FINAL

ENGINEERING EVALUATION / COST ANALYSIS FOR ARSENIC IN SOIL VOLUMES I, II and III

SPRING VALLEY OPERABLE UNITS 4 AND 5 WASHINGTON, D.C.

CONTRACT DAHA90-94-D-0010,
TASK ORDER DA01
DERP-FUDS HTRW PROJECT
NO. C03DC091802

Prepared For:
U.S. ARMY CORPS
OF ENGINEERS
BALTIMORE DISTRICT

PARSONS

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December 17, 2003

Mr. Lan Reeser
CENAB-EN-HN
Baltimore District Corps of Engineers
10 South Howard Street
Baltimore, MD 21201

Re: Engineering Evaluation/Cost Analysis For Arsenic in Soil – Final, Volumes I, II, and III
Spring Valley Operable Units 4 and 5, Washington, DC
National Guard Bureau Contract No. DAHA90-94-D-0010, Task Order DA01
DERP-FUDS HTRW Project Number C03DC091802

Dear Mr. Reeser:

Enclosed are hard copies of the Final Spring Valley OU-4 and OU-5 EE/CA. Each hard copy contains a CD of the document in PDF format.

Volume I is the EE/CA report. Volume II is the presentation of the data tables and the data validation reports. Volume III includes the technical memos and other supporting sampling data.

With the inclusion of additional results from sites sampled since the Draft-Final version of this document, the EE/CA now covers all sampling from inception through September 30, 2003. This version reflects input from approximately 100 comments received from Community Members, the Spring Valley Restoration Advisory Board Technical Advisor, the DC Department of Health, American University, and comments/questions received at the August 2003 Community Meeting. The Responsiveness Summary document has been included in Volume I as Appendix C.

To assist the reader, the following summarizes the major changes from the July 2003 Draft-Final version of this EE/CA:

- The title of the document was changed to reflect that removal alternatives address only arsenic in soil, even though many other samples for analytes other than arsenic were collected.

- It was clarified that this document represents one specific step in the overall CERCLA process and that a supplementary document encompassing the forthcoming groundwater investigation and the complete assessment of the AUES List sampling results will be prepared.

- It was clarified that the arsenic screening level of 12.6 parts per million (ppm) and the remediation endpoint of 20 ppm reflect the Spring Valley Partners consensus approach to characterizing and remediating arsenic in Spring Valley, and are not risk-based numbers.

- It was clarified that the Technical Memoranda, presented in full in Volume III and summarized in Volume I, were limited studies and that no project decisions were based on their findings.

- It was clarified that Phytoremediation may become an appropriate remedy for some properties should the demonstration study so indicate. It is not currently available as a remediation alternative.

- DC Department of Health comments on the AUES List sampling, and the USACE's complete response to those comments, were added to Volume III.

If you have any questions, please call me at 703-934-2345.

Sincerely,

PARSONS

Thomas J. Bachovchin, P.G.
Project Manager

TJB:jb

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ENGINEERING EVALUATION / COST ANALYSIS FOR ARSENIC IN SOIL

SPRING VALLEY OPERABLE UNITS 4 and 5 WASHINGTON, D.C.

VOLUME I

CONTRACT DAHA90-94-D-0010, TASK ORDER DA01
DERP-FUDS HTRW PROJECT NO. C03DC091802

Prepared For:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

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December 17, 2003

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1 # ACRONYM LIST

ABPs	Agent Breakdown Products
ANOVA	Analysis of Variance
ARARs	Applicable or Relevant and Appropriate Requirements
AU	American University
AUES	American University Experiment Station
bgs	Below Ground Surface
CDC	Child Development Center
CENAB	Corps of Engineers Baltimore District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Conversion Factor
COC	Chemical of Concern
COPC	Chemicals of Potential Concern
CSA	Comprehensive Sampling Area
CSM	Conceptual Site Model
CSS	Chemical Safety Submission
CTA	Central Testing Area
CVAA/CVAO	Chlorovinylarsonic acid/Chlorovinylarsine oxide
CWA	Clean Water Act
CWM	Chemical Warfare Materiel
DA	Department of the Army
DoD	Department of Defense
DCDOH	District of Columbia Department of Health
DERP/FUDS	Defense Environmental Restoration Program/Formerly Used Defense Sites
EA	Exposure Area
EE/CA	Engineering Evaluation/Cost Analysis
EPC	Exposure Point Concentration
EPCRA	Emergency Planning and Community Right-to-Know Act
FUDS	Formerly Used Defense Site
GSD	Geometric Standard Deviation
H	Mustard Agent
HBESL	Health-Based Environmental Screening Level

HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
ICP	Inductively Coupled Plasma
IR	Soil Ingestion Rate
IRIS	Integrated Risk Information System
IUR	Inhalation Unit Risk
L	Lewisite
LDRs	Land Disposal Restrictions
LOAEL	Lowest-Observed-Adverse-Effect Level
MCLs	Maximum Contaminant Levels
Mg	Manor Glenelg
mg/kg	Milligram per Kilogram (parts per million)
mph	Miles per hour
NCP	National Contingency Plan
NOAEL	No-Observed-Adverse-Effect Level
NTCRA	Non-Time Critical Removal Action
OE	Ordnance and Explosives
OSHA	Occupational Safety and Health Act
OSR	Operation Safe Removal
OSR FUDS	Operation Site Removal Formerly Used Defense Site
OU-3	Operable Unit 3
OU-4	Operable Unit 4
OU-5	Operable Unit 5
Partners	The USEPA, DCDOH, and USACE
PEF	Particulate Emission Factor
POI	Point of Interest
PPM	Part-per-Million
PQL	Practical Quantitation Limit
PRGs	Preliminary Remediation Goals
PRSCs	Post Removal Site Controls
RA	Risk Assessment

RBCs	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RME	Reasonable Maximum Exposure
SDA	Small Disposal Area
SF	Slope Factor
SOW	Scope Of Work
SPLP	Synthetic Precipitate Leaching Procedure
SSLs	Soil Screening Levels
SSS	Site Safety Submission
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TCRA	Time Critical Removal Action
TEC	Topographic Engineering Center
UCL	Upper Confidence Limit
ULB	Urban Land Brandywine
ULMg	Urban Land-Manor Glenelg
ULSC	Urban Land-Sassafras Chillum
USACE	U.S. Army Corps Of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compound

EXECUTIVE SUMMARY

E.1 EE/CA OVERVIEW

E.1.0.1 This Engineering Evaluation/Cost Analysis (EE/CA) for arsenic and other selected chemicals at Spring Valley Operable Unit 4 and Operable Unit 5 contains: a summary of the site history; a description of the site investigation and summary of the site investigation results; a description of the nature and extent of arsenic contamination; a risk evaluation summarizing remediation endpoints and comparison criteria; the objective and goal of the removal action; an analysis of identified removal action alternatives; and, a recommendation for the selected alternative. This document does not evaluate future actions related to non-arsenic compounds.

E.2 BACKGROUND AND SITE DESCRIPTION

E.2.0.1 To address potential contamination associated with activities conducted at the former American University Experiment Station (AUES), located in Spring Valley, Washington, DC, an investigation was undertaken by the U.S. Army Corps of Engineers (USACE). A remedial investigation (RI) of the Operation Safe Removal Formerly Used Defense Site (OSR FUDS) completed by the USACE in June 1995 (USACE, 1995) determined that no further action was required, with the exception of potential future characterization activities at an area designated as the Spaulding and Captain Rankin Areas. During a 1997 review of the 1995 RI (USACE 1998), resulting from a District of Columbia Department of Health (DCDOH) report, the area investigated on the American University campus during the 1995 RI as Point of Interest (POI) No. 24 was re-examined and re-positioned to 4801 Glenbrook Road. A geophysical investigation of the grounds at 4801 Glenbrook Road determined that two geophysical anomalies had the potential characteristics of burial pits or trenches. The pits were subsequently excavated and all Chemical Warfare Materiel (CWM), ordnance and explosive (OE) items, and hazardous items were removed for appropriate off-site disposal. Although the actual location of POI 24 has not yet been determined, future investigations will focus on the 4825 Glenbrook Road property.

E.2.0.2 To address concerns voiced by DCDOH, the United States Environmental Protection Agency (USEPA), Region III, collected surface soil and subsurface soil samples in and around 4801, 4825, and 4835 Glenbrook Road to supplement their Risk Assessment (USEPA, 1999a). Based on the interim results from the USEPA Region III sampling, historical information, and the USEPA Risk Assessment, it was determined that the soil of these three properties (4801, 4825, and 4835 Glenbrook Road) could have been impacted by AUES activities in the vicinity of the two burial pits. To evaluate the potential impact, the USACE performed a site investigation to determine the nature and extent of contamination found in the surface and subsurface soils of 4801 Glenbrook Road. This area was designated as Operable Unit 3 (OU-3).

E.2.0.3 The analysis of the USACE site investigation data and the USEPA data indicated elevated levels of arsenic at 4801, 4825, and 4835 Glenbrook Road. The subsurface samples identified elevated levels of arsenic in areas where the surface soil sample results also detected elevated levels of arsenic. Based on the results of the OU-3 site investigation, an EE/CA (OU-3 EE/CA) (USACE, 2000b) and baseline risk assessments for 4801, 4825, and 4835 Glenbrook Road were prepared to respond to the potential hazard associated with arsenic contamination in the soil.

E.2.0.4 Based on the findings of the above investigations, an expanded area (approximately 91 acres) was further investigated as Operable Unit 4 (OU-4). OU-4 included approximately 80 private residences and significant portions of the current American University. This investigation indicated arsenic concentrations above risk-based concentrations and above normal background levels. In consultation with the USEPA and the DCDOH, the USACE then undertook an extensive characterization of the remaining Spring Valley FUDS boundary, some 577 acres, designated as Operable Unit 5 (OU-5). The soils of both OUs were characterized for arsenic and selected chemicals associated with AUES activities. This EE/CA addresses the findings of the OU-4 and OU-5 soil investigations.

E.3 OU-4 AND OU-5 CHARACTERIZATION

E.3.0.1 Within OU-4 and OU-5, all acreage, residential and non-residential, was divided into one-half acre (approximate) exposure areas, or sites, for sampling purposes. 1,484 sites were investigated and the soil characterized for arsenic contamination. Of these, 287 sites also had the soil characterized for selected CWM constituents representative of past practices at that specific site. The findings indicate that slightly more than 11% of the sites had arsenic above the screening criteria of 12.6 mg/kg (95^{th} percentile of the background data set). Although a small number of samples had detections for possible CWM degradation products, none of the sites contained any of the CWM or CWM degradation products at levels above their respective screening criteria.

E.4 EE/CA OBJECTIVE

E.4.0.1 The objective of this EE/CA is to evaluate and analyze site data and to recommend and justify a preferred alternative to address the contamination in the soil. The selected removal action alternative must be protective of human health and the environment. To ensure that the selected removal action alternative is also protective of groundwater and the potential for construction worker exposure, this EE/CA also addresses the potential for vertical migration of arsenic. The objective of this EE/CA does not include evaluation of future actions related to non-arsenic compounds in soil. This document does not address groundwater; a separate groundwater investigation is currently underway.

E.5 REMOVAL ACTION ALTERNATIVES

E.5.0.1 In order to satisfy the objectives, the following removal action alternatives were identified and evaluated:

- No Action;
- Institutional Controls and Engineering Controls;
- Phytoremediation (the use of plants to remove arsenic contamination);
- Soil Stabilization (the use of cement-like substances to prevent migration);
- Soil Washing (the use of solvents to remove arsenic contamination); and
- Excavation and Landfill Disposal (physical removal and landfilling of arsenic contamination).

E.6 RECOMMENDED ALTERNATIVE

E.6.0.1 Excavation and landfill disposal was selected as the recommended alternative for those areas of the Spring Valley FUDS identified as having arsenic in the soil above the remediation endpoint. This is the most effective alternative, achieves the project objectives in the timeliest manner, and has already been successfully implemented at various portions of the site.

1. INTRODUCTION

1.1 PROJECT AUTHORIZATION

1.1.0.1 This project addresses the Spring Valley Formerly Used Defense Site (FUDS) and falls under the Defense Environmental Restoration Program/Formerly Used Defense Sites (DERP/FUDS). This work is being performed under Contract DAHA90-94-D-0010, Task Order DA01, DERP/FUDS Project no. C03DC091802, for the U.S. Army Corps of Engineers (USACE), Baltimore District (CENAB). The work scope and objectives are in accordance with the response program identified in the National Contingency Plan (NCP), 40 CFR 300, and particularly subpart E, sections 300.400 through 300.415 and subpart I, sections 300.800 through 300.825. The United States Environmental Protection Agency's (USEPA) *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (USEPA, 1993) was also used for this project. All activities involving work in areas potentially contaminated with ordnance and explosives (OE) and chemical warfare materiel (CWM) was conducted in full compliance with U.S. Army Engineering and Support Center, Huntsville (USAESCH), CENAB, Department of the Army (DA), and Department of Defense (DoD) requirements.

1.2 SCOPE AND OBJECTIVE

1.2.0.1 The scope of this Engineering Evaluation/Cost Analysis (EE/CA) is to characterize and evaluate potential soil contamination within the Spring Valley Formerly Used Defense Site (Spring Valley site) for the purpose of recommending a removal action alternative. The Spring Valley site is located in the Spring Valley neighborhood of Washington, DC. The presence of arsenic resulting from past U.S. Army activities has been documented in the soil within the Spring Valley site. The regional map showing the Spring Valley site relative to Washington, DC is shown in Figure 1-1. The Spring Valley site location map is presented as Figure 1-2.

1.2.0.2 This document does not evaluate future actions related to non-arsenic compounds, nor does it address groundwater; a separate groundwater investigation is currently underway. An overarching Remedial Investigation document that integrates these other investigations will be prepared. The USACE is committed to following the NCP through performance of additional Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions, as warranted, ultimately resulting in issuance of a Decision Document (DD) that provides for close out of the site.

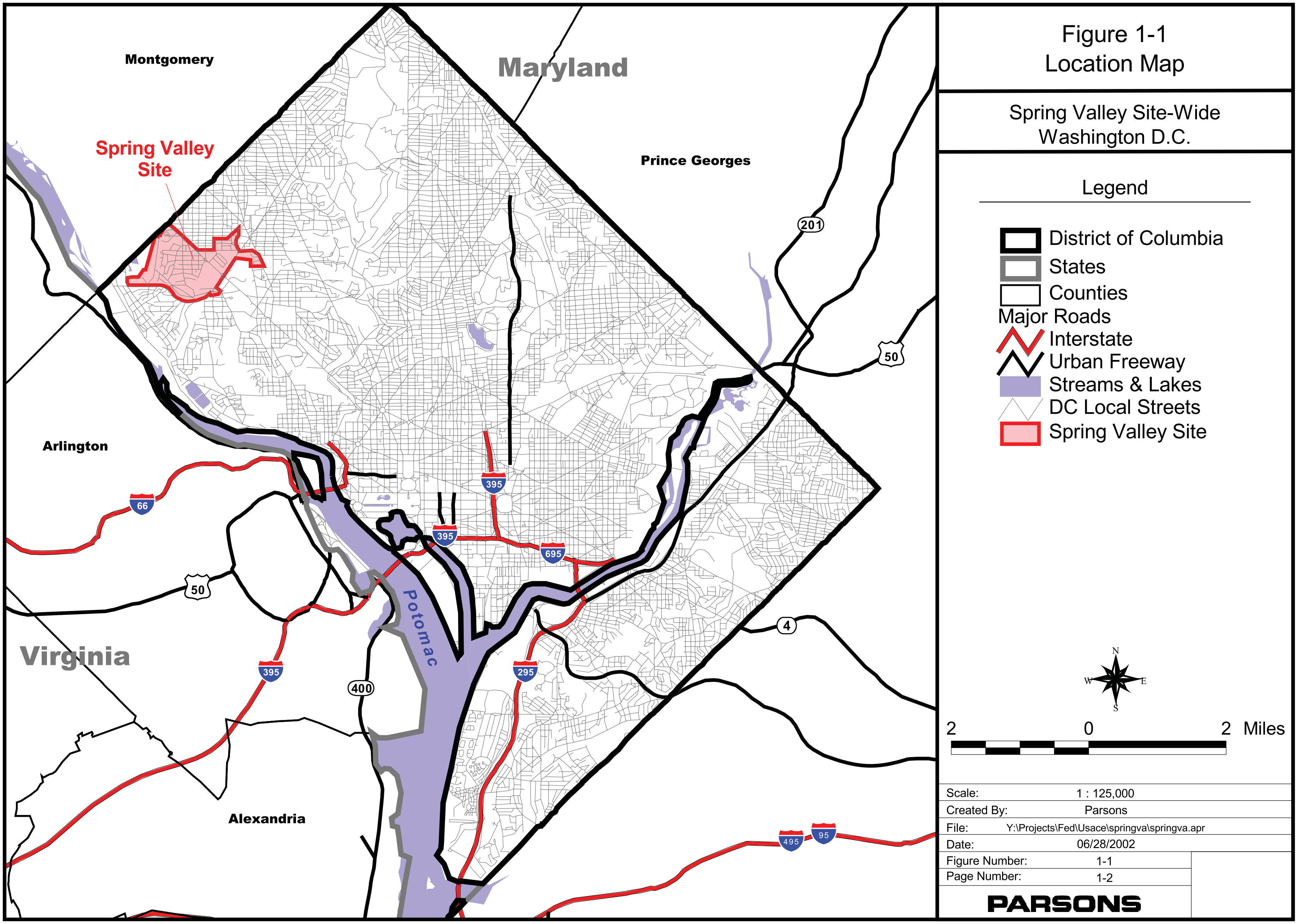
Figure 1-1
Location Map
Spring Valley Site-Wide
Washington D.C.
Legend
District of Columbia
States
Counties
Major Roads
Interstate
Urban Freeway
Streams & Lakes
DC Local Streets
Spring Valley Site
N
W
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2
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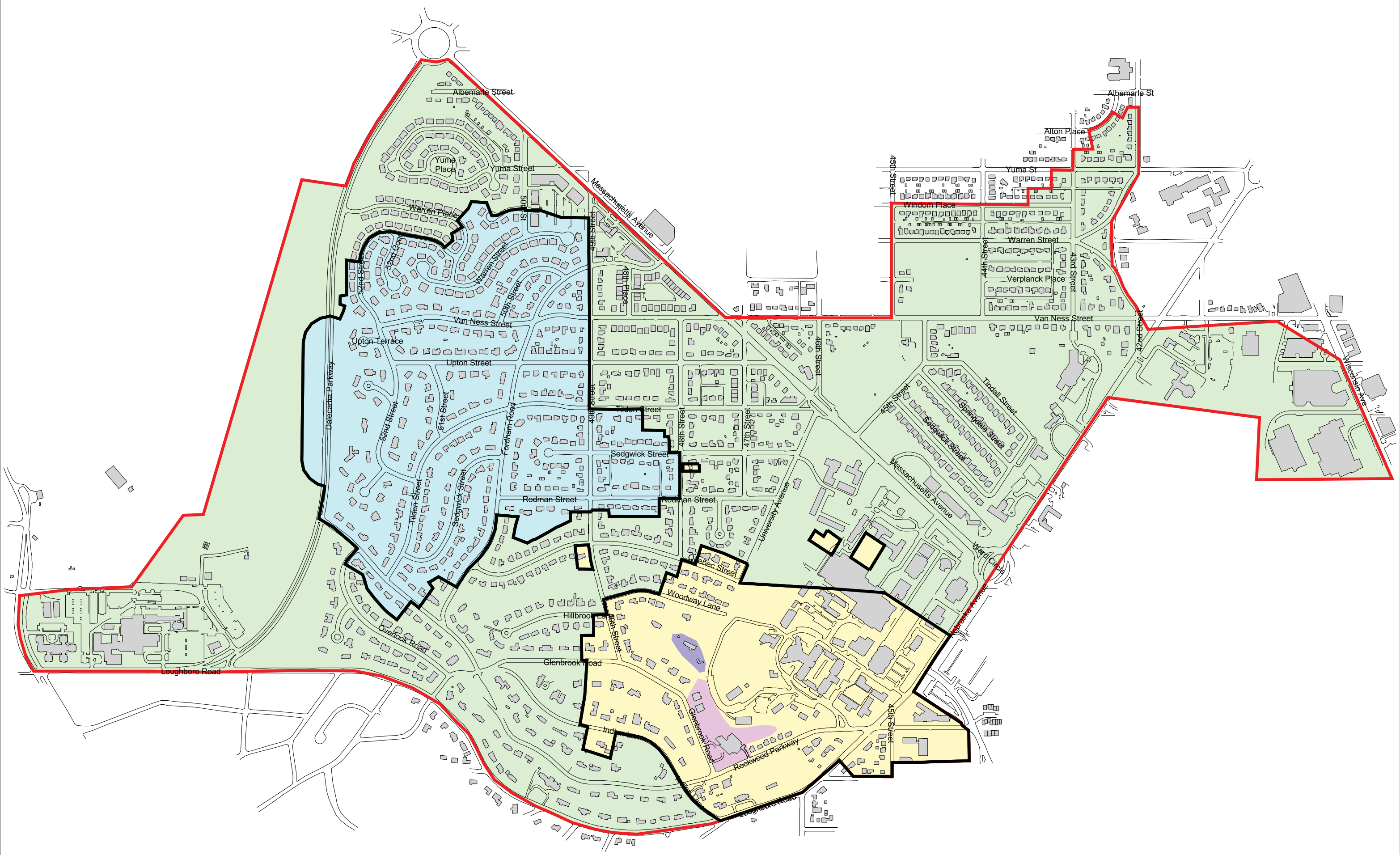

Figure 1-2
Site Location Map

Spring Valley Operable Units 4 & 5
Washington D.C.

Legend

- Spring Valley Boundary
- Buildings
- Roads
- OU-2
- OU-3
- OU-4
- Central Testing Area (CTA)
- Comprehensive Sampling Area (CSA)

Note:
OU-5 area is CTA plus CSA

N S E W

0 1000 Feet

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1.2.0.3 The objective of this EE/CA is to evaluate and analyze site data and to recommend and justify a preferred alternative to address the contamination in the soil. The selected alternative must protect human health and the environment. To perform the analysis and evaluation, the following tasks were completed:

- Determined the nature and extent of arsenic and other constituents in the surface and subsurface soils at the site;
- Performed a streamlined risk evaluation of contaminants found in soils at the site;
- Identified requirements that were applicable or relevant and appropriate to the hazard and removal action and set cleanup goals where no such requirements were identified;
- Identified and developed removal action alternatives;
- Screened the removal action alternatives; and
- Performed a comparative analysis of the remaining removal action alternatives.

1.3 SITE BACKGROUND

1.3.0.1 The U.S. Army operated the former American University Experiment Station (AUES) in a portion of Spring Valley during World War I. In January 1993, a utility contractor accidentally uncovered buried ordnance at a property in Spring Valley. Following removal of the ordnance, the USACE conducted an investigation of the area. A Remedial Investigation (RI) documenting the Operation Safe Removal FUDS (OSR FUDS) activities completed by the USACE in June 1995 (USACE, 1995) determined that no further action was required, with the exception of potential future characterization activities at an area designated as the Spaulding and Captain Rankin Areas (Operable Unit 2). During a 1997 review (RI Evaluation Report, USACE, 1998) of the 1995 OSR FUDS RI Report, initiated by the District of Columbia Department of Health (DCDOH), the area investigated on the American University campus during the 1995 RI as Point of Interest (POI) No. 24 was re-examined and re-positioned to 4801 Glenbrook Road. It was determined that two geophysical anomalies on the grounds of 4801 Glenbrook Road had the potential characteristics of pits or trenches. The pits were excavated and all CWM, OE items, and hazardous items, were removed for appropriate off-site disposal. Although the actual location of POI 24 has not yet been determined, future investigations will focus on the 4825 Glenbrook Road property.

1.3.0.2 To address concerns of the DCDOH, the USEPA Region III collected surface soil and subsurface soil samples in and around 4801, 4825, and 4835 Glenbrook Road to supplement their Risk Assessment (USEPA, 1999). It was determined that the soil of these three properties could have been impacted by AUES activities in the vicinity of the two burial pits. The USACE performed an EE/CA (USACE, 2000b) to determine the nature and extent of contamination found in the surface and subsurface soils of the three properties. The area of these three properties was designated as Operable Unit 3 (OU-3). See Figure 1-2.

1.3.0.3 Based on these events, a partnership was formed with the relevant agencies involved in the decision-making process. The Spring Valley Partners (Partners), the USEPA, DCDOH, and USACE ensure that the concerns of all parties are addressed. Additionally, advisory entities were created, including the Restoration Advisory Board (RAB) and the Scientific Advisory Panel. The Partners continue to work cooperatively on cleanup issues and project decisions, involving the public through the RAB and public outreach coordination.

1.4 CURRENT INVESTIGATION

1.4.0.1 Based on the findings of the above investigations and the recommendation of DCDOH, an expanded area (approximately 91 acres) was further investigated as Operable Unit 4 (OU-4). OU-4 included approximately 80 private residences and significant portions of the current American University (AU). This investigation indicated arsenic concentrations above risk-based concentrations and above normal background levels. In consultation with the USEPA and the DCDOH, the USACE then undertook an extensive characterization of the remaining Spring Valley FUDS, some 577 acres, designated as Operable Unit 5 (OU-5). The soils of both Operable Units were characterized for arsenic and selected CWM compounds associated with AUES activities. This EE/CA addresses the findings of the OU-4 and OU-5 investigations.

1.4.0.2 Within OU-4 and OU-5, all acreage, residential and non-residential, was divided into one-half acre (approximate) exposure areas, or sites, for sampling purposes. To date, 1,484 sites have been investigated and the soil characterized for arsenic contamination. Of these, 287 sites also had the soil characterized for selected CWM constituents representative of past practices at that specific site. The findings indicate that slightly more than 11% of the sites had arsenic above the screening criteria. Although a small number of samples had detections for possible CWM degradation products, none of the sites contained any of the CWM or CWM degradation products at levels above their respective screening criteria.

1.5 REPORT ORGANIZATION

1.5.0.1 This EE/CA comprises three volumes. The EE/CA report in Volume I consists of an Executive Summary, 10 sections, and 2 appendices. Section 1 contains an introduction to the project. Section 2 provides a site description and history. Section 3 discusses the field investigation performed and the results of that investigation. Section 4 discusses the source, nature, and extent of contamination. Section 5 contains a risk evaluation, including a discussion of the applicable comparison criteria and remediation endpoints. Section 6 discusses the removal action goal and objectives. Section 7 provides the identification and analysis of the removal action alternatives. Section 8 provides the comparative analysis of removal action alternatives. Section 9 describes the recommended removal action alternative. Section 10 provides the references. Appendix A contains detailed maps of individual sites and features relevant to the sampling effort. Appendix B contains a detailed presentation of the costs associated with the recommended alternative.

1.5.0.2 Volume II, Sampling Results and Data Validation, presents all OU-4 and OU-5 sample data organized by type of sampling and the associated data validation reports, as well as the USEPA split sampling results.

1.5.0.3 Volume III, Technical Memoranda and Other Supporting Data, presents the following memoranda and data reports relevant to the characterization of OU-4 and OU-5:

- Arsenic Speciation Technical Memorandum
- Arsenic Bioavailability Technical Memorandum
- Arsenic SPLP Technical Memorandum
- AUES List Sampling – Report of Results
  - 3819 48th Street, 4710 Quebec Street, 4625 & 4633 Rockwood Parkway
  - AU Lot 12 and Child Development Center
  - Sedgwick Trench Area
- Sampling Procedures – Supporting Memoranda

2. SITE CHARACTERIZATION

2.1 SITE DESCRIPTION

2.1.1 Site Location and History

2.1.1.1 The Spring Valley site is located in the Spring Valley neighborhood of northwest Washington, DC. The 668-acre area currently includes approximately 1,200 private residences, foreign embassies, AU, Wesley Seminary, and numerous commercial properties. It includes the former AUES and Camp Leach. The area was originally 661 acres, but further refinement of the boundary at the northeastern extension (between 42nd Street and Wisconsin Avenue) and the southeastern area (around Newark and 34th Street) added approximately seven acres. During World War I, the U.S. Government established the AUES to investigate the testing, production, and effects of noxious gases, antidotes, and protective masks. The AUES was located on the grounds of the current AU and used additional portions of property in the vicinity to conduct this research and development of CWM (including mustard, Lewisite, and Adamsite agents), irritants, and smokes. The areas not used for testing were used to house and train troops (Camp Leach). Some areas that were part of AUES, but which are not within the current 668- acre FUDS boundary, will be addressed under future investigations.

2.1.1.2 In the spring of 1921, the Construction Division began salvage and restoration work and all temporary facilities were dismantled. At the end of the war, interest in buying properties for residential use slowly grew. Those properties formerly occupied by the AUES, but not part of the university property, were developed for housing (USACE, 1995).

2.1.2 Structure and Topography

2.1.2.1 Cut and fill maps were generated by USACE for the OSR FUDS RI (USACE, 1995) by merging 1918 and 1983 topographic maps. The 1983 topographic map was based on elevation data revised in 1965. The maps were digitized and then horizontally aligned by using features common to both maps (e.g. roads, street intersection and buildings). The vertical alignment was performed by digitally correcting the scale followed by a comparison of the contour lines. Vertical alignment was also confirmed by identifying two peak elevations with no apparent changes between 1918 and 1991. Based on the subsurface soil borings collected at 4801 Glenbrook Road it was confirmed that the cut and fill maps accurately depict areas of cut and fill within OU-3 vicinity

2.1.2.2 This information was supplemented by an aerial survey conducted in November 2000 for the OU-4 investigation. This provided updated 2-foot elevation contour intervals. The cut and fill maps were regenerated based on the 1918 topographic map's 10-foot elevation contour intervals and the new contour intervals.

2.1.3 Geology and Soil Information

2.1.3.1 Four geological formations are apparent in the vicinity of the site. These formations (from west to east) are the Sykesville Formation, the Dalecarlia Intrusive Suite, an Actinolite Schist, and the Coastal Plain Terrace Formation (USGS 1994). The Sykesville Formation is sedimentary melange consisting of fragments of metagraywacke, migmatites, amphibolite, and actinolite schist in a quartzofeldspathic matrix. The Dalecarlia Intrusive Suite consists of massive to well-foliated biotite monzogranite and lesser granodiorites. The Actinolite Schist unit consists of actinolite schist, actinofels, actinolite-chlorite schist and lesser talc bearing rocks. The Coastal Plain Terrace Gravel consists of highly weathered, crudely bedded gravel, sand, silt, and clay (Fleming, A. H., Drake, A. A., Jr., McCartan, Lucy, 1994). The Piedmont Formations are igneous or metamorphic in origin. The Coastal Plain Terrace Formation is fluvial in origin (Fleming, A. H., Drake, A. A., Jr., McCartan, Lucy, 1994). Schistosity is the major structural feature of the Piedmont rocks and saprolite at the site.

2.1.3.2 Four soil associations are present within Spring Valley: the Urban Land-Sassafras Chillum (ULSC), the Urban Land-Manor Glenelg (ULMg), Manor Glenelg (Mg), and Urban Land Brandywine (ULB). The ULMg soil association is a well to moderately well drained soil resulting from the weathering of the basement rocks (schist). The ULSC soil results from the weathering of Coastal deposits. However, typically these soils have been greatly disturbed by construction and landscaping activities. The bedrock consists of a variety of metasedimentary rocks of actinolite schist. Relatively competent saprolite material is encountered at depth that ranges between 6 to 10 feet below ground surface (bgs). This material appears to be the transition between loose soil material and highly competent bedrock. During the 4801 Glenbrook Road burial pit investigation, extremely competent saprolite was still being encountered after excavation to 18 feet.

2.1.4 Groundwater

2.1.4.1 Groundwater depth at the site is not known. During the investigation of the burial pits at 4801 Glenbrook Road, one pit extended as deep as 18 feet and at no time was groundwater encountered. There are various aquifer systems associated with the site vicinity. These include terrace gravels and fracture system aquifers associated with the Piedmont formations, saprolite systems, and fill systems. Groundwater may be found in any and all of these aquifers, however, the majority of the groundwater would be expected to be found in the underlying bedrock that comprises the fracture system aquifer. Additionally, there are a number of major fault and fold systems in the site vicinity. These features, as well as the topography of the site, will affect the general flow of groundwater.

2.1.4.2 There is no evidence to suggest that the groundwater aquifers are used for drinking water. The District of Columbia is supplied water by a treated and tested water distribution system. However, it is the DCDOH position that all groundwater could potentially be used for drinking water and therefore, DCDOH has requested a groundwater investigation. This investigation is currently underway.

2.1.5 Surrounding Land Use and Populations

2.1.5.1 Land use in and around Spring Valley is primarily low-density residential (three to four dwellings per acre). The campus of AU is considered institutional use. Zoning on site is also predominantly for single-family detached housing except on the AU Campus, which is zoned for apartments.

2.2 SENSITIVE ECOSYSTEMS

2.2.1 Flora and Fauna

2.2.1.1 During the OSR FUDS RI, research was conducted into the nature and type of fauna and flora found within Washington, DC. Due to the extensive development of Spring Valley, native vegetation is generally limited to narrow bands associated with the intermittent streams or the area west of Dalecarlia Parkway. The dominant plant species are red maple, white oak, red oak, chestnut oak, mountain laurel, and greenbriar. The District of Columbia exhibits a diverse fauna for an area that is principally urban in character. Approximately 35 species of mammals and 175 species of birds occur within the District of Columbia throughout the year. The occurrence of parklands generally determines the relative abundance and location of wild life (USACE, 1995).

2.2.2 Aquatic Life and Wetlands

2.2.2.1 There are numerous small creeks and streams throughout the District of Columbia. For the OU-3 EE/CA, the small creek located east of the house at 4801 Glenbrook Road was reviewed in more detail than any other creeks or streams. It was determined that the small size and the extensive development of the area would limit the types of aquatic organisms that might be present. The stream may contain frogs, toads, oligocheates (worms), snails, and assorted aquatic insects. No evidence that the creek supports a population of native fish was found. Wetlands in the site vicinity are limited. No wetlands were impacted by the OU-4 and OU-5 investigation activities.

2.2.3 Wildlife and Endangered Species

2.2.3.1 Because Spring Valley is largely developed, wildlife species found are typical of those found in most urban-suburban areas. Mammals that can be found in and around the site include, the gray squirrel, as well as raccoons, opossums, eastern chipmunks, field mice, deer, voles, and moles (USACE, 1995).

2.2.3.2 Common birds in the area include those that have adapted to an urban-suburban environment such as the American robin, catbird, mockingbird, Carolina chickadee, Carolina wren, downy woodpecker, common flicker, European starling, house sparrow, rock dove, mourning dove, and song sparrow. Black vultures and turkey vultures have aerial coverage throughout the vicinity. Migrating birds such as Canadian geese and other waterfowl frequent the area (USACE, 1995). Because Spring Valley and the areas surrounding it are mostly developed, they provide little habitat for rare, threatened, or endangered species. According to the U. S. Fish and Wildlife Service, "Except for occasional transient individuals, no proposed or federally listed endangered or threatened species are known to exist within the Spring Valley site" (US Department of the Interior, 2003).

2.3 METEOROLOGY

2.3.1.1 Observational records have been kept continuously at locations within the District of Columbia since November 1870. These weather-monitoring stations were relocated to Reagan National Airport and Dulles International Airport when these airports opened in the 1940s and 1970, respectively. The District of Columbia area has an average yearly temperature of 54.5ºF, and the climate in the area is classified as modified continental. The average length of the growing season is 200 days. The coldest average daily temperatures are in late January and early February (upper 20sºF), and the warmest average daily temperatures are in mid-July (upper 80sºF).

2.3.1.2 Normal annual precipitation is approximately 41 inches and is distributed evenly throughout the year. Thunderstorms may occur at any time, but are most frequent during the later spring and summer. Downpours and gusty winds most often accompany the storms. Tropical storms can bring heavy rains. Hailstorms can occur in the spring. Rainfalls of over 7 inches have occurred during hurricanes. Average snowfall is approximately 20 inches per year. Although a snowfall of 10 inches or more in 24 hours is unusual, several notable snowfalls of more the 25 inches within 24 hours have occurred. Winds are generally light and variable, but thunderstorms can bring gusty winds. Usually, the gusts from windstorms are not severe. Prevailing wind direction is from the northwest. The average wind speed in the Washington D.C. area is approximately 9 miles per hour (mph). Wind gusts can be expected to peak at approximately 40 mph, but may occasionally reach approximately 60 mph. Tornadoes and tropical storms occur infrequently, but these storms can and have caused damage in the District of Columbia area.

2.4 RELATED REMOVAL ACTIONS/INVESTIGATIONS

2.4.1 OSR FUDS Remedial Investigation

2.4.1.1 In January 1993, a utility contractor accidentally uncovered buried ordnance at a property in Spring Valley. Following removal of the ordnance, the USACE conducted a Remedial Investigation [OSR FUDS RI (USACE, 1995)] of the entire area within the OSR FUDS boundary. During the investigation, some 53 areas of potential hazards were identified and designated as POIs. The investigation utilized geophysical technology to identify buried ordnance and soil sampling to identify areas of soil contamination. In June 1995, the USACE determined that no further action was required at the Spring Valley site, with the exception of a portion of the site known as the Spaulding and Captain Rankin Areas.

2.4.1.2 In June 1994, an EE/CA was performed for the Spaulding and Captain Rankin Areas (USACE 1996a) to determine the appropriate action for addressing the soil and material contained within the former shell pits and surrounding areas. The shell pits had the potential to contain: intact OE items; scrap OE items; and, intact containers filled with CWM and CWM breakdown products. Some OE-related items were encountered, including OE scrap, frag, and fused components. The only compounds identified that posed an unacceptable risk to human health were lead and arsenic in the soil. During the removal, all material was taken off site for disposal. Mustard was identified in one bunker drain line, however this was most likely the result of an analytical quality assurance anomaly associated with the original analysis. In June 1996, the USACE recommended that no further action be taken at the Spaulding and Captain Rankin Areas.

2.4.2 Burial Pit EE/CA Investigation

2.4.2.1 During a 1997 review (RI Evaluation Report, USACE, 1998) of the 1995 OSR FUDS RI Report, initiated by DCDOH, the area investigated on the American University campus during the 1995 RI as POI 24 was re-examined and re-positioned to 4801 Glenbrook Road. POI 24 had been identified as a probable pit through interpretation of a 1918 aerial photograph. To further evaluate the situation, the USACE performed a geophysical investigation of the grounds at 4801 Glenbrook Road to locate and characterize the potential burial pit. It was determined that two geophysical anomalies on the grounds of 4801 Glenbrook Road had the potential characteristics of pits or trenches. Nine other anomalies did not have the characteristics of pits or trenches. All eleven anomalies were investigated and resolved. Although the actual location of POI 24 has not yet been determined, future investigations will focus on the 4825 Glenbrook Road property

2.4.2.2 To perform the investigation of the eleven anomalies, a Site Safety Submission (SSS) [*Site Safety Submission, Spring Valley, Operable Unit 3, Washington, DC,* prepared for the U.S. Army Engineering and Support Center, Huntsville (USAESCH), by Parsons Engineering Science, Inc. (USACE 1999b), as changed, amended, and approved by the Department of Defense Explosive Safety Board (DDESB) and the U.S. Army Technical Center for Explosives Safety (USATCES)], was prepared. Investigative work on the two burial pits at 4801 Glenbrook Road began in March 1999 and concluded approximately one year later. The objective of the investigation was to determine the extent and nature of the material contained within the two burial pits. Approximately 288 pieces of ordnance, 14 of which were chemical munitions; 175 glass bottles, 77 of which contained acids and other chemicals; 39 cylinders, and 9 metal drums, were recovered. Additional compounds detected in soil samples included various volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals (most notably arsenic). The excavation of the pits concluded when the pit characterization soil samples (floor and wall samples) did not detect CWM, CWM breakdown products, or elevated levels of VOCs, SVOCs, or metals. All recovered material was disposed off site at a facility appropriate for the type of material and level of contamination, as follows: all CWM contaminated scrap, or

CWM contaminated soil was disposed at a licensed industrial waste disposal incinerator; material determined to be hazardous under the Resource Conservation and Recovery Act (RCRA) guidelines was disposed of at a RCRA subtitle C landfill; material considered RCRA non-hazardous or not contaminated with CWM was disposed of in a sanitary landfill.

2.4.2.3 Another burial pit (Test Pit 23), partially on 4801 Glenbrook Road and partially on the adjacent 4825 Glenbrook Road property was investigated in the same manner (Site Safety Submission, Addendum 10, USACE, March 2001). Several hundred OE items and a three CWM-related items were recovered from this pit. The 4801 Glenbrook Road portion was cleared, backfilled, and restored, while the 4825 Glenbrook Road site was temporarily backfilled pending resolution of various administrative issues.

2.4.3 Small Disposal Area

2.4.3.1 In April 1999, during a USEPA Spring Valley sampling event, a DCDOH representative discovered surface debris located on AU property in the vicinity of the 4801 Glenbrook Road site. The area, designated as the Small Disposal Area (SDA) was thought to be a burial site potentially associated with AUES CWM research and testing activities. The investigation was conducted under the Site Safety Submission, Addendum 09, USACE, October 2000. In January 2001, debris including old used oil filters, glass and labware, and other miscellaneous debris, was removed from the SDA by the USACE. Soil contaminated with elevated levels of arsenic, lead, and mercury was encountered. Historical evidence suggests that during the operation of the AUES, the SDA was very close to the perimeter fence of the AUES. An archaeological review of the items recovered during the excavation concluded that there were likely at least two dumping episodes, and that the manufacturing date ranges of the laboratory artifacts are consistent with use during the AUES activities, but the data do not confirm whether these materials were dumped before or after closure of the AUES. The area was backfilled and closed following the 2001 removal. The approximate location of the SDA is at the eastern tip of the OU-3 boundary shown in Figure 1-2.

2.4.4 Time Critical and Non-Time Critical Removal Actions

2.4.4.1 To address concerns of the DCDOH, the USEPA Region III collected surface soil and subsurface soil samples in and around 4801, 4825, and 4835 Glenbrook Road to supplement their Risk Assessment (USEPA, 1999). It was determined that the soil of these three properties could have been impacted by AUES activities in the vicinity of the two burial pits. The USACE performed grid sampling to determine the nature and extent of contamination found in the surface and subsurface soils of the three properties (OU-3). The OU-3 EE/CA and baseline risk assessments for 4801, 4825, and 4835 Glenbrook Road addressed the potential hazard associated with arsenic contamination in the soil. A Non-Time Critical Removal Action (NTCRA) was performed to address the arsenic-contaminated soil at 4825 and 4801 Glenbrook Road. The soil removal was conducted from December 2000 to August 2002. The soil at 4835 Glenbrook Road is expected to be addressed in a future removal action.

2.4.4.2 Grid sampling conducted in January 2001 as part of the OU-4 and OU-5 investigation identified arsenic contamination in the surface soils at the Child Development Center (CDC). This property, located on AU property within the boundaries of OU-4, was formerly used for AUES activities. A Time Critical Removal Action (TCRA) was performed to address contaminated soil at the CDC. The soil removal was completed by November 2001 *(Post Removal Action Report, USACE, Draft Final, December 2002).*

2.4.4.3 Grid sampling conducted in March 2001 as part of the OU-4 and OU-5 investigation identified arsenic contamination in the surface soils on other portions of the AU campus. A TCRA was also conducted to address this arsenic-contaminated soil at the AU athletic fields and other AU lots located within OU-4. These areas include grids associated with AU lots 8, 10, 11, 12, 13, 14, and 15; soil borings that were sampled in AU Lots 16, 19, 23 and 24; and the grounds around Kreeger Hall and Watkins Hall. These areas were also formerly used for AUES activities. The soil removal was begun in the summer of 2002 and is on-going (*Removal Action Design, USACE, June 2002).*

2.4.4.4 The USACE determined that TCRAs would also be performed at several residential properties. The prioritization of these properties was based on the results of the arsenic testing. An Exposure Point Concentration (EPC), derived from the 95 percent Upper Confidence Limit (UCL) of the grid arsenic data, was used as the primary prioritization strategy. Other factors used to prioritize removals included access agreements and proximity logistics, where otherwise lower priority sites close to high priority sites were also scheduled. Tier I properties had EPCs greater than or equal to 90 ppm arsenic. Tier II properties had at least one grid greater than or equal to 150 ppm arsenic. This work was begun in July 2002 and is on-going. These properties include:

Tier I (EPC > 90 ppm)	Tier II (one grid > 150 ppm)
▪ 4446 Tindall Street	▪ 4641 Rockwood Prkwy
▪ 4438 Tindall Street	▪ 4230 Fordham Street
▪ 4219 50th Street	▪ 4647 Massachusetts Avenue
▪ 4119 45th Street	▪ 4007 49th Street
▪ 4460 Springdale Street	▪ 3709 Corey Street
▪ 4115 45th Street	▪ 4651 Massachusetts Avenue
▪ 4456 Springdale Street	▪ 4637 Rockwood Prkwy
▪ 4442 Tindall Street	▪ 5001 Rockwood Prkwy
▪ 4434 Tindall Street	▪ 4624 Van Ness Street
▪ 4425 Upton Street	▪ 4655 Massachusetts Avenue
	▪ Group 5, Lot 15
	▪ 4850 Rockwood Prkwy
	▪ 3800 52nd Street

2.4.5 OE/CWM Investigations

2.4.5.1 Various investigations focusing on identification of geophysical anomalies and the search for and subsequent remediation of OE/CWM burial pits (if present) have been undertaken or are in the process of being conducted. Because those investigations focus on finding OE/CWM burial pits and therefore have different objectives than the subject of this document (arsenic-contaminated soil), only a general summary of those activities is presented here.

2.4.5.2 The Partners developed a prioritization scheme to focus on those areas requiring additional geophysical investigation and those anomalies requiring intrusive investigation. A Chemical Safety Submission (CSS) was prepared as a site-wide plan to address the safe performance of the investigation and recovery of OE or CWM items associated with the AUES. As described in the CSS, based on the site history and previous investigations, the following items could be present: empty or CWM-filled ordnance, including 75mm rounds, Livens projectors, 3-inch Stokes mortars; or related items such as ceramic jars potentially containing CWM. In addition to the intrusive investigation described in section 2.4.2, anomalies were investigated and/or excavated at a POI known as the Sedgwick Trench area and also on portions of the current AU Campus (AU Lots).

2.4.6 Other

2.4.6.1 In the 1930's a house was built at 4801 Glenbrook Road. In the early 1980's this house was demolished and the residence for the Ambassador of the Republic of South Korea to the United States was constructed. The two remaining lots north of 4801 Glenbrook Road remained undeveloped until 1992. In 1992 two houses were built north of 4801 Glenbrook Road on the lots of 4825 and 4835 Glenbrook Road. During the construction of the 4825 house, some glassware was encountered, and construction workers reportedly complained about an exposure during work activities. During the construction of the house at 4835 Glenbrook Road a closed 55-gallon drum, laboratory jars and equipment, and ceramic pieces were encountered. The soil where this material was encountered was characterized as having had a "rotten odor". The site was evaluated by Environmental Management Systems Inc. (EMS) who performed a site investigation and deemed the site "okay" to continue work (Apex, 1996). In 1996 workers at 4835 Glenbrook Road were excavating to install trees and experienced irritation to the eyes and respiratory system. Laboratory glassware was observed in this excavation. Apex Environmental over-excavated the holes and performed a site investigation of 4835 Glenbrook Road. Other than the material removed, Apex concluded that there were no significant levels of contamination.

3. SAMPLE PROGRAM AND RESULTS

3.1 SAMPLE PROGRAM OVERVIEW

3.1.0.1 The sample program for OU-4 and OU-5 was designed using the *Soil Screening Guidance: User's Guide, (USEPA, July 1996)* [Soil Screening Guidance]. Detailed procedures for conducting the sample program are contained in the *Final Work Management Plan for Spring Valley Operable Unit 4 (USACE 2000a)* and the *Final Work Management Plan for Spring Valley Operable Unit 5 (USACE 2002)* [WMP]. The sample program acknowledges the uncertainties inherent in any investigation of this type. Uncertainties derive from the use of assumptions, professional judgment, imperfections in the sampling and analytical processes, and whether data are truly representative of contaminant and site conditions. These uncertainties have been minimized in this investigation by following standard accepted sampling practices, using approved analytical methodologies, and validating the sample results in accordance with USEPA guidelines.

3.1.0.2 Both OUs contain residential properties and non-residential acreage (commercial property, undeveloped areas, parks, etc.). In accordance with the Soil Screening Guidance, this acreage was divided into one-half acre lots (approximate) to represent discrete exposure areas (EAs). Each EA, whether residential property or non-residential acreage, was considered a "site", i.e., a discrete exposure area to be sampled. For tracking purposes, the sites were further categorized by type of exposure area as either residential properties (homes) or non-residential acreage (lots).

