modified by Parsons Memorandum of October 15, 2004 meets the DEC criteria of attaining the practicable cleanup of this site specific area in a cost effective approach to pre release conditions. This concept is approved for inclusion in the Feasibility Study and PRAP for this SEAD.

As part of this concept we have accepted determination of the horizontal extent of contamination by connecting sample points beyond the contaminated area which meet the cleanup criteria of 60 ppm Chromium and 167 ppm Lead. No removal will be necessary beyond this predetermined boundary. The assumed areas use to estimate cost and volume of contamination will be further delineated with sample results prior to the Remedial Action. The vertical attainment of the cleanup criteria will be verified by sampling post excavation and is not to be determined prior to excavation.

If you have questions, please call me at (518)- 402-9812.

Sincerely,

A. Joseph White, P.E.
Environmental Engineer 3

C:\A-Remedial Bureau A\a Site Specific\Region 8\Seneca Army Depot 8-50-006\OU 6- SEAD 4\approval knee of the curve.wpd

ecc: Mr. Steve Absolom, Seneca Army Depot
C. Bethoney, NYSDOH
P. Jones, SCIDA
J. Vasquez, USEPA
R. Battaglia, Seneca Army Depot