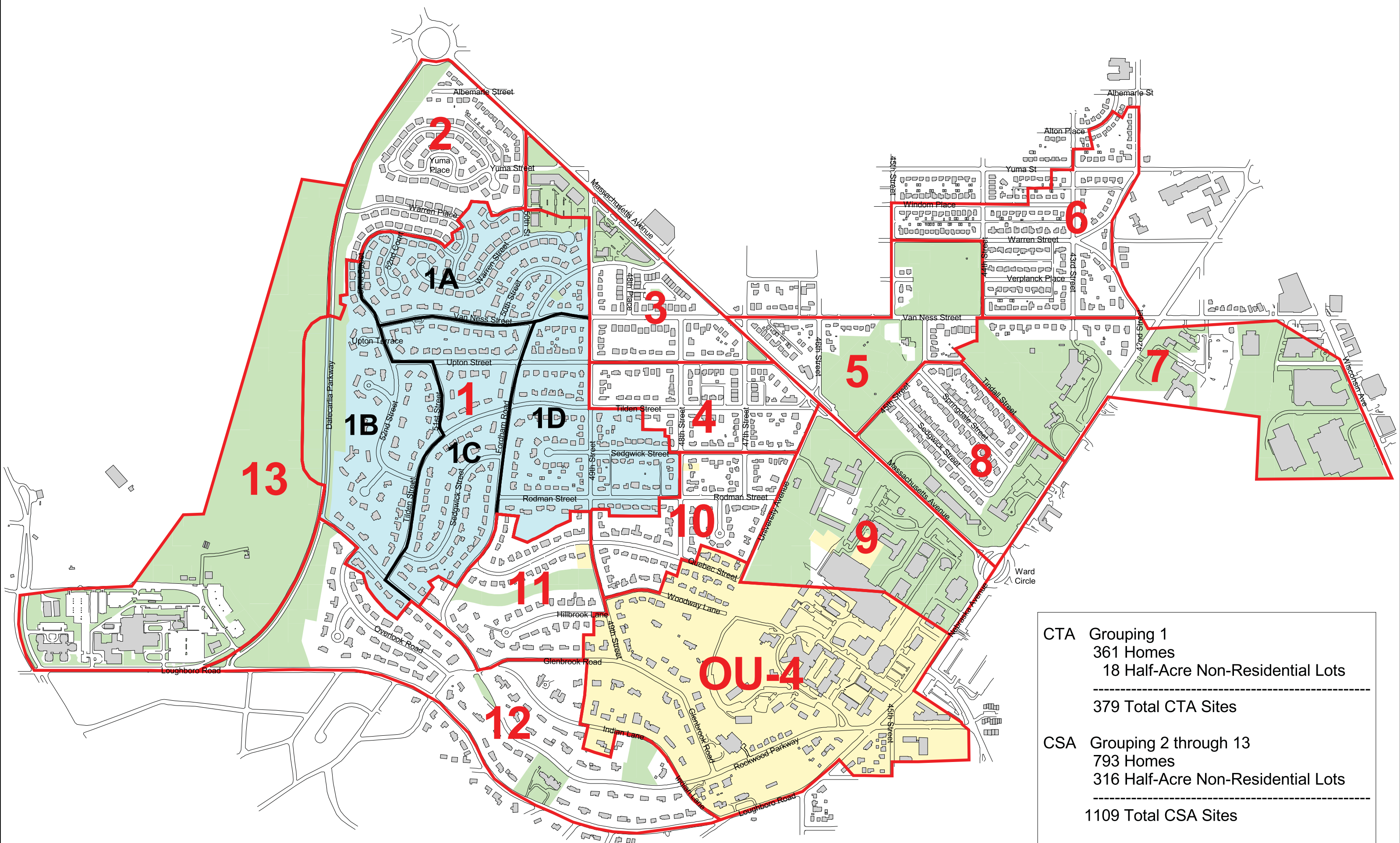
3.1.0.3 Figure 3-1 presents the entire Spring Valley site boundary with the OU-4 and OU-5 boundaries indicated. Detailed maps of individual sites showing cut and fill contours, groundscar data, surveyed boring locations, and other information relevant to understanding the sampling effort are contained in Appendix A.

3.1.0.4 The sampling effort for OU-4 began in August 2000 and for OU-5 in June 2001; the effort is on-going as of the date of this document. A cut-off date of September 30, 2003 was used to present and discuss sample data for this document. This represents approximately 93% of all available sites in OU-4 and OU-5. Complete validated sampling results for each site and each type of sampling through September 30, 2003, are contained in the data tables in Volume II (Sampling Results and Data Validation).

3.1.0.5 Surface and sub-surface sampling was completed throughout Spring Valley; the following subsections discuss the area-specific sampling by type and location.

3.1.1 OU-4

3.1.1.1 The area defined as OU-4 is approximately 91 acres of residential properties and non-residential acreage, including 80 homes and 34 lots (114 total sites). This acreage total does not



CTA	Grouping 1 361 Homes 18 Half-Acre Non-Residential Lots 379 Total CTA Sites
CSA	Grouping 2 through 13 793 Homes 316 Half-Acre Non-Residential Lots 1109 Total CSA Sites
OU-4	80 Homes 34 Half-Acre Non-Residential Lots 114 Total OU-4 Sites

Figure 3-1 Geographical Groupings

Spring Valley Operable Units 4 & 5
Washington D.C.

Legend

- CTA Groupings
- Groupings
- Buildings
- Roads
- Non-Residential Acreage
- CTA
- OU-4

Note:
OU-5 Acreage comprises groupings 1 through 13.

CSA is groupings 2 through 13.

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas. Sampling of these lots will be based on open accessible portions determined in the field.

0 1000 Feet

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include the area of commercial or other non-residential buildings that could not be sampled, but does include the acreage of paved areas such as parking lots. This count is based on aerial photographic surveys and available real estate records. The lots are mainly AU property (AU Lots). Some properties outside of the established OU-4 boundary were sampled as OU-4 sites to accommodate specific requests, prior to the establishment of OU-5. As indicated on Figure 3-1, the area of OU-3 is contained within the OU-4 boundary. Sites sampled within OU-3 were addressed in the OU-3 EE/CA.

3.1.2 OU-5 Central Testing Area (CTA)

3.1.2.1 Based on the past usage of areas within OU-5, the OU-5 soil sampling effort was divided into two phases: 1) the Central Testing Area (CTA), and 2) the Comprehensive Sampling Area (CSA). The CTA includes the POIs where AUES CWM field testing was documented based on aerial and ground photographs, testing reports, and other historical documents. The CTA boundary was established by including a 200-foot buffer around the POIs with documented field testing. Once each POI 200-foot buffer was established, the CTA boundary line connected all the POI 200-foot outer boundary lines, enclosing all of that acreage within a larger area designated as the CTA. The CTA is approximately 132 acres. The CTA contains 361 homes and 18 lots (379 total sites).

3.1.3 OU-5 Comprehensive Sampling Area (CSA)

3.1.3.1 The CSA includes all the remaining acreage outside of the CTA (not including the OU-3 and OU-4 area. The CSA is approximately 445 acres. The CSA contains 793 homes and 316 lots (1109 total sites).

3.1.4 Geographical Groupings

3.1.4.1 In order to most efficiently perform the sampling, the OU-5 sites were geographically grouped (Figure 3-1). For OU-5, the CTA is one grouping, while the CSA is divided into 12 groupings. The arbitrary boundaries of the groupings were intended to be approximately equal work efforts to help plan the sampling. The groupings also helped track specific samples by providing location-based nomenclature.

3.1.4.2 Table 3.1 summarizes the total site count organized by OU and Geographical Groupings.

Table 3.1
Site Count

Geographical Grouping	Homes	Lots	Total Sites	Acreage
OU-4				
OU-4 Total	**80**	**34**	**114**	**91**
OU-5 (CTA)				
1A	104	3	107	
1B	57	15	72	
1C	85	0	85	
1D	115	0	115	
CTA Total	**361**	**18**	**379**	**132**
OU-5 (CSA)				
2	109	11	120	
3	79	8	87	
4	90	0	90	
5	46	33	79	
6	149	0	149	
7	17	66	83	
8	76	20	96	
9	0	47	47	
10	83	0	83	
11	59	6	65	
12	85	21	106	
13	0	104	104	
CSA Total	**793**	**316**	**1109**	**445**
OU-5 Totals	**1154**	**334**	**1488**	**577**
OU-4 + OU-5				
OU-4 + OU-5 Totals	**1234**	**368**	**1602**	**668**

3.2 SAMPLE PROCEDURES

3.2.1 Quadrant Surface Sampling – OU-4 and CTA

3.2.1.1 In general accordance with the Soil Screening Guidance, each OU-4 and CTA site was divided into four equal areas called quadrants. Six (6) surficial soil samples (sub-samples) were collected per quadrant. These sub-samples were composited to make one sample for the quadrant for submittal to the analytical laboratory (4 samples per site). The sub-samples were collected from random locations within the quadrant. For CTA properties approximately two acres or larger, the property was divided into approximately half-acre lots. Each of those half-acre lots received the quadrant sampling described above. For OU-4 properties approximately two acres or larger, each quadrant received 12 random sub-samples. Samples were not collected where cultural features and/or current site features prevented access to the surface soils (i.e. equipment sheds, patios, gravel roads etc.). Samples were collected from the first six inches of surficial soil.

3.2.1.2 It should be noted that the actual procedure used to collect quadrant samples deviated slightly from the Soil Screening Guidance. The Soil Screening Guidance calls for six total samples per site, with each sample comprising one sub-sample from each of the four quadrants. An analysis was performed to ensure that the deviation from the Soil Screening Guidance procedure would not compromise attainment of the project decision error goals described in the WMP. The memorandum describing this analysis is contained in Volume III of this document.

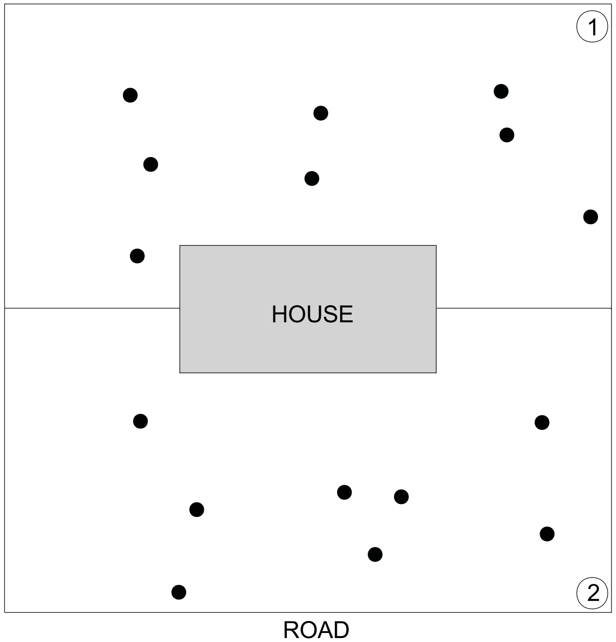
3.2.2 Half Surface Sampling – CSA

3.2.2.1 The CSA sampling design considered that this acreage did not contain documented CWM field testing areas. Therefore, fewer samples were collected (in general, because of the documented CWM field testing, the CTA included a more focused sampling approach than the CSA). Each CSA site was divided into two equal halves (essentially the front and backyard for a home). Eight (8) surficial soil samples (sub-samples) were collected from each half. This number of sub-samples maintained the relative statistical power of the quadrant sampling approach used for OU-4 and the CTA. Samples were not collected where cultural features and/or current site features prevented access to the surface soils. Samples were collected from the first six inches of surficial soil. For properties approximately two acres or larger, the property was divided into approximately half-acre lots. Each of those half-acre lots received the half sampling described above. A statistical analysis was also performed to demonstrate that the CSA sampling approach maintained the relative statistical power of the quadrant approach and to show that the project decision error goals described in the WMP could be achieved using this procedure. The CSA statistical memorandum is also contained in Volume III of this document.

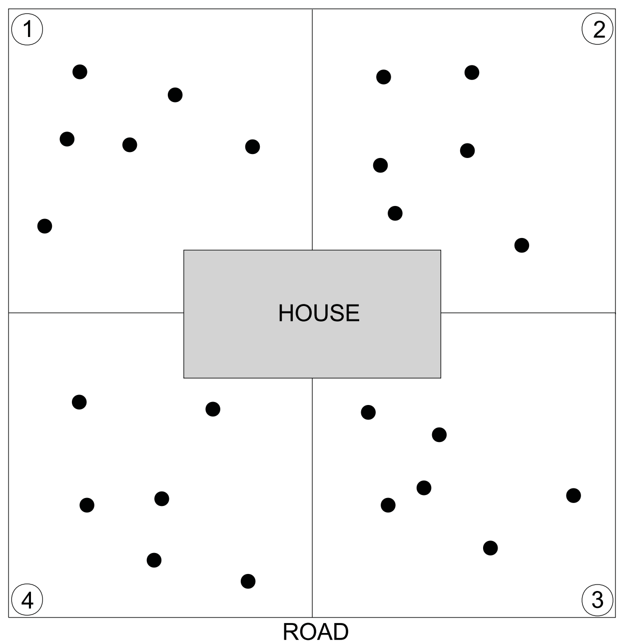
3.2.2.2 Figure 3-2 presents the example sampling configurations for each approach.

3.2.3 Subsurface Sampling – OU-4

3.2.3.1 In general, one subsurface boring was advanced at each site. For properties approximately two acres or larger, two borings were advanced per lot. Subsurface borings were advanced following clearance by the anomaly avoidance personnel. Sampling of the boring was continuous. A Geoprobe was used to obtain the boring samples. A Geoprobe is a thin bore sampling instrument that uses direct push technology to obtain a subsurface sample. To help site the boring, the cut and fill map developed during the 1995 RI was used to determine which areas



Example Half Sampling Configuration - CSA
(8 sub-samples composited into 1 for the half)



Example Quadrant Sampling Configuration - CTA & OU4
(6 sub-samples composited into 1 for the quadrant)

Figure 3-2
Example - Quadrant and Half Sampling Configuration

Spring Valley Operable Units 4 & 5
Washington D.C.

Legend

- ● Sub-Sample Location Randomly Placed
- (1) Quadrant or Half

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represent fill material since 1918 levels. The standard rationale for siting a boring was as follows: the boring locations reflected the USEPA Photographic Interpretation Center (EPIC) identified groundscars and stressed vegetation (features that may indicate areas potentially related to the former AUES activities). If none were present, the boring was located in a fill area, with the boring extending two feet beyond the fill (to a maximum depth of 10 feet). In an area of cut or a level area, the boring was advanced six feet below ground surface (bgs).

3.2.4 Subsurface Sampling – CTA

3.2.4.1 In general, one subsurface boring was advanced at each site. For properties approximately two acres or larger, the property was divided into approximately half-acre lots and one boring was advanced per lot. Subsurface borings were advanced following clearance by the anomaly avoidance personnel. Sampling of the boring was continuous. A direct push Geoprobe contractor was used to obtain the boring samples.

3.2.4.2 For most sites, the standard rationale described below directed where the boring was located. Certain CTA-POI locations followed a different rationale; those are also described below.

To help site the boring, the cut and fill map developed during the 1995 RI was used to determine which areas represent fill material since 1918 levels. The standard rationale for siting a boring was as follows: the boring locations reflected the USEPA Photographic Interpretation Center (EPIC) identified groundscars or stressed vegetation (features that may indicate areas potentially related to the former AUES activities). If none were present, the boring was located in a fill area, with the boring extending two feet beyond the fill (to a maximum depth of 10 feet). In an area of cut or a level area, the boring was advanced six feet below ground surface (bgs). Areas of fill that contain groundscars or stressed vegetation were the priority location for the boring.

3.2.5 Subsurface Sampling – CSA

3.2.5.1 Within the CSA, borings were placed on approximately 15% of the sites (approximately 166 sites). The sites were selected based on the prioritization analysis listed in Table 3.2 with borings in the highest priority sites (Priority 1) selected first, then Priority 2, etc., until the total amount (15% or 166 sites) was reached. Once a CSA site was selected using the prioritization logic, the standard rationale for locating the boring at the site was used. Additionally, for CSA sites that exceeded the arsenic screening level (discussed in section 3.2.6), that did not originally get a subsurface boring using the prioritization logic, borings were placed based on grid sampling results as follows: if any CSA half arsenic result was greater than 43 milligrams per kilogram (mg/kg), a boring with analytical parameters as discussed in Section 3.3.2 was placed.

Table 3.2
Subsurface Boring Placement Rationale (In Order of Priority)

1.	Overlapping ground scars in undisturbed area (cut/fill ≤ 4 ft.)
2.	Overlapping ground scars in disturbed area (cut/fill: 4 ft. < cut ≤ 10 ft., 4 ft. < fill ≤ 10 ft.
3.	Ground scar and later stressed vegetation or single 1918 ground scar in undisturbed area.
4.	Ground scar and later stressed vegetation or single 1918 ground scar in disturbed area.
5.	Single ground scar (post 1918) in undisturbed area.
6.	Single ground scar (post 1918) in disturbed area.
NOTES:	♦ Cut and fill refers to the ground scar or stressed vegetation, not the entire lot. ♦ Borings must be placed in ≤ 8 ft. fill for lots with existing houses and ≤ 10 ft. fill for undeveloped lots.

3.2.6 Grid Sampling

3.2.6.1 Sites containing surface sample results exceeding the screening level of 12.6 mg/kg [also described as parts-per-million (ppm)] arsenic received further investigation. Development of the screening level and a discussion of other comparison criteria, are presented in Section 5. Sites with at least one quadrant or half sample exceeding 12.6 mg/kg arsenic were grid sampled. The grid system consisted of 20-foot by 20-foot squares (grids) oriented across the entire site, with a single discrete sample collected at the grid center. On a case-by-case basis, some sites received a tighter grid system (10-foot by 10-foot), for example, some residences near the Sedgwick Trench Area. Also, some sites that had sample results less than the screening level, but which were in close proximity to other sites that contained screening level exceedances, were also grid sampled.

3.2.6.2 Table 3.3 summarizes the sample count by site type and analytical parameter. The table includes sampling through September 30, 2003.

Table 3.3
Sample Count

Area	Arsenic Surface	Arsenic Sub-surface \1	Specialty Parameters \2	Arsenic Grid
OU-4	428	648	250	1,291
OU-5 CTA	1,556	2,538	101	2,369
OU-5 CSA	2,138	1,387	184	3,696
Total	4,122	4,573	535	7,356

\1 Includes all soil boring samples collected during both quadrant/half & grid sampling. This counts all one-foot sample intervals in a single boring.

\2 Includes all specialty parameter samples collected during both quadrant/half & grid sampling.

3.3 ANALYTICAL PROGRAM

3.3.1 Surface Sample Analyses

3.3.1.1 The quadrant and half surface samples are composites. With the exception of the AU Lots and 4835 Glenbrook Road, these were analyzed for arsenic only. Surface samples for the AU Lots and 4835 Glenbrook Road also received mustard agent breakdown product (ABP) analysis. The grid samples are discrete samples; they were also analyzed for arsenic only. Note that the 4835 Glenbrook Road property is actually within OU-3. Although the arsenic contamination associated with this property is addressed in separate OU-3 documentation (Action Memorandum), the ABP results are discussed in this document.

3.3.2 Subsurface Sample Analyses

3.3.2.1 The subsurface samples were discrete samples collected at the bottom of each one-foot interval in the boring and analyzed for arsenic. Additionally, specific lists of compounds to be analyzed, based on the documented AUES activities, were developed for the CTA POI sites (POIs are shown on Figure 3-3, presented later in the discussion). These POI-specific lists of compounds were organized into sample plans as shown in Table 3.4. All CSA borings were analyzed for Sample Plan 2 parameters. These sample plans were collectively designated as “Specialty Parameters” to distinguish from arsenic-only analysis.

3.3.2.2 The POI-specific specialty parameters were only collected from one interval in the boring. With the exception of the POI 13 and Sedgwick Trench borings, the selected one-foot interval was the 1918 level (6 inches above and 6 inches below) as determined by the cut and fill data. In cut areas, or zero cut/fill, the specialty parameter sample was collected at 0-12 inches bgs. The trench boring samples were collected at the trench bottom, the most likely area of residual contaminants.

3.3.2.3 Subsurface sample analyses for the OU-4 samples were different from the OU-5 analyses. The OU-4 sites that were part of the AU campus (AU Lots) received a boring with arsenic analysis at every foot, plus mustard ABP analysis for the subsurface sample collected at the 1918 level. Table 3.4. indicates the specific mustard ABPs. The OU-4 sites that were private homes only received arsenic analyses for the subsurface samples, with the exception of portions of the sampling described in sections 3.8 through 3.11 below.

Table 3.4
Subsurface Sample Plans

Sample Plan No.	Sample Plan 1	Sample Plan 2	Sample Plan 3	Sample Plan 4
Area	**POI 19**	**POIs 15R & 16R, and CSA Subsurface**	**POIs 7R, 13, 39**	**POI 38**
Compounds	Arsenic	Arsenic	Arsenic	Arsenic
	Mustard	Mustard	Mustard	Tetryl
	Mustard ABPs (Oxathiane, Dithiane, Thiodiglycol)	Mustard ABPs (Oxathiane, Dithiane, Thiodiglycol)	Mustard ABPs (Oxathiane, Dithiane, Thiodiglycol)	Trinitrotoluene (TNT)
		Lewisite ABPs (CVAA/CVAO)	Lewisite ABPs (CVAA/CVAO)	Nitroglycerin
		Cyanide	Cyanide	2,4 dinitrotoluene (2,4-DNT)
			Tetryl	2,6 dinitrotoluene (2,6-DNT)
			Trinitrotoluene (TNT)	Nitrobenzene
			Nitroglycerin	
			2,4 dinitrotoluene (2,4-DNT)	
			2,6 dinitrotoluene (2,6-DNT)	
			Nitrobenzene	

3.4 OU-4 SAMPLING RESULTS

3.4.1 Arsenic Sampling Results

Through September 30, 2003, 107 sites (73 homes and 34 lots) had been sampled within OU-4. This includes surface and subsurface samples. Of these, 21 sites exceeded the screening level of 12.6 mg/kg arsenic and warranted follow-on grid sampling. The highest surface quadrant arsenic result was 101 mg/kg. The highest subsurface quadrant boring arsenic result was 124 mg/kg. This result was from the 0-1 foot bgs sample from the boring. The highest subsurface quadrant boring arsenic result at a depth greater than 1 foot bgs was 71.4 mg/kg. This result was from the 1-2 foot bgs sample from the boring. Based on arsenic concentrations in subsurface boring samples from four of the AU lots (AU lot 16, 19, 23, and 24), follow-on work was warranted as described in Section 2.4.4.

3.4.1.1 A summary of these results, as well as a summary of the following discussions, is presented in Table 3.5. The complete data tables for all the sampling can be found in Volume II.

Table 3.5
Results Summary

Sample Type	Highest Arsenic Result (mg/kg)	Sample ID\1	Exceed Arsenic Screening Criteria?	Detected Specialty Parameter (compound) \2	Sample ID\1	Exceed Specialty Screening Criteria?	Follow-on Action\3
OU-4 Surface	101	OU4-4625RP-3	YES	Thiodiglycol	OU4-AU06-2	NO	Grid Sampling
OU-4 Subsurface	124	OU4-AU12-SB1	YES	Thiodiglycol	OU4-AU24-SB2	NO	Removal
OU-4 Grid	498	OU4-CDC-(150,140)	YES	NONE	NA	NA	Removal
OU-5 CTA Surface	105	CTA-1A-4219(50)-4	YES	NONE	NA	NA	Grid Sampling
OU-5 CTA Subsurface	62.8	CTA-1C-5046Sedg-SB1	YES	Cyanide	CTA-1C-3940FR-SB(9-10)	NO	Removal
OU-5 CTA Grid	613	CTA-1B-3800(52)-(40,80)	YES	NONE	NA	NA	Removal
OU-5 CSA Surface	202	CSA-5-4115(45)-2	YES	NONE	NA	NA	Grid Sampling
OU-5 CSA Subsurface	20.6	CSA-9-L44-SB3	YES	Cyanide	CSA-2-5133YS-SB(2-3), CSA-3-4105(49)-SB(7-8), CSA-10-4813WL-SBB(2-3), and CSA-10-4813WL-SBA(8-9)	NO	TBD
OU-5 CSA Grid	529	CSA-5-4115(45)-(0,20)	YES	NONE	NA	NA	Removal

\1 Sample nomenclature explained in WMP and in Volume II.
\2 Compound was detected, but concentration was well below the screening level.
\3 Follow-on action based on arsenic results. Action may not have been completed by date of this report.
NA - Not applicable. TBD – To be determined

3.4.2 Specialty Parameters Sampling Results

3.4.2.1 The mustard ABPs collected on the AU lots are considered to be the specialty parameters for OU-4 sampling and the 4835 Glenbrook Road property. Mustard ABPs were only detected in two OU-4 samples, representing two different AU lots. The detected ABP was thiodiglycol, and each detection was well below the screening level for this compound. The 4835 Glenbrook sampling indicated thiodiglycol detections in each of the four quadrant surface samples. The concentrations were well below the screening level for this compound. A discussion of the screening level for thiodiglycol, as well as for other comparison criteria, is presented in Section 5.

3.4.3 Grid Sampling Results

3.4.3.1 As indicated above, 21 of the 107 sampled OU-4 sites exceeded the arsenic screening level and received grid sampling. Additionally, as a conservative measure, one site (4629RP) that did not exceed the arsenic screening level was grid sampled because of proximity to numerous other sites that had arsenic screening level exceedances. A total of 22 OU-4 sites were grid sampled. The highest OU-4 grid sample arsenic result was 498 mg/kg.

3.4.3.2 Figure 3-3 presents the grid sampled site locations. This figure includes OU-4 and OU-5 sites sampled, and for which data had been validated, through September 30, 2003, in order to track with the data tables presented in Volume II. Individual site maps showing grid results are also included in Volume II.

3.5 OU-5 CTA SAMPLING RESULTS

3.5.1 Arsenic Sampling Results

Through September 30, 2003, 364 sites (355 homes and 9 lots) had been sampled within the OU-5 CTA. This includes surface and subsurface samples. Of these, 51 sites exceeded the screening level of 12.6 mg/kg arsenic and warranted follow-on grid sampling. The highest surface quadrant arsenic result was 105 mg/kg. The highest subsurface quadrant boring arsenic result was 62.8 mg/kg. This result was from the 0-1 foot bgs sample from the boring. The highest subsurface quadrant boring arsenic result at a depth greater than 1 feet bgs was 22.8 mg/kg. This result was from the 4-5 foot bgs sample from the boring. In September 2001, the USEPA took 16 split samples with the USACE at selected CTA locations. The results, which indicate no discrepancies between USEPA and USACE arsenic concentrations, are presented in Volume II.

3.5.2 Specialty Parameters Sampling Results

3.5.2.1 The only specialty parameter detected in an OU-5 CTA sample was cyanide. Cyanide was detected in only one of the 101 specialty samples collected in the CTA. The cyanide

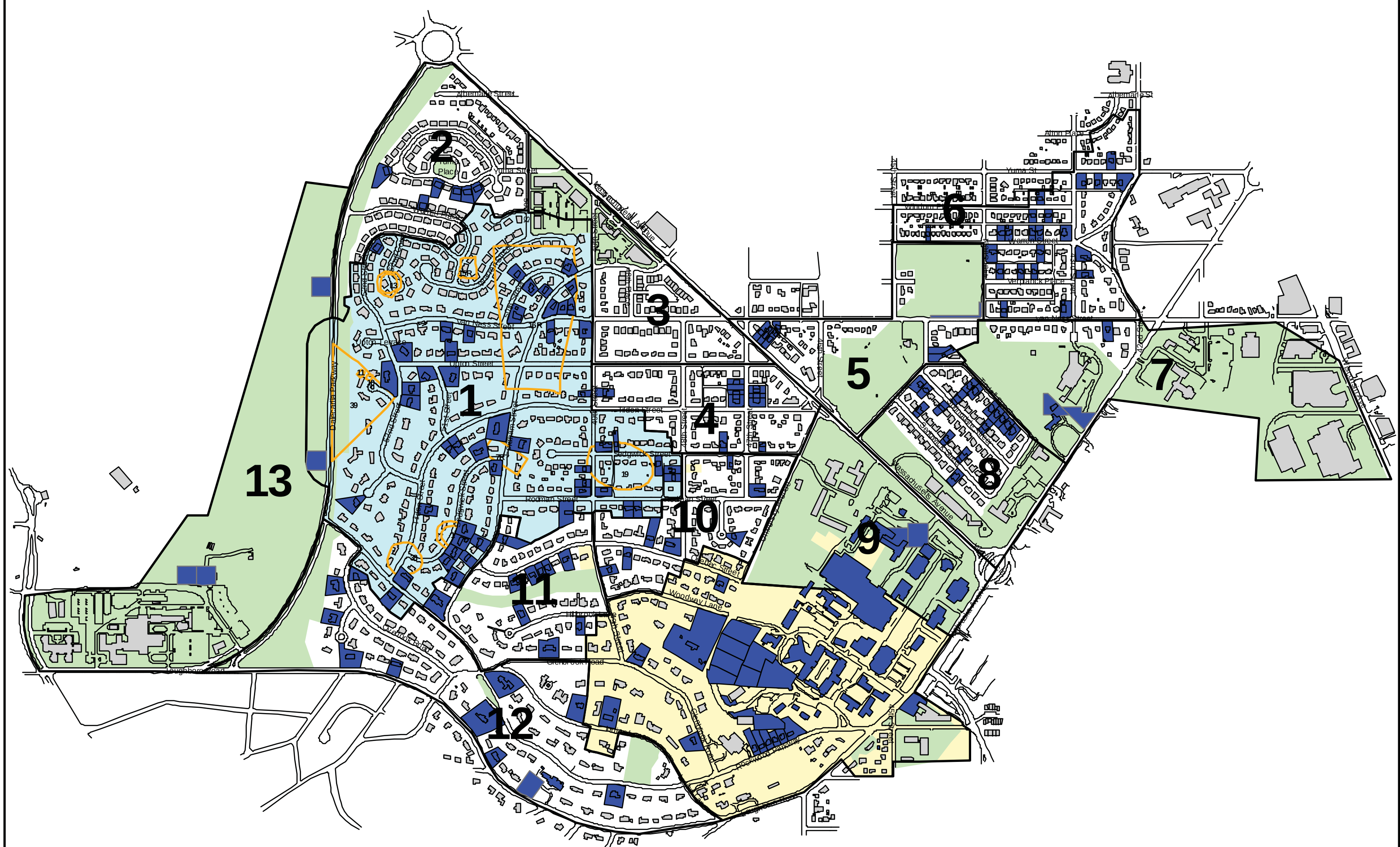

Figure 3-3
Grid Sampled Sites

Spring Valley Operable Units 4 & 5
Washington D.C.

Legend

- Grid Sampled Property
- Groupings
- POIs
- Buildings
- Roads
- Non-Residential Acreage
- CTA
- OU-4

Notes:

OU-5 Acreage comprises groupings 1 through 13.

CSA is groupings 2 through 13.

A site needed to exceed 12.6 ppm arsenic in order to warrant grid sampling.

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detection was well below the screening level for this compound. Section 4.4 provides a discussion of the extent of the specialty parameter detections. Discussion of the screening level for cyanide, as well as for other comparison criteria, is presented in Section 5.

3.5.3 Grid Sampling Results

3.5.3.1 As indicated above, 51 of the 364 sampled OU-5 CTA sites exceeded the arsenic screening level, warranting grid sampling. Of the 51 sites, 50 had been grid sampled through September 30, 2003. The highest OU-5 CTA grid sample arsenic result was 613 mg/kg. See Figure 3-3.

3.6 OU-5 CSA SAMPLING RESULTS

3.6.1 Arsenic Sampling Results

3.6.1.1 Through September 30, 2003, 1013 sites (758 homes and 255 lots) had been sampled within the OU-5 CSA. This includes surface and subsurface samples. Of these, 100 sites exceeded the screening level of 12.6 mg/kg arsenic and warranted follow-on grid sampling. The highest surface composite sample arsenic result was 202 mg/kg. The highest subsurface boring arsenic result was 20.6 mg/kg. This result was from the 2-3 foot bgs sample from the boring.

3.6.2 Specialty Parameters Sampling Results

3.6.2.1 The only specialty parameter detected in an OU-5 CSA sample was cyanide. Cyanide was detected in only four of the 179 specialty samples collected in the CSA. Two of the four detections were from the same property (4813WL), although from different borings and at different depths. All of the cyanide detections were well below the screening level for this compound. Discussion of the screening level for cyanide, as well as for other comparison criteria, is presented in Section 5.

3.6.3 Grid Sampling Results

As indicated above, 100 of the 1012 sampled OU-5 CSA sites exceeded the arsenic screening level, warranting grid sampling. Of the 100 sites, 100 had been grid sampled through September 30, 2003. The highest OU-5 CSA grid sample arsenic result was 529 mg/kg. See Figure 3-3. In November 2001, the USEPA took 20 split samples with the USACE at selected CSA grid locations. The results, which indicate no discrepancies between USEPA and USACE arsenic concentrations, are presented in Volume II.

3.7 USEPA BACKGROUND SAMPLING ACTIVITIES

3.7.1 Sample Procedures and Analyses

3.7.1.1 In 1993 and 1994, the USEPA performed a background study of Spring Valley soils. The procedure was to collect 12 split samples from the background soil samples collected by USACE during the 1995 OSR FUDS RI. These samples were used in the USEPA Risk Assessment (USEPA, 1999). The samples were collected within the OSR FUDS boundary and represent the four soil associations (ULMg, ULSC, Mg, and ULB) encountered in Spring Valley. In August 1999, the USEPA collected 30 background samples from outside of the OSR FUDS boundary; these samples reflected the four soil associations present within Spring Valley and were collected to provide data to supplement the USEPA Risk Assessment. Figure 3-4 shows the background sampling locations.

3.7.2 Background Sampling Results

3.7.2.1 The USEPA 1993 and 1994 background sampling results are summarized in the USEPA Risk Assessment. The August 1999 background sampling results are summarized in the *Background Trip Report, Spring Valley OU3, Washington DC*, prepared for the USEPA Region III (Federal Facilities Branch) by Roy F. Weston (Site Assessment Technical Assistance Team) (USEPA, 1999d). The data from the two events were combined to provide a statistically more robust background data set. Background summary statistics for arsenic are presented in Table 3.6. Additional discussion of the use of these data is presented in Section 5.

3.8 SPECIATION SAMPLING ACTIVITIES

3.8.1 Sample Procedures and Analyses

Arsenic speciation sampling was conducted in November 2002 to provide a better understanding of arsenic speciation (trivalent vs. pentavalent arsenic and organic vs. inorganic arsenic compounds) in site-specific soils. The objective of this limited study was to determine if there were differences between site-specific soils and background soils in terms of arsenic speciation (trivalent vs. pentavalent arsenic and organic vs. inorganic arsenic compounds). According to the Agency for Toxic Substances and Disease Registry (ATSDR), studies have indicated that organic arsenicals are usually less toxic than inorganic arsenic compounds. Differences in arsenic species could be attributed to anthropogenic (resulting from influences of human beings) sources of arsenic. Anthropogenic sources of arsenic may be associated with AUES activities, but could also be associated with the use of pressure-treated lumber, pesticides, herbicides, coal, or fertilizer. It has been shown that natural processes can also change the oxidation states of arsenic regardless of the original source (Oremland and Stolz, May 2003). All speciation sampling was performed in accordance with the *Final WMP Amendment 3, (October 2002)*.

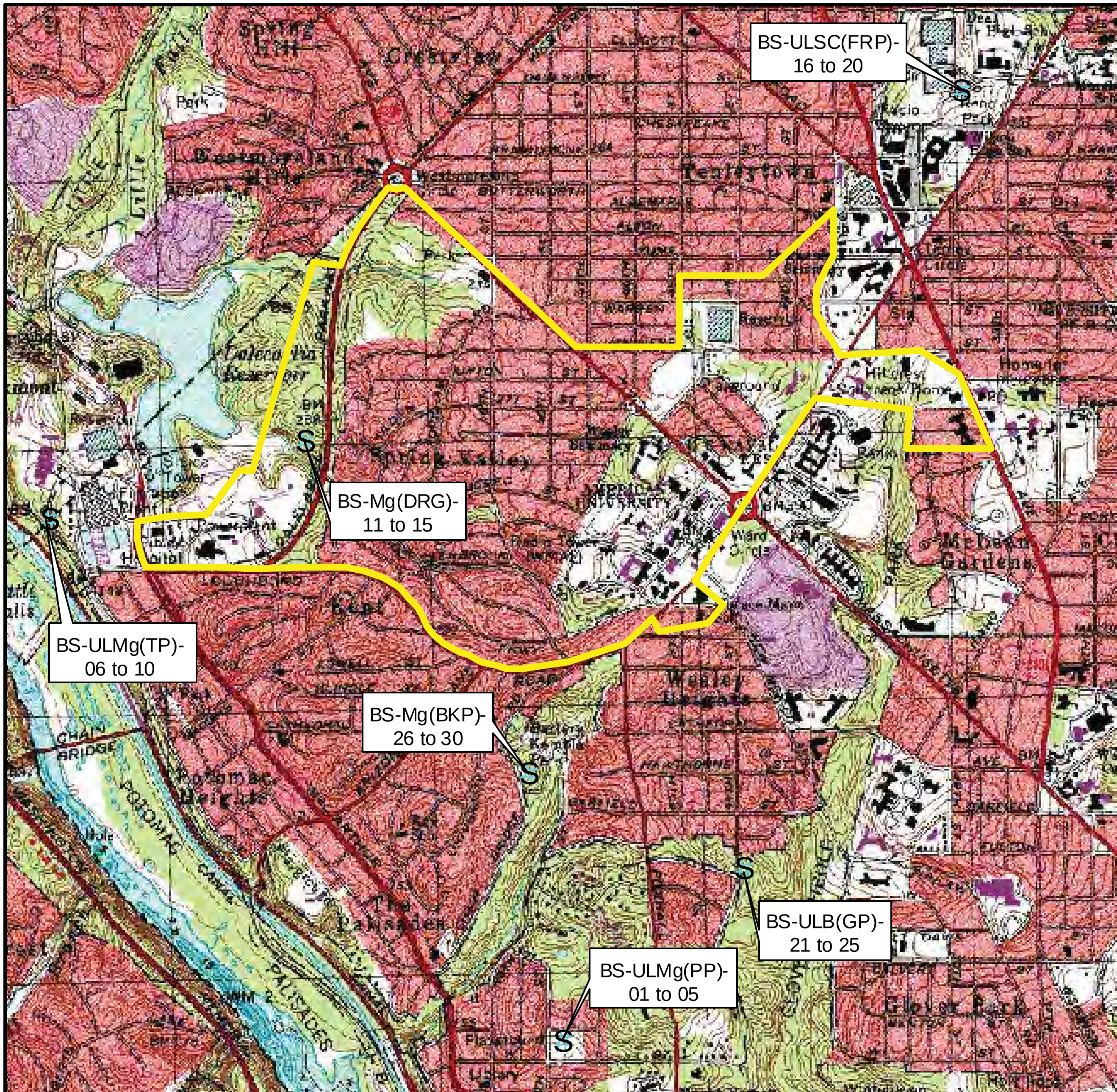

Figure 3-4
Background Sample Locations

Spring Valley Operable Units 4 and 5
Washington D.C.

Legend

SV FUDS Boundary

DRG - Dalecarlia Reservoir Grounds
FRP - Fort Reno Park
TP - West of Water Treatment Plant
BKP - Battery Kemble Park
GP - Glover Parkway
PP - Palisades Park

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Table 3.6
Background Summary Statistics

Parameter	Sample Number	Geometric Mean	Median	Minimum	Maximum	95th Percentile
Arsenic (mg/kg)	42	5.05	4.55	0.97	18	12.6

Note: In May 2002 it was discovered that one duplicate sample had inappropriately been used to calculate the above statistics. A recalculation indicated a 95th percentile of the data set to be 12.98 mg/kg. To be conservative, the lower of the two values (12.6 mg/kg) continued to be used as the screening criteria for the project.

3.8.1.1 Based on the results of the grid sampling, grids with relatively high arsenic concentrations, distributed throughout Spring Valley, were sampled for speciation in November 2002. Additionally, six background samples representing the four soil types were collected from the same locations the USEPA sampled; these were also analyzed for arsenic speciation. These background samples were collected to ensure that the site sample soil types were represented for the purposes of comparing site data and background data. However, only three of the four soil types were present in the sampled site soils. Samples were sent to the Battelle Marine Science Laboratories for arsenic speciation testing. The samples were analyzed by Battelle Marine Sciences Laboratories for inorganic arsenic (IA), arsenite (As+3), arsenate (As+5), monomethylarsonic acid (MMA), and dimethylarsinic acid (DMA). Battelle Marine Sciences Laboratories followed the procedures outlined in *Method 1632, Chemical Speciation of Arsenic in Water and Tissue by Hydride Generation Quartz Furnace Atomic Absorption Spectrometry, Revision A (USEPA, 2001).*

3.8.2 Speciation Sampling Results

3.8.2.1 The following discussion is a summary of the Technical Memorandum contained in Volume III of this EE/CA. Of the 15 samples (including QA/QC) analyzed for arsenic speciation, all of the samples had detectable concentrations of total arsenic and As^{+5}, and 14 of the 15 samples had detectable concentration of As^{+3}. Of the 15 samples collected, 7 were considered background samples and 7 were collected as site samples. The lab randomly selected an internal duplicate to make a total of 15 samples analyzed.

3.8.2.2 The reason for attempting to quantify the different forms of arsenic at the site was to determine if the species can be determined to be site-related or the result of releases that are not related to AUES activities. Differences in the pattern of background arsenic compared to the site-related samples could indicate the source of the arsenic (i.e., naturally occurring vs. anthropogenic). If the species are site-related, then it may be possible to make some conclusions regarding the relative risk associated with site-related contamination compared to the risk associated with exposure to naturally occurring arsenic.

3.8.2.3 The results indicate that concentrations of Total Arsenic, As^{+5}, and As^{+3}, appear elevated in the site samples when compared to background samples. Also, the ratio of As^{+5}/Total As was significantly higher in the site samples. While there is no indication that anthropogenic activities would specifically contribute one species of arsenic over another, naturally occurring arsenic would likely have the same profile of arsenic species. This profile is indicated by the ratios of the arsenic species to total arsenic. Differences in the ratios of As^{+5}/Total As between site samples and background samples is a possible indicator of potential anthropogenic sources of arsenic contamination. In addition, no organic arsenic compounds were detected in either site or background samples.

3.8.2.4 The findings suggest that, due to the significant difference in the As^{+5}/Total As ratios, the arsenic observed in the site samples may be from a different source than the arsenic in the background samples. Based solely on this study, the source of the As^{+3} and As^{+5} in the site samples cannot be determined. While the findings show that there may be an anthropogenic source of arsenic at the site, because of the uncertainties associated with the types of arsenic originally used at the site and the effects that more than 80 years of weathering may have, the findings cannot clearly indicate what that source may be. The anthropogenic source of arsenic may be associated with AUES, but it could also be associated with the use of pressure-treated lumber, pesticides, herbicides, coal, or fertilizer.

3.8.2.5 Because of the limitations of the study, the arsenic speciation findings were not relied upon to make Spring Valley project decisions. Neither the 12.6 mg/kg arsenic screening level nor the 20 mg/kg arsenic remediation endpoint (see Section 5) was based on the results of this study.

3.9 BIOAVAILABILITY SAMPLING ACTIVITIES

3.9.1 Sample Procedures and Analyses

3.9.1.1 Arsenic bioavailability sampling was conducted on a limited basis to provide a better understanding of the site-specific bioavailability (that fraction of arsenic absorbed into the bloodstream of the human body) of arsenic and to provide more information for human health risk evaluations. All bioavailability sampling was performed in accordance with the *WMP Amendment 3, Final (October 2002)*. A more detailed presentation of investigation objectives, background, and procedures, is contained in the *Technical Memorandum for Arsenic Bioavailability Study, USACE, (January 2002),* included in Volume III of this EE/CA.

3.9.1.2 In an attempt to sample areas of known arsenic contamination, the AU CDC investigation findings were used to focus sample locations. In March 2001, the three highest arsenic concentrations inside the AU CDC area and the three highest outside the CDC (but within AU Lot 12) were sampled for bioavailability. Additionally, six background samples representing the four soil types were collected from the same locations the USEPA sampled.

These were the same sample locations as the initial speciation sampling described in Section 3.8. All samples were collected as discrete surface soil samples, from 0-6 inches in depth. These samples were collected to match the soil types within Spring Valley to ensure that each of the four soil types were represented for the purposes of comparing site data and background data. The samples were submitted to the Laboratory for Environmental and Geological Studies, University of Colorado, at Boulder. Specifically, samples were submitted for determinations of the bioavailability of arsenic from soil. In addition, a determination of the types of particles (inorganic vs. organic) that contain bound arsenic was conducted.

3.9.2 Bioavailability Sampling Results

3.9.2.1 The following discussion is a summary of the Technical Memorandum contained in Volume III. Of the fifteen samples (including QA/QC) analyzed for bioavailability, only eleven samples had detectable concentrations in the test solution that could be used to derive a percent bioavailability. For those samples with detectable concentrations, the percent bioavailability ranged from 3% to 50%.

3.9.2.2 The data presented can be interpreted to conclude that risk estimates derived using detected concentrations of arsenic will likely overestimate the potential risks and hazards associated with exposures to the soils. Based on a bioavailability factor of 3%, these risks and hazards will be overestimated by up to a factor of 33 and remediation criteria developed without accounting for bioavailability will result in criteria that can be up to 33 times too stringent. Even using the most conservative of these bioavailability values (50%) results in the reduction of risk and hazard estimates by one-half and an increase of any calculated remediation criteria by a factor of two.

3.9.2.3 In addition to the bioavailability study, a determination of the types of arsenic-bearing particles was conducted using both electron microprobe and chemical analysis. In general the data indicated the arsenic-bearing phases to be either iron oxides, manganese oxides, iron arsenic sulfates or clays, as determined by particle analysis. An interpretation of the data, when compared to the bioavailability data discussed above, shows that for the four samples where the arsenic-bearing phase was predominantly iron oxides (97 – 100%), and where clays were not identified as an arsenic-bearing phase, the bioavailability ranged from 7 – 22%. For the single sample that had clays identified as an arsenic-bearing phase (OU4-CDC, 150,140), the bioavailability was determined to be 50%. Data from the single sample suggests that arsenic in clays may be more bioavailable and that risk estimates will likely be overestimated for soils where the arsenic-bearing phase is exclusive of clays.

3.9.2.4 Due to the limited amount of data available, a regression model was not developed to determine a bioavailability adjustment factor (BAF) for use at Spring Valley. However, the most conservative assumption would be to use a BAF of 50%, based on the single highest bioavailability obtained from any sample. The range of bioavailability in the remaining samples was 3%-22%, with a mean of 10%. Finally, although these findings indicate that assuming 100% bioavailability is conservative, no project decisions were based on the measured bioavailability range. That is, 100% bioavailability was assumed for the project.

3.9.2.5 Because of the limitations of the study, the arsenic bioavailability findings were not relied upon to make Spring Valley project decisions. Neither the 12.6 mg/kg arsenic screening level nor the 20 mg/kg arsenic remediation endpoint was based on the results of this study.

3.10 SPLP SAMPLING ACTIVITIES

3.10.1 Sample Procedures and Analyses

3.10.1.1 Synthetic Precipitation Leaching Procedure (SPLP) sampling was performed to help evaluate the potential leachability of arsenic from the soil to groundwater. The objective was to help evaluate the potential leachability of arsenic from the soil to groundwater. Specifically, the objective was to determine the concentration of arsenic in soil that, upon leaching from soil to groundwater, will not result in an arsenic concentration that exceeds the groundwater Maximum Contaminant Level (MCL). A more detailed presentation of investigation objectives, background, and procedures, is contained in the *Technical Memorandum for SPLP Arsenic Sampling, USACE, (January 2002),* included in Volume III of this EE/CA.

3.10.1.2 SPLP sampling performed in support of the OU-3 EE/CA as well as additional SPLP sampling conducted for OU-4 is discussed in the Technical Memorandum. In May 2000, Parsons collected SPLP soil samples (42 total samples) at 4801 Glenbrook Road in support of the OU-3 EE/CA. In February 2001, composited 0-2 foot intervals from the grids with the highest 5% of arsenic concentrations (4 total samples) within the CDC were analyzed for SPLP arsenic. All sampling for the OU-3 EE/CA was performed in accordance with *Change 05, Revised Sampling and Analysis Plan*, 4801 Glenbrook Road, (May 2000). All sampling at the CDC was performed in accordance with the *WMP Amendment 1, Revised Final (February 2001)*.

3.10.1.3 According to USEPA guidance (USEPA, 1996), a leach test may be more appropriate to help evaluate the potential leachability of arsenic from the soil to groundwater. USEPA guidance (USEPA, 1995) states that the SPLP was originally designed as an alternative to the Toxicity Characteristic Leaching Procedure (TCLP). The SPLP is designed to determine the mobility of both organic and inorganic contaminants contained in wastes and is intended to simulate the effect of acid rain on land-disposed wastes. The primary difference between the two tests is the composition of the leaching medium. While the TCLP relies on extraction fluids that simulate the organic acids that would form from decomposing wastes in a landfill, the SPLP requires the use of extraction fluids that simulate acid rain.

3.10.2 SPLP Sampling Results

3.10.2.1 The following discussion is a summary of the Technical Memorandum contained in Volume III. A total of 46 samples were collected and subjected to the procedure. Of these 46 samples, only seven resulted in detectable concentrations of arsenic in the leachate. Six of the seven samples (total arsenic of 11.5, 25.9, 16, 66.2, 217, and 668 mg/kg) with detectable arsenic in leachate had a high correlation between soil concentration and leachability. The correlation coefficient for these six samples was 0.99. When the seventh detected sample (total arsenic of 498 mg/kg) was included in the data set, the correlation coefficient dropped to 0.36. Using all the data points, a soil concentration of 217 mg/kg arsenic was the highest that did not exceed the 50 ug/L arsenic MCL. USEPA revised the arsenic MCL to 10 ug/L [Federal Register (66 FR 6975)] on January 22, 2001. Using all the data points, a soil concentration of 66.2 mg/kg arsenic was the highest that did not exceed the revised 10 ug/L MCL. Using the linear regression equation from the six samples with high correlation indicates that concentrations in soils up to 244 mg/kg would not result in an exceedance of the MCL of 50 ug/L. Using the same linear regression equation from the six samples with high correlation, a soil concentration of up to 56 mg/kg would not result in an exceedance of the revised MCL of 10 ug/L.

3.10.2.2 These concentrations suggest that arsenic leaching to groundwater does not appear to be a significant pathway since concentrations that result in an MCL exceedance are greater than the remediation endpoint concentrations proposed for soil (20 mg/kg, discussed further in Section 5). That is, soil greater than 20 mg/kg arsenic would be identified for removal action. The possibility that arsenic may have already leached to groundwater from soil, prior to removal actions, will be addressed separately by the current groundwater investigation.

3.10.2.3 Please note that the arsenic SPLP findings were not relied upon to make Spring Valley project decisions. Neither the 12.6 mg/kg arsenic screening level nor the 20 mg/kg arsenic remediation endpoint was based on the results of this study. The groundwater investigation will obtain site-specific data to characterize whether arsenic has leached to the groundwater from site soils.

3.11 AUES LIST SAMPLING ACTIVITIES

3.11.1 Sample Procedures and Analyses

3.11.1.1 Three investigations were performed to assess for the presence of the AUES list of chemicals. The AUES list of chemicals is a list of approximately 200 chemicals or compounds with documented usage at the AUES. Some of these were common, but most were specific to AUES activities. Sampling was performed at three different areas, reflecting different types of sites and past practices. Each of the three efforts was performed as a separate investigation, with separate reports of results submitted. The three areas were:

- 3819 48th Street, 4710 Quebec Street, 4625 and 4633 Rockwood Parkway;
- CDC/AU Lot 12; and
- Sedgwick Trench Area.

3.11.1.2 A more detailed presentation of results is contained in the: Report of Analytical Results (3819 48th Street, 4710 Quebec Street, 4625 and 4633 Rockwood Parkway), USACE, (May 2002); Report of Analytical Results (CDC/AU Lot 12), USACE, (April 2002); and Report of Analytical Results (Sedgwick Trench Area), USACE, (April 2002). Each of these reports is included in Volume III of this EE/CA.

3.11.1.3 In accordance with the *Revised Final Work Management Plan for Follow-on Sampling for OU-4 Residential Lots, Amendment 2 (Parsons, April 2001),* Parsons collected soil samples from four residences. These locations were selected because of relatively high arsenic concentrations, or information from other sources suggesting a high likelihood of finding potential contamination. The effort included three AUES List samples each from 4710 Quebec Street, 4625 Rockwood Parkway, and 4633 Rockwood Parkway, and four AUES List samples from 3819 48th Street, for a total of 13 AUES List samples. The samples were discrete samples collected at 0-6 inches bgs, 9-15 inches bgs, or 12-18 inches bgs, depending on location.

3.11.1.4 In accordance with the *Revised Final Work Management Plan, Amendment 1, AU Lot 12/Child Development Center (Parsons, February 2001),* Parsons collected 32 soil samples from the CDC/AU Lot 12 area. Of the 32 samples, 16 were analyzed directly for the AUES List chemicals. The other 16 were analyzed for various parameters as detailed in Volume III. The samples were discrete samples collected primarily at 0-6 inches bgs, with some taken at varying depths.

3.11.1.5 In accordance with the *Revised Final Work Plan for Sedgwick Trench Area Investigation (Parsons, June 2001),* Parsons collected five soil samples (four samples plus one duplicate sample) from the Sedgwick Trench. The samples were discrete samples collected at the presumed bottom of the trench.

3.11.1.6 Because many of the CWM-related compounds were not common and did not have established or routine analytical methodologies, the analytical plan called for analysis for related chemicals that had routine analytical methodologies and that could be directly analyzed. These included Target Compound List (TCL) and Target Analyte List (TAL) constituents, CWM compounds, and CWM degradation products. For the AUES List chemicals that could not be directly analyzed, indicator compounds were developed to make determinations of whether the chemicals could be present. Therefore, the final list of parameters included TCL compounds and CWM degradation products.

3.11.2 AUES List Sampling Results

3.11.2.1 This EE/CA discusses how the AUES List investigation was performed and presents the data (Volume III). However, because of the complex nature of the data and the need for careful interpretation of the results, no evaluation of the results is included in this document. Pending completion of this evaluation, a separate report addressing all results will be prepared.

3.11.2.2 Because many of the AUES List chemicals were not common and did not have established or routine analytical methodologies, the possible presence or absence of these chemicals was inferred by the presence or absence of its indicator compound. Of the approximately 200 AUES List chemicals, 138 could be analyzed using the methods described above. Of the 138 chemicals, only 59 could be directly analyzed; for the remaining 79 chemicals, presence or absence of the chemical could only be inferred.

3.11.2.3 For the chemicals that could be directly analyzed, detections were compared to appropriate criteria as discussed further in Section 5. Where the presence or absence of the chemical could only be inferred, it is likely that some false positives resulted. For example, because arsenic trifluoride does not have a routine analytical method, arsenic and fluoride were used as the indicator compounds for this chemical. The presence of both compounds in detectable amounts resulted in a conclusion that the presence of arsenic trifluoride in the sample could not be ruled out. However, since arsenic and fluoride are common compounds and would be expected even in the absence of arsenic trifluoride, this could result in false positives. As a result, the additional work on evaluating these results may no longer rely on inferring the presence of a compound by use of indicator compounds.

3.11.2.4 Upon further discussion of these results by the Partners, the USEPA recommended additional ways to focus the conclusions of the analytical results. The recommendations included: stoichiometry analysis to see if the concentrations of the indicator compounds relative to the parent chemical could provide stronger support for a presence/absence conclusion; fate and transport analysis to see if the parent chemical or its indicators would likely be present more than 80 years after the chemical was used at AUES; and, relative toxicity evaluations to examine whether the indicator compounds detected might be more harmful than the parent chemical, thereby reducing the importance of the absolute determination of the presence of the parent chemical. The Partners agreed with the recommendations. Pending completion of this analysis, separate reports evaluating all results will be submitted.

3.11.2.5 Figure 3-5 presents the locations of the speciation, bioavailability, SPLP, and AUES List samples.

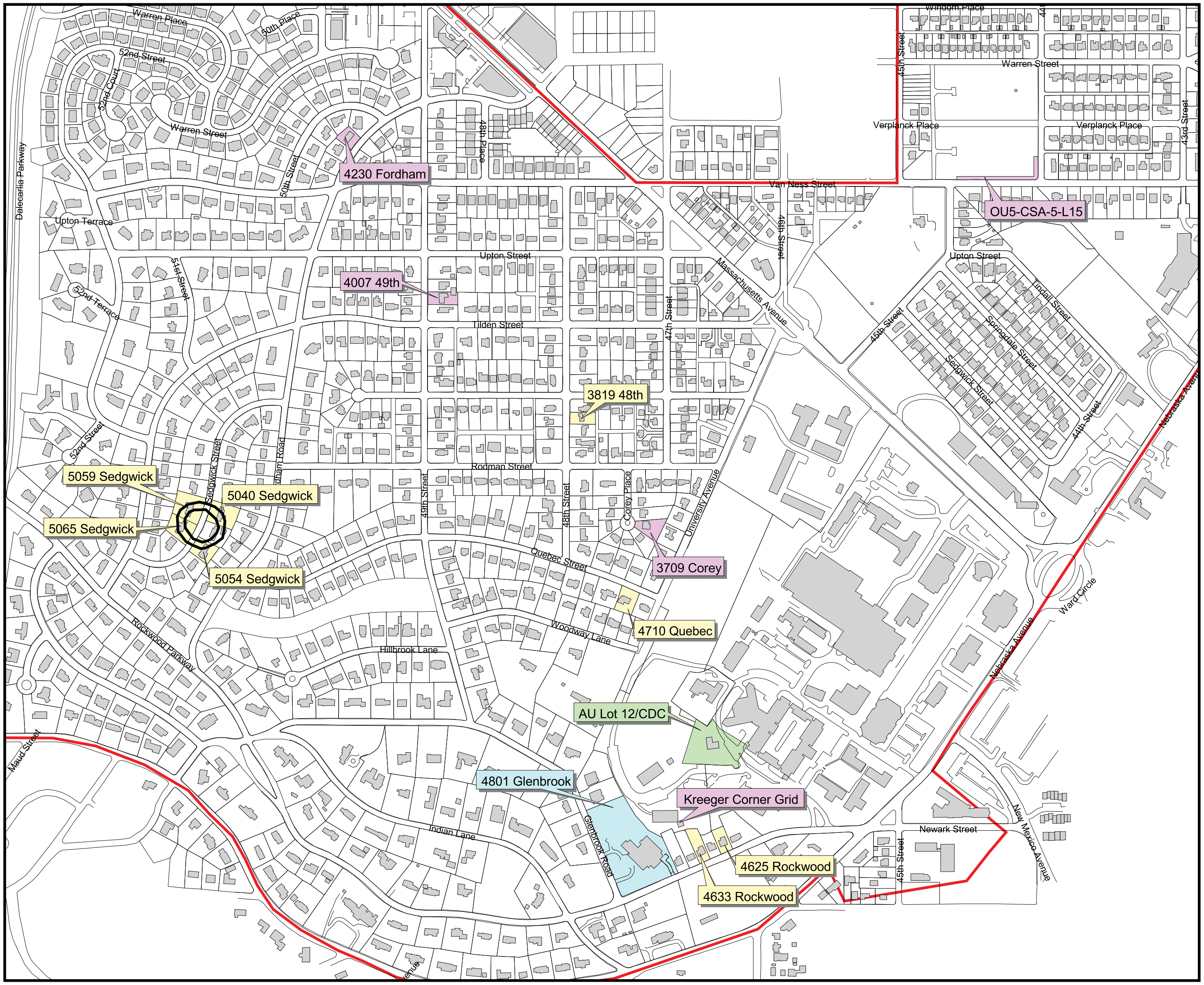

Figure 3-5
Sample Location Overview

Spring Valley Operable Units 4 & 5
Washington D.C.

Legend

- Sedgwick Trench
- Roads
- Buildings
- Speciation Samples
- AUES List, Bioavailability, and SPLP Samples (CDC)
- AUES List Samples
- SPLP Samples
- Parcels
- SV Boundary

Note:
Background sampling locations associated with speciation and bioavailability are shown in figure 3-4.

500 0 500 Feet

1 inch = 500 feet

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PARSONS

4. SOURCE, NATURE, AND EXTENT OF CONTAMINATION

4.0.0.1 This section presents the results of this OU-4 and OU-5 EE/CA investigation. The results of the other Spring Valley investigations described in Section 2.4 are not included here. Any significant findings from those investigations have been addressed in separate actions.

4.1 SOURCE

4.1.1.1 Arsenic has been identified as a Chemical of Concern (COC) in the soil at Spring Valley. This identification is based on the concentrations discussed in Section 3 and a comparison of those concentrations to screening criteria as discussed in Section 5. This is also based on the findings of previous investigations, including the OU-3 EE/CA Risk Assessments (USACE, October 2000 and April 2002). There are likely several sources of arsenic in the soil at Spring Valley. Arsenic is naturally occurring and widely distributed in the environment. Arsenic levels may have been increased by human activities other than those associated with the AUES, including fertilizer, pesticide and herbicide usage, and coal burning. One of the most wide-spread sources of arsenic is the use of pressure treated wood (chromated copper arsenate or CCA). Arsenic in the soil could also be related to AUES activities, as several AUES List compounds, most notably Lewisite, contain arsenic.

4.2 NATURE AND PHYSICAL CHARACTERISTICS OF ARSENIC

4.2.1.1 The Chemical Abstract Service (CAS) number for arsenic is 744-03-82. The atomic weight of arsenic is 75 and the specific gravity of arsenic is 5.73. The following description is from the Agency for Toxic Substances and Disease Registry (ATSDR) fact sheet. Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic combines with oxygen, chlorine, and sulfur to form inorganic compounds. Arsenic in plants and animals combines with carbon and hydrogen to form organic arsenic compounds. Organic arsenic is usually less harmful than inorganic arsenic. Inorganic arsenic compounds are mainly used to preserve wood, but can also be used to make insecticides and weed killers. Organic arsenic compounds are sometimes used as pesticides. The Department of Health and Human Services and the USEPA have determined that inorganic arsenic is a human carcinogen (ATSDR, July 2001).

4.2.1.2 Arsenic also exists in different electronic valence states. Among the inorganic arsenic compounds, the trivalent arsenites are somewhat more toxic than the pentavalent arsenates. Arsenite compounds are 4 to 10 times more soluble than arsenate compounds. The arsenates will fix to soil more easily and are therefore not very mobile. The adsorption of arsenite is highly dependent upon the pH range. Under anaerobic conditions, arsenate may be reduced to arsenite. Arsenite is more subject to leaching because of its higher solubility. The transport of arsenic through the soil column is highly dependent upon these physical and chemical properties as well as that of the soil. Arsenic is readily and strongly bound to the soil by the presence of fixing agents such as iron. Surface dust and erosion are common mechanisms of arsenic transport.

4.2.1.3 At Spring Valley, arsenic speciation (Section 3.8) indicates possible anthropogenic sources when compared to the background samples. In particular, As^{+5} is significantly higher on site than in the background samples. As indicated in that section, the nature of the anthropogenic source, AUES activities or other (coal, fertilizer, pesticides use, etc.), could not be determined. The bioavailability study (Section 3.9) suggests that the arsenic bearing phases in Spring Valley soils are mainly iron oxides, manganese oxides, iron arsenic sulfates, or clays. Soil type does not appear to be a major factor in arsenic concentrations as there appeared to be little difference between arsenic concentrations among the four soil types sampled.

4.3 EXTENT OF ARSENIC CONTAMINATION

4.3.1 Surface Soil

4.3.1.1 As discussed in more detail in Section 5, composite surface soil arsenic concentrations greater than 12.6 mg/kg triggered further investigation and the resulting grids containing arsenic concentrations greater than 20 mg/kg (remediation endpoint) were identified for removal action. The grid sampling focussed the extent and distribution of arsenic contamination by identifying those grids containing arsenic concentrations greater than 20 mg/kg.

4.3.1.2 Figure 4-1 presents the sites throughout Spring Valley that received grid sampling. The individual sites have been color-coded on the figure to indicate relative arsenic concentrations. The color-coding was applied to the entire site if one or more samples were above the designated arsenic concentration. Some sites that were grid sampled showed no arsenic concentrations greater than 20 mg/kg. Those sites are shown on the figure although they are not identified for removal activity. As discussed in more detail in Section 5, the color increments on the figure represent grids exceeding 20 mg/kg, 43 mg/kg and 150 mg/kg arsenic. Further discussion of the rationale for the arsenic concentration increments is contained in Section 5.

4.3.1.3 As shown on the figure, 64 sites had at least one grid result greater than 20 mg/kg arsenic, but less than or equal to 43 mg/kg arsenic. 64 sites had at least one grid result greater than 43 mg/kg arsenic, but less than or equal to 150 mg/kg arsenic. 19 sites had at least one grid result greater than 150 mg/kg arsenic. Note that most of the residential sites scheduled for a TCRA (Section 2.4.4) contained at least one grid result greater than 150 mg/kg arsenic. Volume II contains individual grid result maps for every grid-sampled site as well as a large-scale fold out map for finding specific sites by street address.

4.3.1.4 Based on the planning for the NTCRAs to be completed, there are approximately 800 grids (greater than 20 mg/kg) to be removed. This represents a volume of almost 24,000 cubic yards of arsenic contaminated soil.

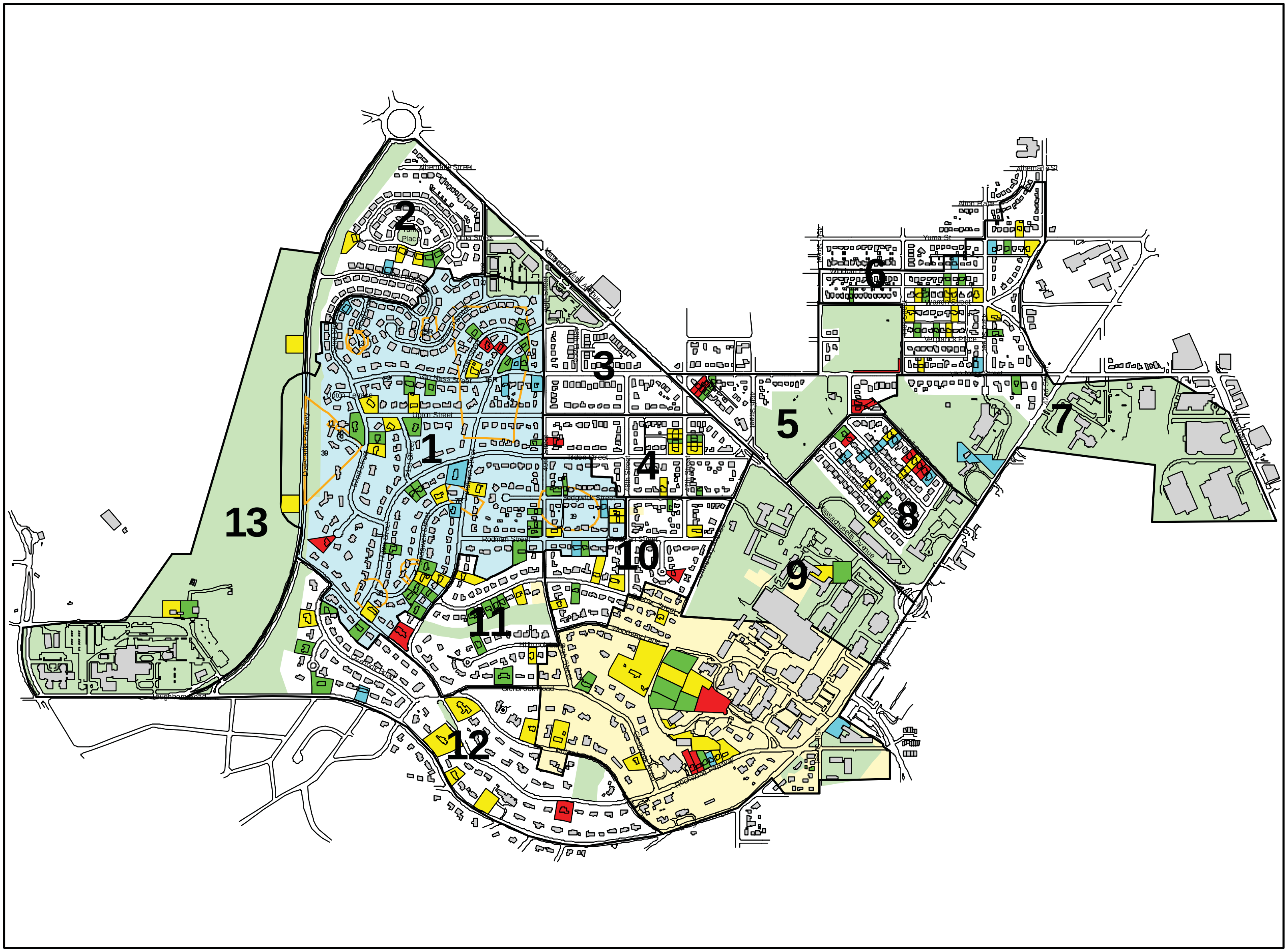

Figure 4-1
Grid Sampled Sites
(Showing Relative Arsenic Concentrations)

Spring Valley Operable Unit 4 & 5
Washington D.C.

Legend

At least one grid sample:

- > 0 - 20 ppm As (22)
- > 20 - 43 ppm As (65)
- > 43 - 150 ppm As (65)
- > 150 ppm As (19)
- Groupings
- POIs
- Buildings
- Roads
- Non-Residential Acreage
- CTA
- OU-4

Notes:

OU-5 Acreage comprises groupings 1 through 13.

CSA is groupings 2 through 13.

A site needed to exceed 12.6 ppm arsenic in order to warrant grid sampling.

N E S W

0 1000 Feet

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4.3.2 Subsurface Soil

4.3.2.1 Few subsurface samples exhibited levels of arsenic greater than 20 mg/kg. As previously indicated in Section 3.4.1, subsurface arsenic concentrations resulted in removals at AU lots 16, 19, 23, and 24. In general, where elevated arsenic levels were found in subsurface samples, the depth was the 0-1 foot bgs interval.

4.3.3 Migration Potential

The migration potential for arsenic in the soils at Spring Valley was evaluated through the SPLP sampling discussed in Section 3.10. The SPLP concentrations suggest that arsenic leaching to groundwater does not appear to be a significant pathway. This is because the arsenic soil concentrations that would result in an arsenic MCL exceedance were greater than the remediation endpoint (discussed further in Section 5) and would therefore be removed. The possibility that arsenic may have already leached to groundwater from soil, prior to removal actions, will be addressed in the current groundwater investigation.

4.4 EXTENT OF SPECIALTY PARAMETER DETECTIONS

4.4.0.1 This discussion does not address the AUES List sampling summarized in Section 3.11 (those results, which are presented in Volume III of this EE/CA, require further analysis and the evaluation will be presented in a separate document). For the OU-4 and OU-5 sampling other than the AUES List sites, few compounds other than arsenic were detected. Figure 4-2 indicates detections of thiodiglycol (a non-specific mustard ABP, i.e., thiodiglycol is not necessarily the result of mustard) and cyanide at six sites. These are detections of the parameter, not exceedances of their screening criteria. The detected concentrations were well below the screening criteria (see Table 5.1). Thiodiglycol was detected in two OU-4 sites (AU Lots). One detection was in a surface sample and one was in a subsurface sample. Cyanide was detected in five samples (representing four sites). Each of these detections was from a subsurface sample. While these detections are below screening criteria, the need for further sampling will be evaluated by the USACE with input from USEPA, DCDOH, and all other stakeholders.

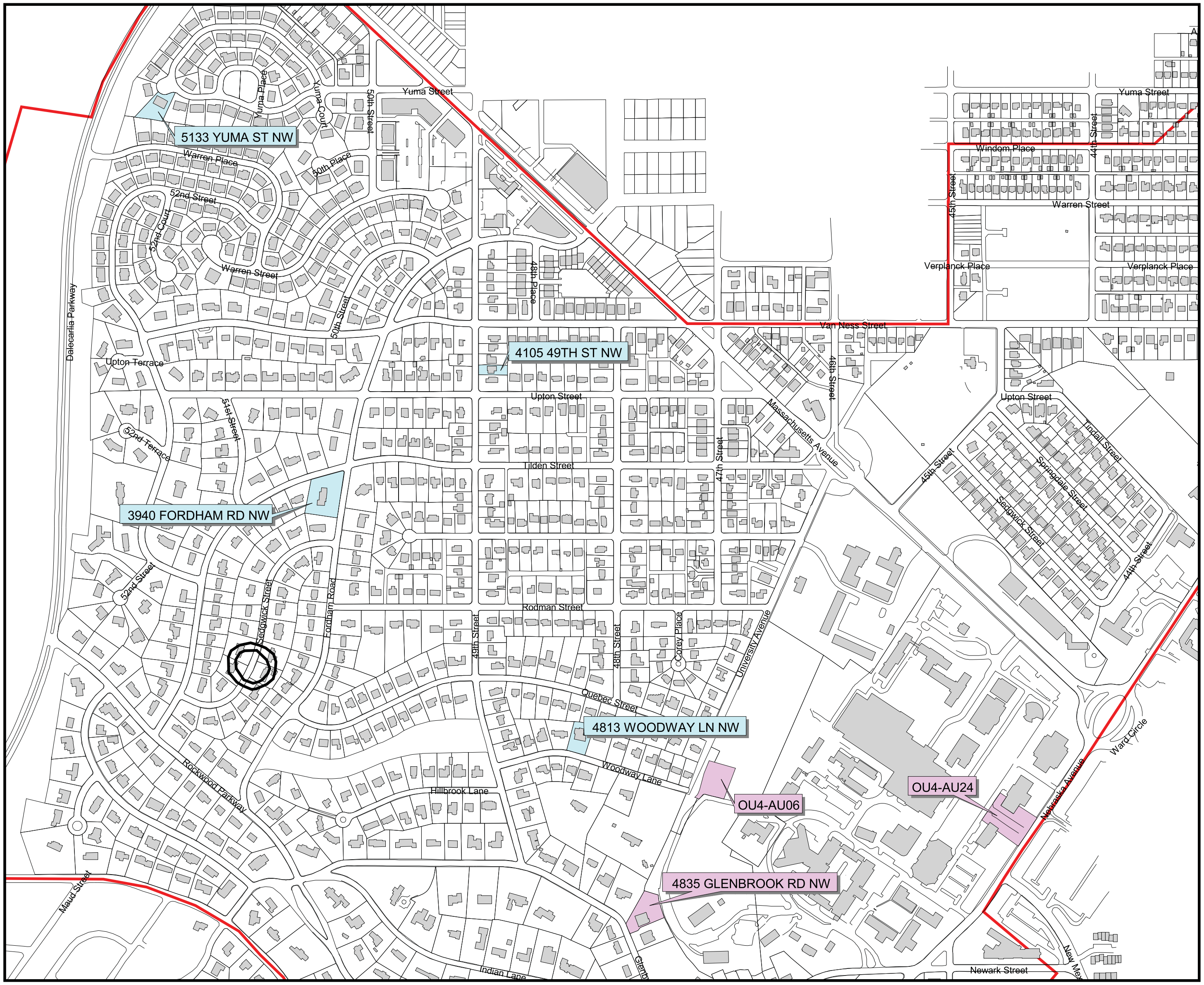

Figure 4-2
Specialty Parameter Detections
(Not Including AUES List Sampling)

Spring Valley Operable Units 4 & 5
Washington, D.C.

Legend

- Sedgwick Trench
- Roads
- Buildings
- Parcels
- SV Boundary

Specialty Parameter Detections:
- Thiodiglycol
- Cyanide

Note:
These are detections. None of the detections exceeded the screening criteria for the parameter.

With the exception of AU06, all detections were from subsurface samples.

500 0 500 Feet

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PARSONS

5. STREAMLINED RISK EVALUATION

5.1 INTRODUCTION

5.1.0.1. Risk Assessments (RA), associated with the OU-3 EE/CA, were performed to estimate the potential risks/hazards to current and future receptors from site related contamination at 4801, 4825, and 4835 Glenbrook Road. The initial RA at 4801 and 4825 Glenbrook (USACE, October 2000) was supplemented by additional data from 4835 Glenbrook (USACE, April 2002). Some of the information presented in this section was derived from those RAs. A summary of the soil screening levels, comparison criteria, and remediation endpoints developed for the analytical parameters for the project is presented in Table 5.1.

Table 5.1
Analytical Parameters and Comparison Criteria

Parameter	Units	Comparison Criteria			Remediation Endpoint\4
		RBC	Background\2 (screening level)	Other\3	
Arsenic	mg/kg	0.43\1	12.6		20
Specialty Parameters:					
CVAA/CVAO	ug/kg	890\a			NA
Sulfur Mustard	ug/kg			10	NA
1,4-Dithiane	ug/kg	78,000\b			NA
1,4-Oxathiane	ug/kg	78,000\a, b			NA
Thiodiglycol	ug/kg	39,100\a, b			NA
2,4-Dinitrotoluene	ug/kg	16,000\b			NA
2,6-Dinitrotoluene	ug/kg	7,800\b			NA
2,4,6-Trinitrotoluene	ug/kg	21,000\1			NA
Nitrobenzene	ug/kg	3,900\b			NA
Nitroglycerine	ug/kg	46,000\1			NA
Tetryl	ug/kg	78,000\b			NA
Cyanide, Total	mg/kg	160\b			NA

\1 USEPA's published Risk-Based Concentrations [for Cyanide, (Free) Cyanide RBC was used].
\2 95th Percentile of arsenic background samples.
\3 US Army Center for Health Promotion and Preventive Medicine (USACHPPM) residential Health-Based Environmental Screening Level (HBESL).
\4 Only arsenic required development of a remediation endpoint, as no other parameters were detected above the comparison criteria listed.
NA - Not Applicable.
\a RBC derived for the 1995 RI (USACE, 1995).
\b RBC for non-carcinogen adjusted downward by a factor of 10 to account for cumulative effect of several compounds possibly present.

5.2 ARSENIC SCREENING LEVEL

5.2.0.1 The RAs determined arsenic to be the COC. A toxicity screening was performed by comparing the maximum detected concentrations of arsenic to USEPA Region III Residential Risk-Based Concentrations (RBCs). For compounds such as arsenic, where natural background concentrations are greater than RBCs, the toxicity screening can be performed using the background concentrations. Therefore, as discussed in Section 3.7, a background study was performed. The 95^{th} percentile of the background arsenic data set was 12.6 mg/kg whereas the Region III residential RBC is 0.43 mg/kg. Thus, the screening level for arsenic at the Spring Valley site was established at 12.6 mg/kg. The use of the 95^{th} percentile of the background arsenic data set to screen for arsenic contamination was a consensus approach of the Partners.

5.3 ARSENIC REMEDIATION ENDPOINT

5.3.0.1 A remediation endpoint for arsenic of 20 mg/kg was jointly proposed by the Partners. The endpoint is that soil arsenic concentration above which remediation will be recommended. This concentration is considered protective of human health and the environment. The Scientific Advisory Panel, established to assist the community in understanding the overall approach to technical issues affecting Spring Valley, recommended adoption of this remediation endpoint, saying that "the level should not pose a health hazard to the community and should not threaten the natural ecological systems of northwest Washington, DC." (*Scientific Advisory Panel Report*, May 29, 2002 Meeting).

5.3.0.2 The remediation endpoint of 20 mg/kg is a consensus approach of the Partners. For comparison purposes, the highest background sample collected was 18 mg/kg and the calculated, non-cancer Soil Screening Level (SSL) is 23.5 mg/kg (based on a child resident receptor). 20 mg/kg is a cleanup level for arsenic in soil that has been adopted by many states. Finally, the 20 mg/kg level is conservative in that it does not make use of any bioavailability factors, as discussed in Section 3.9.

5.3.0.3 In limited situations, soil containing up to 43 mg/kg arsenic may be left in the root zones of trees or where access and other construction limitations make soil removal difficult or unsafe. The decision to exercise this option in a given situation will be based on discussion and concurrence between the property owner, the USEPA, DCDOH, and USACE representatives. 43 mg/kg is the USEPA emergency removal concentration for arsenic in soil. This is a risk-based value for a residential surface soil scenario corresponding to a cancer risk of 1 in 10,000.

5.3.0.4 Prior to acceptance of the 20 mg/kg concentration, some of the earlier removals, such as the CDC (section 2.4.4) used a remediation endpoint of 26 mg/kg arsenic. This was the 99.8^{th} percentile of the background arsenic data set, or approximately twice the screening level of 12.6 mg/kg.

5.3.0.5 Figure 4-1 indicates other comparison criteria for arsenic. These are intended simply to organize the presentation of the data. The 150 mg/kg level was a value agreed upon by the Partners to help plan and prioritize the TCRAs (see Section 2.4.4).

5.4 SPECIALTY PARAMETERS

5.4.0.1 A summary of the soil screening levels, comparison criteria, and remediation endpoints developed for the analytical parameters for the project, including arsenic, is presented in Table 5.1.

5.4.0.2 For the most part, RBCs were used as the comparison criteria for the specialty parameters. Typical risk assessment practice is to adjust the RBC downward by a factor of ten, based on non-carcinogenic effects, to account for the potential cumulative toxicological effects of several compounds being present in a sample. For those compounds without published RBCs, these were either specifically derived for the parameter or another standard was used. The RBCs for Lewisite ABPs (CVAA/CVAO), 1,4-Oxathiane, and thiodiglycol, were derived for the 1995 RI (USACE, 1995). The mustard comparison standard was based on the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) residential Health-Based Environmental Screening Level (HBESL). Table 5.1 indicates which compounds had adjusted RBCs and which compounds had derived RBCs.

5.5 GROUNDWATER

5.5.0.1 A groundwater investigation is currently underway. Fieldwork is expected to be initiated in the Spring of 2004. The potential risk from arsenic in soil leaching to groundwater was evaluated through the SPLP study described in Section 3.10. This SPLP study suggests that arsenic leaching to groundwater does not appear to be a significant pathway assuming the removal actions for soil greater than the remediation endpoint of 20 mg/kg. The possibility that arsenic may have already leached to groundwater from soil, prior to removal actions, will be addressed in the current groundwater investigation.

6. IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

6.1 REMOVAL ACTION OBJECTIVES

6.1.0.1 The objectives established for this removal action guide the development of the alternatives and provide focus to the comparison of acceptable removal action alternatives. These objectives also assist in clarifying the goal of reducing the hazard posed by elevated arsenic concentrations in the surface soils and achieving an acceptable level of protection to the public and environment. These objectives include:

- Prevent exposure to elevated levels of arsenic in surface and subsurface soils; and
- Prevent future migration of arsenic contamination.

6.2 REMOVAL ACTION GOAL

6.2.0.1 In order to achieve the objectives of this removal action, a removal goal was established. As discussed in Section 5, the remediation goal or endpoint established for arsenic for the Spring Valley FUDS is 20 mg/kg (with the exception of some of the earlier removal efforts and the limited situations where 43 mg/kg is applicable, as described in section 5.3). The goal of this removal action is to reduce the hazard to human health and the environment posed by arsenic concentrations greater than 20 mg/kg in surface and subsurface soils at the Spring Valley FUDS. Based on the results of the site investigation, addressing soil with arsenic concentrations greater than 20 mg/kg is expected to remove the potential for downward migration of leachable arsenic to the groundwater. However, it is anticipated that the current groundwater investigation will provide specific data regarding the downward migration of arsenic to the groundwater.

6.3 EXTENT OF REMOVAL ACTION

6.3.0.1 As described in Section 4, a grid system consisting of 20-foot by 20-foot grid squares (or 10-foot by 10-foot in some cases) was established during the site investigation. All grids containing a sample greater than 20 mg/kg of arsenic were identified for removal action. These sites are shown in Figure 4-1.

6.4 SCHEDULE

The proposed removal actions (some TCRAs have been completed as described in Section 2.4.4) for the arsenic contamination in soils at the Spring Valley Site are scheduled to begin immediately after the public comment period on this EE/CA has ended. It is expected that the removal work will take several years to complete.

7. IDENTIFICATION & ANALYSIS OF REMOVAL ACTION ALTERNATIVES

7.0.0.1 This section describes the removal action alternatives identified for this project and the individual analysis of each alternative. The criteria used to evaluate the alternatives are defined below.

7.0.0.2 The following analysis also considers that a single remedy for potentially 140 plus sites throughout Spring Valley may not be practical and that private home owners may want less intrusive alternatives. Although other alternatives are not available at this time, the USACE plans to conduct a greenhouse study and feasibility study for phytoremediation in 2004. A determination will be made based on the results of the study as to whether or not phytoremediation can be an effective arsenic removal technology in Spring Valley.

7.1 IDENTIFICATION OF REMOVAL ALTERNATIVES

7.1.0.1 The USACE has identified six removal alternatives. These include:

- Alternative 1: No Action;
- Alternative 2: Institutional Controls and Engineering Controls;
- Alternative 3: Phytoremediation;
- Alternative 4: Soil Stabilization;
- Alternative 5: Soil Washing; and
- Alternative 6: Excavation and Landfill Disposal.

The following sections provide a brief description of each identified alternative.

7.1.1 Alternative 1: No Action

7.1.1.1 The no action alternative would involve leaving the properties in their current state. The no action alternative provides a comparative baseline against which other alternatives can be evaluated. Under this alternative, no removal action will be taken, and any identified contaminants are left "as is," without the implementation of any containment, removal, treatment, or other protective actions. This alternative does not provide for the monitoring of soil, and does not provide for any active or passive institutional controls to reduce the potential for exposure (e.g., physical barriers, deed restrictions).

7.1.1.2 No potential action-specific ARARs are identified for this alternative.

7.1.2 Alternative 2: Institutional Controls and Engineering Controls

7.1.2.1 The institutional controls alternative would include limiting access to areas with elevated arsenic concentrations in the surface soil and developing deed restrictions. The areas identified are located in the yards of residential properties. Limiting access to these areas could be achieved in a variety of ways, depending on the specific location and orientation of contaminated grids within a particular property and the desires of the individual property owner. Options could include fencing the area; covering the area with concrete or brick for use as a patio or sitting area, for example; or planting the area with groundcover plants that do not require routine maintenance. These options would all prevent physical contact with the contaminated soil and would reduce or eliminate runoff from the contaminated surface soil and thus reduce the spread of the contamination. This alternative would also include the development of deed restrictions to legally bind the current and future property owner to appropriate access and use restrictions. The deed restrictions would include prohibition of gardening and routine landscaping activities in these areas. Finally, an institutional control plan would be developed in cooperation with the property owners and local agencies and would include a delineation of enforcement and maintenance responsibilities.

7.1.2.2 No potential action-specific ARARs are identified for this alternative.

7.1.3 Alternative 3: Phytoremediation

7.1.3.1 Phytoremediation is an innovative remedial technology in which plants are used to remove contaminants from the environment. In the case of arsenic contaminated soils, this method can also be described as phytoaccumulation/phytoextraction and refers to the uptake and translocation of metal contaminants in the soil by plant roots into the aboveground portions of the plants. Certain plants called hyperaccumulators absorb unusually large amounts of metals in comparison to other plants. One or a combination of these plants is selected and planted at a site based on the type of metals present and other site conditions. As discussed in paragraph 7.0.0.2, the USACE is currently undertaking a greenhouse feasibility study of this technology.

7.1.3.2 Individual treatability studies would need to be conducted to determine the appropriateness of this alternative to site-specific conditions. If the treatability study determines that this technique is appropriate for a site, the selected plants would be installed in the contaminated areas. Based on the removal rates and capacities determined during the treatability study, the plants are harvested periodically and disposed appropriately. The harvested plants would be replaced with new plants, as necessary, in order to achieve the remediation endpoint.

7.1.3.3 The treatment program would be monitored and maintained on a regular basis and would likely require some type of institutional controls (i.e., temporary access controls such as fencing) to address exposure to contamination in the interim between installing the plants and achieving the remediation endpoints. The duration of operation and maintenance for this technology is very site-specific and can vary depending on cleanup goals, contaminant concentrations, growth rate of the plantings, depth of contamination, and climate (e.g., temperature, precipitation, etc.).

7.1.3.4 No potential action-specific ARARs are identified for this alternative.

7.1.4 Alternative 4: Soil Stabilization

7.1.4.1 Soil stabilization is a remediation technique in which contaminated soil is treated with a binding/stabilizing agent such as iron to minimize the rate of contaminant migration and to reduce the toxicity of the soil. Stabilization may be achieved through *in situ* (in place) or *ex situ* (out of place) treatment approaches. A treatability study would be conducted to determine the appropriateness of this alternative to site-specific conditions. If the treatability study determines that this technique is appropriate for a site, specific design parameters would be determined. Soil in those areas identified as requiring removal would be treated on site, either in situ or excavated and transported to an on-site treatment facility, and then replaced in the excavation. Soil would initially be excavated to a depth of two feet below ground surface. Soil samples would be collected from the bottom of these excavations and analyzed for confirmation purposes. All excavated soil would be treated and returned to the excavation. Clean fill from an off-site source would be used on top of the replaced soil as necessary to fill the excavation to grade. However, the most likely scenario is that the soil volume will increase during the stabilization process such that it would not fit into the original excavation.

7.1.4.2 The regulatory provisions governing erosion and sediment control, storm water management, fugitive dust emissions, noise control, hazardous waste accumulation, and land disposal are identified in section 7.3.2.5 as potential action-specific ARARs for this proposed removal action.

7.1.5 Alternative 5: Soil Washing

7.1.5.1 Soil washing is a remediation technique in which contaminants are separated from the soil particles to which they are sorbed. This is achieved through washing of the soil with a leaching agent, surfactant, or chelating agent or through pH adjustments. For the removal of heavy metals such as arsenic, chelating agents are most commonly used. A treatability study would be conducted to determine the appropriateness of this alternative to site-specific conditions. If the treatability study concludes that this technology is appropriate to this site, an on-site treatment facility would be designed and constructed. Excavation of contaminated soil would proceed as described in the previous section. A portion of the treated soil could be used as backfill although it would be necessary to supplement this soil with clean backfill from off site. This is due to the fact that some of the soil volume would be included in the contaminated sludge generated during the process. This sludge would be disposed at an appropriate off-site facility.

7.1.5.2 The regulatory provisions governing erosion and sediment control, storm water management, fugitive dust emissions, noise control, hazardous waste accumulation, hazardous waste storage tank management, and land disposal are identified in section 7.3.2.5 as potential action-specific ARARs for this proposed removal action.

7.1.6 Alternative 6: Excavation and Landfill Disposal

7.1.6.1 The excavation and landfill disposal alternative would involve excavating soils in areas identified as requiring removal. Excavation of contaminated soil would proceed as described in Section 7.6.6. Excavated soil would be characterized and transported to an appropriate off-site disposal facility. The excavated soil would be characterized in accordance with the requirements of the disposal facility. If the soil is characterized as RCRA hazardous, it would be transported to a RCRA subtitle C landfill where it would be pretreated and disposed. If the soil is characterized as RCRA non-hazardous, it would be transported to a sanitary landfill for disposal.

7.1.6.2 The regulatory provisions governing erosion and sediment control, storm water management, fugitive dust emissions, noise control, and hazardous waste accumulation are identified in section 7.3.2.5 as potential action-specific ARARs for this proposed removal action.

7.2 INTRODUCTION TO EVALUATION CRITERIA

7.2.0.1 The USEPA provides specific criteria by which to judge removal actions in EE/CAs in their document *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* EPA/540-R-93-057 (USEPA, 1993). The three general categories are effectiveness, implementability, and cost.

7.2.0.2 The effectiveness of an alternative refers to its ability to meet the cleanup objective within the scope of the removal action. This criterion also evaluates whether the alternative can be conducted in a manner that is safe to the public, the workers, and the environment. The effectiveness category is divided into four evaluation criteria that roll up into one overall criterion, Overall Protection of Human Health and the Environment. The four subcriteria are: Compliance with Applicable or Relevant and Appropriate Requirements (ARARs); Long-Term Effectiveness; Reduction of Toxicity, Mobility, or Volume through Treatment; and Short-Term Effectiveness.

7.2.0.3 The implementability category includes the technical and administrative feasibility of implementing an alternative; the availability of various services and materials required during its implementation; and the acceptance that local residents and agencies have expressed towards the various alternatives. Site conditions, characteristics of each technology, availability and reliability, the regulatory climate, and community concerns are considered under this criterion. The implementability category is divided into five evaluation criteria including: Technical Feasibility; Administrative Feasibility; Availability of Services and Materials; State (Support Agency) Acceptance; and Community Acceptance.

7.2.0.4 Finally, each alternative is evaluated to determine its projected overall implementation cost. Included in the cost calculation is an estimate of time necessary to complete the proposed alternative. Each of the evaluation criteria introduced above is discussed in greater detail in the following paragraphs.

7.3 EVALUATION CRITERIA: EFFECTIVENESS

7.3.1 Overall Protection of Public Health and Environment

7.3.1.1 This criterion evaluates each alternative on how well it can achieve and maintain protection of public health and the environment. This criterion draws on assessments of the four subcriteria described below.

7.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

7.3.2.1 Section 121(d)(1) of CERCLA, 42 U.S.C. § 9621(d)(1), requires that on-site removal actions attain federal standards, requirements, criteria, limitations or more stringent state standards determined to be legally applicable or relevant and appropriate to the circumstances at a given site. For removal actions, compliance with ARARs is required to the extent possible based on the urgency of the situation and the scope of the action contemplated. 40 C.F.R. § 300.415(j).

7.3.2.2 Applicable requirements are those cleanup standards, controls, and other substantive environmental protection requirements promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance found at a CERCLA site. 40 C.F.R. § 300.400(g)(1). Relevant requirements are those that are not applicable to a specific release or removal action, but are sufficiently similar to the circumstances of the release or removal action and therefore relevant and appropriate. 40 C.F.R. § 300.400(g)(2). Only state standards that are more stringent than the federal requirements may be considered ARARs. Generally, ARARs fit into three categories: chemical-specific, location-specific, and action-specific ARARs. The following are potential ARARs that may apply.

7.3.2.3 **Chemical-Specific ARARS**. Chemical-specific ARARs set health or risk-based concentration limits in various environmental media for specific hazardous substances, pollutants, or contaminants. These ARARs establish either protective cleanup levels for the chemical of concern in the designated media or indicate the appropriate level of concern.

- **ARSENIC:** Arsenic has been identified as a substance found at the site for which consideration of any potential chemical-specific ARARs is warranted. As discussed in Section 5, analysis of soil samples collected at the site detected the presence of arsenic in concentrations exceeding the screening levels. The medium of concern is soil.

7.3.2.3.1 **Soil** – There are no current chemical-specific ARARs for arsenic in soil. No directly applicable requirements that address the level of arsenic in soil were identified. Treatment levels under the land disposal restriction (LDR) regulations, see 40 C.F.R. §§ 268.34(a) and 268.48, were considered as potentially relevant and appropriate and rejected in accordance with 40 C.F.R. § 300.400(g)(2). Specifically, while the LDR treatment level in question may be relevant in the instant case because it applies to arsenic in soil, the requirement is inappropriate. LDRs are triggered by "placement" of restricted RCRA hazardous wastes in land-based units. Placement occurs when wastes are land disposed in on-site or off-site land-based RCRA units, such as landfills or surface impoundments. Placement does not occur if wastes are left in place. See memorandum from Jonathan Z. Cannon, Acting Assistant Administrator Office of Solid Waste and Emergency Response, *Policy for Superfund Compliance With the RCRA Land Disposal Restrictions* OSWER Directive 9347.1-0 (Nov. 8, 1986). Similarly, the District of Columbia's Hazardous Waste Management regulations (DC Code Sections 8-1301 et seq.), which apply to disposal sites, were found not to be ARARs for a cleanup level for arsenic in soil.

7.3.2.4 **Location-Specific ARARs**. Location specific ARARs prevent damage to unique or sensitive areas, such as floodplains, wetlands, and fragile ecosystems. They also restrict activities that may be harmful as a result of the characteristics of the site or the immediate environment. These requirements function like and may overlap the potential action-specific ARARs discussed below.

- Based on the identified grids with arsenic exceedances, removal activities are not expected to impact floodplains, wetlands, or sensitive ecosystems. As a result, no location-specific ARARs are identified for the Spring Valley site.

7.3.2.5 **Action-Specific ARARs**. Action-specific ARARs set controls or restrictions on specific removal activities at a site. They specify performance levels, actions or technologies, as well as specific levels for discharges or residual chemicals. Potential action-specific ARARs are addressed below.

7.3.2.5.1 **Erosion and Sediment Control –** The following regulatory provisions qualify as potential action-specific ARARs for this purpose:

Removal actions are required to comply with the underlying substantive requirements of 21 D.C.M.R. § 502.1. As such, removal activities must address and comply with erosion and sediment control requirements during and after completion of all land disturbing activities where applicable.

The District of Columbia Department of Consumer and Regulatory Affairs 1987 Standards and Specifications for Soil Erosion and Sediment Control are incorporated into the D.C.M.R. by reference at 21 D.C.M.R. § 501.4. Compliance with erosion and sediment regulations will ensure compliance with surface water quality consistent with District of Columbia antidegradation policy. Additional erosion and sediment control requirements include 21 D.C.M.R. § 539, which prescribes principles for designing erosion and sediment control measures, including the maximum allowable period of exposure and the maximum area that can be exposed.

7.3.2.5.2 **Storm Water Management** – The following regulatory provisions qualify as potential action-specific ARARs for this purpose:

21 D.C.M.R. § 526.1 requires appropriate storm water management measures to control or manage run-off during any earth moving or land change activity, unless the activity is exempt. Exempt activities include construction or grading operations that disturb less than 5,000 square feet of land. Based on an average of seven grids requiring removal per site, less than 5,000 square feet of land will be disturbed per site. However, some sites will exceed that limit. Additional storm water management requirements include:

- 21 D.C.M.R. § 528 – Provides for a waiver or variance from the storm water management requirements if the applicant can demonstrate that storm water runoff from the property in question will not adversely impact receiving wetlands, water courses, or waterways.
- 21 D.C.M.R. § 529 – Prescribes the minimum storm water management requirement that must be met before any land may be developed in the District.
- 21 D.C.M.R. § 530 – Identifies minimum storm water management measures that, singly or in combination, must be implemented by developments constructed in the District.

The requirements of 21 D.C.M.R. § 529 and 21 D.C.M.R. § 530 are not applicable but are relevant and appropriate because storm water management must be considered when disturbing more than 5,000 square feet of land.

7.3.2.5.3 **Fugitive Dust Emissions** – 21 D.C.M.R. § 605 qualifies as a potential action-specific ARAR for this purpose. It requires the taking of reasonable precautions to minimize the emission of fugitive dust into the outdoor atmosphere. Regulated activities include unpaved roads and parking lots, vehicles transporting dusty material or with wheels that accumulate dirt, the loading and unloading of dusty materials, and the stockpiling of dusty material.

7.3.2.5.4 **Noise Control**–20 D.C.M.R. § 2802.2 qualifies as a potential action-specific ARAR for this purpose. It prescribes a maximum noise level of 60 decibels for construction activities conducted in residential areas between the hours of 7:00 a.m. and 7:00 p.m. Construction noise levels are measured 25 feet from the outermost limit of the site. 20 D.C.M.R. § 2802.3.

7.3.2.5.5 **Hazardous Waste Determination-**40 C.F.R. § 261 determination of whether the arsenic-laden soil is a hazardous waste subject to the hazardous waste storage, transportation, manifest, land disposal restrictions, and other hazardous waste requirements in 40 C.F.R. parts 260 - 268 and the comparable DC Hazardous Waste Management Act and Munitions Regulation.

7.3.2.5.6 **Accumulation of Hazardous Waste**–40 C.F.R. § 262.34 qualifies as a potential action-specific ARAR for this purpose. It prescribes standards for the temporary accumulation of hazardous waste on site, including labeling, container, and storage requirements.

7.3.2.5.7 **Hazardous Waste Storage Tank Management**—40 C.F.R. part 264, subpart J qualifies as a potential action-specific ARAR for this purpose. It prescribes requirements for managing tank systems that are used to treat hazardous wastes.

7.3.2.5.8 **Land Disposal**–40 C.F.R. § 268.40 qualifies as a potential action-specific ARAR for any potential on-site land placement of hazardous soil. It prohibits the land disposal of arsenic waste unless the waste has been treated to concentrations at or below 1.4 mg/L in wastewater or 5.0 mg/L TCLP in non-wastewater.

7.3.3 Long-Term Effectiveness

7.3.3.1 This criterion measures how an alternative maintains the protection of human health and the environment after the removal objective has been met. The analysis focuses on:

- The permanence of the removal action alternative;
- The magnitude of residual risk following completion of the removal action; and
- The need for and the adequacy and reliability of any post removal site controls (PRSCs) (e.g., access limitations, deed restrictions, long-term monitoring etc.) used to manage the treated residuals or untreated wastes that remain at the site following the removal action.

7.3.4 Reduction of Toxicity, Mobility or Volume through Treatment

7.3.4.1 Based on the USEPA’s preference that a chosen removal alternative will reduce toxicity, mobility, or volume through treatment, an alternative must be evaluated based upon the following (USEPA 1993):

- The treatment processes(es) employed and the material(s) it will treat;
- The amount of hazardous materials to be destroyed or treated;
- The degree of reduction expected in toxicity, mobility, or volume;
- The degree to which the treatment will be irreversible;
- The type and quantity of residuals that will remain after treatment; and
- Whether the alternative meets the USEPA’s preference for treatment.

7.3.5 Short-Term Effectiveness

7.3.5.1 This criterion addresses the effects of an alternative during the implementation phase, prior to the removal objectives being met. More specifically, each alternative will be examined for:

- Protection of the community and workers during the removal action;
- Adverse environmental impacts resulting from construction and implementation; and
- The time required to meet the removal objectives.
- This criterion accounts for factors such as air quality, fugitive dust, transportation of hazardous materials, potential threats to worker and the reliability of mitigation measures, and potential environmental impacts including spills and releases.

7.4 EVALUATION CRITERIA: IMPLEMENTABILITY

7.4.1 Technical Feasibility

7.4.1.1 This criterion evaluates the ease of implementing a specific alternative. This criteria evaluates:

- The reliability of the technology and operational difficulties;
- The ability to perform the alternative in the allotted time;
- The need and ease of conducting future removal actions following the initial undertaking; and
- The environmental conditions with respect to set-up, construction and operation of the alternative.

7.4.2 Administrative Feasibility

7.4.2.1 This criterion focuses on the planning stages for each alternative and includes consideration of:

- Adherence to non-environmental laws (e.g., Siting of a treatment plant in a residential neighborhood);
- Coordinating services needed to carry out an alternative;
- Arranging the delivery of services in a timely manner; and
- Addressing the concerns of other regulatory agencies.

7.4.3 Availability of Services and Materials

7.4.3.1 This criterion evaluates the following sub-criteria:

- Availability of the technology and the personnel needed to perform the operation based on schedule;
- Availability of off-site treatment, storage and disposal for materials; and
- Need for and availability of supporting services (e.g., Power lines, laboratory services etc.).

7.4.4 State (Support Agency) and Community Acceptance

7.4.4.1 This criterion evaluates technical and administrative concerns of the supporting agency. Community acceptance of the alternative(s) is also evaluated. These concerns may include the time it takes to initiate the alternative and the time it takes to reach the endpoint.

7.5 EVALUATION CRITERIA: COST

7.5.0.1 This criterion determines and evaluates projected costs. These costs include direct capital costs (i.e., costs to perform the alternative), indirect capital costs (e.g., design expenses, legal fees, and permit fees), and post removal site control costs (e.g., monitoring, operation and maintenance costs).

7.6 EVALUATION OF ALTERNATIVES

7.6.0.1 This section details the analysis of each individual alternative with respect to the evaluation criteria described previously. Where known, indications of regulator, property owner, and community reaction, based on comments at past meetings, is provided for informational purposes only. Input received from stakeholders during the public comment period for this EE/CA report will be incorporated into the Final EE/CA and may affect the alternatives evaluation.

7.6.1 Alternative 1: No Action

Effectiveness: The No Action alternative would not provide for overall protection of human health and the environment. Section 4 identifies areas where arsenic concentrations in surface soil exceeded removal action goals. Arsenic concentrations in the surface soils would not be expected to decrease over time with no treatment. Therefore, this alternative would not be effective in achieving the removal goals and objectives of this EE/CA in the short-term or long-term, nor does it reduce toxicity, mobility or volume.

Implementability: The no action alternative, though implementable, will be technically ineffective and administratively impossible. Also, based on past comments, DCDOH, USEPA, and the community are unlikely to accept this alternative as it fails to achieve the removal goals and objectives. No services or materials would be required to implement this alternative.

Cost: There are no costs associated with the no action alternative.

Outcome: The no action alternative will not be further evaluated because it fails the effectiveness and implementability criteria.

7.6.2 Alternative 2: Institutional Controls and Engineering Controls

Effectiveness: In order to be protective of human health and the environment, the institutional controls alternative would have to prevent contact with the surface soil. This alternative does not achieve any reduction in toxicity, mobility, or volume through treatment; however, limiting access to the contaminated soil would limit potential exposure and, depending on the specific type of access control implemented, mobility may also be reduced through the reduction of infiltration and/or surface runoff from the soil during precipitation events. Although this alternative may be effective in the short term with the cooperation and understanding of current owners/residents and the proper protection of workers involved in the implementation, the long-term effectiveness of institutional controls such as access restrictions and limitations is difficult to ensure, particularly since these are private residences. Even if a current owner agrees to abide by the institutional controls, a future owner may not agree and could demand an alternate removal action.

Implementability: It is technically feasible to design and install physical barriers such as fences, concrete or brick patios, or groundcover plantings to limit access to the surface soils as well as to develop deed restrictions. The materials and services required to implement this alternative are available. The administrative feasibility of institutional controls is less certain as it would require the cooperation of many parties, including the property owners/residents, and numerous local agencies. An institutional control plan describing the controls as well as delineating responsibility for enforcement and maintenance of the controls must also be developed and agreed to by all parties. DCDOH, USEPA, property owner, and community acceptance has not been established.

Cost: The cost for this alternative ranges from approximately $20 per ton of contaminated soil removed for a concrete patio; approximately $90 per ton of contaminated soil removed for a brick patio; or approximately $29 per ton for ground cover plants. These costs are based on approximately 45 tons of soil removed per 20-foot by 20-foot by 2-foot grid. Decorative fencing (6 feet tall with no gates) would cost approximately $4800 per grid (i.e., $107 per ton of contaminated soil). These costs do not include maintenance (e.g., irrigation for ground cover plants), the development of deed restrictions, or costs otherwise associated with institutional control implementation.

Outcome: This alternative provides limited effectiveness and could be difficult to implement. However, even though this alternative leaves contaminated soil in place, individual residents may prefer this alternative to other removal alternatives that would require potentially extensive land disturbing activities on their property. Therefore, this alternative will be further evaluated.

7.6.3 Alternative 3: Phytoremediation

Effectiveness: A treatability study would be required to determine the potential effectiveness of this alternative at a particular site. If the treatability study indicates that phytoremediation is appropriate to site-specific conditions, this alternative would be protective of human health and the environment in the long-term, once the endpoints are achieved. However, the substantial time it would likely take to reach the remediation endpoints makes it ineffective in the short-term. During the potentially long interim period, the alternative would require regular monitoring, maintenance and access limitations. Phytoremediation would reduce mobility and toxicity in the soils, eliminating the residual risk, however, the toxic constituents would be transferred to the plants which would require periodic harvesting, disposal and replacement. Appropriate health and safety precautions would be required during construction and maintenance of this alternative in order to protect workers and the community during implementation.

Implementability: This alternative would require a treatability study to determine its technical feasibility. The technology in general is still largely in the developmental stages. Administratively, this alternative would require long-term plans for maintenance and monitoring. Enforcement would also be required during the interim between installing the plants and reaching the endpoints to ensure that the plants are being maintained and to ensure compliance with access controls established to protect human health in the interim. Availability of materials will depend on the specific materials identified during the treatability study. Restrictions in place during the phytoremediation effort would limit the resident's ability to utilize a portion of the property. DCDOH, USEPA, property owner, and community acceptance has not been established.

Cost: Based on a review of the literature, this alternative would cost between $15 and $31 per ton of soil. These costs include planting of the selected species, harvesting and disposal. The cost will vary based on various factors including the type of plant(s) required, climate factors (e.g., amount of irrigation needed), nutrient requirements, the number of harvesting and replanting cycles required, and disposal requirements. This alternative may also involve an additional cost of approximately $20 per ton for fencing (three foot high wooden picket fence with gate) which may be necessary to restrict access to the area during treatment. The estimated cost for the treatability study required to determine the technical feasibility and design parameters is $127 per ton. This is based on the current costs for the field portion of the phytoremediation demonstration test and an assumed economy of scale for many individual sites.

Outcome: The technical feasibility of this alternative for the site-specific conditions is unknown. Therefore, implementation of this alternative would be delayed pending completion of the treatability study. However, phytoremediation may be effective and implementable for certain individual properties where the owner may not want the potentially extensive land disturbing activities required for some of the other alternatives. Thus, this alternative will be further evaluated.

7.6.4 Alternative 4: Soil Stabilization

Effectiveness: This alternative would achieve protection of human health and the environment through immobilization of arsenic, thus reducing toxicity and mobility. During implementation of this alternative, proper controls would be required to minimize dust generated during the excavation and mixing process. In designing the stabilization process for the site, one consideration would be residual risks associated with the long-term stability of the treated material (i.e., the potential that the material would degrade under site conditions, thus releasing arsenic to the environment). More specifically, the following issues would require consideration:

- Hazards from the operation of heavy equipment, damage to underground utilities, or other occupational injuries;
- Airborne contaminated dusts and waste materials;
- Weathering of the treated material such that the ability to maintain the immobilization of contaminants is compromised; and
- Confirmatory sampling.

Implementability: This technology is available. However, a treatability study would be required to determine the technical feasibility of this alternative for site-specific conditions. The study would require a determination regarding the variability of site conditions within Spring Valley between the individual residential properties or lots included in this EE/CA (i.e., the scope of the study could require evaluation of multiple site conditions in order to determine the effectiveness of this alternative for an individual site). The soil at the site, which has typically been classified as clayey silt, may cause problems with the stabilization process because in general the higher the clay content the more difficult the procedure becomes. It also may not be possible to construct an on-site treatment plant either at the site because it is located in a residential neighborhood, or at the Federal Property. It would be very labor intensive to construct an on-site treatment plant. Because of the bulking of soil during this process, this alternative could create difficulties for future landscaping and construction activities, or alternatively, could require relocation/disposal of the soil volume that does not fit back into the original excavation. Hauling of soil through the neighborhood would be disruptive and potentially create opportunities for spills. DCDOH, USEPA, property owner, and community acceptance has not been established.

Cost: This alternative would cost approximately $38/ton for *ex-situ* treatment or approximately $35/ton for *in-situ* treatment. This does not include costs for handling any treated soil volume that cannot be replaced in the excavation (i.e., due to soil bulking). These costs also do not include the costs for the treatability study required to determine the technical feasibility and design parameters for this alternative.

Outcome: The technical feasibility of this alternative for the site-specific conditions is unknown. Therefore, implementation of this alternative would be delayed pending completion of the treatability study. This alternative may not be effective in the long-term due to degradation of the stabilized soil replaced on-site. In addition, this alternative may not be administratively implementable due to issues of siting an on-site treatment plant in a residential neighborhood or at the Federal Property. Because of the bulking of soil during this process, this alternative could create difficulties for future landscaping and construction activities. Therefore, this alternative will not be further evaluated.

7.6.5 Alternative 5: Soil Washing

Effectiveness: This alternative would be protective of human health and the environment. It will remove the arsenic from site soils to levels below the cleanup level, thus reducing the mobility, toxicity, and volume of contaminated soil. The arsenic removed from the soil will be contained in the sludge and wastewater generated during the washing process which would require proper handling and disposal appropriate for the concentrations of arsenic in the waste stream. This alternative would be effective in the long-term as the arsenic concentrations in the soil will be reduced below the cleanup levels and the residual risks will be eliminated. During implementation of this alternative, proper controls would be required to minimize dust generated during the excavation and washing process. Additionally, the materials used in the washing process may pose a risk to human health and the environment during implementation of this alternative. More specifically, the following issues would require consideration:

- Hazards from the operation of heavy equipment, damage to underground utilities, or other occupational injuries;
- Airborne contaminated dusts and waste materials;
- Confirmatory sampling;
- Additional management of waste generated by soil washing process; and,
- Emissions from extracting agents or solvents used in the solvent extraction process or the wastes generated during the extraction/washing process.

Implementability: This alternative would require a treatability study to determine whether it is technically feasible for site-specific conditions. In general, the clayey silt content of the soils at the site will make it more difficult to achieve the desired endpoints using this technology. It is uncertain whether soil washing could take place on-site or at the Federal Property location due to the chemicals needed in the process, the waste generated, and the potential for spills of these materials. Hauling of soil through the neighborhood, if needed for this alternative, would be disruptive and potentially create opportunities for spills. Although this technology exists, it is labor intensive and vendors utilizing this technology are few. Parsons was unable to obtain a removal or cost from any vendors utilizing this technology. This alternative may also complicate landscaping efforts due to soil sterility issues. DCDOH, USEPA, property owner, and community acceptance has not been established.

Cost: This alternative would cost approximately $190 per ton of soil treated [Cost from RS-MEANS document, *Environmental Remediation Cost Data 6th Annual Edition* (RS-MEANS 2000)]. This cost does not include the costs for the treatability study required to determine the technical feasibility and design parameters for this alternative.

Outcome: The technical feasibility of this alternative for the site-specific conditions is unknown. Therefore, implementation of this alternative would be delayed pending completion of the treatability study. Furthermore, it may not be possible to construct a treatment plant on site or at the Federal Property location. The materials and services required to implement this alternative are not widely available, based on the lack of response from potential vendors contacted by Parsons. Therefore, this alternative will not be further evaluated.

7.6.6 Alternative 6: Excavation and Landfill Disposal

<u>Effectiveness:</u> This alternative would be protective of human health and the environment. It will remove the arsenic from site soils to the 20 mg/kg cleanup level (or in limited situations, up to 43 mg/kg as described in Section 5.3), thus eliminating the arsenic's mobility and reducing the toxicity and volume of contaminated soil at the site. This alternative would be effective in the long-term as the soils with elevated arsenic concentrations will be removed from the site, eliminating residual risk, and it will require only a short period of time until the endpoints are reached. During implementation of this alternative, controls would be required to minimize dust generated during the excavation.

The excavated soils must be disposed, consistent with 40 C.F.R. § 300.440, in a treatment, storage, or disposal facility that EPA determines to be acceptable. If the excavated soils are characterized as RCRA hazardous, they would have to be stabilized by the RCRA Subtitle C hazardous waste landfill and then deposited in the landfill. If they are not considered RCRA hazardous, they can be disposed of directly into a sanitary landfill. It should be noted that past experience at the site has shown that the vast majority of the soil would be characterized as non-hazardous. Sanitary landfills are required to have liners and caps such that the residential human health hazard presented by the soils would be controlled. Even after closure of the sanitary landfill, the soils would be controlled as part of landfill management.

More specifically, the following issues would require consideration:

- Hazards from the operation of heavy equipment, damage to underground utilities, or other occupational injuries;
- Airborne contaminated dusts and waste materials;
- Confirmatory sampling; and
- Storage, labelling, and transportation requirements.

<u>Implementability:</u> This alternative is technically and administratively feasible. The materials and services required to implement this alternative are readily available. DCDOH, USEPA, property owner, and community acceptance has been established through the on-going TCRA and NTCRA efforts described in Section 2.

<u>Cost:</u> This alternative would cost approximately $437 per ton (disposal of material as RCRA non-hazardous at a sanitary landfill), and approximately $546 per ton (disposal of material as RCRA hazardous at a RCRA Subtitle C landfill).

<u>Outcome:</u> This alternative is both effective and implementable. It will be retained for further evaluation.

8. COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

8.0.0.1 Based on the individual analysis of alternatives presented in Section 7, the remaining alternatives include:

- Institutional Controls
- Phytoremediation
- Excavation and Landfill Disposal

The three other alternatives identified in Section 7 were eliminated during the individual analysis for various reasons including lack of effectiveness and/or implementability. This section presents a comparative analysis of the remaining alternatives to determine their relative performance in relation to each of the criteria. The purpose of this analysis is to identify the advantages and disadvantages of the remaining alternatives relative to one another so that key factors that would affect the remedy selection can be identified. Table 8.1 presents a summary of the comparative analysis.

8.1.1 Effectiveness

The excavation and landfill disposal alternative would be most protective of human health and the environment overall:

- This alternative will be conducted in a manner that complies with the following action-specific ARARs:
    - **Erosion and Sediment Control**—21 D.C.M.R. §§ 501.4, 502.1 and 539 (discussed in paragraph 7.3.2.5.1 above) are applicable ARARs for this removal action.
    - **Storm Water Management**—21 D.C.M.R. §§ 529 and 530 (discussed in paragraph 7.3.2.5.2 above) are relevant and appropriate ARARs for this removal action.
    - **Fugitive Dust Emissions**—21 D.C.M.R. § 605 (discussed in paragraph 7.3.2.5.3 above) is an applicable ARAR for this removal action.
    - **Noise**—20 D.C.M.R. § 2802.2 and 2802.3 (discussed in paragraph 7.3.2.5.4 above) are applicable ARARs for this removal action.
    - **Accumulation of Hazardous Waste**—40 C.F.R. § 262.34 (discussed in paragraph 7.3.2.5.5 above) is a relevant and appropriate ARAR for this removal action.
    - **Hazardous Waste Storage Tank Management**—40 C.F.R. § 264, Subpart J, (discussed in paragraph 7.3.2.5.6 above) is a relevant and appropriate ARAR for this removal action.
    - **Land Disposal**—40 C.F.R. § 268.40 (discussed in paragraph 7.3.2.5.7 above) is a relevant and appropriate ARAR for this removal action.

Table 8.1
Summary of Comparative Alternatives Analysis

Screening Criterion	Institutional Controls	Phytoremediation	Excavation and Landfill Disposal
Effectiveness			
Protection of Human Health and Environment	○	◑	●
Compliance with ARARs	○	◑	●
Long-Term Effectiveness	○	◑	●
Reduction of Toxicity, Mobility, and Volume through Treatment[/1]	○	●	◑
Short-Term Effectiveness	◑	○	●
Implementability			
Technical Feasibility	◑	○	●
Administrative Feasibility	○	◑	●
Availability of Materials and Services	●	○	●
Supporting Agency Acceptance	○	○	●
Community Acceptance	○	○	●
Cost ($/ton)	$127 to $197 [/a]	$162 to $178 [/b]	$437 to $546[/c]
Recommended	○	◑	●

● = Favorable

◑ = Fair

○ = Not Favorable/Potential Problems

/1 Reflects EPA's preference for <u>treatment</u> (i.e., for technologies that will permanently and significantly reduce toxicity, mobility or volume of the hazardous substances as their principal element), *EPA 540-R-93-057, Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*

/a Includes between $20 per ton for a concrete patio and $90 per ton for a brick patio; plus $107 per ton for decorative 6' fencing. These costs do not include maintenance (e.g., irrigation for ground cover plants), the development of deed restrictions, or the development of the institutional control plan.

/b Includes between $15 and $31 per ton for planting of the selected species, harvesting and disposal, $20 per ton of soil for temporary 3' picket fencing, and $127 per ton for the treatability study required to determine the technical feasibility and design parameters for this alternative. The treatability cost is based on the field portion of the current demonstration test costs and an economy of scale assumption ($40,000 per site).

/c $437 per ton (disposal of material as RCRA non-hazardous at a sanitary landfill, most likely scenario based on past site experience); $546 per ton (disposal of material as RCRA hazardous at a RCRA Subtitle C landfill). For the entire site, 800 grids or 36,000 tons are anticipated for a total of $15.7 million, assuming non-hazardous material.

- The institutional controls alternative and the phytoremediation alternative (depending on the results of the treatability study) are also each expected to attain all pertinent action-specific ARARs for this site.
- The excavation and landfill disposal alternative is also effective in the long-term whereas there may be problems with the institutional controls alternative in the long-term regarding enforcement of compliance with use limitations, particularly if the property is transferred to a new owner.
- Assuming that a treatability study indicates that phytoremediation would be effective for a particular site, the phytoremediation alternative would be more favorable compared to the excavation and landfill disposal alternative in terms of reduction of toxicity, mobility, and volume **through treatment**. However, the excavation and landfill disposal alternative will remove the arsenic contaminated soil from the site for placement into a controlled landfill, thereby reducing the toxicity and mobility of the soil through the controls in place at the landfill and reducing the volume of contaminated soil at the site.
- The excavation and landfill disposal alternative is the most favorable in terms of short-term effectiveness. The appropriate controls for protection of workers, the community and the environment during implementation of the alternative are readily available and easily implemented. This alternative will achieve the removal objectives in a substantially shorter time frame than the phytoremediation alternative or the institutional controls alternative, which is likely to require substantial time to develop an institutional control plan delineating enforcement and maintenance responsibilities.
- Finally, while the excavation and landfill disposal alternative will attain the 20 mg/kg remediation endpoint, the institutional controls alternative will not, and it is not currently known whether phytoremediation can attain this level.

8.1.2 Implementability

The excavation and landfill disposal alternative is the most implementable of the three remaining alternatives:

- In terms of technical feasibility, the excavation and landfill disposal alternative is favorable in comparison to the other remaining alternatives. It is more reliable than the other alternatives and would have fewer operational difficulties; it can be performed in a shorter period of time; and there will not be a need to conduct future removal actions. Most importantly, this alternative has been performed at various areas throughout the Spring Valley site as discussed in Section 2 and associated unknowns or potential problems have been identified and largely resolved.
- In terms of administrative feasibility, the excavation and landfill disposal alternative is favorable in comparison to the other remaining alternatives. The institutional controls alternative could have substantial problems during implementation due to the required coordination amongst various government agencies and the individual property owners to select an access control option appropriate for each site (i.e., concrete vs. brick vs. groundcover). Development of an institutional control plan agreed to and complied with by all parties could also present administrative difficulties for the institutional controls alternative. The phytoremediation alternative

could also have problems in terms of administrative feasibility due to the required maintenance of the plants and compliance with temporary access controls.

- The materials and services for both the institutional controls alternative and the excavation and landfill disposal alternative are readily available. The availability of materials and services could be an issue for the phytoremediation alternative depending on the type of the plants identified during the treatability study and because it is an innovative technology.
- Based on historical removal actions involving the excavation and landfill disposal of arsenic contaminated soil from other portions of the Spring Valley site, it has been assumed that the excavation and landfill disposal option is acceptable to DCDOH, USEPA, the property owner, and the community. Input received from these stakeholders during the public comment period for this EE/CA report will be incorporated into the Final EE/CA and may affect the alternatives evaluation.

8.1.3 Cost

Table 8.1 summarizes the estimated costs for each alternative. Costs were developed using standard cost estimating tools, literature values, estimates from remedial contractors, and costs for similar work previously conducted by the USACE. The excavation and landfill disposal alternative specifically reflects the actual costs from the portions of the work described in Section 2.4 that the USACE performed. The phytoremediation treatability costs were based on actual costs for the field portion of the current demonstration test, plus economy of scale assumptions. As described in Section 7.6.2, Institutional Controls involves some costs that were not included in the summary costs presented in the table.

9. RECOMMENDED REMOVAL ACTION ALTERNATIVE

9.0.0.1 The analysis considered that a single remedy for potentially 140 plus sites throughout Spring Valley may not be practical and that private home owners may want less intrusive alternatives. Although other alternatives are not available at this time, the USACE plans to conduct a greenhouse study and feasibility study for phytoremediation in 2004. A determination will be made based on the results of the study as to whether or not phytoremediation can be an effective arsenic removal technology in Spring Valley.

9.1 RECOMMENDED REMOVAL ACTION ALTERNATIVE

9.1.0.1 Based on the evaluations presented in Sections 7 and 8, the recommended alternative is excavation and landfill disposal. This alternative satisfies the removal action goal of reducing the risk posed by elevated arsenic concentrations in surface soil at the sites. This alternative satisfies the evaluation criteria because it will meet the removal objectives in an acceptable amount of time, pose limited risk during implementation, is readily implementable both from a technical and administrative standpoint, and can be accomplished at a reasonable cost. This alternative was selected after evaluating six alternatives separately under each criterion.

9.1.0.2 Figure 4-1 illustrates the areas requiring removal. Soil will initially be excavated to a depth of two feet below ground surface in these areas. Soil samples will be collected from the bottom and sidewalls of these excavations and analyzed for total arsenic. If the arsenic concentrations in the soil samples exceed 20 mg/kg, additional soil will be excavated in that area. This excavation and sampling procedure will continue until the samples collected do not exceed 20 mg/kg arsenic. Clean fill from an off-site source will be used to fill the excavation to grade. The excavated areas would be re-landscaped to conditions equivalent to the pre-existing condition.

9.1.0.4 Excavated soil would be characterized and transported to an appropriate off-site disposal facility. The excavated soil would be characterized in accordance with the requirements of the disposal facility. If the soil is characterized as hazardous, it will be transported to a RCRA subtitle C landfill where it will be pretreated and disposed. If the soil is characterized as non-hazardous, it will be transported to a sanitary landfill for disposal where it will be disposed of directly, without pretreatment. Past experience at the site has shown that the vast majority of the soil would be characterized as non-hazardous.

9.2 DETAILED COST ESTIMATE

9.2.0.1 A detailed cost estimate was prepared for the recommended alternative and is presented in Appendix B. The alternative was costed for two scenarios: disposal at a hazardous waste facility and disposal at a non-hazardous waste facility. These costs include excavation, transportation, disposal, and support requirements for the recommended alternative. The excavation and landfill disposal alternative specifically reflects the actual costs from the portions of the work described in Section 2.4 that the USACE performed. As noted above, although both costs are included, past experience at the site has shown that the vast majority of the soil would be characterized as non-hazardous.

10. REFERENCES

Apex Environmental, Inc., 1996. Final Report Conducted on President's Residence, 4835 Glenbrook Road, Washington, DC. Apex Environmental, Inc.

RS-MEANS, 2000. Environmental Remediation Cost Data 6th Annual Edition.

SCIENCE, 2003. The Ecology of Arsenic, Science, Vol 300, Ronald Oremland and John Stolz, May 9, 2003.

USACE, 1995. Remedial Investigation Report for the Operation Safe Removal Formerly Used Defense Site, Washington DC Prepared for US Army Corps of Engineers, Huntsville Division and Baltimore District. Prepared by Parsons Engineering Science, Inc.

USACE, 1996a. Engineering Evaluation/ Cost Analysis, Captain Rankin Area Shell Pits Operation Safe Removal Project, Washington DC Prepared for US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District. Prepared by US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District; and Parsons Engineering Science, Inc.

USACE, 1996b. Remedial Investigation Report, Spaulding and Captain Rankin Areas, Operation Safe Removal Formerly used Defense Site, Washington D.C.

USACE, 1998. Remedial Investigation Evaluation Report for the Operation Safe Removal Formerly Used Defense Site, Washington DC Prepared for US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District. Prepared by US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District; and Parsons Engineering Science, Inc.

USACE, 1999a. Change 01 to the Site Safety Submission, Arsenic Sampling Plan 4801 and 4825 Glenbrook Road, Spring Valley Operable Unit 3, Washington DC Prepared for US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District. Prepared by US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District; and Parsons Engineering Science, Inc.

USACE, 1999b. *Site Safety Submission, Spring Valley, Operable Unit 3, Washington, DC*, prepared for the USAESCH by Parsons Engineering Science, Inc. (USACE 1999), as changed, amended, and approved by the Department of Defense Explosive Safety Board (DDESB) and the U.S. Army Technical Center for Explosives Safety (USATCES)],

USACE, 1999c. Sampling and Analysis Plan, 4801 Glenbrook Road, Spring Valley Operable Unit 3, Washington DC Prepared for US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District. Prepared by US Army Engineering and Support

Center, Huntsville; US Army Corps of Engineers, Baltimore District; and Parsons Engineering Science, Inc.

USACE, 2000. Site Safety Submission, Addendum 09, (Small Disposal Area Intrusive Investigation) Spring Valley Operable Unit 3 Washington, DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District, October 2000. Prepared by Parsons.

USACE, 2000a. Final Work Management Plan, Remedial Investigation/Feasibility Study, Spring Valley OU-4. Prepared for US Army Corps of Engineers, Baltimore District, August 2000. Prepared by Parsons.

USACE, 2000b. Revised Final Engineering Evaluation/Cost Analysis, 4801, 4825, and 4835 Glenbrook Road Washington, D.C. Prepared for US Army Corps of Engineers, Baltimore District (October 2000). Prepared by Parsons.

USACE, 2000c. Change 05 to the Site Safety Submission, Revised Sampling and Analysis Plan Arsenic Sampling Plan for 4801 Glenbrook Road, Spring Valley Operable Unit 3, Washington DC Prepared for US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District. Prepared by US Army Engineering and Support Center, Huntsville; US Army Corps of Engineers, Baltimore District; and Parsons Engineering Science, Inc.

USACE, 2001. Site Safety Submission, Addendum 10, (Test Pit Investigation at 4825 Glenbrook Road) Spring Valley Operable Unit 3 Washington, DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District, March 2001. Prepared by Parsons.

USACE, 2001a. Work Management Plan Amendment 1 AU lot 12/ Child Development Center Grid Sampling, Remedial Investigation/Feasibility Study Spring Valley Operable Unit 4 Washington D.C. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District. Prepared by Parsons Engineering Science, Inc.

USACE, 2001b. Work Management Plan Amendment 2 Follow-on Sampling for OU-4 Residential Lots, Remedial Investigation/Feasibility Study Spring Valley Operable Unit 4 Washington DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District. Prepared by Parsons Engineering Science, Inc.

USACE, 2001c. Work Plan for Sedgwick Trench Area Investigation, Remedial Investigation/Feasibility Study, Spring Valley Operable Unit 5 Washington DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District. Prepared by Parsons Engineering Science, Inc.

USACE, 2002. Final Work Management Plan for Spring Valley Operable Unit 5 (Parsons, October 2002), Remedial Investigation/Feasibility Study, Spring Valley Operable Unit 5

Washington DC. Prepared for US Army Corps of Engineers, Baltimore District. Prepared by Parsons.

USACE, 2002. Post Removal Action Report, Time Critical Removal Action Child Development Center, Spring Valley Operable Unit 4 Washington, DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District, December 2002. Prepared by Parsons.

USACE, 2002, Removal Action Design, Time Critical Removal Action, American University Athletic Fields and Other Critical American University Lots, Spring Valley Operable Unit 4, Washington, DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District, June 2002. Prepared by Parsons.

USACE, 2002. Work Management Plan Amendment 3 Follow-on Sampling for OU-4 American University Lots, Remedial Investigation/Feasibility Study Spring Valley Operable Unit 4 Washington DC. Prepared for US Army Engineering and Support Center, Huntsville, US Army Corps of Engineers, Baltimore District, October 2002. Prepared by Parsons.

USACE, 2002. Risk Assessment for 4835 Glenbrook Road, Spring Valley OU-3, Washington DC. Prepared for US Army Corps of Engineers, Baltimore District, April 2002. Prepared by Parsons.

US Department of the Interior, 2003. Correspondence with US Fish and Wildlife Service, Mary J. Ratnaswamy, Program Supervisor, Threatened and Endangered Species, November 26, 2003.

USEPA, 1991. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors, interim final (USEPA, 1991).

USEPA, 1993. Office of Emergency and Remedial Programs, August 1993. *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA.* Washington, D.C. EPA/540-R-93-057.

USEPA, 1996. Soil Screening Guidance Technical Background Document. Office of Solid Waste and Emergency Response. EPA/540/R-95/12B.

USEPA, 1999b. Washington D.C., Army Munitions Site, Spring Valley, Draft Risk Assessment Report, USEPA Region III (USEPA, October 1999).

USEPA, 1999c. Sampling and Analysis Plan Addendum #1, Spring Valley OU3, Washington D.C. Prepared for the USEPA Region III (Federal Facilities Branch) by Roy F. Weston (Site Assessment Technical Assistance Team) May 27, 1999.

USEPA, 1999d. Interim Trip Report Appendix 1, Spring Valley OU3, Washington D.C. Prepared for the USEPA Region III (Federal Facilities Branch) by Roy F. Weston (Site Assessment Technical Assistance Team).

USEPA, 1999e. Sampling and Analysis Plan Addendum, Spring Valley OU3, Washington D.C. Prepared for the USEPA Region III (Federal Facilities Branch) by Roy F. Weston (Site Assessment Technical Assistance Team) May 27, 1999.

USEPA, 2000. Background Trip Report, Spring Valley OU3, Washington D.C. Prepared for the USEPA Region III (Federal Facilities Branch) by Roy F. Weston (Site Assessment Technical Assistance Team), January 2000.

USEPA, 2000. Spring Valley, Washington D.C., American University Property (Spring Valley OU3), Human Health Risk Assessment Report, USEPA Region III (USEPA, August 2000).

USEPA, 2001. Method 1632. Chemical Speciation of Arsenic in Water and Tissue by Hydride Generation Quartz Furnace Atomic Absorption Spectrometry. Revision A, January 2001.

USGS, 1994. Geologic Map of the Washington West Quadrangle, District of Columbia, Montgomery and Prince George's Counties, Maryland, and Arlington and Fairfax Counties, Virginia, by Fleming, A. H., Drake, A.A., Jr., McCartan, Lucy.

APPENDIX A

SITE DETAIL MAPS BY GEOGRAPHICAL GROUPING

GEOGRAPHICAL GROUPINGS
(OU-4, CTA & CSA)

OU-4 GROUPING A (DETAIL)
OU-4 GROUPING B (DETAIL)
OU-4 GROUPING C (DETAIL)

CTA GROUPINGS
- CTA GROUPING 1A
- CTA GROUPING 1B–North (DETAIL)
- CTA GROUPING 1B-South (DETAIL)
- CTA GROUPING 1C-North (DETAIL)
- CTA GROUPING 1C-South (DETAIL)
- CTA GROUPING 1D

CSA GROUPING 2
- CSA GROUPING 2A (DETAIL)
- CSA GROUPING 2B (DETAIL)

CSA GROUPING 3
- CSA GROUPING 3A (DETAIL)
- CSA GROUPING 3B (DETAIL)

CSA GROUPING 4

CSA GROUPING 5
- CSA GROUPING 5A (DETAIL)
- CSA GROUPING 5B (DETAIL)

CSA GROUPING 6
- CSA GROUPING 6A (DETAIL)
- CSA GROUPING 6B (DETAIL)

CSA GROUPING 7
- CSA GROUPING 7A (DETAIL)
- CSA GROUPING 7B (DETAIL)

CSA GROUPING 8

CSA GROUPING 9

CSA GROUPING 10

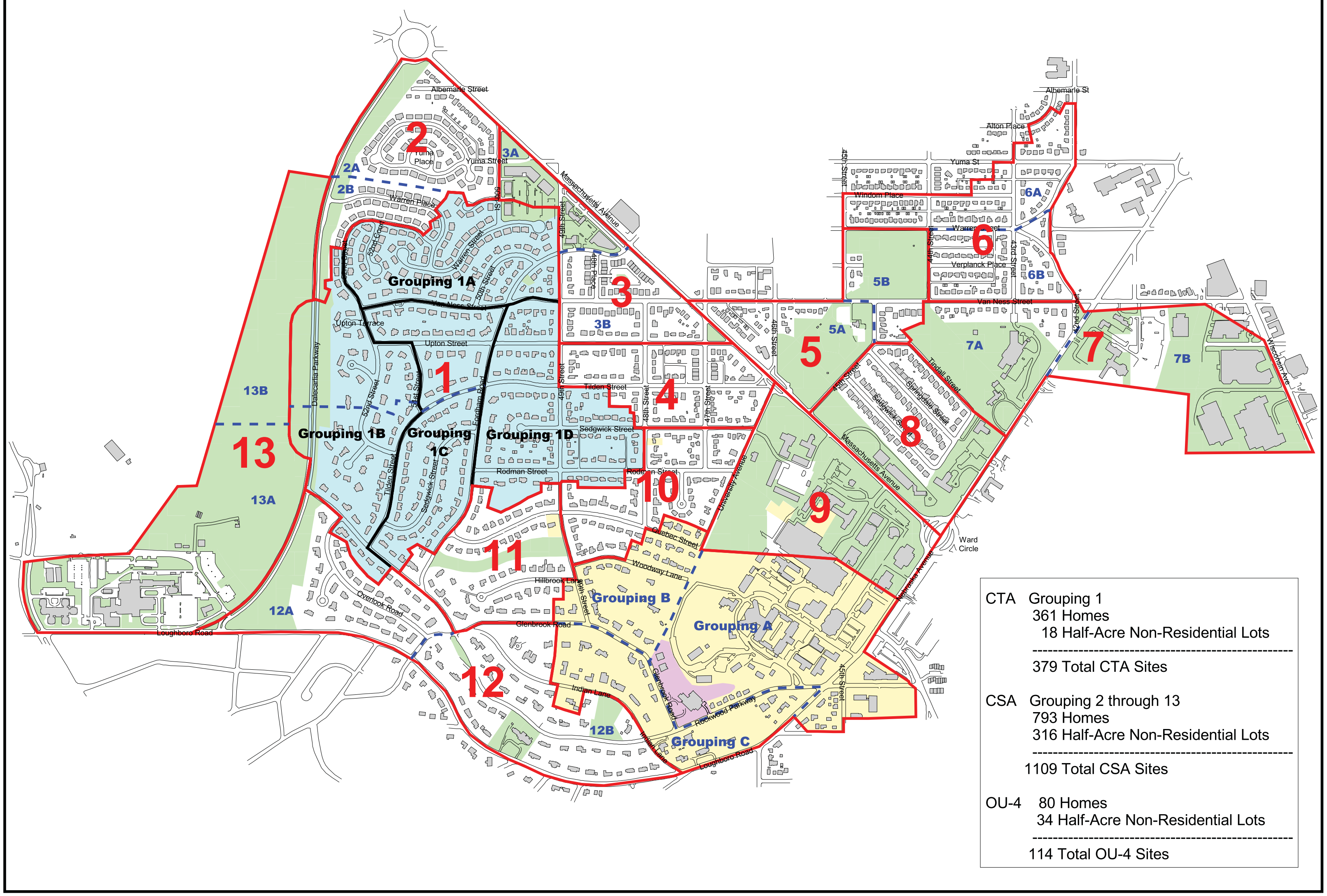
CSA GROUPING 11

CSA GROUPING 12
- CSA GROUPING 12A (DETAIL)
- CSA GROUPING 12B (DETAIL)

CSA GROUPING 13
- CSA GROUPING 13A (DETAIL)
- CSA GROUPING 13B (DETAIL)

Geographical Groupings

Spring Valley
Operable Units 4 & 5
Washington D.C.



CTA	Grouping 1 361 Homes 18 Half-Acre Non-Residential Lots
	379 Total CTA Sites
CSA	Grouping 2 through 13 793 Homes 316 Half-Acre Non-Residential Lots
	1109 Total CSA Sites
OU-4	80 Homes 34 Half-Acre Non-Residential Lots
	114 Total OU-4 Sites

Legend

- Grouping Divisions
- Central Testing Area Divisions
- Groupings
- Buildings
- Roads
- Non-Residential Acreage
- CTA (Group 1)
- OU-3
- OU-4

Note:
OU-5 Acreage comprises groupings 1 through 13.

CSA is groupings 2 through 13.

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas. Sampling of these lots will be based on open accessible portions determined in the field.

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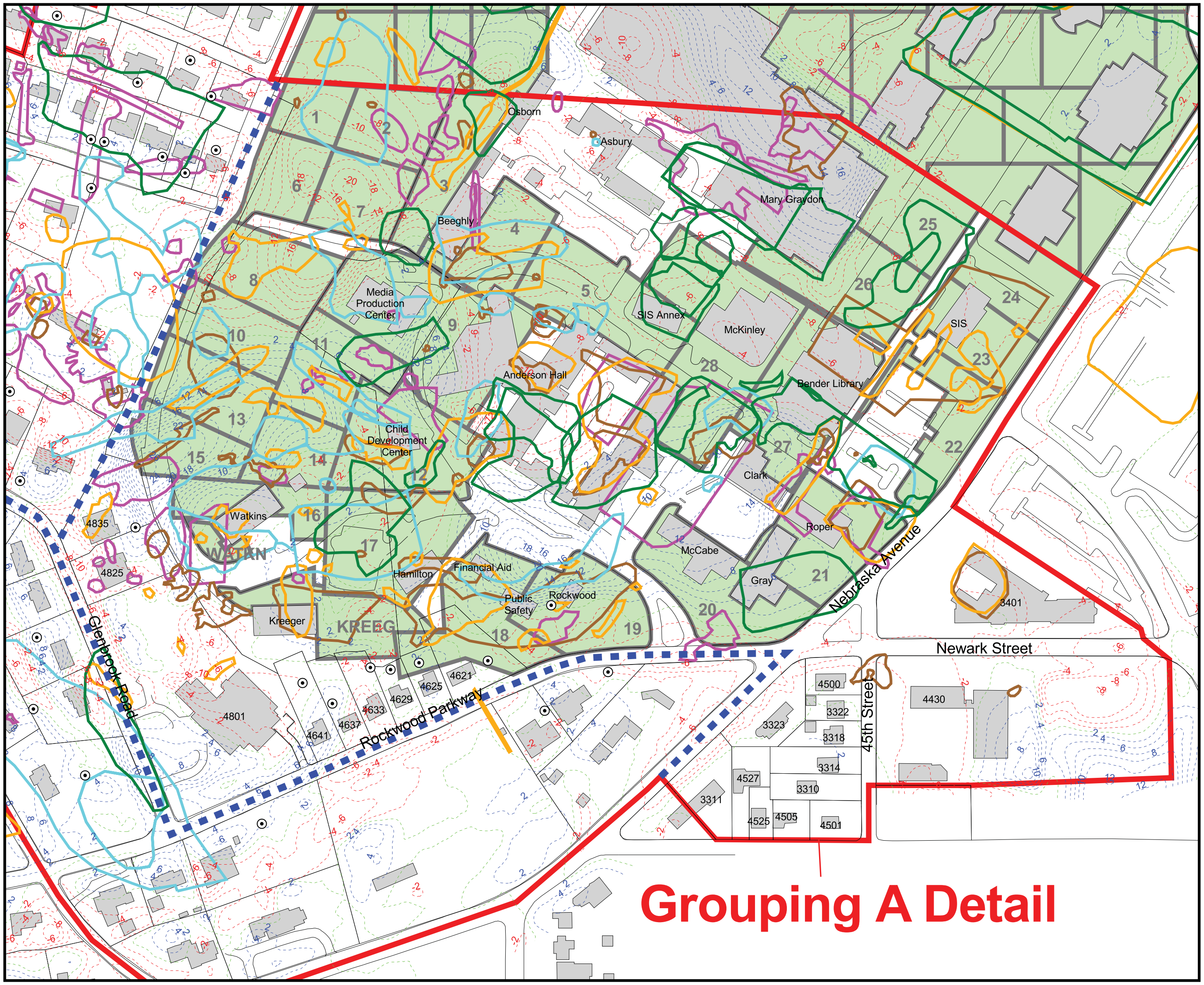

Operable Unit 4
Grouping A Detail

Spring Valley Operable Unit 4
Washington D.C.

Legend

- Boring Locations
- Boundary between A, B & C Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- OU-4
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

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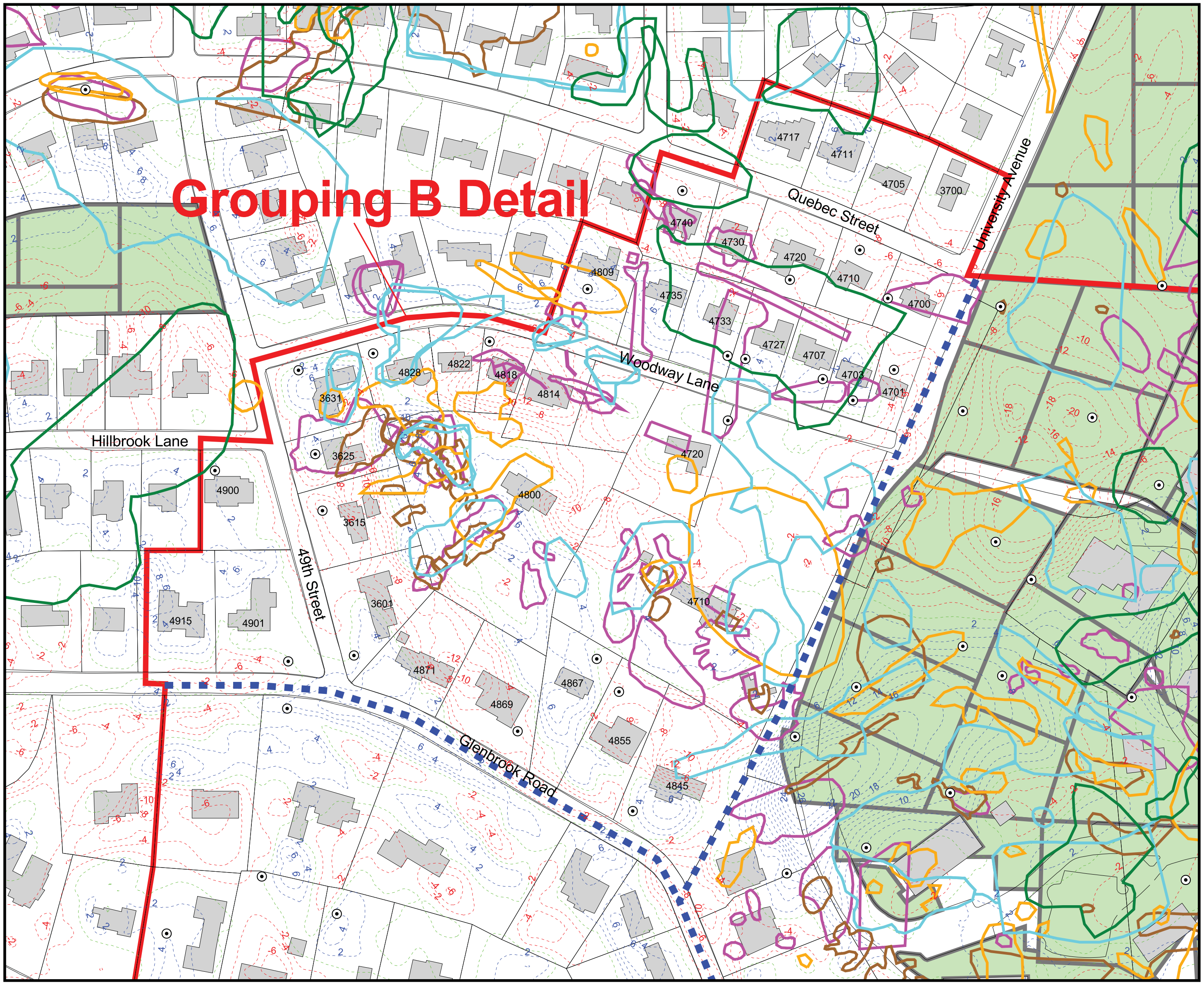

Operable Unit 4
Grouping B Detail

Spring Valley Operable Unit 4
Washington D.C.

Legend

- Boring Locations
- Boundary between A, B & C Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- OU-4
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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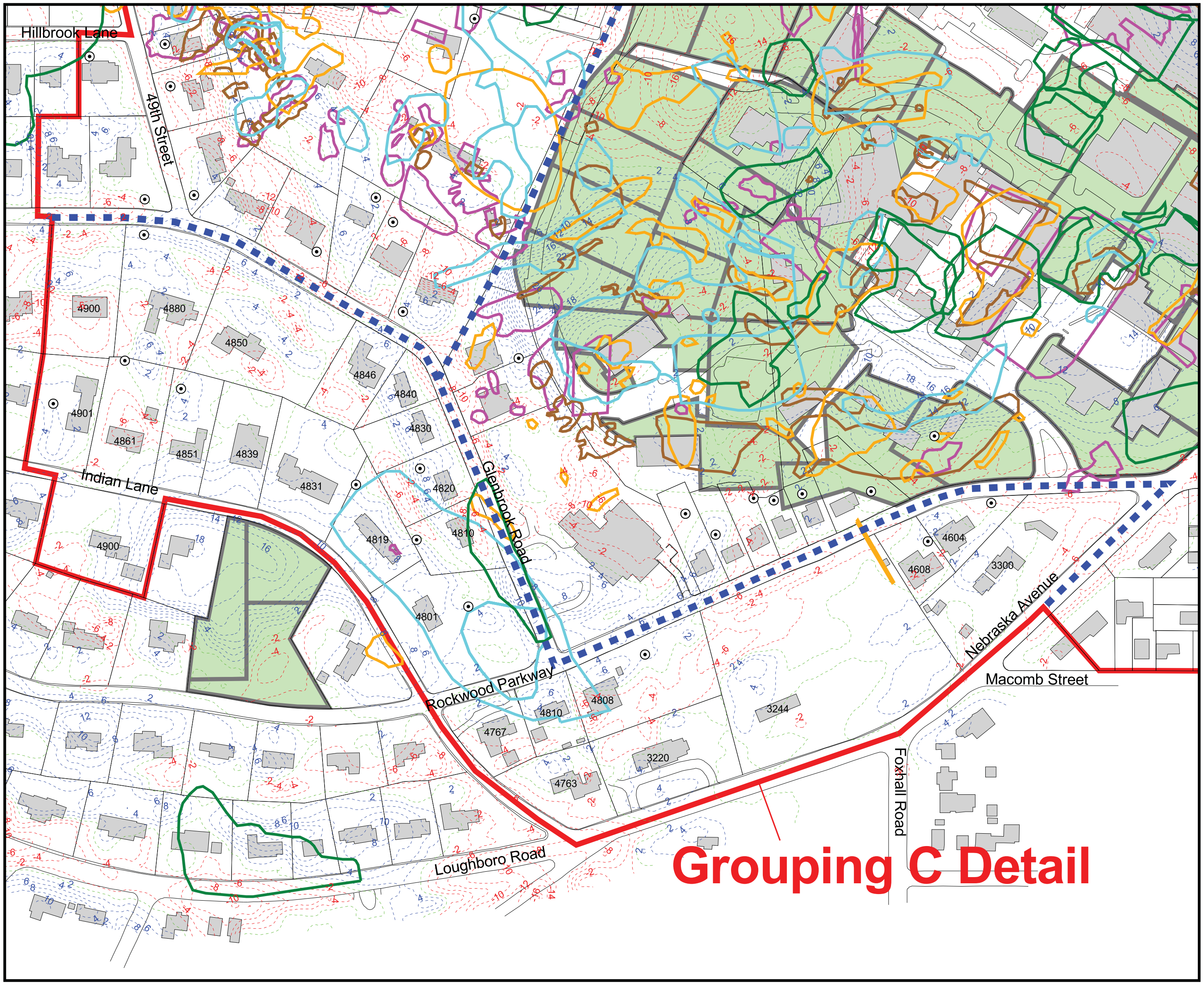
Operable Unit 4
Grouping C Detail

Spring Valley Operable Unit 4
Washington D.C.



Legend

- Boring Locations
- Boundary between A, B & C Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- OU-4
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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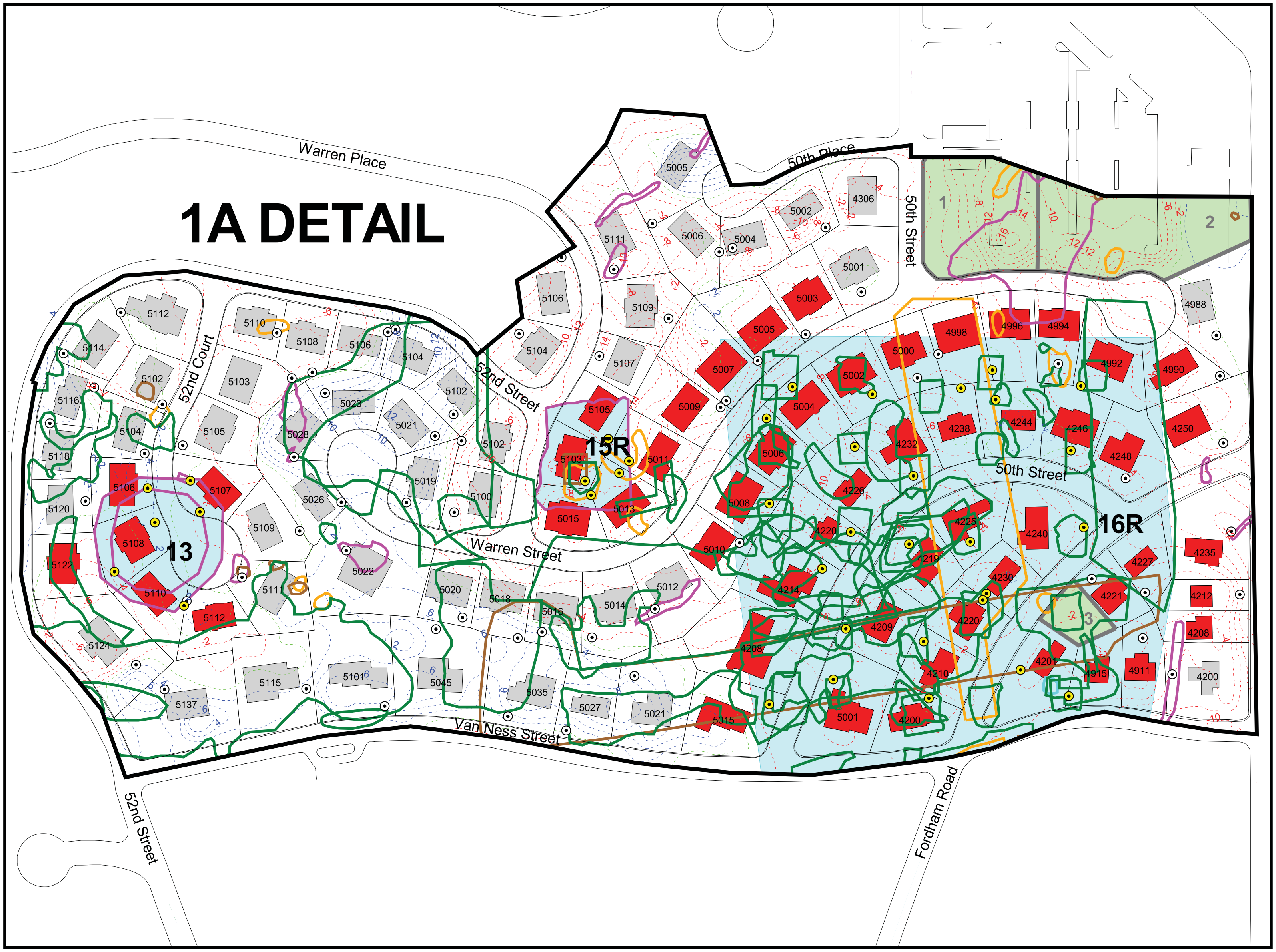

CTA
Grouping 1A

Spring Valley Operable Unit 5
Washington D.C.

Legend

Boring Location
- Arsenic
- POI-Specific Parameters

Roads
Stressed Vegetation
1928 Ground Scars
1927 Ground Scars
1922 Ground Scars
1918 Ground Scars
Cut & Fill
- Cut
- Level
- Fill

Parcels
Non-Residential Lots
CTA Grouping 1A
Residence Within a POI
Building
POIs

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

N E S W

0 200 Feet

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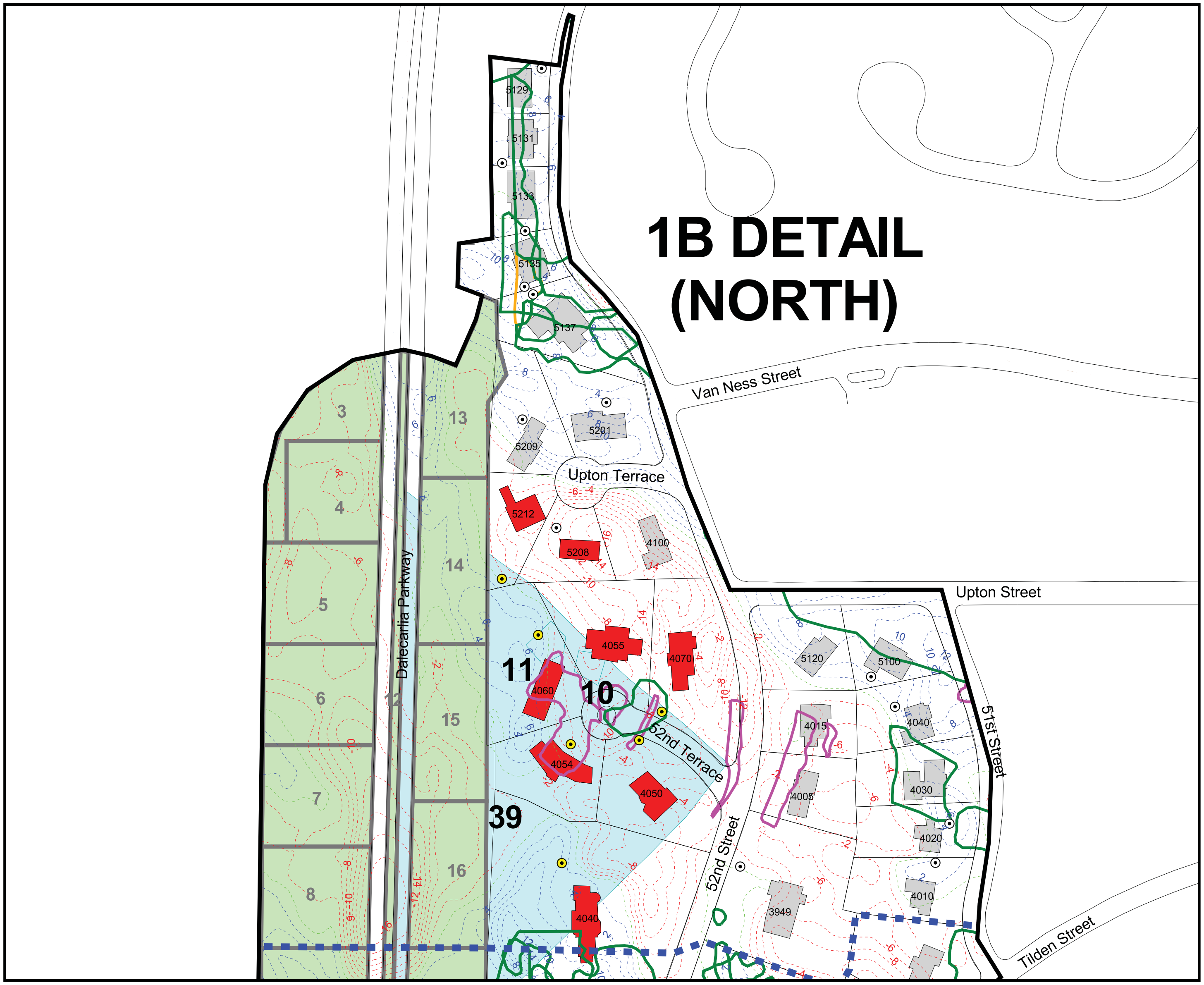

CTA
Grouping 1B-North Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

Boring Locations
- Arsenic
- POI-Specific Parameters

- Boundary between North & South Detail
- Roads
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill

- Parcels
- Non-Residential Lots
- CTA Grouping 1B
- Residence Within a POI
- Building
- POIs

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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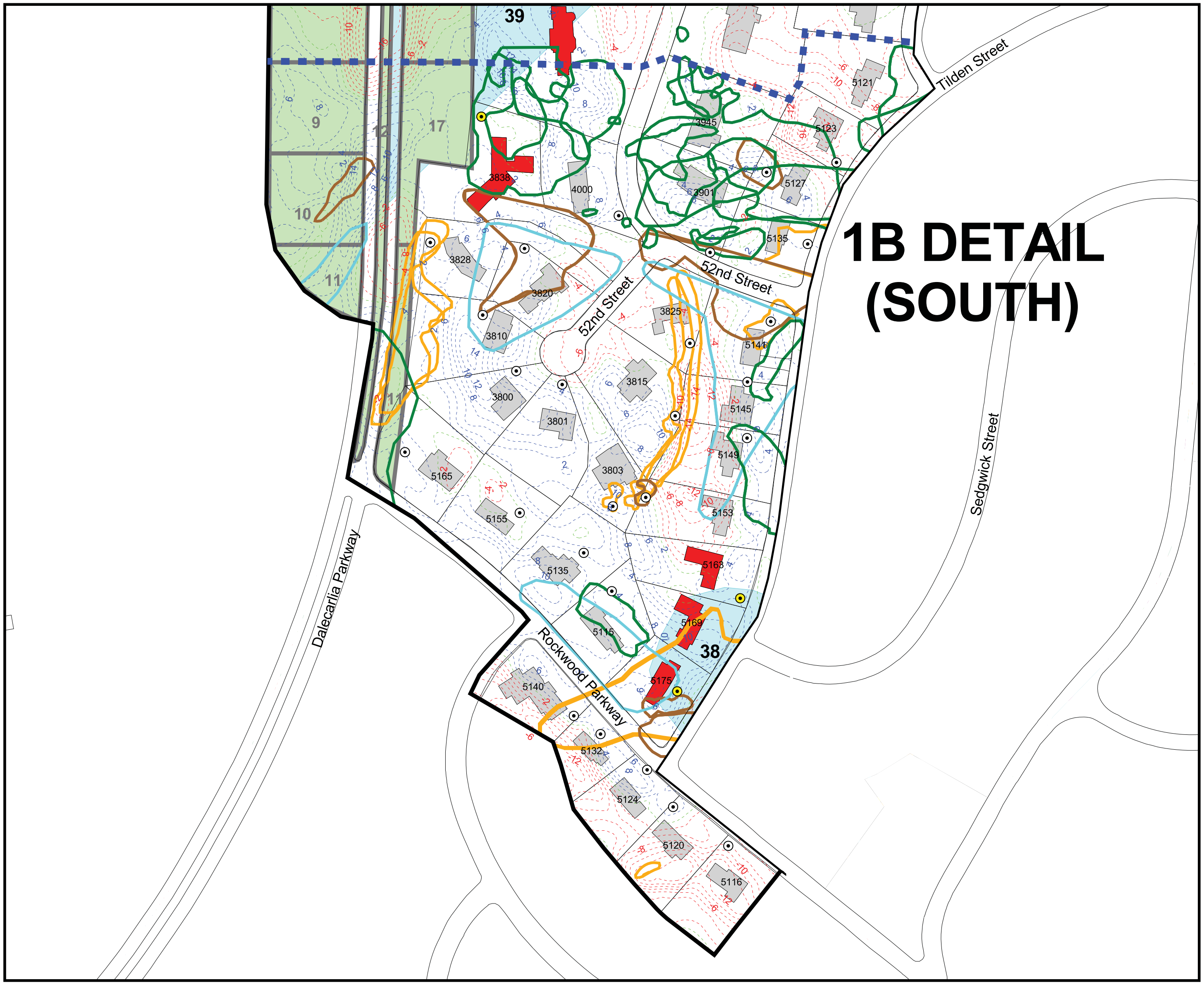

CTA
Grouping 1B-South Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

Boring Locations
- Arsenic
- POI-Specific Parameters

Boundary between North & South Detail
Roads
Stressed Vegetation
1928 Ground Scars
1927 Ground Scars
1922 Ground Scars
1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill

Parcels
Non-Residential Lots
CTA Grouping 1B
Residence Within a POI
Building
POIs

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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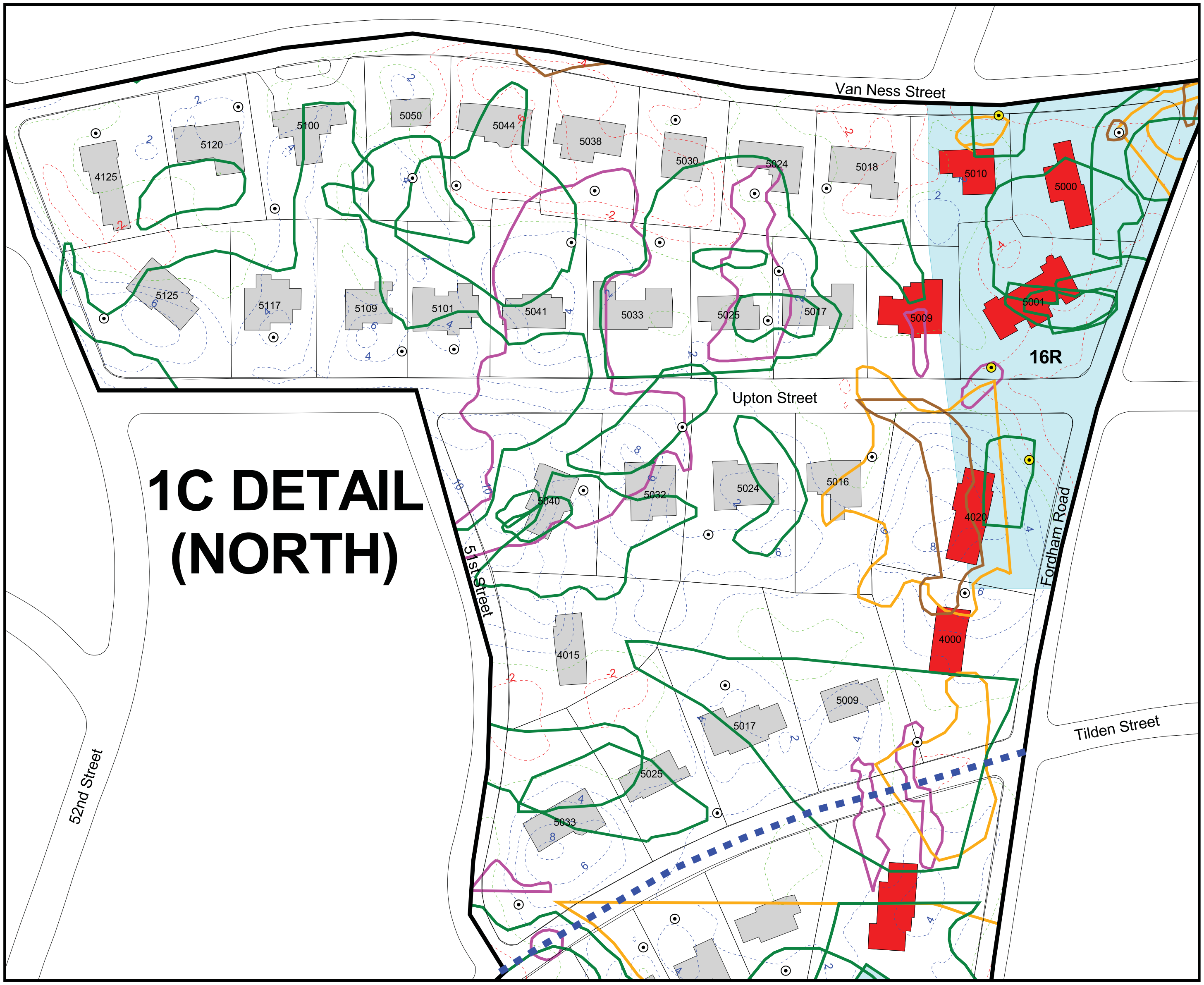

CTA
Grouping 1C-North Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

Boring Locations
- Arsenic
- POI-Specific Parameters
- Boundary between North & South Detail
- Roads
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill
- Parcels
- Non-Residential Lots
- CTA Grouping 1C
- Residence Within a POI
- Building
- POIs

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

100 0 100 Feet

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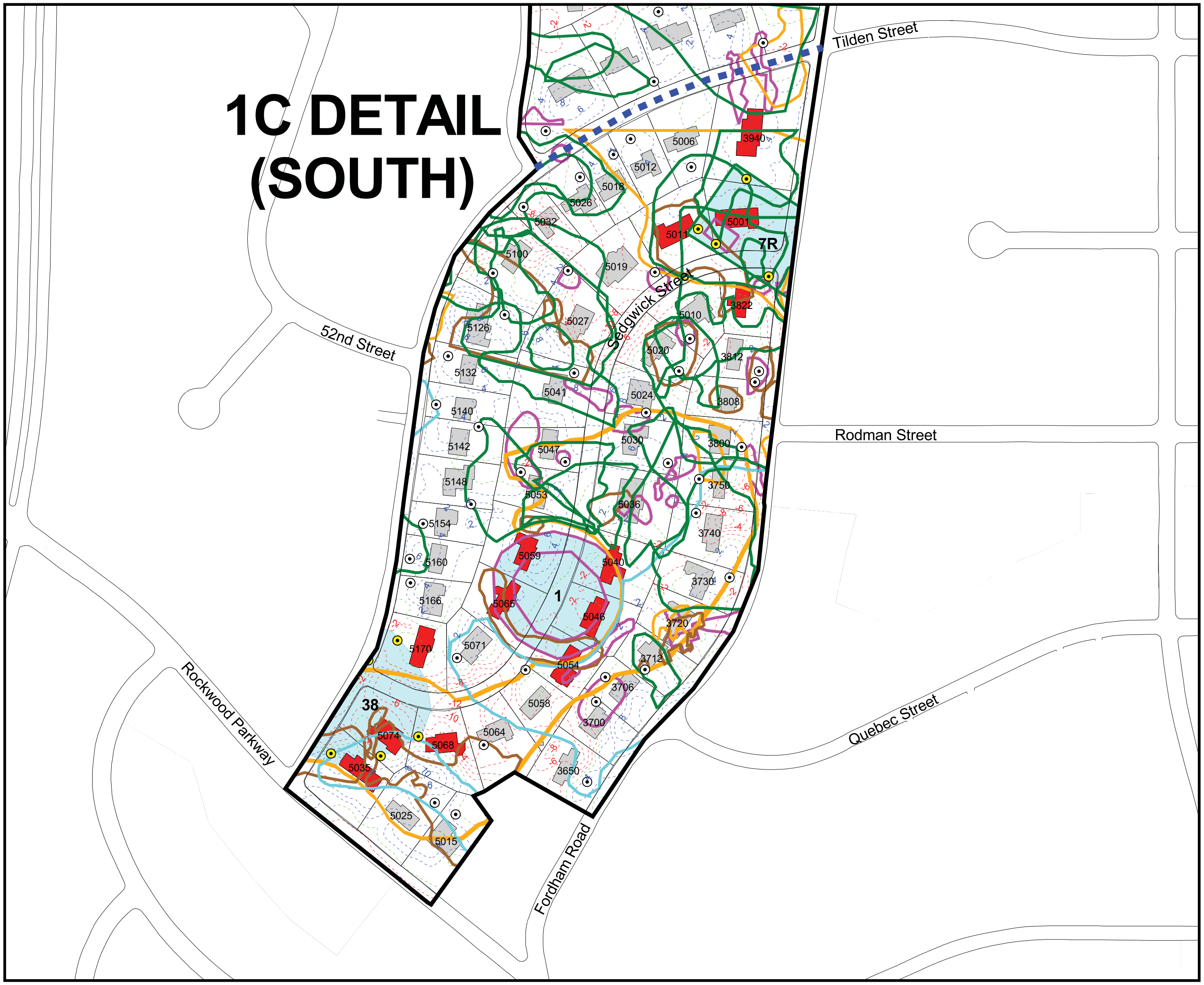

CTA
Grouping 1C-South Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

Boring Locations
- Arsenic
- POI-Specific Parameters

Boundary between North & South Detail
Roads
Stressed Vegetation
1928 Ground Scars
1927 Ground Scars
1922 Ground Scars
1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill

Parcels
Non-Residential Lots
CTA Grouping 1C
Residence Within a POI
Building
POIs

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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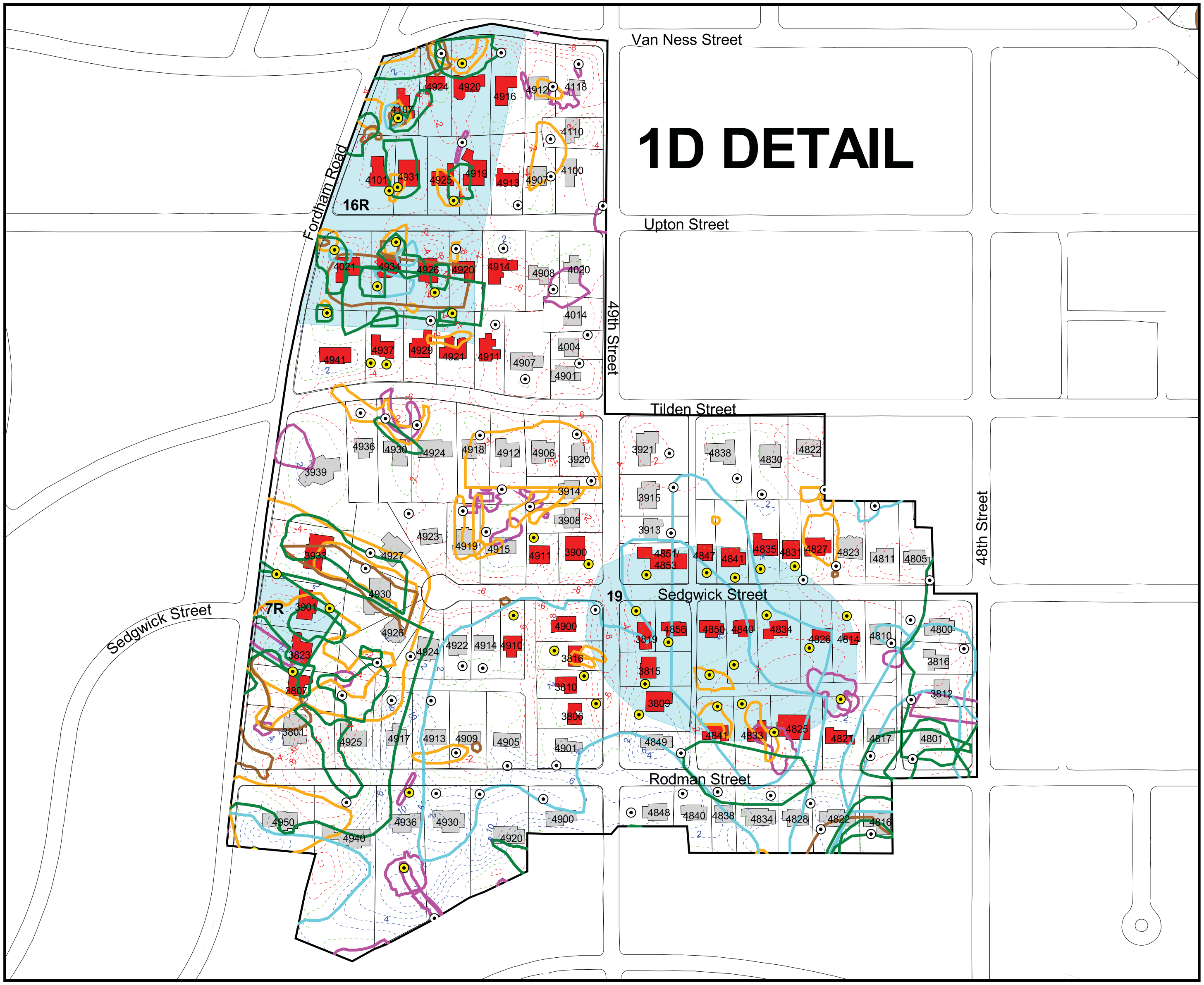

CTA
Grouping 1D

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Location
  - Arsenic
  - POI-Specific Parameters
- Roads
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Non-Residential Lots
- CTA Grouping 1D
- Residence Within a POI
- Building
- POIs

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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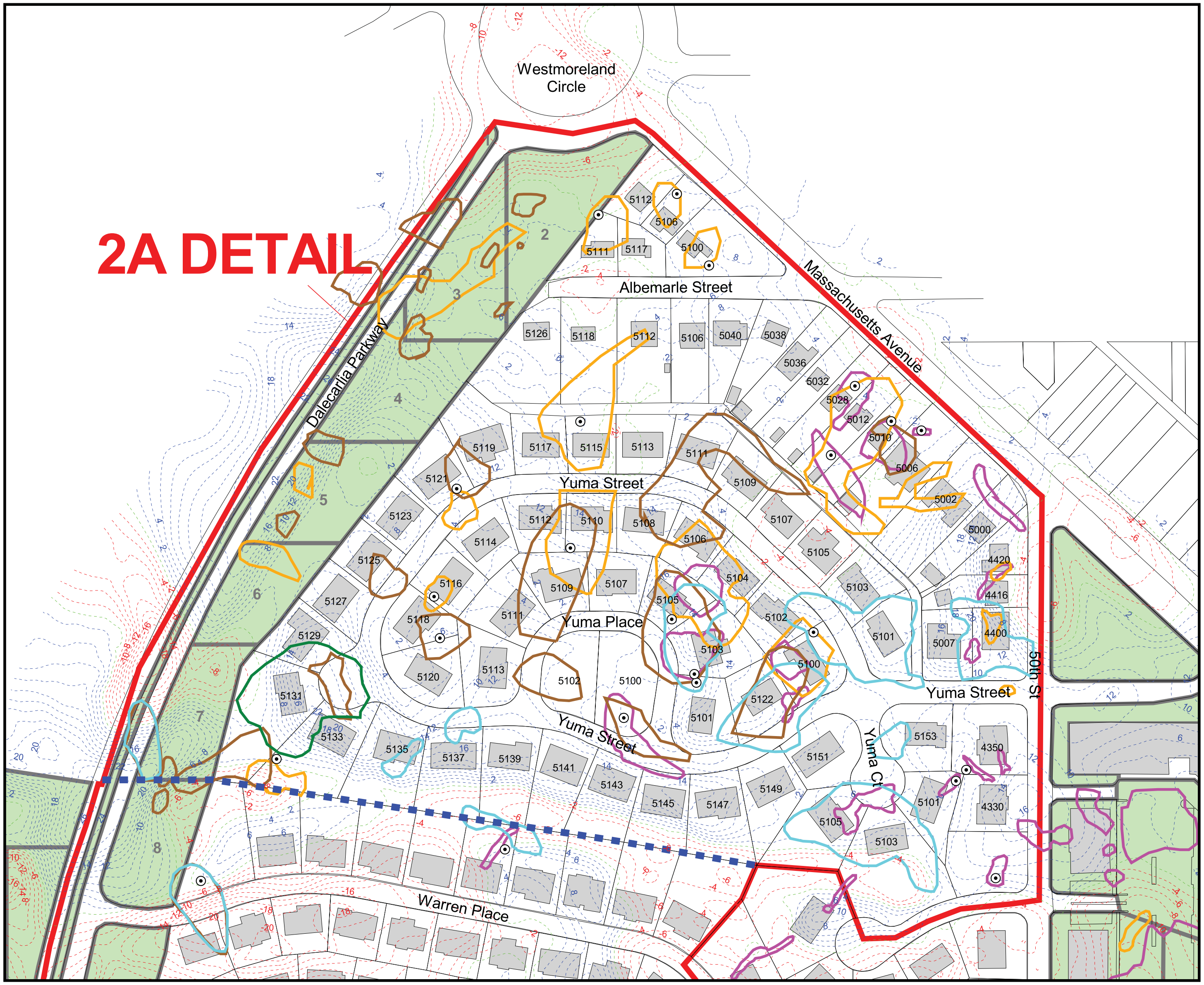

CSA
Grouping 2A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 2
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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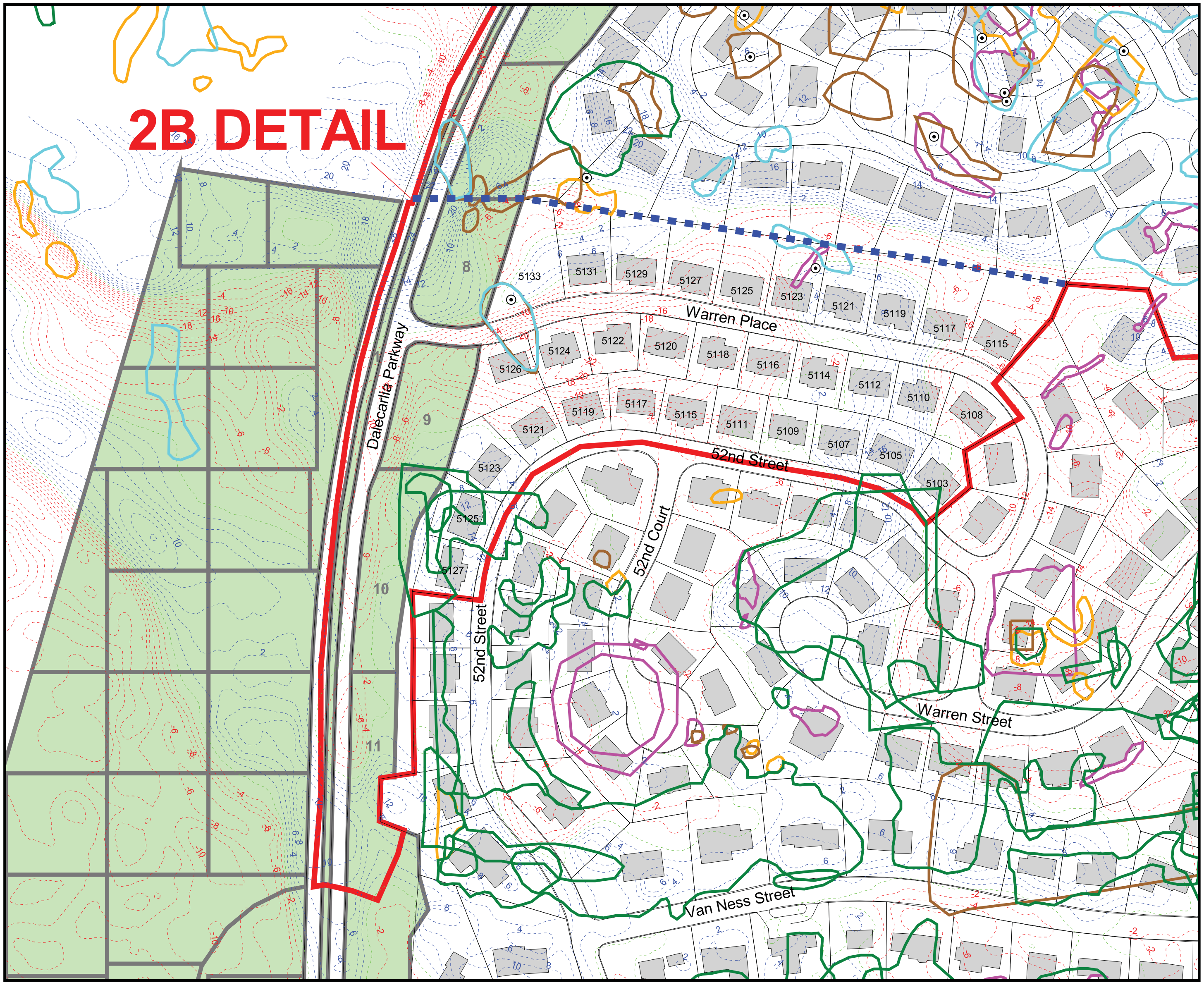

CSA
Grouping 2B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 2
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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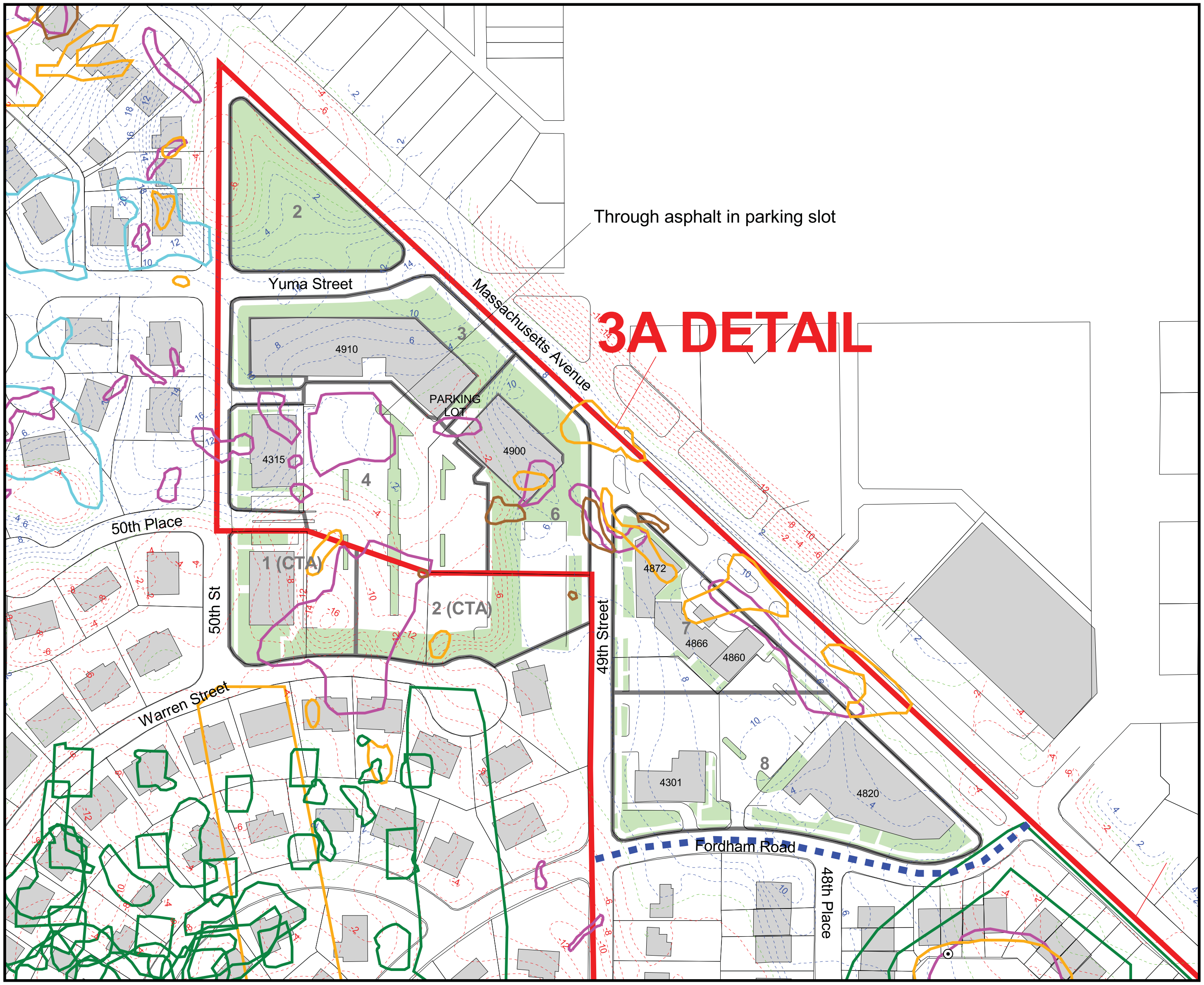

CSA
Grouping 3A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 3
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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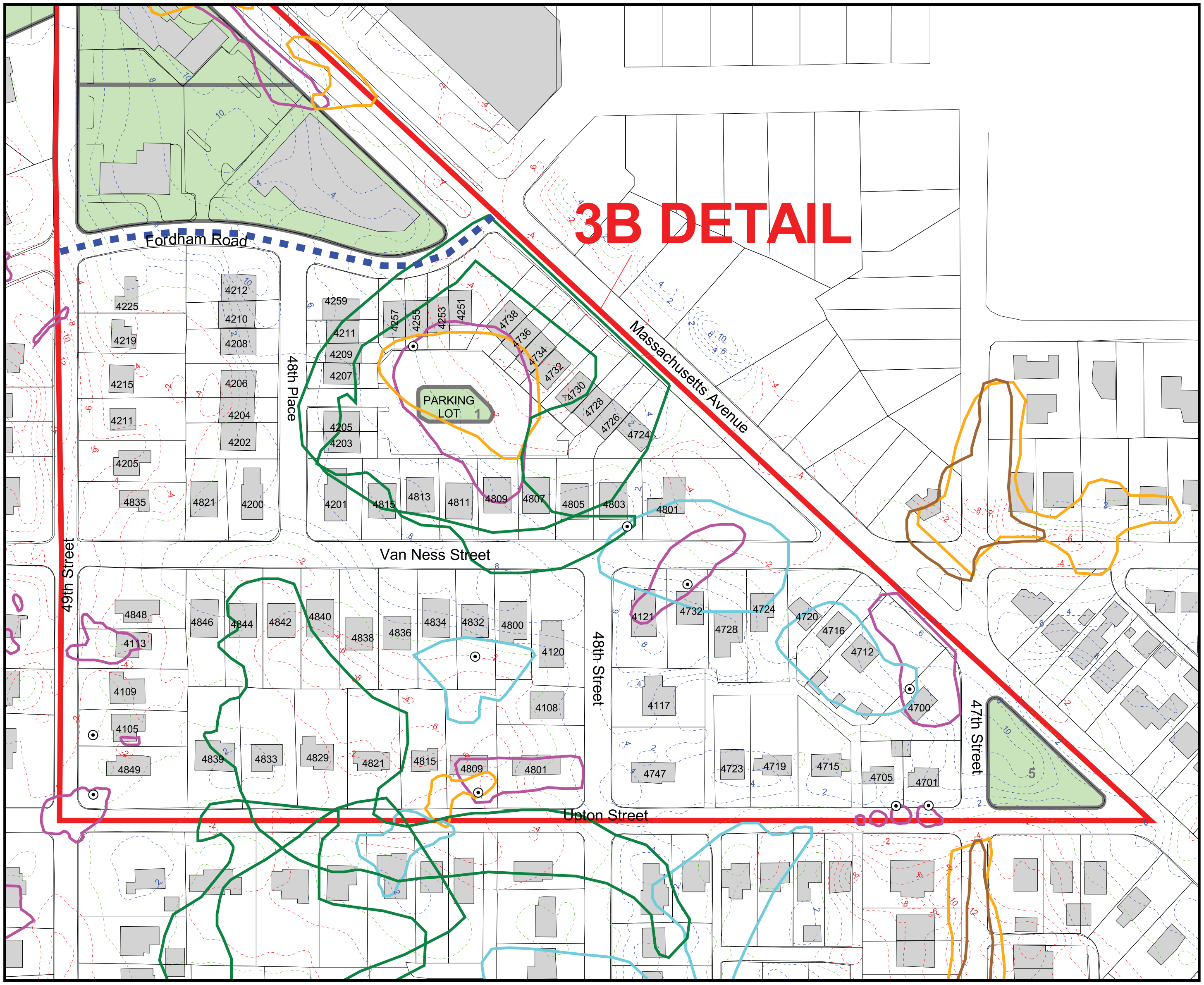

CSA
Grouping 3B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 3
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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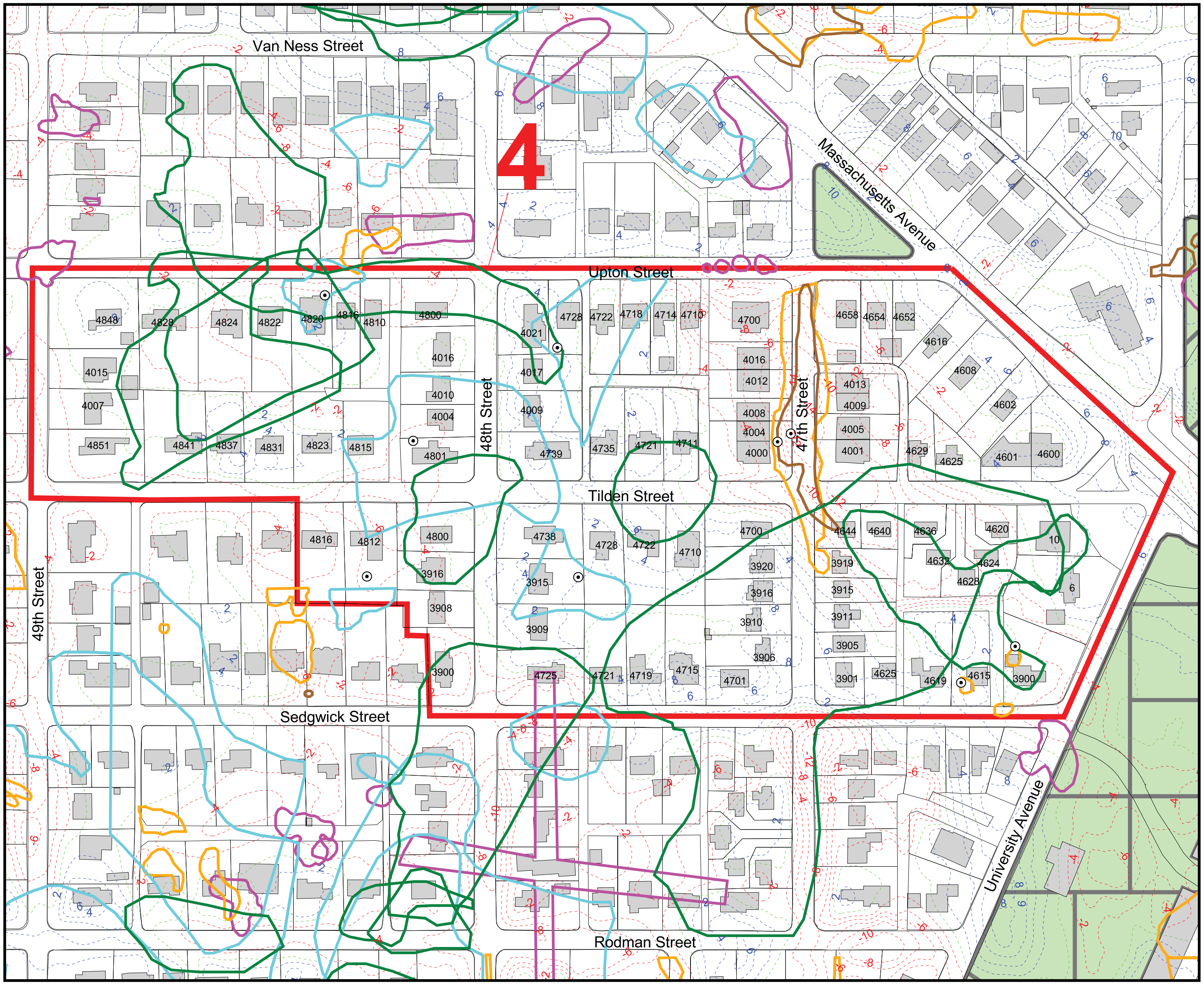

CSA
Grouping 4

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Stressed Vegetation
- 1928 Ground Scars
- 1922 Ground Scars
- 1927 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 4
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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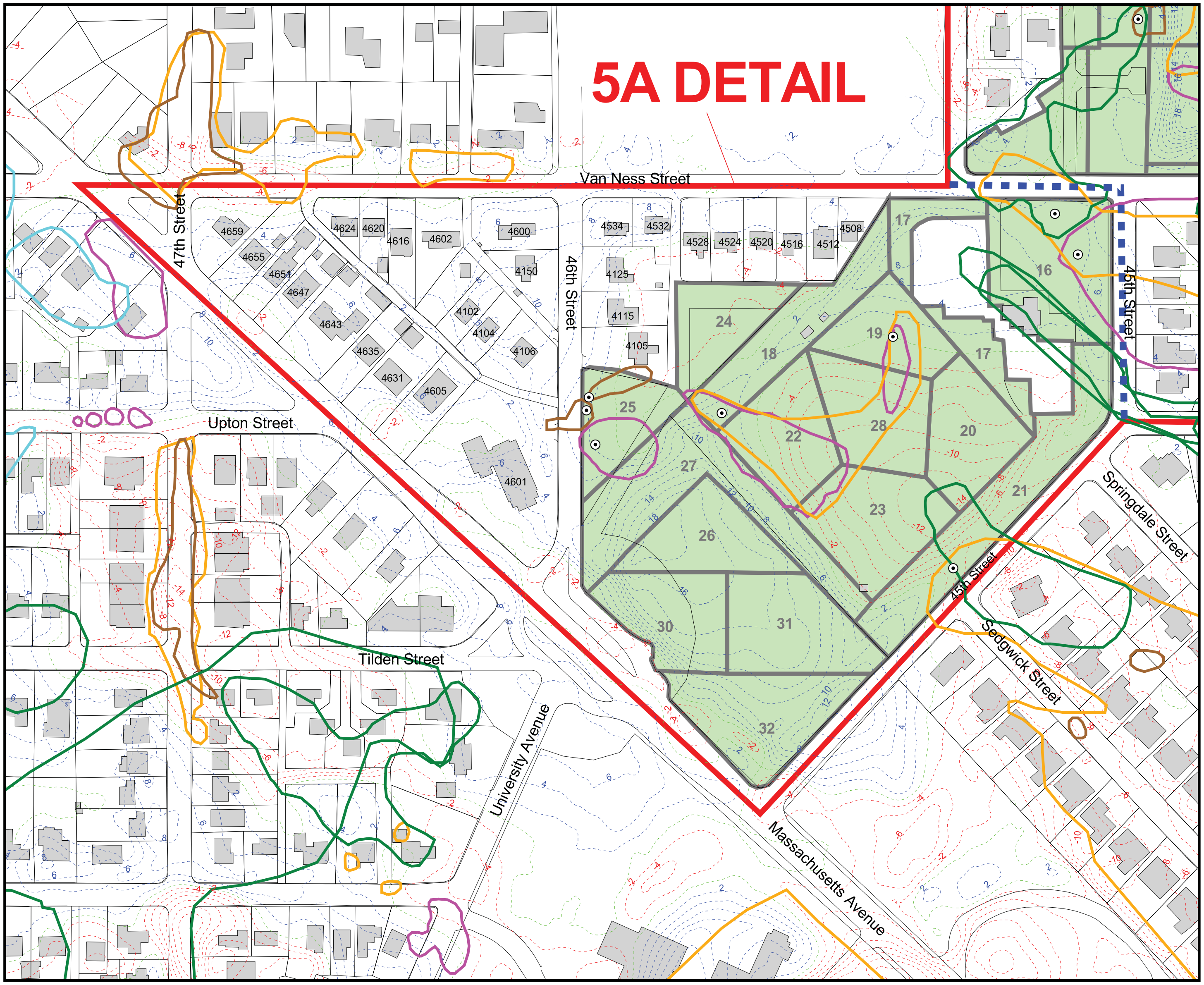

CSA
Grouping 5A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 5
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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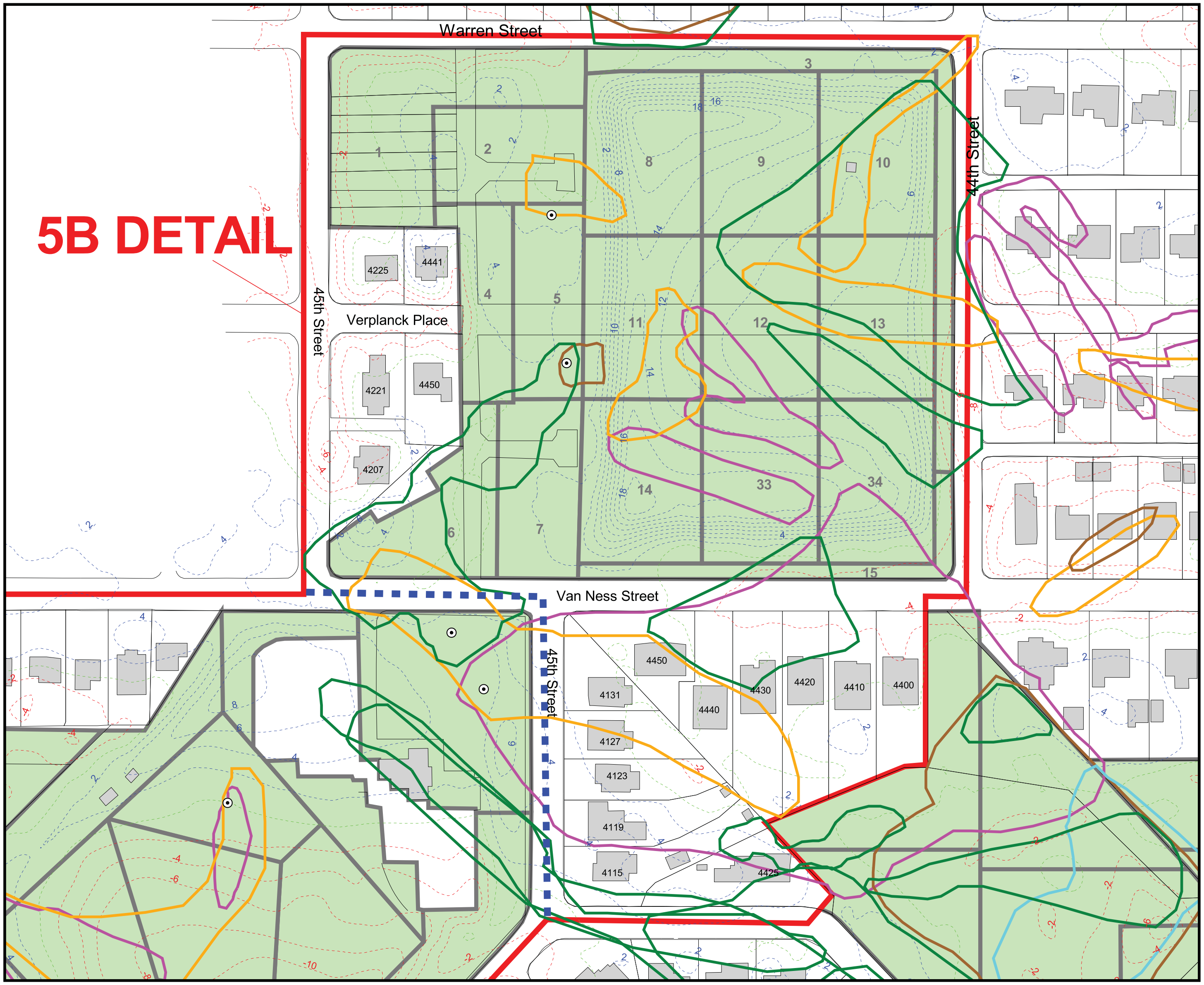

CSA
Grouping 5B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 5
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

100 0 100 Feet

Scale:	1 : 1200
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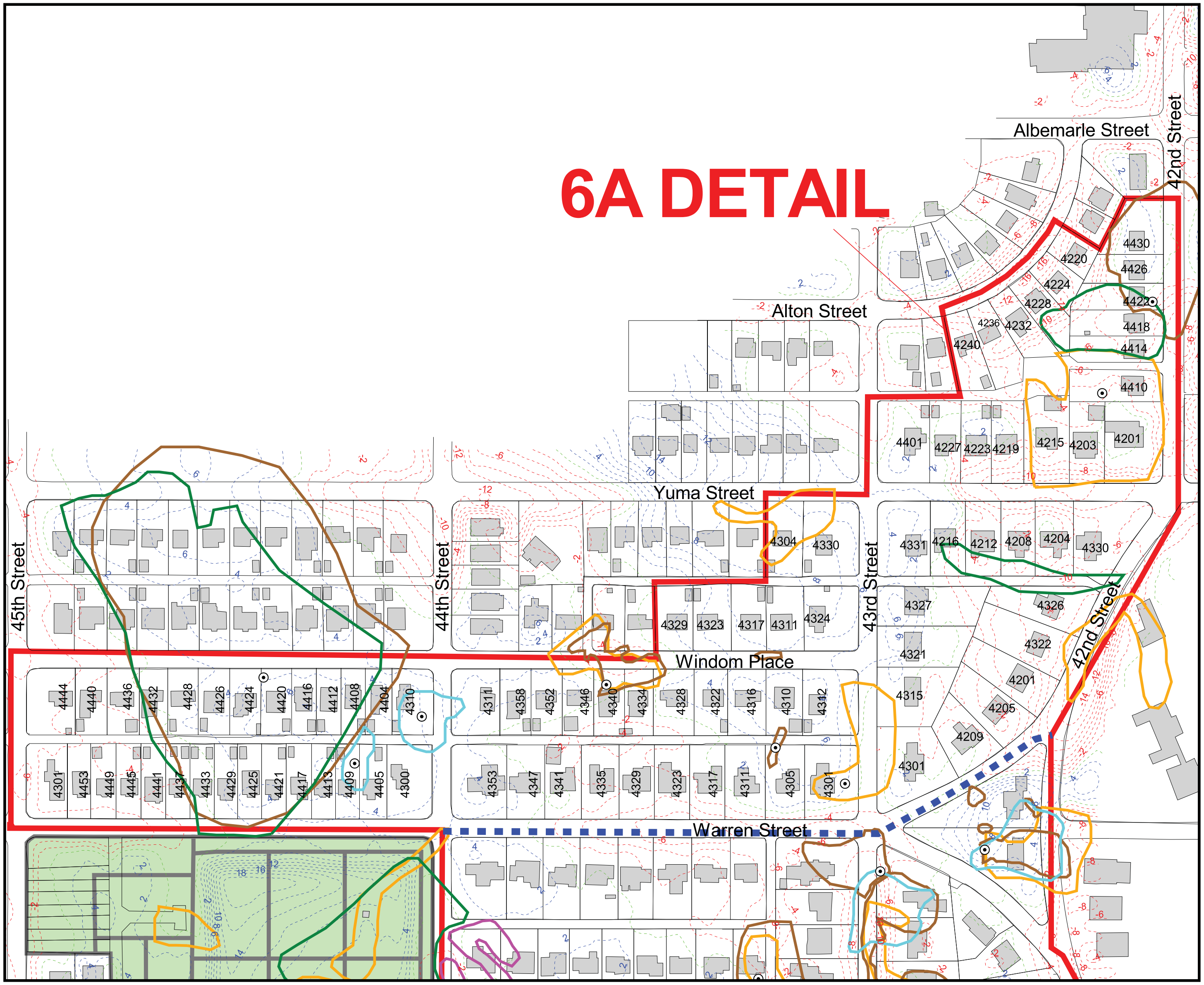

CSA
Grouping 6A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 6
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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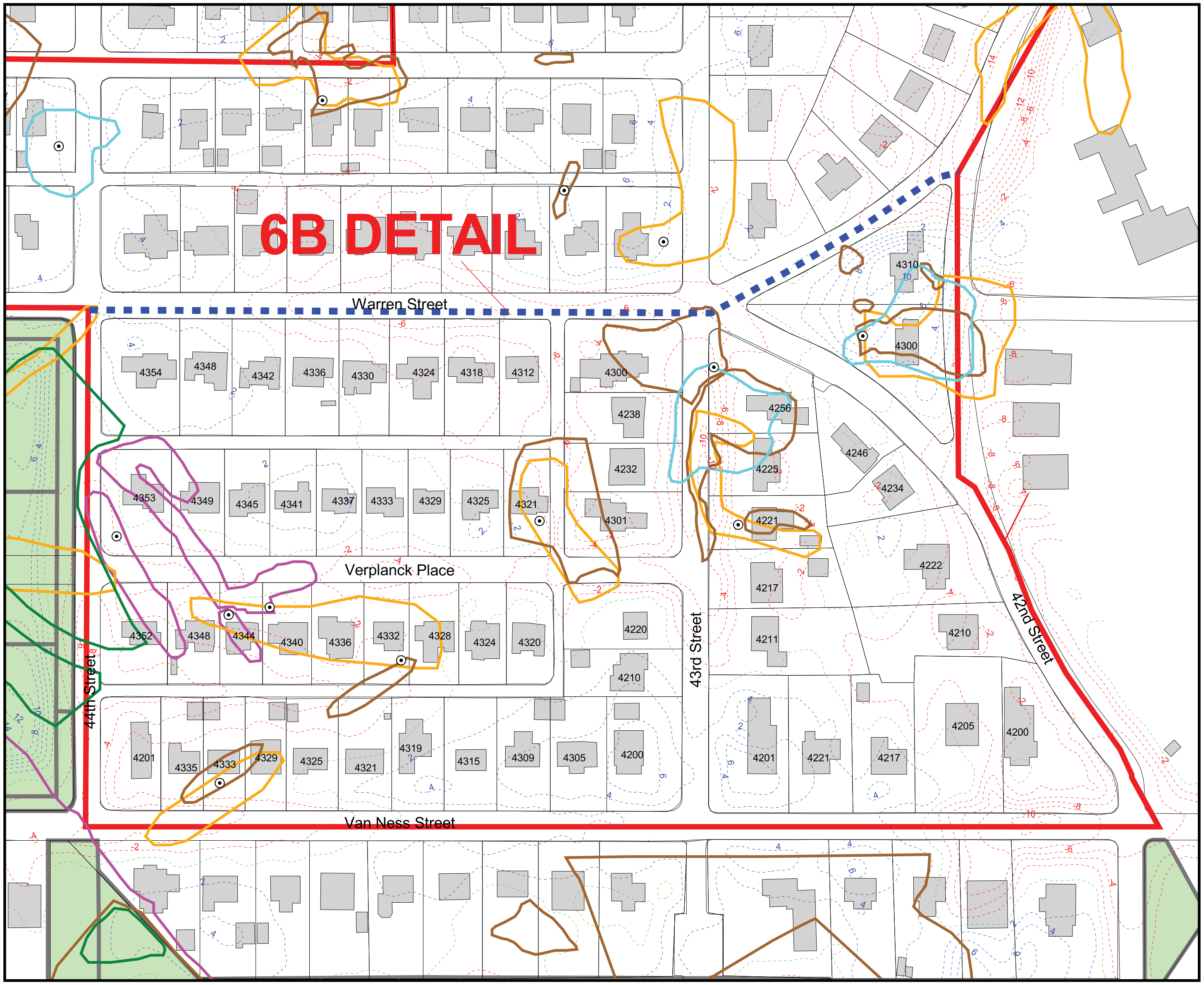

CSA
Grouping 6B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 6
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

100 0 100 200 Feet

Scale:	1 : 1200
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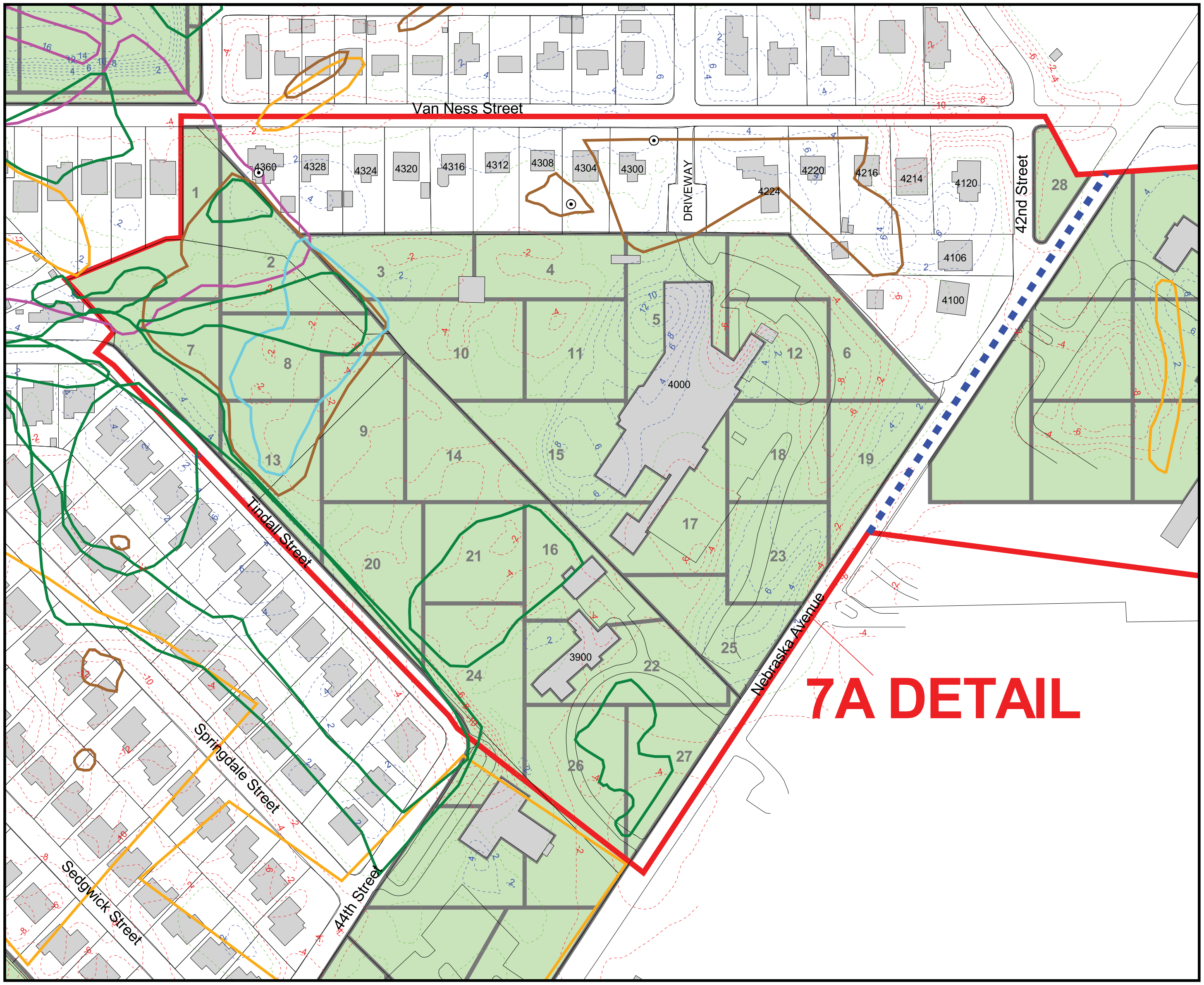

CSA
Grouping 7A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill
- Parcels
- Grouping 7
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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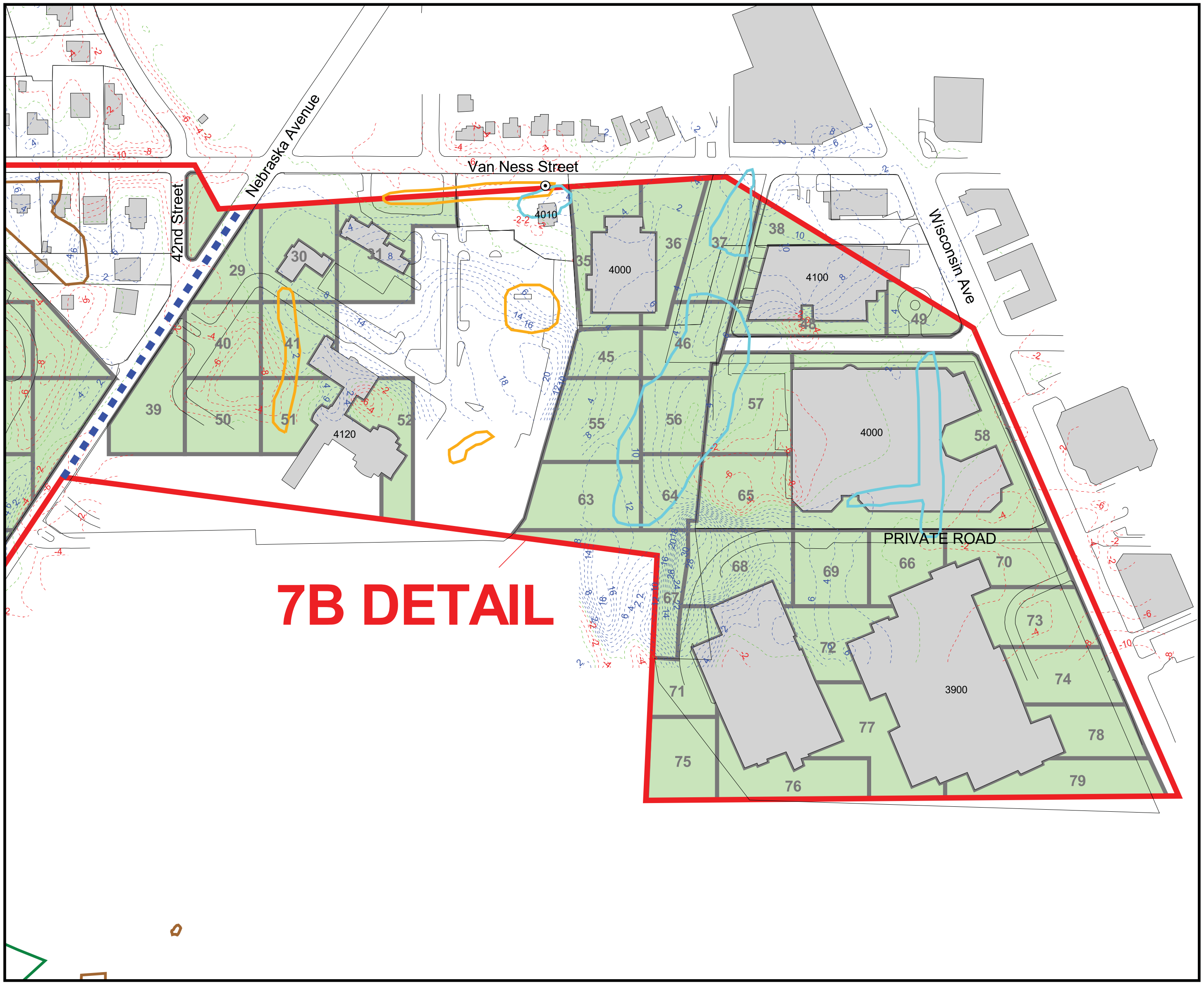

CSA
Grouping 7B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 7
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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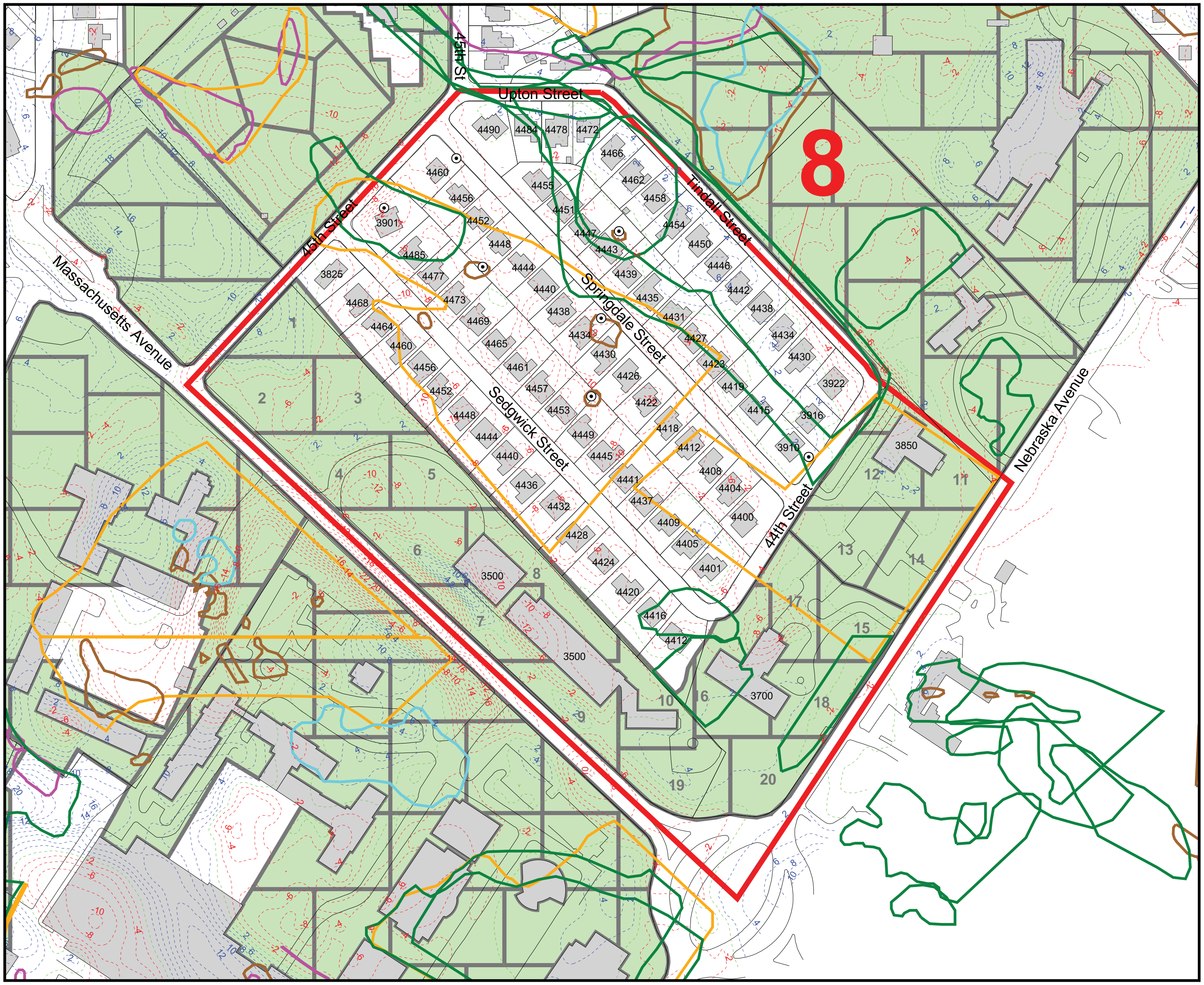

CSA
Grouping 8

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Stressed Vegetation
- 1928 Ground Scars
- 1922 Ground Scars
- 1927 Ground Scars
- 1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill
- Parcels
- Grouping 8
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

Scale:	1 : 2400
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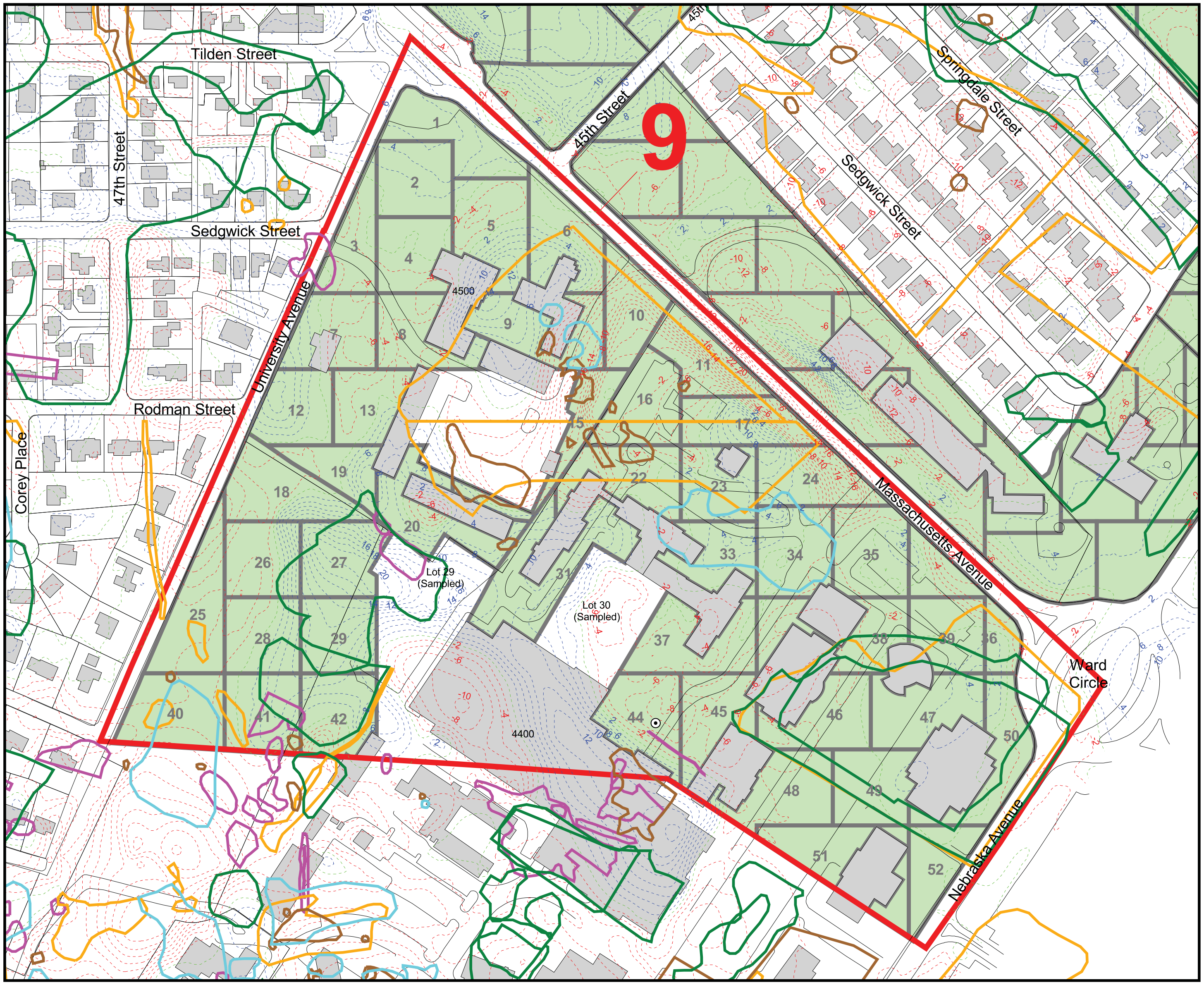

CSA
Grouping 9

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Stressed Vegetation
- 1928 Ground Scars
- 1922 Ground Scars
- 1927 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 9
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

Scale:	1 : 2400
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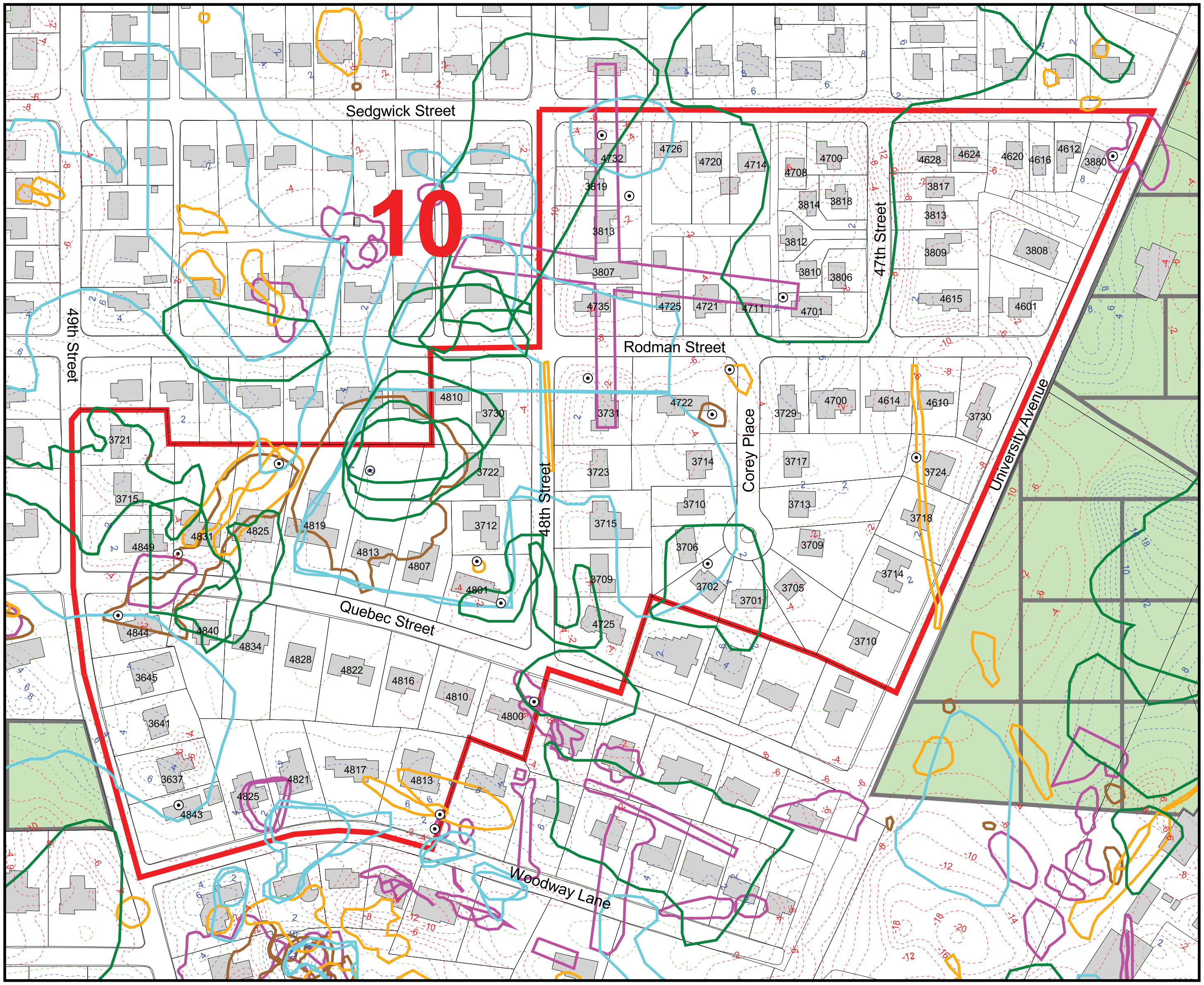

CSA
Grouping 10

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Stressed Vegetation
- 1928 Ground Scars
- 1922 Ground Scars
- 1927 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 10
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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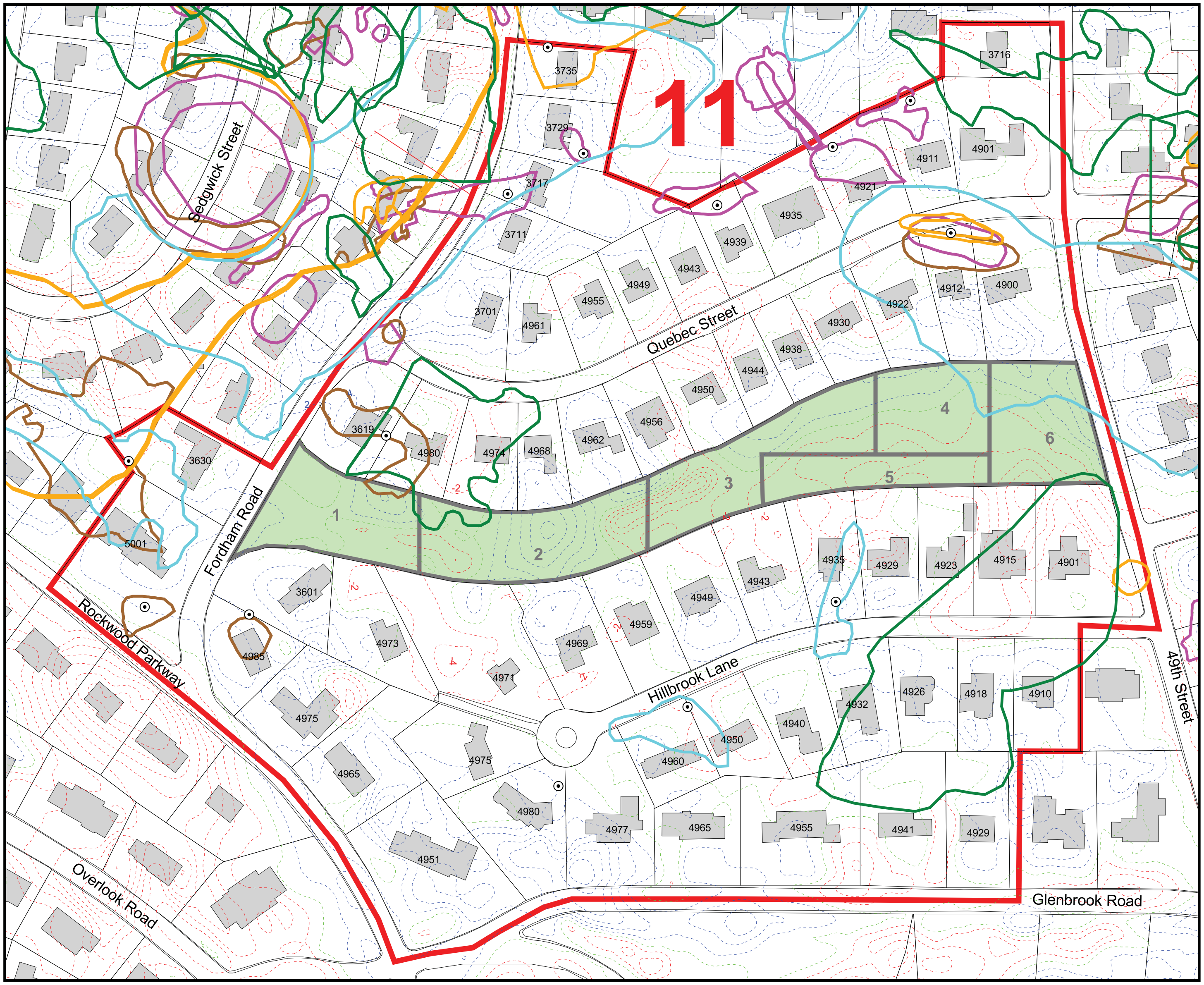

CSA
Grouping 11

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Stressed Vegetation
- 1928 Ground Scars
- 1922 Ground Scars
- 1927 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 11
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

150 0 150 Feet

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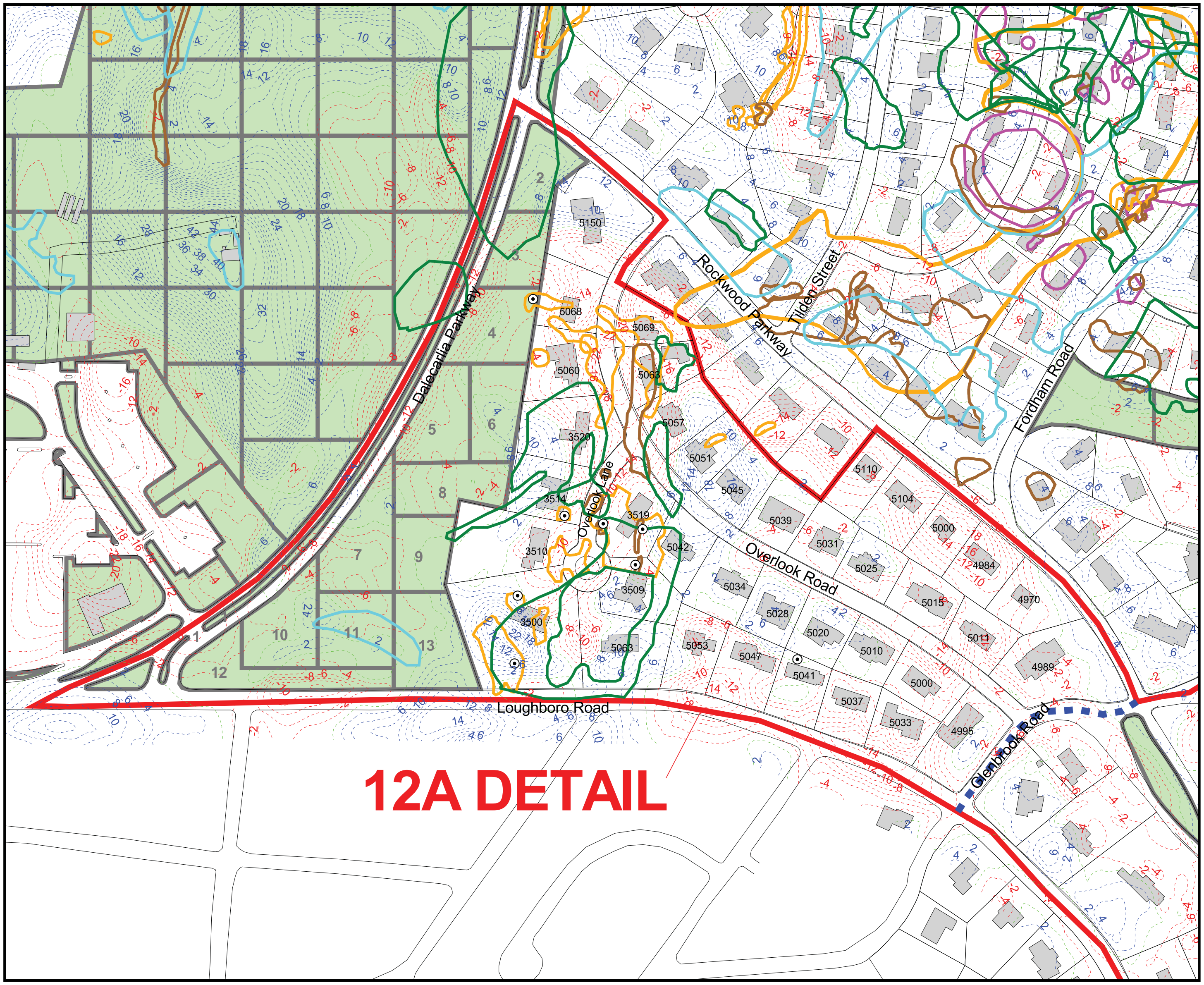

CSA
Grouping 12A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 12
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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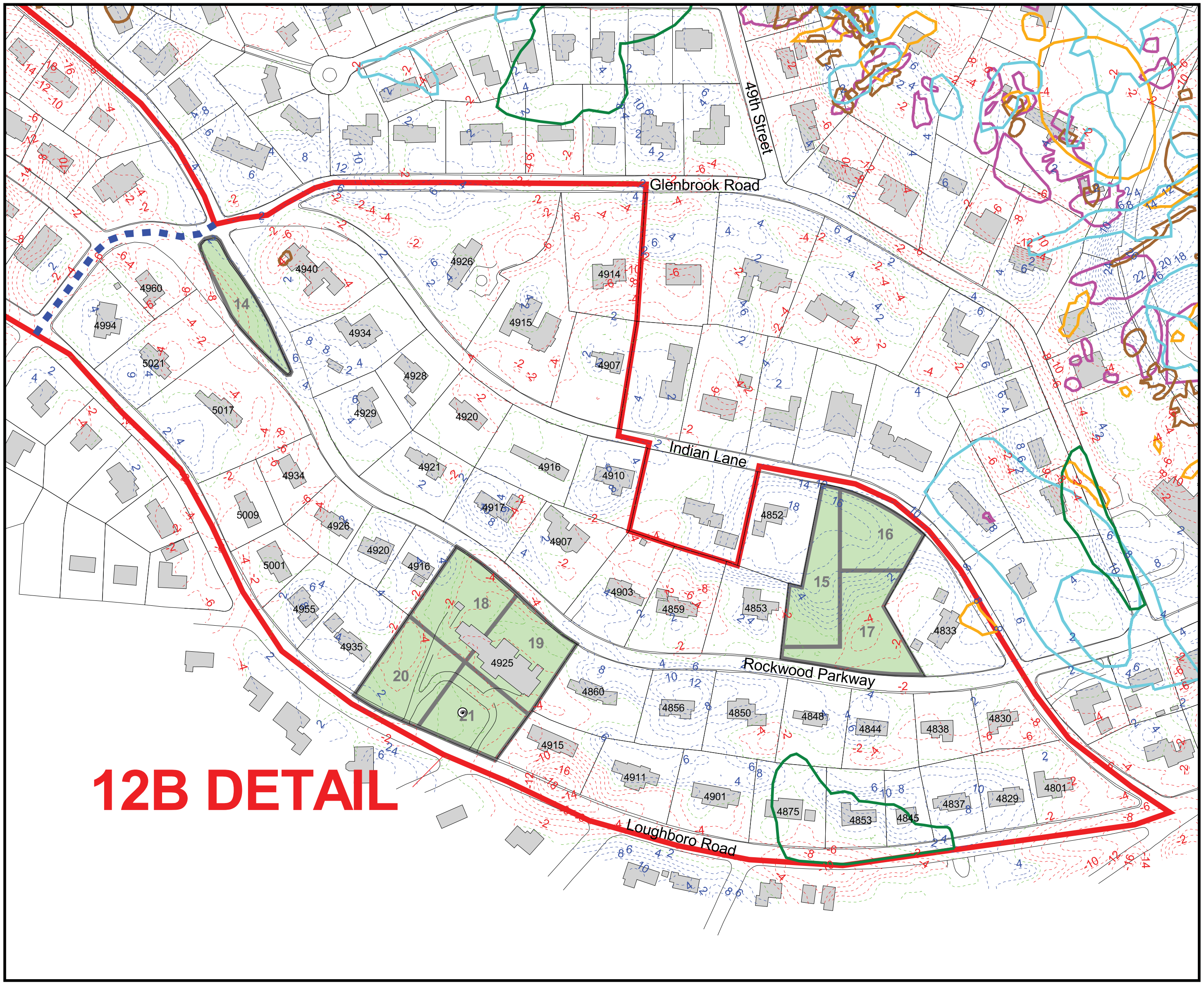

CSA
Grouping 12B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars
- Cut & Fill
  - Cut
  - Level
  - Fill
- Parcels
- Grouping 12
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

200 0 200 Feet

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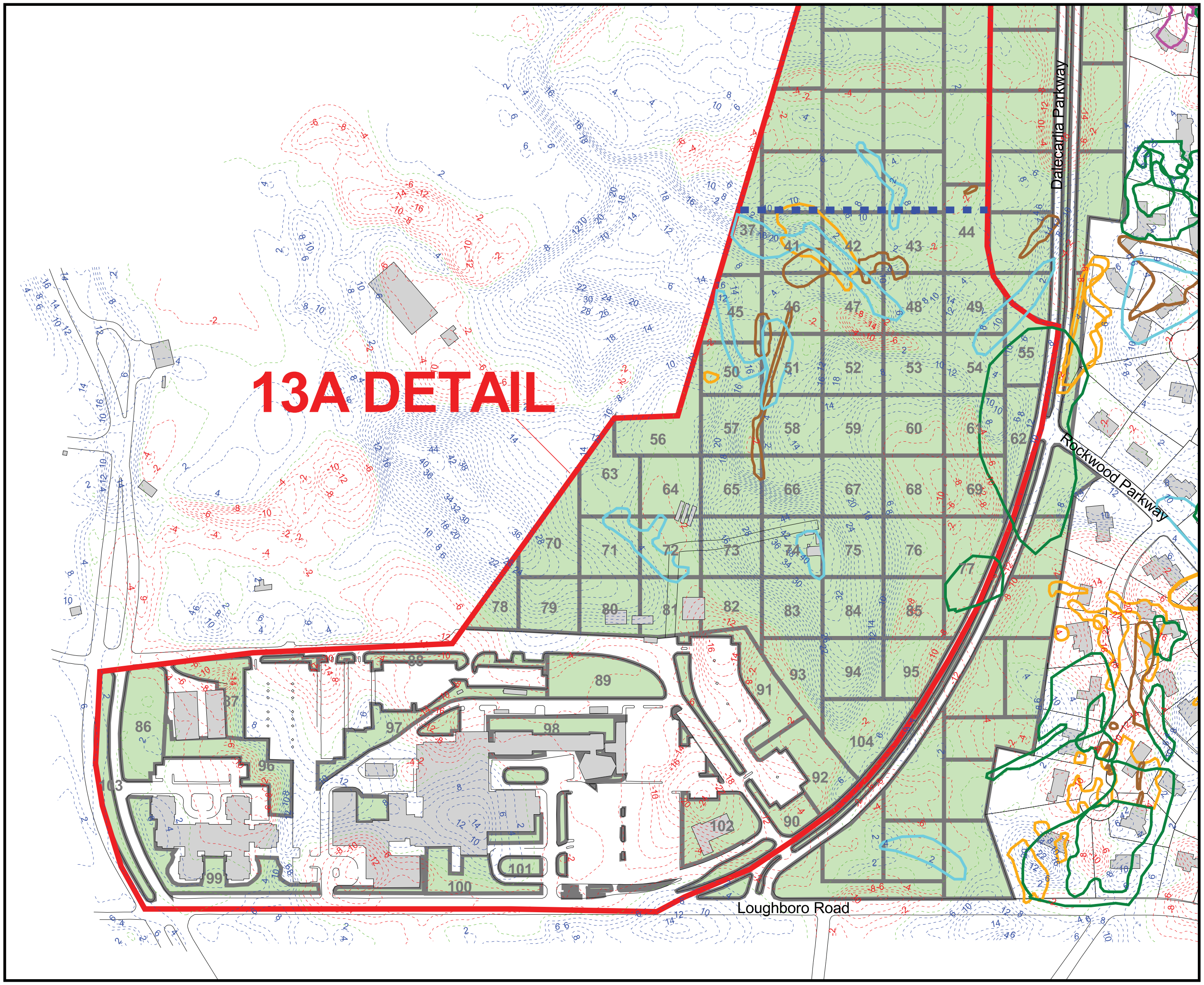

CSA
Grouping 13A Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill
- Grouping 13
- Parcels
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

300 0 300 Feet

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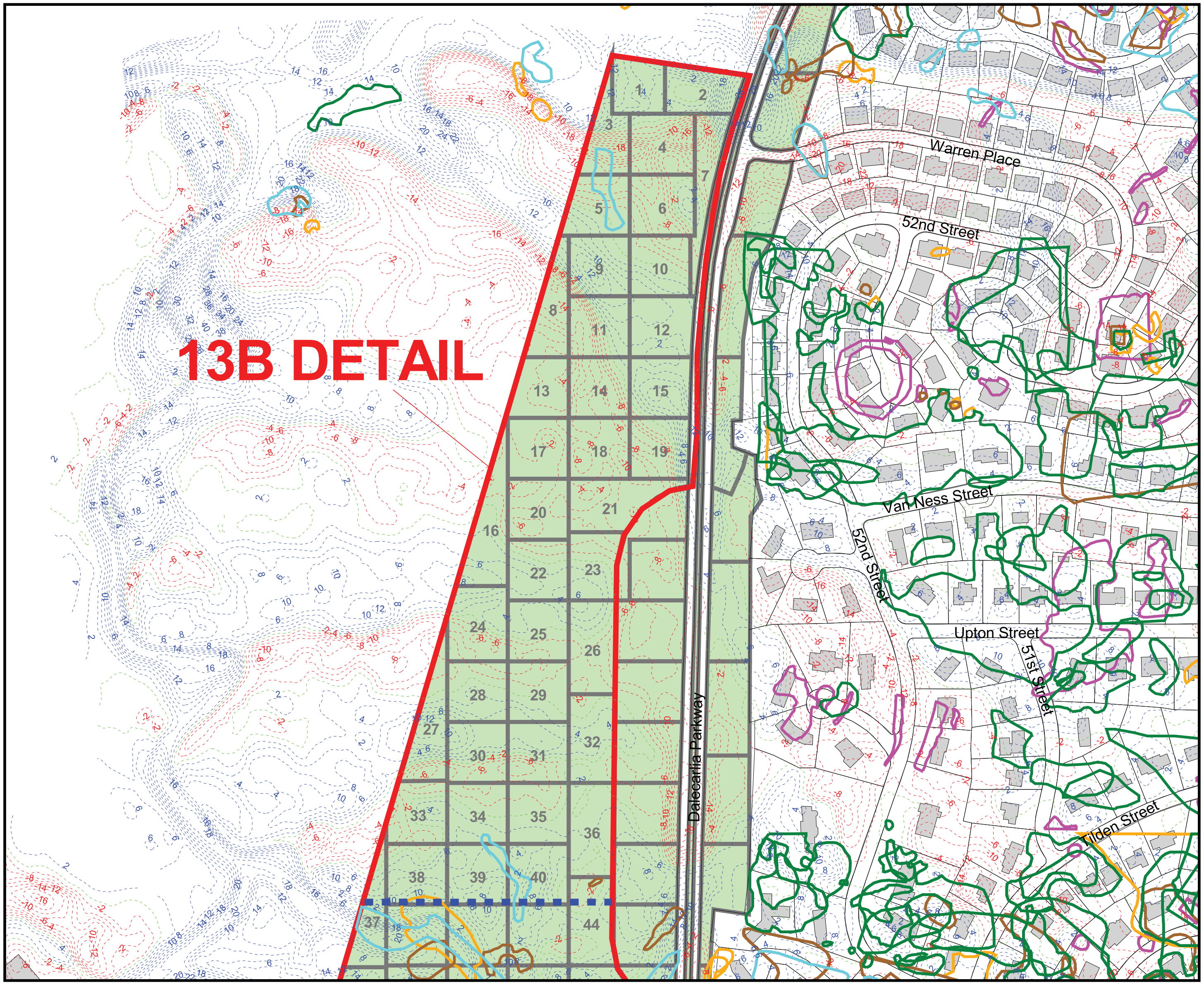

CSA
Grouping 13B Detail

Spring Valley Operable Unit 5
Washington D.C.

Legend

- Boring Locations
- Boundary between A & B Detail
- Stressed Vegetation
- 1928 Ground Scars
- 1927 Ground Scars
- 1922 Ground Scars
- 1918 Ground Scars

Cut & Fill
- Cut
- Level
- Fill

- Grouping 13
- Parcels
- Buildings
- Roads
- Non-Residential Lots

Note:
- Single family houses and each townhouse count as 1 residential lot.
- Commercial and other types of buildings are not included in the residential count.
- The non-residential acreage count does not include the area of the commercial building, but does include paved parking lots and other potentially inaccessible areas.
- Non-residential acreage is divided into 1/2 acre (approximate) lots.

300 0 300 Feet

Scale:	1 : 3000
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PARSONS

APPENDIX B

EXCAVATION AND LANDFILL DISPOSAL
COST SUMMARY

(TABLES B-1 and B-2)

Table B-1 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Non-Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item						Bare Costs: Materials		Bare Costs: Labor		Bare Costs: Equipment		Cost Including O&P	
WBS		Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal
33101	**A.**	**MOBILIZATION AND PREPARATORY WORK**											
	01	Mobilization of Construction Equipment and Facilities		1	LS	$ 2,000.00	$ 2,000.00	$ -	$ -	$ -	$ -	$ -	$ 2,000.00
	02	Mobilization of Personnel		1	LS	$ 1,000.00	$ 1,000.00		$ -		$ -		$ 1,000.00
	03	Remediation Work Plan	Senior Engineer	8	hr	$ -	$ -	$ 149.50	$ 1,196.00	$ -	$ -	$ -	$ 1,196.00
			Engineer	12	hr	$ -	$ -	$ 88.40	$ 1,060.80	$ -	$ -	$ -	$ 1,060.80
			CADD Operator/GIS	8	hr	$ -	$ -	$ 68.90	$ 551.20	$ -	$ -	$ -	$ 551.20
			Admin Aide	8	hr	$ -	$ -	$ 59.54	$ 476.32	$ -	$ -	$ -	$ 476.32
			Publication/Reproduction	10	copy	$ 20.00	$ 200.00	$ -	$ -	$ -	$ -	$ -	$ 200.00
	10	Population Relocation		1	LS	$ 7,000.00	$ 7,000.00		$ -		$ -		$ 7,000.00
	90	Permitting - District of Columbia DCRA Land Disturbance		1	LS	$ 500.00	$ 500.00	$ -	$ -	$ -	$ -	$ -	$ 500.00
			SUBTOTAL				**$ 10,700.00**		**$ 3,284.32**		**$ -**		**$ 13,984.32**
33102	**B.**	**MONITORING, SAMPLING AND ANALYSIS**											
	06	Confirmation Soil Sampling	Analytical Costs	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,489.00	$ 1,489.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 1,489.00**
33103	**C.**	**SITE WORK**											
	02	Clearing-Related Activities - Tree removal	Cut and Chip Light trees	0.1	ACRE	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,875.00	$ 287.50
			Tree Removal w/ Chain Saws, 4-6" dia.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 168.00	$ 840.00
			Tree Removal w/ Chain Saws, 8-12" dia.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 252.00	$ 1,260.00
			Tree Subcontractor Service (Large Tree, including stump)	1	LS	$ -	$ -	$ 10,000.00	$ 10,000.00	$ -	$ -	$ -	$ 10,000.00
		- Stump removal											
			1-1/2 CY Backhoe, 4-6" diam.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 29.50	$ 147.50
			1-1/2 CY Backhoe, 8-12" diam.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 80.00	$ 400.00
	03	- Soil Excavation											
		Gross	Light Equipment w/ operator	80	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.15	$ 4,011.73
			1 CY Bucket w/ operator	65	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.04	$ 1,497.60
		By Hand (heavy soil or clay)	Laborer	65	CY	$ -	$ -		$ -	$ -	$ -	$ 100.00	$ 6,500.00
	05	- Fencing											
			Installing as Temporary	300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 7.80	$ 2,340.00
			Removal of Temporary Fencing	300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 7.45	$ 2,235.00
			Fence Material Allowance	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000.00	$ 2,000.00
			Reinstall Fence (Labor Only)	300	LF	$ -	$ -	$ 6.25	$ 1,875.00	$ -	$ -	$ -	$ 1,875.00

Table B-1 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Non-Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item						Bare Costs							
						Materials		Labor		Equipment		Cost Including O&P	
WBS		Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal
	90	Surveying		1	DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 625.00	$ 625.00
	91	Miscellaneous Expenses	Per Diem	10	M/DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 200.00	$ 2,000.00
			Portable Water Tank	5	DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 95.50	$ 477.50
			SUBTOTAL				**$ -**		**$ 11,875.00**		**$ -**		**$ 36,496.83**
33105	**D.**	**EROSION AND SEDIMENT CONTROL**											
	13		Jute Fence	325	SY	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.21	$ 393.25
			Silt Fence	400	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.73	$ 292.00
			Hay Bales	250	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.00	$ 500.00
			Remove Hay Bales	1	TON	$ -	$ -	$ -	$ -	$ -	$ -	$ 385.00	$ 385.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 1,570.25**
33301	**E.**	**SUPERVISION AND ADMINISTRATION**											
			Construction Manager	28	hr	$ -	$ -	$ 85.80	$ 2,402.40	$ -	$ -	$ -	$ 2,402.40
			SSHO	28	hr	$ -	$ -	$ 80.60	$ 2,256.80	$ -	$ -	$ -	$ 2,256.80
			UXO Technician	28	hr	$ -	$ -	$ 65.00	$ 1,820.00	$ -	$ -	$ -	$ 1,820.00
			Per Diem	10	M/DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 200.00	$ 2,000.00
			SUBTOTAL				**$ -**		**$ 6,479.20**		**$ -**		**$ 8,479.20**
33119	**F.**	**DISPOSAL**											
	21	Hauling From Site to Landfill		315	tons	$ 20.00	$ 6,300.00	$ -	$ -	$ -	$ -	$ -	$ 6,300.00
	22	Non- Hazardous Soil Disposal		315	tons	$ 21.00	$ 6,615.00	$ -	$ -	$ -	$ -	$ -	$ 6,615.00
			SUBTOTAL				**$ 12,915.00**		**$ -**		**$ -**		**$ 12,915.00**
33120	**G.**	**SITE RESTORATION**											
	01	Earthwork											
		- Backfill	Material Only	273	LCY	$ -	$ -		$ -	$ -	$ -	$ 10.00	$ 2,730.00
		Gross	2-1/2 CY Loader w/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 2.39	$ 217.49
			Dozer w/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 2.87	$ 261.17
		By Hand	Laborer	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 22.50	$ 2,047.50
		- Compaction											
		Gross	Air Tamp. W/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 8.30	$ 755.30
			Vibratory Plate w/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 5.75	$ 523.25
		By Hand	6" Layers	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 13.10	$ 1,192.10

Table B-1 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Non-Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item						Bare Costs							
						Materials		Labor		Equipment		Cost Including O&P	
WBS		Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal
	04	Revegetation and Planting											
		- Seeding and Sodding	Area of Approx. 2800 sf	1	LS	$ -	$ -		$ -	$ -	$ -	$ 1,200.00	$ 1,200.00
		- Landscape Restoration	Replace existing landscaping and features	1	LS	$ -	$ -		$ -	$ -	$ -	$ 25,000.00	$ 25,000.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 33,926.81**
33121	**H.**	**DEMOBILIZATION**											
		Demobilization		1	LS	LS	$ -	$ -	$ -	$ -	$ -	$ 2,000.00	$ 2,000.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 2,000.00**
33222	**I.**	**OTHER REQUIREMENTS**											
	90	POST REMEDIATION ACTIVITIES											
		-Closure Report	Senior Engineer	8	hr	$ -	$ -	$ 149.50	$ 1,196.00	$ -	$ -	$ -	$ 1,196.00
			Engineer	12	hr	$ -	$ -	$ 88.40	$ 1,060.80	$ -	$ -	$ -	$ 1,060.80
			CADD Operator	8	hr	$ -	$ -	$ 68.90	$ 551.20	$ -	$ -	$ -	$ 551.20
			Admin Aide	8	hr	$ -	$ -	$ 59.54	$ 476.32	$ -	$ -	$ -	$ 476.32
			Publication/Reproduction	10	per	$ 20.00	$ 200.00	$ -	$ -	$ -	$ -	$ -	$ 200.00
			SUBTOTAL				**$ -**		**$ 3,284.32**		**$ -**		**$ 3,484.32**

TOTAL COST SUMMARY

	Task	Total per Task
A.	MOBILIZATION AND PREPARATORY WORK	$13,984
B.	MONITORING, SAMPLING AND ANALYSIS	$1,489
C.	SITE WORK	$36,497
D.	EROSION AND SEDIMENT CONTROL	$1,570
E.	SUPERVISION AND ADMINISTRATION	$8,479
F.	DISPOSAL	$12,915
G.	SITE RESTORATION	$33,927
H.	DEMOBILIZATION	$2,000
I.	OTHER REQUIREMENTS	$3,484
	SUB-TOTAL	**$114,346**
	Contingency based on tasks C, D, F, G, H (10%)	$9,295
	Project Management based on Tasks C, D, F, G, H (5%)	$4,648
	Remedial Design based on Tasks C, D, F, G, H (10%)	$9,295
	TOTAL	**$137,584**

Per Grid Cost (30 CY)	**Per Ton Cost (45 tons/grid)**
$19,655	**$437**

Table B-1 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Non-Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item					Bare Costs						Cost Including O&P	
					Materials		Labor		Equipment			
WBS	Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal

KEY - ASSUMPTIONS

O&P = Overhead and Profit

COST ESTIMATE REFLECTS AN AVERAGE SITE WITH **7 GRIDS REQUIRING REMOVAL**
Note that based on sampling to date, it is anticipated that approximately 800 total grids will require removal.

A.	MOBILIZATION AND PREPARATORY WORK	-Assumed Draft and Final versions of Remediation Work Plan would be prepared. -Assumed electronic versions of existing site drawings will be adequate to produce excavation plans (I.e., additional surveying/creation of new base maps will not be required for planning). -Assumed existing health and safety documents would apply (I.e., no new health and safety submittals included). -Assumed existing quality assurance project plan would apply. -Permitting assumed fee based on amount of land disturbance. Includes application preparation time.
B.	MONITORING, SAMPLING, AND ANALYSIS	-Assumed 7 samples (1 confirmation sample per grid) analyzed for total arsenic ($65/sample) plus TCLP disposal characterization sample ($1,034). -Assumes each grid will meet the remedial objective at the initial excavation depth of 2 feet.
C.	SITE WORK	-Assumes a 1.5 factor for the soil conversion of CY to TON. -Assumes extent of soil contamination has been determined. -Assuming 30% of work can be done with "heavy" equipment, 40% with "light" equipment, and 30% of work done by hand. -Clearing: Up to 12" trees with manageable heights - remove with chain saws and stump removal equipment. 12" trees and larger, and any trees close to the houses, etc. - Utilize tree subcontractior to remove. The number of trees to remove is approximated as (5) 4-6" diameter, (5) 8-12" diameter per 7 grids excavated.
E.	SUPERVISION AND ADMINISTRATION	- Assumed that removal actions will occur in sequence (Site Manager, SSHO and UXO Tech. remain on-site from job to job)
F.	DISPOSAL	-Assumes non-hazardous landfill disposal
G.	SITE RESTORATION	-Assumed 1" topsoil layer and seeding. No other landscaping allowance. -Assumed equal compaction by methods of Air Tamping, Vibratory Plate, and Hand Methods. -Assumed 30% more soil required from backfill to allow for compaction.
I.	OTHER - POST REMEDIATION ACTIVITIES	-Assumed Draft and Final versions of closure report would be prepared. -Assumed closure report would simply describe the activities conducted. -The Closure Report will include the final actual costs of the work.

Table B-2 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

WBS		Cost Item: Task & Subtask	Item	Quantity	Units	Bare Costs: Materials $/Unit	Materials Subtotal	Labor $/Unit	Labor Subtotal	Equipment $/Unit	Equipment Subtotal	Cost Including O&P $/Unit	Cost Including O&P Subtotal
33101	A.	**MOBILIZATION AND PREPARATORY WORK**											
	01	Mobilization of Construction Equipment and Facilities		1	LS	$ 2,000.00	$ 2,000.00	$ -	$ -	$ -	$ -	$ -	$ 2,000.00
	02	Mobilization of Personnel		1	LS	$ 1,000.00	$ 1,000.00		$ -		$ -		$ 1,000.00
	03	Remediation Work Plan	Senior Engineer	8	hr	$ -	$ -	$ 149.50	$ 1,196.00	$ -	$ -	$ -	$ 1,196.00
			Engineer	12	hr	$ -	$ -	$ 88.40	$ 1,060.80	$ -	$ -	$ -	$ 1,060.80
			CADD Operator/GIS	8	hr	$ -	$ -	$ 68.90	$ 551.20	$ -	$ -	$ -	$ 551.20
			Admin Aide	8	hr	$ -	$ -	$ 59.54	$ 476.32	$ -	$ -	$ -	$ 476.32
			Publication/Reproduction	10	copy	$ 20.00	$ 200.00	$ -	$ -	$ -	$ -	$ -	$ 200.00
	10	Population Relocation		1	LS	$ 7,000.00	$ 7,000.00		$ -		$ -		$ 7,000.00
	90	Permitting - District of Columbia DCRA Land Disturbance		1	LS	$ 500.00	$ 500.00	$ -	$ -	$ -	$ -	$ -	$ 500.00
			SUBTOTAL				**$ 10,700.00**		**$ 3,284.32**		**$ -**		**$ 13,984.32**
33102	B.	**MONITORING, SAMPLING AND ANALYSIS**											
	06	Confirmation Soil Sampling	Analytical Costs	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,489.00	$ 1,489.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 1,489.00**
33103	C.	**SITE WORK**											
	02	Clearing-Related Activities - Tree removal	Cut and Chip Light trees	0.1	ACRE	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,875.00	$ 287.50
			Tree Removal w/ Chain Saws, 4-6" dia.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 168.00	$ 840.00
			Tree Removal w/ Chain Saws, 8-12" dia.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 252.00	$ 1,260.00
			Tree Subcontractor Service (Large Tree, including stump)	1	LS	$ -	$ -	$ 10,000.00	$ 10,000.00	$ -	$ -	$ -	$ 10,000.00
		- Stump removal											
			1-1/2 CY Backhoe, 4-6" diam.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 29.50	$ 147.50
			1-1/2 CY Backhoe, 8-12" diam.	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 80.00	$ 400.00
	03	- Soil Excavation											
		Gross	Light Equipment w/ operator	80	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ 50.15	$ 4,011.73
			1 CY Bucket w/ operator	65	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.04	$ 1,497.60
		By Hand (heavy soil or clay)	Laborer	65	CY	$ -	$ -		$ -	$ -	$ -	$ 100.00	$ 6,500.00
	05	- Fencing											
			Installing as Temporary	300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 7.80	$ 2,340.00
			Removal of Temporary Fencing	300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 7.45	$ 2,235.00
			Fence Material Allowance	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000.00	$ 2,000.00
			Reinstall Fence (Labor Only)	300	LF	$ -	$ -	$ 6.25	$ 1,875.00	$ -	$ -	$ -	$ 1,875.00

Table B-2 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item						Bare Costs						Cost Including O&P	
						Materials		Labor		Equipment			
WBS		Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal
	90	Surveying		1	DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 625.00	$ 625.00
	91	Miscellaneous Expenses	Per Diem	10	M/DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 200.00	$ 2,000.00
			Portable Water Tank	5	DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 95.50	$ 477.50
			SUBTOTAL				**$ -**		**$ 11,875.00**		**$ -**		**$ 36,496.83**
33105	**D.**	**EROSION AND SEDIMENT CONTROL**											
	13		Jute Fence	325	SY	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.21	$ 393.25
			Silt Fence	400	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.73	$ 292.00
			Hay Bales	250	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.00	$ 500.00
			Remove Hay Bales	1	TON	$ -	$ -	$ -	$ -	$ -	$ -	$ 385.00	$ 385.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 1,570.25**
33301	**E.**	**SUPERVISION AND ADMINISTRATION**											
			Construction Manager	28	hr	$ -	$ -	$ 85.80	$ 2,402.40	$ -	$ -	$ -	$ 2,402.40
			SSHO	28	hr	$ -	$ -	$ 80.60	$ 2,256.80	$ -	$ -	$ -	$ 2,256.80
			UXO Technician	28	hr	$ -	$ -	$ 65.00	$ 1,820.00	$ -	$ -	$ -	$ 1,820.00
			Per Diem	10	M/DAY	$ -	$ -	$ -	$ -	$ -	$ -	$ 200.00	$ 2,000.00
			SUBTOTAL				**$ -**		**$ 6,479.20**		**$ -**		**$ 8,479.20**
33119	**F.**	**DISPOSAL**											
	21	Hauling From Site for Treatment		315	tons	$ 25.00	$ 7,875.00	$ -	$ -	$ -	$ -	$ -	$ 7,875.00
	22	Hazardous Soil Disposal		315	tons	$ 125.00	$ 39,375.00	$ -	$ -	$ -	$ -	$ -	$ 39,375.00
			SUBTOTAL				**$ 47,250.00**		**$ -**		**$ -**		**$ 47,250.00**
33120	**G.**	**SITE RESTORATION**											
	01	Earthwork											
		- Backfill	Material Only	273	LCY	$ -	$ -		$ -	$ -	$ -	$ 10.00	$ 2,730.00
		Gross	2-1/2 CY Loader w/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 2.39	$ 217.49
			Dozer w/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 2.87	$ 261.17
		By Hand	Laborer	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 22.50	$ 2,047.50
		- Compaction											
		Gross	Air Tamp. W/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 8.30	$ 755.30
			Vibratory Plate w/ Operator	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 5.75	$ 523.25
		By Hand	6" Layers	91	LCY	$ -	$ -		$ -	$ -	$ -	$ 13.10	$ 1,192.10

Table B-2 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item						Bare Costs						Cost Including O&P	
						Materials		Labor		Equipment			
WBS		Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal
	04	Revegetation and Planting											
		- Seeding and Sodding	Area of Approx. 2800 sf	1	LS	$ -	$ -		$ -	$ -	$ -	$ 1,200.00	$ 1,200.00
		- Landscape Restoration	Replace existing landscaping and features	1	LS	$ -	$ -		$ -	$ -	$ -	$ 25,000.00	$ 25,000.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 33,926.81**
33121	H.	**DEMOBILIZATION**											
		Demobilization		1	LS	LS	$ -	$ -	$ -	$ -	$ -	$ 2,000.00	$ 2,000.00
			SUBTOTAL				**$ -**		**$ -**		**$ -**		**$ 2,000.00**
33222	I.	**OTHER REQUIREMENTS**											
	90	POST REMEDIATION ACTIVITIES											
		-Closure Report	Senior Engineer	8	hr	$ -	$ -	$ 149.50	$ 1,196.00	$ -	$ -	$ -	$ 1,196.00
			Engineer	12	hr	$ -	$ -	$ 88.40	$ 1,060.80	$ -	$ -	$ -	$ 1,060.80
			CADD Operator	8	hr	$ -	$ -	$ 68.90	$ 551.20	$ -	$ -	$ -	$ 551.20
			Admin Aide	8	hr	$ -	$ -	$ 59.54	$ 476.32	$ -	$ -	$ -	$ 476.32
			Publication/Reproduction	10	per	$ 20.00	$ 200.00	$ -	$ -	$ -	$ -	$ -	$ 200.00
			SUBTOTAL				**$ -**		**$ 3,284.32**		**$ -**		**$ 3,484.32**

TOTAL COST SUMMARY

	Task	Total per Task
A.	MOBILIZATION AND PREPARATORY WORK	$13,984
B.	MONITORING, SAMPLING AND ANALYSIS	$1,489
C.	SITE WORK	$36,497
D.	EROSION AND SEDIMENT CONTROL	$1,570
E.	SUPERVISION AND ADMINISTRATION	$8,479
F.	DISPOSAL	$47,250
G.	SITE RESTORATION	$33,927
H.	DEMOBILIZATION	$2,000
I.	OTHER REQUIREMENTS	$3,484
	SUB-TOTAL	**$148,681**
	Contingency based on tasks C, D, F, G, H (10%)	$9,295
	Project Management based on Tasks C, D, F, G, H (5%)	$4,648
	Remedial Design based on Tasks C, D, F, G, H (10%)	$9,295
	TOTAL	**$171,919**

Per Grid Cost (30 CY)	Per Ton Cost (45 tons/grid)
$24,560	**$546**

Table B-2 Detailed Cost Estimate
Soils Contaminated with Arsenic
(Excavation and Disposal - Hazardous Landfill, 7 Grids)
Spring Valley OU-4 and OU-5 EECA

Cost Item					Bare Costs						Cost Including O&P	
					Materials		Labor		Equipment			
WBS	Task & Subtask	Item	Quantity	Units	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal	$/Unit	Subtotal

KEY - ASSUMPTIONS

O&P = Overhead and Profit

COST ESTIMATE REFLECTS AN AVERAGE SITE WITH **7 GRIDS REQUIRING REMOVAL.**
Note that based on sampling to date, it is anticipated that approximately 800 total grids will require removal.

A.	MOBILIZATION AND PREPARATORY WORK	-Assumed Draft and Final versions of Remediation Work Plan would be prepared. -Assumed electronic versions of existing site drawings will be adequate to produce excavation plans (I.e., additional surveying/creation of new base maps will not be required for planning). -Assumed existing health and safety documents would apply (I.e., no new health and safety submittals included). -Assumed existing quality assurance project plan would apply. -Permitting assumed fee based on amount of land disturbance. Includes application preparation time.
B.	MONITORING, SAMPLING, AND ANALYSIS	-Assumed 7 samples (1 confirmation sample per grid) analyzed for total arsenic ($65/sample) plus TCLP disposal characterization sample ($1,034). -Assumes each grid will meet the remedial objective at the initial excavation depth of 2 feet.
C.	SITE WORK	-Assumes a 1.5 factor for the soil conversion of CY to TON. -Assumes extent of soil contamination has been determined. -Assuming 30% of work can be done with "heavy" equipment, 40% with "light" equipment, and 30% of work done by hand. -Clearing: Up to 12" trees with manageable heights - remove with chain saws and stump removal equipment. 12" trees and larger, and any trees close to the houses, etc. - Utilize tree subcontractior to remove. The number of trees to remove is approximated as (5) 4-6" diameter, (5) 8-12" diameter per 7 grids excavated.
E.	SUPERVISION AND ADMINISTRATION	- Assumed that removal actions will occur in sequence (Site Manager, SSHO and UXO Tech. remain on-site from job to job)
F.	DISPOSAL	-Assumes treatment prior to landfill disposal at a non-hazardous facility
G.	SITE RESTORATION	-Assumed 1" topsoil layer and seeding. No other landscaping allowance. -Assumed equal compaction by methods of Air Tamping, Vibratory Plate, and Hand Methods. -Assumed 30% more soil required from backfill to allow for compaction.
I.	OTHER - POST REMEDIATION ACTIVITIES	-Assumed Draft and Final versions of closure report would be prepared. -Assumed closure report would simply describe the activities conducted. -The Closure Report will include the final actual costs of the work.

APPENDIX C

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY- COMMENTS AND RESPONSES ON THE

ENGINEERING EVALUATION / COST ANALYSIS FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (JULY 18, 2003 DRAFT-FINAL)

SPRING VALLEY OPERABLE UNITS 4 AND 5 WASHINGTON, D.C.

CONTRACT DAHA90-94-D-0010, TASK ORDER DA01
DERP-FUDS HTRW PROJECT NO. C03DC091802

Prepared For:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

Prepared By:

PARSONS
10521 ROSEHAVEN STREET
FAIRFAX, VIRGINIA 22030

December 17, 2003

<u>RESPONSIVENESS SUMMARY</u>

THIS DOCUMENT CONTAINS RESPONSES TO COMMENTS ON THE

DRAFT-FINAL SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (JULY 18, 2003)

Comments were received from:

- **Kent Slowinski, RAB Community Member**
- **Dr. Peter deFur, RAB Consultant**
- **DC Department of Health (DCDOH)**
- **American University**
- **J. Michel and Mary Fontaine M. Marcoux, Community Residents**
- **August 5, 2003 Community Meeting Participants**

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

No.	NAME	COMMENT AND RESPONSE
1	**Kent Slowinski**	The Spring Valley soil sampling, upon which the EE/CA is based, is flawed. Contrary to USACE statements, sampling has not been in compliance with EPA's Soil Screening Guidance (SSG). USACE's Spring Valley soil sampling apparently has only a 90% confidence level, whereas EPA's SSG requires a 95% level of confidence as confirmed in USACE's Sampling Plan Rationale (SPR). What does this mean for residents? Why should you be concerned? **RESPONSE**: EPA's Guidance does not require a specific decision error tolerance. The validity of the sampling plan has been clarified previously. The plan was developed in conjunction with, and approved by, the USEPA and DCDOH. Additionally, a briefing of the plan to the RAB was conducted on September 10, 2002; the slides for that briefing are posted on the USACE Spring Valley Project web site: www.nab.usace.army.mil/projects/WashingtonDC/springvalley.htm The RAB Science Task Group and RAB Technical Advisor, Dr. deFur, provided favorable feedback regarding the validity and thoroughness of the sampling scheme at the January 2003 RAB meeting.
2	**Kent Slowinski**	If your neighbor's property has elevated arsenic levels, there is a good chance your property does too. Arsenic contamination doesn't respect property lines. The actual number of properties with elevated arsenic is likely to double due to flaws in the soil sampling plan. The Spring Valley remediation will likely take twice as long, or contaminated properties will not be remediated. One possible solution - USACE resample properties adjacent to properties with elevated arsenic as many residents have requested, and as I recommended in May 2002. **RESPONSE:** The presence of elevated arsenic on any one property does not indicate contamination on the adjacent properties. Arsenic is "chased" across property lines when the perimeter confirmation sampling during the removal effort indicates high arsenic. However, this has had to be done in only a small percentage of the cases, providing further support for the thoroughness of the sampling plan.
3	**Kent Slowinski**	Lewisite should be added as a contaminant of concern. Has anyone contacted the contractors that Mr. Umpleby reports were exposed to Lewisite on his property? Who should? Contractors were also exposed, possibly to Lewisite, at 4825 and 4835 Glenbrook Road, in 1992 and 1996.

No.	NAME	COMMENT AND RESPONSE
		RESPONSE: A contaminant of concern is any compound identified as being present at levels that pose unacceptable risks. Lewisite breakdown products (CVAA and CVAO) have been analyzed for on more than 200 properties throughout the community as part of the Operable Unit 4 and 5 investigations. There have not been any detections of Lewisite breakdown products on the sampled properties, indicating that Lewisite is not a chemical of concern for the broader community. Lewisite has been found in containers recovered from specific burial areas located in the Rockwood Parkway/Glenbrook Road area and in the soil in direct contact with the recovered containers. Lewisite and other materials present at these specific burial areas do present a potential risk to the community and are removed during the burial pit excavations. Risks at these specific locations do not transfer to other locations where lewisite or its breakdown products have not been found. The Lewisite concern expressed by Mr. Umpleby was conveyed to USACE in 2002, and an additional soil sample was collected in his garden area and analyzed for agent breakdown products, including CVAA and CVAO. This sample taken in 2002 was in addition to a soil boring collected from his property in 2001 and analyzed for arsenic and these other parameters. Results from both the soil boring and the additional soil sample taken did not detect any agent breakdown products. Mr. Umpleby raised concerns during the August 5, 2003, community meeting. See additional discussion in the Responses to Comments and Questions for that meeting. USACE is aware of the reported historical exposures at 4825 and 4835 Glenbrook Road. The investigation and removal of any AUES-related contamination at 4825 and 4835 Glenbrook Road is an on-going part of the Spring Valley project.
4	**Kent Slowinski**	Where are the TCLP test results? Are the SPLP and TCLP the same? Major Peloquin said there "wasn't significant leaching of arsenic" in soil removed from AU's intramural field. This suggests there was leaching. Should the arsenic contaminated soil have been taken to King and Queen County Sanitary Landfill, or to a hazardous waste facility? Should state regulators in VA be notified? Where will future contaminated soil be taken for disposal/ treatment? **RESPONSE:** The Toxicity Characteristic Leaching Procedure (TCLP) and the Synthetic Precipitation Leaching Procedure (SPLP) are not the same. The TCLP is performed to provide characterization for disposal. Typically, disposal facilities, including the King and Queen Landfill, base their acceptance of a waste on the TCLP results. For this project, all wastes that are sent off site for disposal are sampled and characterized and sent to the appropriate disposal facility in accordance with the facility's RCRA permit. The waste must meet the facility's

No.	NAME	COMMENT AND RESPONSE
	Response Continued	waste acceptance criteria established by the facility's permit. Furthermore, in accordance with the NCP (40 CFR 300.440), the EPA Offsite Coordinator is notified when "CERCLA waste" is going to be sent off site for disposal to ensure the disposal facility is in compliance with their operating permit. The TCLP results for soils removed from Spring Valley are not presented in the EE/CA because the EE/CA does not address the actual removal of soil. The EE/CA is an analysis of removal alternatives for the site. The EE/CA informs the public on the alternatives and is a part of the public information process that allows the community and regulators to comment on the removal action. All removal actions have been or will be documented in stand-alone reports. Those reports would contain all relevant disposal data, manifests, etc. The SPLP is a leach test that simulates an acid rain environment and is appropriate for a contaminated soil scenario. It helps ascertain whether contamination in the soil is likely to leach into groundwater. The use of the SPLP is specifically discussed in Section 2.5 of the USEPA Soil Screening Guidance.
5	**Kent Slowinski**	The SPLP test data suggests groundwater contamination has already occurred. Has the groundwater in high arsenic level properties been tested? Are there plans to test these areas for arsenic and AUES chemicals? Has the groundwater in these areas been tested, or are there plans to test in these areas for arsenic and AUES chemicals? This groundwater enters homes through flooded basements when groundwater level rises. Should residents be warned? Do you think groundwater contamination has already occurred? Is the Rick Woods burial pit contributing to groundwater contamination? Should MD environmental officials be contacted? Does the Washington Aqueduct (WA) have any groundwater sampling data? Should the WA be part of the FUDS? What is the likelihood of other AUES chemicals detected at burial pits causing groundwater contamination? **RESPONSE:** As indicated in paragraph 1.2.0.2 of the EE/CA, a Spring Valley groundwater investigation is underway, with the initial field phases being implemented in Fiscal Year 2004. It is anticipated that the findings of the groundwater study will answer the other questions posed above. Some groundwater data do exist for the Washington Aqueduct property, and these data are being shared among the partnering agencies, discussed in our monthly partnering meetings, and considered in the development of the upcoming groundwater investigation.
6	**Kent Slowinski**	Prior to remediation, USACE should test properties with elevated arsenic levels for the AUES List of Chemicals if residents have health concerns, or if residents request the sampling. Properties should be resampled upon resident request.

No.	NAME	COMMENT AND RESPONSE
		RESPONSE: The name of this EE/CA has been changed to better reflect the fact that arsenic is the only contaminant being addressed by the response alternatives presented. USACE's multi-tiered sampling approach for OU-4 and OU-5 has not identified any other chemicals beside arsenic that require soil removal. Sampling at 10 locations (9 properties) for AUES List chemicals did not reveal the presence of any other chemicals requiring attention in this EE/CA. Based on these findings, there is no justification for conducting the proposed sampling upon request on individual properties. USACE is taking action to better understand and address community concerns, where possible, regarding the AUES List and community health issues. Specifically, an AUES List Work Group has been established to address scientific uncertainties associated with the AUES List sampling effort. Minutes and other materials from this multi-stakeholder work group can be found on the Spring Valley Project web site at: www.nab.usace.army.mil/projects/WashingtonDC/springvalley.htm. Regarding community health, USACE continues to have community health discussions with local residents, the Spring Valley RAB, and our partnering agencies. USACE's position and efforts associated with community health concerns were conveyed to the community, the USEPA, and DCDOH in an October 22 memorandum to Mr. Cas Heuer, a copy of which was provided to community RAB members on October 27. A copy of this memo will be available in the Information Repository and the Administrative Record. It can also be obtained by contacting Spring Valley project's community outreach team at **(410) 962-0157.**

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

No.	NAME	COMMENT AND RESPONSE
1.	**Dr. Peter deFur**	The subjects, title and in places sections of the text lead the readers to consider that this EE/CA may do more than simply address the arsenic contamination issues. These need to be corrected. The reader should have no doubt that non-arsenic issues are not addressed in the remediation actions proposed here. **RESPONSE**: The name of this EE/CA has been changed to better reflect the fact that arsenic is the only contaminant being addressed by the response alternatives presented. Although there is significant data presented for the “other selected chemicals”, the removal decisions reached in the EE/CA address arsenic in soil only.
2.	**Dr. Peter deFur**	The section on bioavailability is not helpful to the discussion or the presentation. The methods are not presented, and the detailed report only gives some general sense of what was done. The results are not clear, to the point of being ambiguous. Bioavailability studies with which I am familiar are experimental in nature, using test animals or plants to assess the uptake and retention of chemicals in living tissues. This study seems to have been only an assessment of whether arsenic can/will move from soils. I recommend removing the section as written and inserting a brief paragraph stating that some work was conducted and that the results offer little of practical application here. **RESPONSE:** The EE/CA has been revised to present more prominently the fact that the bioavailability study was a limited study. It is correct that these types of studies are experimental in nature, and therefore difficult to derive concrete conclusions from. It is for these reasons that neither the 20 ppm remediation endpoint for arsenic, nor the EE/CA removal alternatives evaluation makes use of the bioavailability data (see paragraph 3.9.2.4). Nevertheless, the USACE feels it is important to describe the many efforts involved in investigating and characterizing the Spring Valley site.
3.	**Dr. Peter deFur**	The EE/CA seeks to accurately portray the extent of the work on the site. The field work has been extensive and still the on-going work reveals new outcomes and unanticipated results. Therefore, the EE/CA needs to make some statement of uncertainty about the sampling and analysis for arsenic. **RESPONSE**: A brief statement of uncertainty inherent in any investigation of this type has been added to Section 3.1. Activity-specific work plans or reports, such as the Technical Memoranda in Volume III, contain more detailed discussions of uncertainties associated with those specific activities.
4.	**Dr. Peter deFur**	Pg. IX; E.1.0.1: “This Document does not evaluate future actions related to non-arsenic compounds.” This is an important point that must be highlighted. Note that the title includes “Other Selected Chemicals.” The inclusion of this phrase in the title is misleading and should be removed. **RESPONSE**: Please see response to Dr. deFur comment #1.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

No.	NAME	COMMENT AND RESPONSE
5.	**Dr. Peter deFur**	Pg. X; E.2.0.4: "(approximately 91 acres)", "some 577 acres". The text is not clear on acreage. I recommend a table that clarifies the matter of acreage. **RESPONSE**: The acreages are given with qualifying terms because they are derived from the Geographic Information System overlays and not a site-specific survey. These values have been added to Table 3.1.
6.	**Dr. Peter deFur**	Pg. X; E.4.0.1: "The objective of this EE/CA does not include evaluation of future actions related to non-arsenic compounds in soil." Good point and it cannot be highlighted enough. **RESPONSE**: Noted.
7.	**Dr. Peter deFur**	Pg. 1-4; 1.3.0.2: "The area of these three properties was designated as Operable Unit 3 (OU-3). The OU designations and explanation is going to be confusing to the reader who is not familiar with the site. I suggest another table that presents the information in a concise and clear form. **RESPONSE**: The OU designations are clearly shown on Figure 1-2 (the preceding page). A reference directing the reader to this figure has been added.
8.	**Dr. Peter deFur**	Pg. 1-4; 1.3.0.3: "Based on these events, a partnership was formed with the relevant agencies involved in the decision making process. The Spring Valley Partners (Partners), the USACE, USEPA, and DCEHA" Please add that the Partners continue to work cooperatively on cleanup issues and decisions, involving the public through the RAB and public outreach coordinator. **RESPONSE:** This has been added.
9.	**Dr. Peter deFur**	Pg. 2-3; 2.2.3: "Wildlife and Endangered Species" ; section 2.2.3.2 There are other sources of information on this subject. The fact is that this EE/CA has focused on human health for excellent reasons. Federal agencies and DC government both have information on the non-human receptors in the vicinity of the site. The EE/CA must include some statement regarding peregrine falcons and bald eagles, both of which may visit the site, especially considering the proximity of the Potomac River that is home to and feeding grounds for bald eagles. US Fish and Wildlife Service needs to be officially consulted on this subject at the earliest opportunity. **RESPONSE:** This section has been updated with more recent information from the Fish and Wildlife Service to ensure that any potential interaction of the referenced species and the site are reflected. Substantial information of this type that has the potential to impact decisions will be obtained during the follow-on Remedial Investigation.

No.	NAME	COMMENT AND RESPONSE
10.	**Dr. Peter deFur**	Pg. 2-5, 2-6; 2.4.3.1: "In April 1999, during a USEPA environmental sampling event, a DCEHA representative discovered surface debris located on AU property in the vicinity of the 4801 Glenbrook Road site.", "Soil contaminated with elevated levels of arsenic, lead, and mercury was encountered. Historical evidence suggests that during the operation of the AUES, the SDA was very close to the perimeter fence of the AUES. However, an archaeological review of the items recovered during the excavation concluded that the disposal occurred in the early 1930's. The area was backfilled and closed following the 2001 removal." This paragraph reads as though EPA was conducting some random or routine sampling in the area; such was not the case. EPA was conducting sampling related to AUES contamination and the report should give a more exact description and context. It would be good to place this in geographical context to the active digging in 2003 and beyond. **RESPONSE**: The EE/CA has been clarified to show that the USEPA event was part of the Spring Valley investigation.
11.	**Dr. Peter deFur**	Pg. 3-3; 3.1.3.1; lines 12-14: "The CSA includes all the remaining acreage outside of the CSA (not including the OU-3 and OU-4 area. The CSA is approximately 445 acres. The CSA contains 793 homes and 316 lots (1109 total sites). This passage is another place where acreage and geographic confusion may occur; consider putting this information into the table that I recommended earlier to summarize all of this type of data. **RESPONSE**: At the start of these discussions, the reader is directed to Figure 3-1, which clearly delineates each area discussed. There is a table within this figure as well as Table 3.1 which further details the site counts. Table 3.1 has been revised to include the acreages as well.
12.	**Dr. Peter deFur**	Pg. 3-3; 3.2.1.1; lines 25-27: "In general accordance with the Soil Screening Guidance, each OU-4 and CTA site was divided into four equal areas called quadrants." Lines 34-35: "Samples were collected from the first six inches of surficial soil." Lines 36-38 .?? One of the limitations of the sampling was the shallow soil sampling. There was evidence that the arsenic was surficial; the evidence does include some deeper cores taken at a depth close to the soil surface from 1918, as I read the WMP's and the related documents. That evidence needs to be noted here, or the reader will be left with the impression that deeper soils were ignored. **RESPONSE:** A sentence has been added to the Section 3 Overview, telling the reader that subsurface samples were a significant part of the sampling plan. The commenter's referenced section, 3.2.1, deals only with Quadrant Surface Sampling. Sections 3.2.3, 3.2.4, 3.2.5, Table 3.2, 3.3.2, and Table 3.4, discuss subsurface sampling. More than 4,500 subsurface soil samples were analyzed for arsenic and very few had concentrations greater than 12.6 ppm. The vast majority of arsenic samples greater than 12.6 ppm were in the surface soils.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

No.	NAME	COMMENT AND RESPONSE
	Response Continued	Surficial sampling was done intentionally at 0-6 inches to characterize the area of greatest exposure to the residents. It was clearly understood by the USACE that the 1918 horizon would be of greatest interest in terms of reflecting AUES activities, as the subsurface boring rationale discussions indicate. However, the overriding concern was the surficial soil to which human receptors are most exposed.
13.	**Dr. Peter deFur**	Pg. 3-5; 3.2.2.1; lines 5-6: “Samples were collected from the first six inches of surficial soil.” 3.2.3.1; line 14: “In general, one subsurface boring was advanced at each site.” Lines 17-19: “A direct push Geoprobe contractor was used to obtain the boring samples. To help site the boring, the cut and fill map developed during the 1995 RI was used to determine which areas represent fill material since 1918 levels.” 3.2.4.1; line 26: “In general, one subsurface boring was advanced at each site. See note above. Even with all this text on surface soils and deeper borings, the naïve reader is not going to follow this text without a clear introduction. Add an explanation on what the Geoprobe is and does. **RESPONSE**: A brief description of a Geoprobe has been added to inform the reader.
14.	**Dr. Peter deFur**	Pg. 3-9; 3.3.2.3; lines 1-2: “for the subsurface samples, with the exception of portions of the sampling described in sections 3.8 through 3.11 below.” 3.4.1; lines 9-11: “The highest surface quadrant arsenic result was 101 mg/kg. The highest subsurface quadrant boring arsenic result was 124 mg/kg. This result was from the 0-1 foot bgs sample from the boring.” Line 14: “The AU lots (AU lot 16, 19, 23, and 24)” I am familiar with the results and the sampling and did ot follow this text well. Please put the numbers in a table. **RESPONSE:** These are summary discussions. Although not every result discussed in the text is shown, Table 3.5 does present this summary information. Additionally, there are several figures that present the data in a reader-friendly format. Given that there were approximately 17,000 samples, and that the data from all of them are presented elsewhere in the document (Volumes II and III), a conscious decision was made to not flood the reader with too many results in Volume I.
15.	**Dr. Peter deFur**	Pg. 3-11; 3.4.3.1; Lines 9-12: “one site (4629RP) that did not exceed the arsenic screening level was grid sampled because of proximity to numerous other sites that had arsenic screening level exceedances. A total of 21 OU-4 sites were grid sampled. The highest OU-4 grid sample arsenic result was 498 mg/kg.” 3.5.1.1; Lines 25-28?? 3.5.2.1; lines 30-31: OU-5 CTA sample was cyanide. Cyanide was detected in only one of the 101 specialty samples collected in the CTA.” This property and the nearby ones are the subject of rather intense interest at present and in the later sections. Please refer to those other sections. **RESPONSE**: Section 4.4, “Extent of Specialty Parameter Detections”, is now referenced.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL* *(July 18, 2003)*

No.	NAME	COMMENT AND RESPONSE
16.	**Dr. Peter deFur**	Pg. 3-13; 3.6.1.1; lines 5-6: "The highest surface composite sample arsenic result was 202 mg/kg." 3.6.2.1; lines 9-10: "The only specialty parameter detected in an OU-5 CSA sample was cyanide. Cyanide was detected in only four of the 179 specialty samples collected in the CSA." 3.6.3.1; lines 19-21 The issue is that cyanide is an indicator of CWM. But because this EE/CA only deals with the arsenic, these results are not directly on point. The EE/CA would be improved if a note were added that these results will be considered in the further investigations and that the presence of cyanide is not normal at these levels. **RESPONSE**: Section 3 is a presentation of the overall sample program and the results. Section 4, which addresses the nature and extent of contamination, does include these discussions in paragraph 4.4.0.1, which concludes that the need for further action regarding cyanide (and other chemicals) is being evaluated by the USEPA, DCDOH, and the USACE.
17.	**Dr. Peter deFur**	Pg. 3-16; 3.8.2.3; lines 27-28: "In addition, no organic arsenic compounds were detected in either site or background samples." 3.8.2.4; lines 35-37: "The anthropogenic source of arsenic may be associated with AUES, but it could also be associated with the use of pressure-treated lumber, pesticides, herbicides, coal, or fertilizer." Is there a statement here that the inorganic arsenic is toxic and the organic is not? If not, please add. **RESPONSE**: This section has been clarified to indicate that, according to ATSDR, organic arsenic is usually less harmful than inorganic arsenic.
18.	**Dr. Peter deFur**	Pg. 3-17; 3.9.1.2; lines 10-12: "In March 2001, the three highest arsenic concentrations inside the AU CDC area and the three highest outside the CDC (but within AU Lot 12) were samples for bioavailability. Additionally, six background samples representing the four soil types were collected from the same locations the USEPA sampled." This whole section is a confusing one and does not add to the EE/CA. **RESPONSE**: The referenced sentence has been clarified. This is a summary of the more detailed complete Technical Memorandum contained in Volume III. Lines 10-12 indicate the sample numbers and locations, and are therefore relevant to the discussion.
19.	**Dr. Peter deFur**	Pg. 3-21: It is not clear why paragraphs 3.11.2 were included beyond the statement in 3.11.2.1. The rest seems unnecessary. **RESPONSE**: Even though the EE/CA does not include an evaluation of the results, those referenced paragraphs help the reader to understand the presentation of the results. Some of this information has been changed to reflect recent discussions of the AUES Work Group.

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No.	NAME	COMMENT AND RESPONSE
20.	**Dr. Peter deFur**	Pg. 4-1; 4.2.1.3; Lines 39-40: "The bioavailability study (Section 3.9) suggests that the arsenic bearing phases in Spring Valley soils are mainly iron oxides, manganese oxides, iron arsenic sulfates, or clays. Soil type does not appear to be a major factor in arsenic concentrations as there appeared to be little difference between arsenic concentrations among the four soil types sampled." I suggest deleting this section as written because the bioavailability study was not adequate for the purposes of this assessment. **RESPONSE**: The EE/CA has been revised to present more prominently the fact that the bioavailability study was a limited study. (See response to Dr. deFur's comment #2.) Nevertheless, the USACE feels it is important to describe the many efforts involved in investigating and characterizing the Spring Valley site.
21.	**Dr. Peter deFur**	Pg. 4-4; 4.4.0.1; line 5: "The discussion does not address the AUES List sampling summarized in section 3.11" This paragraph is a summary only, giving some indication of where to look next for AUES chemicals. **RESPONSE**: Noted.
22.	**Dr. Peter deFur**	Pg. 5-1; 5.3: Section 5.3 explains the basis and origin for the 12.6 and 20 ppm levels used in the SV investigation. As such, this point adds much, but might be better off repeated in an earlier section. **RESPONSE:** Earlier references to these numbers are made in the document, and clear references to the more detailed discussion in Section 5.3 have been added.
23.	**Dr. Peter deFur**	Pg. 5-3; 5.5.0.1; line 6: "Groundwater will be addressed in a future investigation." Please give a timeline for this work. **RESPONSE:** A general statement has been added indicating that planning and discussion of the groundwater investigation has already begun and that fieldwork is expected to be initiated in the Spring of 2004.
24.	**Dr. Peter deFur**	Pg. 6-1; 6.3.0.1; line 23: "All grids containing a sample greater than 20 mg/kg of arsenic were identified for removal action." **RESPONSE**: Noted.
25.	**Dr. Peter deFur**	Pg.7-4; 7.2.0.2; lines 11-13: "The four subcriteria are: Compliance with Applicable or Relevant and Appropriate Requirements (ARARs); Long-Term Effectiveness; Reduction of Toxicity, Mobility, or Volume through Treatment; and Short-Term Effectiveness." **RESPONSE**: Noted.

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No.	NAME	COMMENT AND RESPONSE
26.	**Dr. Peter deFur**	Pg. 7-7; 7.3.2.5.5; line 12: “PARAG Nos. OFF FROM HERE ON” Delete this comment in the text- it is a typo. **RESPONSE**: This has been deleted.
27.	**Dr. Peter deFur**	Pg. 7-10; 7.62; Line 34-35: “This alternative provides limited effectiveness and could be difficult to implement. However, individual residents may prefer this alternative to other removal alternatives that would require potentially extensive land disturbing activities on their property. Therefore, this alternative will be further evaluated.” The COE is doing all they can to accommodate resident wishes, but the text can and should be more clear that this alternative will leave the contaminated soils in place in a residential area where there is no way to guarantee the public safety. **RESPONSE**: This has been clarified.
28.	**Dr. Peter deFur**	Pg. 7-14; Outcome: “This alternative is both effective and implementable. It will be retained for further evaluation.” Good. **RESPONSE**: Noted.
29.	**Dr. Peter deFur**	Pg. 9-1; 9.1.0.1; lines 8-9: “Based on the evaluations presented in Sections 7 and 8, the recommended alternative is excavation and landfill disposal.” 9.1.0.2; Lines 15-16: “Soil will initially be excavated to a depth of two feet below ground surface in these areas. I agree with the recommendations. **RESPONSE:** Noted.

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No.	NAME	COMMENT AND RESPONSE
1.	**DC Department of Health (DCDOH)**	1) ACRONYM LIST page vii. Add to mg/kg definition, (parts per million) **RESPONSE**: This has been added.
2.	**DCDOH**	2) Par. E.2.0.1 page ix. Third sentence, after, "During a 1997 review of the 1995 RI (USACE 1998),"add "…resulting from a District of Columbia Environmental Health Administration Report, ". Change third sentence from, "…(POI) No. 24 was actually located in the vicinity of 4801 Glenbrook Road…" to "…(POI) 24 was believed to be located in the vicinity of 4801 Glenbrook Road…" Add at end of paragraph a listing of principle finds at 4801 Glenbrook. (i.e. 175 bottles, 200 shells, etc.) **RESPONSE**: This language has been revised.
3.	**DCDOH**	3) Par. 1.3.0.1. Change fifth sentence from, "…(POI) No. 24 was actually located in the vicinity of 4801 Glenbrook Road…" to "…(POI) 24 was believed to be located in the vicinity of 4801 Glenbrook Road…" **RESPONSE:** This language has been revised.
4.	**DCDOH**	4) Par. 2.1.4.2. Add at end of paragraph, "DCEHA also requests some groundwater sampling in the vicinity of burial sites to make certain that contaminated groundwater is not heading for surface water bodies such as streams and springs. Finally, DCEHA requests groundwater sampling in an effort to locate as yet undiscovered burial areas." **RESPONSE**: The particulars of the groundwater investigation that is planned for 2004 will be developed with input from the USEPA, DCDOH, and the USACE, and presented to the RAB for further discussion.
5.	**DCDOH**	5) Par. 2.4.1.2 Add prior to last sentence, "Mustard was identified in one bunker drain line." **RESPONSE**: As put forth in the Final Remedial Investigation Report for the Spaulding and Captain Rankin Areas (June 1996), Sections 6.5.1 and 6.5.2, it is the USACE position that these were false positive results. The EE/CA has been changed to reflect this.
6.	**DCDOH**	6) Par. 2.4.2.1 Change, "However, POI 24 was actually located…" to "However, POI 24 was believed in 1997 to be located…" (Note EPIC and DCDOH now believe POI 24 to be located on 4825 Glenbrook Road). **RESPONSE**: The exact location of POI 24 is still in question. Two burial pits were found on the 4801 Glenbrook Road property, and an additional burial pit has been found straddling the property line between 4801 and 4825 Glenbrook Road. Either of these locations could be POI 24. Additional investigation of this latter pit is ongoing. The EE/CA has been revised to reflect these facts.

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No.	**NAME**	**COMMENT AND RESPONSE**
7.	**DCDOH**	7) Figure 3-3. Excellent aid. Suggest adding, " > 12.6 ppm to definition of blue block. **RESPONSE**: Figure 3-3 has been revised to indicate that a site needed to exceed the 12.6 ppm arsenic screen in order to be grid sampled.
8.	**DCDOH**	8) Figure 4-1. Excellent aid. DOH believes that the definition of blue block is incorrect as that broad definition should cover all of Spring Valley. Suggest 12.6 to 20 ppm. Should include arsenic readings for 4801, 4825 and 4835 Glenbrook Road properties. Should add a fifth color for arsenic levels over 400 ppm. Yellow block on AU campus behind Krieger Hall should be blue (or the fifth color) for arsenic reading for small disposal area (i.e. 3350 ppm) and 2450 at nearby excavation. **RESPONSE**: The color scheme is based on the grid results, not the quadrant/half screen results. Since some of the grid sites contained grids with concentrations lower than 12.6 ppm, the definition of the blue block is correct. No decisions were made based on the concentration of 400 ppm that were not made for the sites exceeding 150 ppm. Therefore, to keep the figure readable and user friendly, a fifth color was not used. This figure is presenting the grid results, a very specific set of data. It does not include every arsenic sample collected, and therefore does not include the SDA or other excavation results. To ensure that the reader realizes that those other areas of high arsenic were not ignored, a statement has been added to acknowledge these other areas and other significant sample results.
9.	**DCDOH**	9) Figure 4-2. Excellent aid. Should cover all of current FUDS boundary. Should cover all sample results for the two constituents (possibly using a different color for other sampling efforts). (i.e. thiodiglycol reading on 4625 Rockwood Parkway and 52nd court trench from CBDA sampling. Cyanide reading at Sedgwick trench). Also recheck Corey Place data. **RESPONSE**: Generally, data presented in figures in this EE/CA reflect activities performed for the EE/CA. Data from other past sampling events are not shown, to ensure the document does not deviate from its express purpose and objectives. Specifically, Figure 4.2 is described in Section 4.4 as one that presents the EE/CA sampling results other than the AUES list. The 4625 Rockwood thiodiglycol detection was from the AUES List sampling. Those results will be assessed in detail in another document. No data regarding any non-arsenic detection at a Corey Place residence could be found.
10.	**DCDOH**	10) Par. 5.3.0.2 Add at end. "20 mg/kg is also the cleanup value chosen by the greatest number of states." **RESPONSE**: Language to this effect has been added.

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No.	NAME	COMMENT AND RESPONSE
11.	**DCDOH**	11) Par. 7.1.3.4 Add at end. “However, DCDOH has suggested consideration of this alternative at two sites in order to save large trees.” **RESPONSE**: The EE/CA has been changed to make clear that the phytoremediation alternative is not available at this time. However, it is acknowledged that the USACE is completing a greenhouse and feasibility study of this technology to determine whether this can be an effective alternative at Spring Valley.
12.	**DCDOH**	12) Par. 7.3.2.2 After, “Only state standards that are more stringent than the federal requirements may be considered ARARs.” Add “DC Code § 8-1301 et seq. applies to disposal sites where hazardous waste may enter the environment.” **RESPONSE**: Paragraph 7.3.2.2 does not cite particular regulations, but rather is a general description of ARARs. Paragraph 7.3.2.3.1 of the EE/CA has been changed to add a reference to the DC regulation that applies to disposal sites, and to further note that it was found not to be applicable or relevant and appropriate in setting the cleanup level for arsenic in soil.
13.	**DCDOH**	13) Volume II Sampling Results and Data Validation Arsenic Grid Results Site Grid Map Suggest adding, “ > 12.6 ppm to definition of blue block. **RESPONSE**: The EE/CA has been revised to make clear that a site needed to exceed the 12.6 ppm arsenic screening level in order to be grid sampled.
14.	**DCDOH**	14) Volume III AUES List-Selected OU-4 Residences. This section should include the DCDOH Comments. **RESPONSE**: The DCDOH comments have been added, along with the USACE responses to those comments.
15.	**DCDOH**	15) AUES List-Sedgwick Trench. The use of a metals background column is inappropriate. DCDOH has previously rejected the background sampling because it was conducted on sites influenced by AUES activities. It was for that reason that a new arsenic background sampling was performed. Other metals background has not been determined. **RESPONSE**: The background sampling events performed by EPA (1993/1994 and 1999), which covered arsenic and other metals, were discussed at numerous Partner meetings, and consensus was reached on using these data. (Note: Section 3.7.2 of Volume I gives more detail on these events and how the data are used).

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No.	NAME	COMMENT AND RESPONSE:
1.	**American University**	American University reviewed the EE/CA and asked that various experts working with the University also review the EE/CA to ensure that the procedures and proposals for the OU 4,5 areas meet the applicable regulatory standards. The EE/CA contains partial results of ACOE investigations on the American University (AU) campus and associated AU-properties along with recommendations for remediation. It is our understanding that the EE/CA was conducted under the authority of CERCLA, especially Subpart E "Hazardous Substance Response" and Subpart I "Administrative Record for Selection of Response Action". Based on our review, AU's comments on the EE/CA are as follows: General Comments In general, AU believes that the EE/CA does not conform to EPA guidance, presents an incomplete picture of potential environmental hazards in OU 4,5, is inadequate to support the selected remedy, and, in some cases, is scientifically inaccurate. **RESPONSE:** Noted. Please see responses to individual comments, below.
2.	**American University**	The EPA has published guidance for conducting non-time removal actions under CERCLA Guidance on Conducting Non-Time-Critical Removal Comments under CERCLA, OSWER Directive 9360.0-32, August 1993. ("Non-TCRA Guidance"). This guidance contains the regulatory requirements for conducting an EE/CA. Based on our review, we believe that there are many instances where the draft EE/CA does not follow this document. For example, a key component of this process is publication of an EE/CA approval memorandum (Non-TCRA Guidance Section 2.2). This document is part of the administrative record and establishes the framework for the EE/CA. There is no evidence that this memorandum was ever published for OU 4,5. **RESPONSE:** The Approval Memorandum has recently been signed and placed in the Administrative Record file for this removal action. It serves an internal administrative function by memorializing the fact that USACE management authorized the undertaking of the EE/CA. The public was long ago put on notice, through public meetings, RAB meetings, the Spring Valley Project web site, and the Spring Valley publication, the Corps'pondent, that the EE/CA was being undertaken.
3.	**American University**	As another example, the Non-TCRA Guidance calls for a streamlined risk evaluation (pp. 29-30). Although the EE/CA contains a section with this title, it only refers to background concentrations of arsenic and is not a risk evaluation in the sense of the Non-TCRA-Guidance. Specifically, the Non-TCRA Guidance requires an "estimate of how and to what extent people might be exposed to these chemicals, and provides an assessment of health effects associated with these chemicals." The EE/CA does not contain any of this

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	Comment Continued	information. The EE/CA focuses only on arsenic and only on the chemical portion of the investigation. It is not possible to gain an adequate understanding of OU 4,5 without an evaluation of the full suite of chemicals that were detected at the CDC, Sedgwick Trench area, and other locations. **RESPONSE:** This EE/CA does not evaluate future actions related to non-arsenic compounds. Further, the Guidance states that "the streamlined risk evaluation should focus on the specific problem that the removal action is intended to address" (Section 2.4). Therefore, this EE/CA, in accordance with the Guidance, addresses only arsenic in soil and does not attempt to evaluate risk for any other chemicals encountered. That effort will be completed in the overall RI. To avoid any confusion, the title of the EE/CA has been changed to delete the reference to "Other Selected Chemicals". Regarding the content of a Streamlined Risk Evaluation (SRE), the Guidance makes clear that the lead agency has broad discretion in deciding the SRE's contents, and that it need not include a formal risk assessment. An SRE that identifies only contaminants of concern in the affected media, contaminant concentrations, and the toxicity associated with the chemical can be sufficient to justify taking an action." Non-TCRA Guidance at p. 29. The Guidance also states that an "EE/CA is a flexible document tailored to the scope, goals, and objectives of the non-time critical removal action" (Section 2.1), and that "where a NTCRA is one of a series of response actions or where a completed RI will be available....the EE/CA would be similar to a Focused FS, concentrating on the analysis of two or three appropriate alternatives and providing reference to existing information on the nature and extent of contamination and risks" (Section 2.1). See also, Use of Non-Time Critical Removal Authority in Superfund Response Actions, February 14, 2000. Given that other activities, including a groundwater investigation and the evaluation of the AUES List of chemicals (and possibly other chemicals), are scheduled to be completed and compiled in an overarching RI document, the scenario described in the Guidance is applicable.
4.	**American University**	Another glaring omission is the lack of confirmation sampling data from those areas that have already been remediated. We believe that without these data, it is impossible to evaluate conditions site-wide. In addition, the EE/CA does not contain information from the geophysical analysis and subsequent removal of ordnance or chemical weapons materials. Because these materials may have contained arsenic, it is necessary to be able to review both chemical and geophysical results prior to making a final judgment on the completeness of the removal actions. **RESPONSE**: This EE/CA is clear regarding the scope and goals of the removal action. This EE/CA is not intended to document the actual removal actions. This EE/CA is the supporting document for the removal action to be undertaken, not the Time-Critical Removal Actions already completed. The specifics of those removals already completed, including the confirmation sampling results, will be reported in separate

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	Response Continued	documents. Similarly, the investigations regarding ordnance are separate actions with separate reports, are not part of this EE/CA, and are therefore not included in this document. It would not be appropriate to include the results of those investigations and/or removals in this document. The ordnance investigations and removals follow soil characterization procedures consistent with decisions made for soil in Spring Valley, i.e., arsenic above 20 ppm will be removed (or, in selected locations up to 43 ppm as approved by the USEPA, DCDOH, and the USACE), and any other detections of other chemicals will be addressed the same as the AUES List sampling. Section 5 of the EE/CA provides additional information regarding support for the arsenic levels referenced above.
5.	**American University**	Our analysis shows that some portions of the EE/CA including the bioavailability, speciation and leaching studies, are of poor scientific quality and their results are over-interpreted. For example the "bioavailability study" is of questionable quality and failed to reliably evaluate the oral bioavailability of arsenic, but is relied on throughout the document to support conclusions. Similarly, the leaching study is scientifically flawed, yet used to support decisions about cleanup levels. Due to these reasons, the EE/CA is inadequate to support the proposed remedy. It is our position that these defects should be corrected before the EE/CA is finalized. **RESPONSE:** The EE/CA has been revised to present more prominently the fact that the scope and results of these studies were limited, and that they were not relied on in making decisions. Neither the 20 ppm remediation endpoint for arsenic nor the EE/CA removal alternatives evaluation was based on results of these studies. Nevertheless, the USACE feels it is important to describe the many efforts involved in investigating and characterizing the Spring Valley site, so discussions of these studies remain in the EE/CA.
6.	**American University**	The EE/CA does not discuss how this investigation and recommendations fit into the overall framework for the site. It is not possible to determine, for example, if remedial action in the CERCLA sense is contemplated following completion of removal action or if a 5-year review process will be implemented. **RESPONSE**: The EE/CA has been revised to explain the larger framework at the very beginning of the document. At this time, an RI documenting the results of the other activities related to hazardous substances, including groundwater investigations and the AUES List evaluation, is planned to integrate all actions taken. The ordnance-related investigations and any removal actions involving ordnance are on a separate track from the hazardous substances activities.
7.	**American University**	Possibly most important, due to the cleanup level itself and the ACOE's application of the cleanup level, we are concerned that there may be substantial residual risk remaining after cleanup. This degree of residual risk is a critical piece of information that should be transmitted to all stakeholders so that the stakeholders can determine if there will be residual liability associated with arsenic remaining on their property. This cannot be determined

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	Comment Continued	until the ACOE completes a site-specific risk assessment that uses plausible exposure scenarios to estimate the baseline and residual risk. This may be done with a supplementary document; however, it should be completed prior to finalization of a remedy. **RESPONSE:** As described in the response to comment no. 3 above, the USACE will complete a site-wide RI that will address the existence of residual risks (if any) from arsenic as well as the AUES List of chemicals (and possibly other chemicals). However, the USEPA, DCDOH, and the USACE believe the 20 ppm remediation endpoint will be protective regarding residual risks.
8.	**American University (Specific Comments)**	The ACOE should review the Non-TCRA Guidance document and revise the EE/CA to ensure that all information required by the guidance is contained in the EE/CA. **RESPONSE:** This EE/CA is in compliance with CERCLA and the NCP, and was prepared in accordance with USEPA's Guidance document. All information required by the Guidance is contained in the EE/CA.
9.	**American University**	Section 2.4.3. No evidence is presented to substantiate the allegation that disposal of materials at the SDA occurred in the 1930s. The evidence should be presented or this statement should be removed. **RESPONSE**: The statement has been revised to reflect that items found at the SDA spanned several time periods. Detailed information about all items found in the SDA will be documented in a separate report.
10.	**American University**	Section 2.4.5. The results of the OE/CWM investigations should be presented to give a complete picture of OU 4,5. **RESPONSE:** Please see response to comment no. 4 above.
11.	**American University**	Section 3.8 and Technical Memorandum Arsenic Speciation Study. This material is of limited utility. Basically, all that it shows is that the arsenic on-site is chemically different than the arsenic off-site. The study makes numerous references to sources of arsenic other than AUES chemicals. There is no evidence that pressure-treated lumber, herbicides, pesticides, coal, or fertilizer were the source of arsenic at the site. To the contrary, the chemical signatures found in those samples where complete analyses were performed strongly suggest that these materials were not the source of the arsenic since each of these materials presents a distinct chemical profile, none of which were found at the site. The conclusion "no organic arsenic compounds were detected" is erroneous and should be removed. Only two organic arsenic chemicals were sought in the investigation (MMA, DMA). The investigation did not involve chemical warfare agents containing arsenic (Lewisite, Adamsite, ABPs) or commonly occurring organic arsenic compounds (arsenobetaine, TMA). Because of this, the data are inadequate to support the conclusion. Statements that trivalent arsenic is more toxic than pentavalent arsenic are not relevant to human carcinogenicity, which is the

	Comment Continued	toxicological endpoint of greatest interest. They should be deleted. The blank contained high concentrations of As+3 relative to the samples. Under the "10 times" rule, all the background As+3 results and two of the site results should be rejected. The precision on the lab dupes for As+3 suggests these analyses are unreliable. Finally, there is an insufficient number of samples to support any generalized conclusions from these data. **RESPONSE**: Please see response to no. 5 above. The EE/CA has been revised to emphasize that the speciation study was limited and that its data were not relied on to make any decisions regarding the 20 ppm remediation endpoint or the removal alternatives for arsenic in soil. The “10 times” rule applies to organics, not metals. For metals, the “5 times” rule applies. Even so, these results should have been “B” flagged to indicate the As+3 found in the blank. These are not rejections; the data are usable as qualified. The speciation study report has been revised to show a “JB” qualifier for the affected samples.
12.	**American University**	Section 3.9 and Technical Memorandum Arsenic Bioavailability Study. Our review suggests that this study is of poor scientific quality and is over-interpreted in the EE/CA. The study is actually a bioaccessibility study, not a bioavailability study. A true bioavailability study presents results in vivo or from an in vitro system that simulates in vivo processes. The study presented in the EE/CA does neither. The study states that swine are the best animal model for human bioavailability of arsenic; however, recent work by Roberts clearly shows that primates are the best model. The results are too variable (100% CV) and the number of samples too small to be used with any degree of confidence. The methods used in the analysis have not been published or validated for arsenic; indeed they have only been generally accepted by the scientific and regulatory communities for lead. The ACOE seems to have substantially more confidence in the study methodology and reliability than does their contractor, John Drexler of the University of Colorado. **RESPONSE:** Please see response to no. 5 above. The EE/CA has been revised to emphasize that the bioavailability study was limited in nature and that its data were not relied on to support conclusions or make any decisions regarding the 20 ppm remediation endpoint or the removal alternatives for arsenic in soil. It is precisely because the USACE does not have more confidence in the methodology and reliability than Dr. Drexler has, that the data were not used to make site decisions. Also, where “recent work” post-dates the study presented here, it is impractical to revise or redo the study to reflect each recent development in the field.
13.	**American University**	At the EPA Bioavailability Workshop, April 16-17, 2003, Drexler clearly stated that more work needed to be done before arsenic bioavailabilities can be confidently predicted using any in vitro system Drexler, J.W. "Bioassays: Past and Future". USEPA Bioavailability Workshop. Tampa FL. April 16-17, 2003.. Drexler

	Comment Continued	additionally pointed out that the correlation coefficient r2 for arsenic in vitro compared to EPA swine data was only 0.33 and that the method itself had a CV of 14%. The numerical correlation analyses presented by Drexler graphically show the unreliability of this method. When combined with the variability in the samples, the low precision of the method renders the results too uncertain to use. **RESPONSE:** Please see response to comment no. 12 above.
14.	**American University**	The EE/CA (Section 5.02) states that the most conservative assumption would be to use a bioavailability factor of 50% based on these data. However, given the variability in the data, statistical approaches should be used to study the confidence in the use of any single point estimate derived from these data. The laboratory report contains no information regarding the correspondence (or lack thereof) between Drexler's methods for arsenic analysis and standard EPA methods. There were no data quality objectives stated for this study and inadequate information to assure quality. For example, p. 12 of the Drexler report states that accuracy and precision "will be determined"; however, no results are provided. This study may give a naïve reader the impression that bioavailability has actually been characterized and that human absorption of arsenic from site-soils is reduced. Section 3.9, the technical memorandum, and any references to the bioavailability study should be removed from the report in order to correct this impression. **RESPONSE:** Please see response to comment no. 12 above.
15.	**American University**	Additionally, we would note that AU has asked for this study for at least 2 years. Even though it is dated January 2002, and the underlying laboratory report was dated July 2001, it has not been provided to AU despite frequent requests. **RESPONSE:** These results were discussed at various Partner meetings in the late 2001 timeframe, at which an AU representative was present. Nevertheless, the USACE regrets that this report, which is included in Volume III of this EE/CA, was not forwarded to AU in a timely fashion.
16.	**American University**	Section 3.10 and Technical Memorandum Synthetic Precipitation Leaching Procedure (SPLP) Arsenic Sampling. It is our opinion that this study contains an inadequate number of samples to be used in decision making; only seven samples had SPLP concentrations that were detectable. Further the study was biased toward samples that were likely to yield low SPLP results. The detection limits were too high for this study to be of use. Several samples had detection limits of 50 µg/L which is five times higher than the proposed arsenic drinking water MCL. When all the data are considered, there is a poor correlation between total arsenic and SPLP arsenic. Inputting an additional variable to correct for the detection limit problem, a re-calculated adjusted r2 is 0.28, which is too low to be sufficiently reliable for prediction purposes. Neither this

	Comment Continued	regression analysis nor the analyses presented in the EE/CA appear to be statistically significant at p=0.5 level, although we were not able to precisely replicate the analyses in the EE/CA. **RESPONSE**: 46 samples were analyzed for SPLP arsenic. The fact that only 7 contained detections of SPLP arsenic does not mean the non-detects are not relevant to a study of leachability. It has been clarified in the EE/CA that the SPLP results were not relied upon to derive the 20 ppm remediation level and that the upcoming groundwater investigation will provide additional information concerning whether arsenic has leached to the groundwater. The locations were not biased to low arsenic areas: the 4801 Glenbrook samples were collected from areas where arsenic was expected to be high; the CDC samples were actually biased high as explained in Section 3.10.1.2. There was no detection limit problem. The 3.2 ug/L value should not have been shown for non-detects on the table. The 50 ug/L value should have been shown for all non-detects. 3.2 ug/L is the Instrument Detection Limit (IDL) and 50 ug/L is the Practical Quantitation Limit. The IDL is typically set well below the PQL. In accordance with USEPA Region III guidance for data validation, any detection between 3.2 and 50 ug/L would be reported (J-flagged as estimated; the J qualifier has been added where appropriate). This has been corrected in the table.
17.	**American University**	The main reasons for the lack of correlation are the non-normality of the data, censoring of the data, and small number of data points. Regardless, and even using the best case from the EE/CA (where the highest data point is arbitrarily excluded), the 95% confidence limit on the regression line shows that an arsenic residual in the soil of 20 mg/kg will result in leachate concentrations exceeding the new MCL for arsenic. The discussion on page 7 of the Technical Memorandum is obsolete and should be revised to reflect the current regulatory position regarding arsenic in drinking water. Due to the uncertainties in this study, it cannot be used to support conclusions regarding leachability. This underscores the need for a groundwater study prior to implementing a final remedy. **RESPONSE:** The USACE agrees that a groundwater study is needed before implementation of the final remedy at Spring Valley. As is stated in the EE/CA, follow-on groundwater studies will be performed to provide more detailed information regarding this issue. The groundwater investigation will evaluate all exposure pathways, even though groundwater is not used as a drinking water source in this area. The USACE believes that the regression line shown is correct. Using this line, the data suggest that arsenic in soil of up to 56 mg/kg will not exceeed the MCL of 10 ug/L. The discussion on page 7 clearly addresses the former MCL (50 ug/L) and the new MCL.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*		
18.	**American University**	Section 3.11.2.1. We are not clear on how is it possible to propose and evaluate a remedy when these data are not available? They could have a substantial impact on remedial decision making. **RESPONSE:** The removal action this EE/CA covers is only for arsenic in soil. The AUES List data are being evaluated in a separate action that will ultimately be incorporated into the characterization of the entire site, which will form the basis for the remedial action.
19.	**American University**	Section 3.22.2.3. What is the rationale for using chloride as a surrogate for chlorate? **RESPONSE:** Based on recent discussions regarding evaluation of the AUES List chemicals, the indicator compound procedure is no longer expected to be used to understand these results. The EE/CA has been revised to capture as many of these procedural changes as possible.
20.	**American University**	Section 4.2.1.1. Arsenic has an "atomic weight", not a "molecular weight". The conventional units are g/mol. What is the significance of the specific gravity of atomic arsenic? **RESPONSE:** This error has been corrected. The specific gravity of atomic arsenic is presented as part of a general background discussion of the nature and properties of arsenic.
21.	**American University**	Section 4.2.1.2. We believe that this discussion is overly simplistic. There are complexes of pentavalent arsenic that are highly mobile and complexes of trivalent arsenic that are virtually immobile. Arsenic can also behave as a cation or a covalent organoarsenical in addition to being a component of oxyanions. The ACOE should use a geochemical model (such as MINTEQ) to more precisely define the arsenic speciation and mobility. A demonstration of low mobility is of critical importance to AU. It is our recommendation that the ACOE perform additional leaching tests and combine the leaching results with predictions of a geochemical model to yield a site-specific evaluation of arsenic mobility. **RESPONSE:** Geochemical modeling to supplement the existing leachate testing is not necessary to move forward with removals based on arsenic. The upcoming USACE groundwater investigation will examine the mobility of arsenic and other chemicals that could impact groundwater in the Spring Valley area. Also, please see response to comment no. 17 above.
22.	**American University**	Section 4.2.1.3. The conclusions about alternative sources are unsubstantiated and should be deleted. The conclusions about arsenic mineralogy are not supported by data in the bioavailability report and should be revised. **RESPONSE:** The section does not conclude that these alternatives sources are responsible for areas of high arsenic in Spring Valley. The mineralogy discussion is merely what the data suggest in the limited study; no conclusions or site decisions were based on this information.

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23.	**American University**	Section 4.3.3. The conclusions in this section are unfounded due to the lack of reliability of the SPLP data and should be revised or deleted. **RESPONSE:** Please see response to comment no. 16 above.
24.	**American University**	Section 4.4. Further sampling for cyanide and/or ABPs should be conducted after consultation with all stakeholders, not just the USEPA and DCEHA. **RESPONSE:** Section 2.4 has been revised to clarify that these decisions will be made following discussions with all stakeholders.
25.	**American University**	Section 5. AU feels this entire section is inadequate and must be substantially revised. CERCLA (40 CFR § 300.410) requires an assessment by ATSDR or other sources of the threat to public health. One of the factors to be considered is actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances (40 CFR § 300.415). The standard method for making these determinations is through a risk assessment. **RESPONSE:** The regulation at 40 CFR § 300.410 does not require the assessment asserted. That section concerns the preliminary assessment of a site suspected of containing hazardous substances. A CERCLA preliminary assessment may, but is not required to, include an ATSDR or other assessment, for the purpose of deciding whether to undertake an EE/CA. While the regulation at 40 CFR § 300.415 mentions the food chain in a list of factors to consider in determining whether a removal action is an appropriate response, neither of these sections can be interpreted to mean that a risk assessment is required in the EE/CA.
26.	**American University**	The Non-TCRA Guidance contains explicit requirements for conducting the streamlined risk evaluation that is a component of the EE/CA. It specifically requires using "sampling data from the site to identify the chemicals of concern, provides an estimate of how and to what extent people might be exposed to these chemicals, and provides an estimate of the health effects associated with these chemicals". It further references EPA's Risk Assessment Guidance for Superfund for guidance in conducting risk evaluations. None of this information or analysis is contained in the EE/CA. The EE/CA needs to be revised to yield an estimate of the baseline risk prior to remedial activities. In addition, since substantial quantities of arsenic, a listed hazardous substance, are to be left at the site, the risk assessment should include a calculation of residual risk for the remaining arsenic. It is our recollection that initial discussions between AU and the ACOE led us to the understanding that the ACOE would perform this type of risk assessment using information provided by AU regarding the receptors at the site and their exposure patterns. This was not done, thus the degree of both baseline and residual risk is unknown.

		RESPONSE: Please see response to comment no. 3 above. The EE/CA completed for Operable Unit 3 addressed many of the issues raised in this comment regarding exposure to and health effects of arsenic. Since the exposures for Operable Units 4 and 5 are largely the same as those in Operable Unit 3, conclusions about risk derived from the detailed Human Health Risk Assessment completed as part of the EE/CA for Operable Unit 3 are applicable to Operable Units 4 and 5. The text of Section 5.1.0.1 refers the reader to the Operable Unit 3 EE/CA. The USEPA, DCDOH, and the USACE consider the selected 20 ppm remediation endpoint to be protective of future land uses. The selected remediation level was reviewed by the Mayor's Scientific Advisory Panel. The selected remediation level of 20 ppm is less than the non-cancer goal of 23.5 ppm and is within the EPA's cancer risk management range of 10^{-4} to 10^{-6}. Issues considering potential residual risks were considered when this level was approved and additional testing and modeling is not required to move forward with removals addressing arsenic. Should the follow-on work with the AUES List chemicals or groundwater indicate the possibility of unacceptable risk due to the chemicals, it will be addressed in the final site-wide RI.
27.	**American University**	Section 5.3.0.2. Since the bioavailability study is unreliable, references to bioavailability should be deleted. **RESPONSE:** Please see response to no. 5 above. The EE/CA has been revised to emphasize that the bioavailability study was limited in nature and that its data were not relied on to support conclusions or make any decisions regarding the 20 ppm remediation level or the removal alternatives for arsenic in soil. Nevertheless, the USACE feels it is important to show the numerous efforts attempted to investigate and characterize the Spring Valley site.
28.	**American University**	Section 5.3.0.3. The site-wide cleanup level is 20 mg/kg arsenic. Therefore, all soils exceeding 20 mg/kg must be remediated. Any soil previously remediated to a higher cleanup standard must be revisited and remediated to 20 mg/kg. **RESPONSE:** A variance of up to 43 mg/kg has been approved by the USEPA, the DCDOH, and the USACE for selected locations to accommodate cultural features or access issues. In many places, including on AU property, up to 43 ppm of arsenic in soil has been approved to remain in place to save trees or to address other logistical concerns.
29.	**American University**	Section 5.3.0.4. CERCLA requires consideration of guidance and advisories other than ARARs in making a removal determination (40 CFR § 300.400). This category of criteria is known as "to be considered" or TBCs. The ACOE should present the entire range of TBCs for the site including human health criteria such as RBCs, SSLs, MRLs for both residents and various categories of applicable workers. Groundwater SSLs should also be presented. In addition, the ACOE should determine if TBCs exist for phytotoxicity of arsenic given its history as an herbicide.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*		
		RESPONSE: The EPA regulations advisories or other guidance may be considered for a particular release "as appropriate" (40 CFR 300.400(g)(3)). TBCs may be used when the applicable or relevant and appropriate requirements (ARARs) are not fully protective, so that an acceptable level of risk will be reached; to clarify how particular ARARs should be applied; or to otherwise guide the response action. The use of TBCs is not mandatory. This EE/CA includes a streamlined risk evaluation that takes into account existing information on the nature and extent of contamination and risks, including Human Health Risk Assessments performed in Spring Valley. The USEPA, DCDOH, and the USACE, have determined that consideration of TBCs is not needed in this EE/CA, because the remediation endpoint attains an acceptable level of risk and is considered protective of human health and the environment. This EE/CA concerns arsenic-contaminated soil. Groundwater contamination is being investigated in a separate action, and groundwater concerns will be discussed in the reports coming out of that investigation.
30.	**American University**	Section 5.4, Table 5.1. Support and justification should be provided for "RBCs" or other criteria for those chemicals that do not have dose-response data in EPA's Integrated Risk Information System (IRIS) or an ATSDR toxicity profile. **RESPONSE:** All comparison criteria shown in this table are either EPA-published RBCs or RBCs derived in the 1995 RI (as referenced). Support for the RI-derived values can be found in the 1995 RI. The standard shown for Mustard is the residential Health Based Environmental Screening Level developed by USACHPPM. See the USACHPPM/ORNL Technical Report, March 1999 for additional information regarding justification of this value.
31.	**American University**	Section 5.5. This section should be deleted. The existing SPLP data are too unreliable to support any conclusions. Groundwater should be addressed in a subsequent investigation and incorporated into a final EE/CA. **RESPONSE:** Please see response to comment no. 16 above. The groundwater investigation will be incorporated into a final site-wide RI, not this EE/CA.
32.	**American University**	Section 6.2.0.1. The last sentence of this paragraph is not supported and should be deleted. **RESPONSE:** The sentence has been revised to acknowledge the forthcoming groundwater study that will provide additional data regarding downward migration of arsenic.
33.	**American University**	Section 7.3.3.1. Note that the guidance as listed in this section calls for an evaluation of the magnitude of the residual risk following completion of the removal action. This was not done in the case of any of the proposed alternatives.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*		
		RESPONSE: The Section 7.6 discussions in the EE/CA have been clarified to ensure that "residual risk" has been addressed.
34.	**American University**	Section 7.6.6. We believe that the statement that this alternative would be protective of human health and the environment is not supported by the EE/CA and should be removed. The second sentence states that arsenic will be removed to levels "below the cleanup level", however, elsewhere (e.g. Section 5.3.0.1), the EE/CA states that arsenic above 20 mg/kg will be removed. This contradiction should be investigated and the inconsistencies removed throughout the document. AU's preference is for remediation to levels below 20 mg/kg, not above 20 mg/kg, due to the significant residual risk that will likely remain following remediation. **RESPONSE:** The statement in section 7.6.6 was improperly worded. It has been changed to state that arsenic greater than 20 mg/kg will be removed. The discussion has been further clarified by referencing Section 5.3 which describes that in limited situations, soil containing up to 43 mg/kg arsenic may be left in the root zones of trees or where access and other construction limitations make soil removal difficult or unsafe.

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

NO	NAME	COMMENT AND RESPONSE
1	**J. Michel Marcoux** **Mary Fontaine M. Marcoux**	Because the report shows that our property at 4615 Rodman Street has a substantial number of grids testing for arsenic at over 20 ppm as reported to us by the Corps on February 19, 2002, ... and April 16, 2002,... **we want to know when the Corps will remediate the elevated range of arsenic levels on our property** as we requested the Corps to do over a year and a half ago. See our February 25, 2002, letter to Major Michael D. Peloquin describing our restoration concerns, and Major Peloquin's April 19, 2002, letter to us mentioning a prioritization scheme for elevated arsenic level properties such as ours.... **RESPONSE**: The Marcoux property will be addressed in the first phase of the Non-Time Critical Removal Action that will be initiated early in calendar year 2004. As explained in Major Peloquin's April 19, 2002, letter, the approximately 150 properties having grid sampling results above the 20 ppm cleanup level for arsenic were prioritized. The Time Critical Removal Actions were conducted in 2002-2003 for properties with the highest exposure point concentrations and for properties that had a grid result above 150 parts per million. USACE was not able to address the Marcoux property in either of the Time Critical Removal Actions because arsenic levels on that property did not meet either criterion.
2	**J. Michel Marcoux** **Mary Fontaine M. Marcoux**	We particularly want prompt remediation in order to facilitate sale of our property. Once remediation is complete, we respectfully request the most complete set of comfort or assurance letters to us, from the Corps and the other responsible authorities, regarding remediation effectiveness, to show to potential buyers. **RESPONSE:** USACE, USEPA, and DCDOH, with input from the Spring Valley RAB, have been working on the wording of letters that can be issued to each property owner after the cleanup work is completed.
3	**J. Michel Marcoux** **Mary Fontaine M. Marcoux**	Finally, the Corps' April 16, 2002 letter …confuses us by stating about other chemicals that "your results indicate that none of the other chemicals tested were found at levels greater than what the laboratory's instrumentation can detect" and referring to "review of acceptable levels of chemicals without published RBC's." What are the final results of the testing of our property for chemicals other than arsenic? What are the health consequences of other chemicals present, without regard to detectability by the laboratory's instrumentation? **RESPONSE**: The language regarding 'laboratory instrumentation' is intended to convey that it is scientifically incorrect to say that zero amount of a chemical was detected, or that the chemical was

RESPONSES TO COMMENTS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

NO	NAME	COMMENT AND RESPONSE
	Response Continued	not present. Detection of any chemical is a function of how well the analytical instrument can 'see'. Using the industry standard analytical equipment and methods for performing these analyses, the most that can technically be said is that the chemical was not present at the level to which the instrument can detect it. This is not significant for the chemicals in question since they all can be 'seen' by the instrument at levels well below their health risk levels. Thus, although it is technically possible that the other chemicals might be present below what the instrument can see (the detection limits), the results do confirm that even if certain chemicals are present, they are not present at levels of concern regarding health impacts. The April 16, 2002 letter stated that some chemicals did not have a published RBC. However, since that time, the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) developed a Health-Based Environmental Screening Level for Mustard, which serves as an indicator of the level of unacceptable health risk for mustard. The USACE can now say that none of the other chemicals (other than arsenic) sampled on the Marcoux property were found at concentrations above their respective health risk levels.

RESPONSES TO COMMENTS AND QUESTIONS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

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No.	**NAME**	**COMMENT AND RESPONSE:**
1.	**Umpleby, 49th Street**	I experienced lewisite while digging in my garden. And it came as a surprise to me because of the presentation that I went to on arsenic because I was thinking in terms of a powder or dust in the soil in the form which was arsenic. We went over how do you get it into the body. Well, you have to basically eat the soil. And it didn't accumulate in the body, the body eliminated it. You would have to get a high dosage at one time. And so I came away very unconcerned on the grounds that, well, I'm not accustomed to eating the soil and so there's really not much of a problem. But when I was digging in the yard, I smelled something. I started sneezing. My eyes were burning. And it occurred to me that over near American University the guys that went to the hospital had been digging in the soil. So I went into the house, got on the computer, did a web search on lewisite and read what is available on lewisite. It was very informative. Basically, lewisite is a liquid. It becomes volatile. It turns into a gas and you breathe it. It smells like geraniums. It causes you to sneeze. It burns the eyes. Basically all the symptoms that I had. And then I remembered that I had some guys working in the yard putting in some drainage pipes and they called me the day after and said they really felt bad. There was something wrong with the soil. Well, this was several years ago before all of this stuff came up, and so what could I say? Well, I'm -- I'm sorry, you know, you felt that. I had no idea there was anything wrong with the soil. So, my point would be, anytime you hear the word "arsenic," think "lewisite." Why do they talk about arsenic? Because arsenic is a component of lewisite and you can find arsenic. You can test for arsenic. The data on lewisite is not good, according to the web sites. The data that's available on lewisite has to do with warfare exposures. It does not have to do with long-term deposits in the soil. Lewisite is a non-water soluble liquid. That means water doesn't wash it away. When you get exposed to it is when you disturb the soil and it becomes a gas and you breathe it in. And that's what we're faced with in our yards. And so I would ask that to the extent possible, because I know the data is not there, try to talk about lewisite in addition to arsenic. And it would be helpful to me because that's the way I'm currently thinking because that's what I experienced. **Response to Mr. Umpleby:** Noted. **Follow-up for Responsiveness Summary:** The Lewisite concern expressed by Mr. Umpleby had been conveyed to USACE in 2002 and an additional soil sample had been collected in his garden area and analyzed for agent degradation products, including CVAA and CVAO (Lewisite breakdown products). This sample taken in 2002 was in addition to a soil boring collected from his property in 2001 and analyzed for arsenic and these other parameters. Results from both the soil boring and the additional soil sample taken did not detect any contamination, and the results letter

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No.	NAME	COMMENT AND RESPONSE:
	Response Continued	was provided to Mr. Umpleby in October 2002. Lastly, it should be noted that some glassware debris was recovered during arsenic soil removal on his property in FY-03, and the site safety officer assessed the items and did not determine them to be chemical warfare materiel. However, in light of recent field procedural deficiencies identified in the Lot 18 After Action Report, USACE is reviewing this glassware recovery to make sure no additional action is required. USACE intends to meet with Mr. Umpleby to make sure he has all relevant information pertaining to past AUES activities and USACE efforts on his property, once he can be reached.
2.	**Audience Member (not identified)**	Could you tell me how you're planning to prioritize the non-time critical properties? **Response to Audience Member by Ed Hughes:** Essentially, what we're using is an established method called the Exposure Point Concentration. And that essentially is more or less the average of all the elevated arsenic grids on a given property. That's averaged and it determines an exposure level. And basically, all the properties -- the 118 properties that require remediation are ranked based on their EPC value. And so, in general, we know based on the EPC ranking of a given house essentially where it's going to fall in the lineup. The properties down on the bottom certainly are going to be in the latter part. The properties up top certainly will be prioritized. We do make certain exceptions based on management reasons. If we go to a property that is high-ranking and the property next to it also needs to be remediated, also needs to be dug, in the interest of efficient use of resources we will also -- we will do that adjacent house at the same time. So sometimes different property owners kind of get lucky in that their neighbor has higher levels and they kind of get bumped up in the ranking. If you would like, certainly, one of the numbers we showed earlier, you can talk to one of our representatives. You can talk to Danielle Stern, you can talk to Ben. He's got the numbers right up here. We can let you know where it looks like your property lies in that ranking. **Follow-up for Responsiveness Summary:** The exposure point concentration (EPC) was used to rank the residential properties for the non-time critical removal action. The EPC is the 95 percent upper confidence level (UCL) on the mean concentration of a property. In accordance with EPA guidance, the 95 percent UCL on the mean concentration is used to examine exposure "because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used for this variable"

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No.	NAME	COMMENT AND RESPONSE:
	Response Continued	(EPA, 1992). The EPC was calculated using all of the grid results from a property. A detailed description of how to calculate the EPC was provided to the RAB on 9 July 2002. The overheads used for that presentation are available on the project web site. See http://www.nab.usace.army.mil/projects/WashingtonDC/springvalley/Presentations/RAB-9jul02/index.html.
3.	**David Dragnich**	Bore samplings were taken roughly one in, like, a half an acre it looks like. I was wondering, and I didn't see it in your uncertainty analysis, if there was anything that was done to look at the data to interpret what might be the concentrations between those kinds of samples. Particularly, when I looked at the one slide, it showed excavation right up to -- next to a house, which to me said, well, there must have been some contamination there. How about under the house? Were samples -- are there ways that you can by this sample over here and by this sample over here you can statistically look at the uncertainties and infer whether there is something like "kriging" I think is what -- "kriging" of data? Is that considered at all? **Response to David Dragnich by Ed Hughes:** Essentially, you're asking what confidence level do we know that our samples have found the hot spots. You've seen an excavation go up to a house and you're wondering about underneath the house. Certainly the sampling program that we've instituted is in accordance with the EPA guidance for conducting such sampling activities. In fact, some of the professional folks who've reviewed our sampling plan commented that it exceeded the EPA guidance. And in the midst of my presentation I noted a couple areas where there's actually some conservatism built into the process. One of those coming to mind is the fact that the trigger level for additional sampling is 12.6 parts per million, which is below the far end of the background level, which is 18. Essentially, we're investigating a lot of properties that are still within background level, which is one of the ways it is conservative. When a property goes to grid sampling, it's more focused sampling and essentially it's a statistical scenario as to whether or not we pinpoint every single spot. But the good thing with grid sampling is when a property goes to grid, certain assumptions are made. On 20-by-20-foot grids we have a very good chance of finding a large area of contamination. We have a certain statistical chance of missing a small area of

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No.	NAME	COMMENT AND RESPONSE:
	Response Continued	contamination, but the good thing is it's a smaller chance at missing a smaller area and we stand a greater chance of finding the bigger areas, which pose the bigger risk. So essentially, it does come down to statistics a lot in environmental sampling. What we have noticed is, in all the excavations that we've done so far in the community, is that the elevated arsenic levels essentially do not exist below two to three feet below the ground. So the good thing is we have not had to dig down deeply into the ground. And as far as an excavation up to a house, essentially we dig a 20-by-20-foot grid if the corresponding sample is over 20 parts per million. And that means taking it right up to the house whether or not it needs it or not. So, there are certain levels of conservatism built into the program. We don't claim that we have every single speck of it, but we use every measure of conservative approach to try to make sure that we have the arsenic situation alleviated on a given property and that the overall average of a property is below the level that would trigger a health risk. Tom Bachovchin with Parsons is the contractor who drafted the EE/CA document, and his firm also conducted the site-wide sampling within recent years throughout the neighborhood. And Tom is suggesting that I encourage you to take a look at our large sample map posted on the wall in the back of the auditorium. **Response to David Dragnich by Ted Henry:** I guess the point is that using those types of numbers you can see how we're identifying more properties to do grid sampling that turn out don't need it and very few times are we going into grids that we didn't think had it and actually had arsenic levels of concern. So we tend to be falling to the side of being overly-conservative in the composite to grid sampling approach that we use. **Follow-up for Responsiveness Summary:** When digging grids that required removal, there were very few instances that required excavation laterally into grids not previously identified as containing arsenic over 20 ppm. To provide some additional clarity regarding the conservative nature of the arsenic sampling process, note that while 174 properties required

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No.	**NAME**	**COMMENT AND RESPONSE:**
	Response Continued	grid sampling based on elevated composite results, only 137 were found to need remediation. Additionally, there were very few times during the time critical soil removals where excavation extended into grids or onto properties originally thought to contain only background or normal arsenic levels. For instance, in the tier 1 Time Critical Removal Action addressing 10 properties, only 2 of the 149 grids removed were grids originally thought to be 'clean'. In only 2 of the 149 grids did the contractor have to dig deeper than the 2 feet initially planned. Only once did the contractor have to 'chase' arsenic onto a limited area of an adjacent property where composite sampling did not reveal elevated arsenic. While the above response regarding depth of elevated arsenic was accurate for the TCRA properties, particularly high arsenic concentrations were found below 2-3 feet deep at a few specific locations addressed outside the TCRA, (AU's Child Development Center, 4801 Glenbrook Rd, the SDA). "Kriging" is interpolation or predictive modeling, and an important geostatistical tool. However, it does not work very well where patterns are not clearly discernible, which is the case with arsenic in soil at Spring Valley. Kriging is quite common in groundwater modeling where flow patterns are more predictable.
4.	**Warren Jones**	My property is affected. Will you provide us at the end of this process a letter that documents the fact that you've done this cleanup and that our property is then free of arsenic? **Response to Warren Jones by Gary Schilling:** Yes. There are a couple of different letters that are in the mill right now. There's a letter in the works from the EPA and D.C. Health which are the regulatory groups overseeing this work. The Corps of Engineers also has a letter that we will send out. We have a letter for ordnance work, and you should be getting a letter from the EPA and D.C. Health that has had RAB input -- it has had community input -- once work has been completed to state that we've removed all known arsenic from your property that's above 20 parts per million.
5.	**Lee Monsein**	I was told by a toxicologist that actually is part of the RAB that in his experience working with Region 4 that there was another alternative to arsenic removal that hadn't been mentioned here, and that was something that he termed a point-specific removal.

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No.	NAME	COMMENT AND RESPONSE:
	Comment Continued	In other words, there was just a solid bore that was removed and sampling was done around the site of the bore. When that was clear of whatever the contaminant was, they consider that adequate removal. He called it, a precedent had been set in this particular example. I just wondered whether you had any information about that? **Response to Lee Monsein by Drew Rak, Mitretek:** I have not heard of the specific Region 4 example that you're talking about. However, given the methods by which most of the CWM and therefore the arsenic would have been released either through static testing or spreading out on the ground, most of the arsenic therefore is spread over significant areas and would not be in discreet point areas where you could perhaps take it out of the ground with a six- or eight-inch boring type of opportunity. But I've made a note to look into it, Region 4 toxicology is rather a small group of people. I'm sure I can find out who it is and find out some more about that particular case. **Follow-up for Responsiveness Summary:** After the meeting, the USACE contacted Dr. Monsein for additional information. He indicated that Naval Air Station (NAS) Jackson, FL should be contacted. USACE contacted the Naval Facilities Command (NAVFAC), Southern Division which is the executing agency for the environmental program at NAS Jackson; however, the staff at NAVFAC did not have information about this alternative. USACE also contacted Mr. Ted Simon, a Toxicologist at EPA Region IV. Mr. Simon presented a risk-based and statistically-based methodology for determining which areas in an exposure unit should be slated for removal. The method only identifies areas that should be removed and does not alter the need for construction equipment to perform the excavation. The identification method is based on removing hot-spots within an exposure unit until the average concentration within the entire unit is equal to or less than a predetermined cleanup goal. This process is described in detail in a forthcoming guidance document that EPA Region IV is drafting on behalf of the agency; however, the internal draft guidance document was not available for review by USACE. The process described by Mr. Simon is similar to the process being implemented by USACE at Spring Valley in that it identifies areas for removal using a statistically-based approach. However, the process used by USACE removes all identified areas with elevated arsenic (>20 mg/kg) and not just some areas. Also, in limited instances, areas of up to 43 mg/kg may be left to save cultural/natural resources (e.g., trees).

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6.	**Alex McCrae**	What assurances do we have that the areas closely adjacent to your green map have not been affected by toxic chemicals? And how did you decide on this configuration? What I mean, just for example, how about a couple of blocks north and west of Mass Avenue or north of Van Ness or west or north of whatever the street is there? I guess it would be Yuma. **Response to Alex McCrae by Gary Schilling:** We are looking into that. You asked how the FUDS boundary was delineated. That is a matter of historical record. We had our real estate folks and our historians comb through the records and try to find agreements that would show what areas were used by the Army during that time frame. The partnering group, EPA, D.C. Health, and the Corps of Engineers, have looked at contamination -- the areas that we have tested that have shown arsenic contamination above 20 parts per million. We've looked along the border areas and developed criteria for sampling across the border in areas where the contamination moves up to the border. We have chosen three areas outside of the FUDS boundary that we would like to sample the soil and ensure that those areas have not been affected. We also continue to evaluate information, both historical documents and information that comes from residents both inside and outside of the FUDS boundary. If there is an indication that the activities from the American University Experiment Station affected areas outside of the FUDS boundary, we have a work group -- a task group that's made up, again, of members of EPA, D.C. Health, Corps of Engineers, and the neighborhood's RAB TAPP contractor. And they look at the available information and determine if there is enough information there to investigate that area. A follow-up to this gentleman's question on different alternatives.
7.	**David Dragnich**	I talked to Major Peloquin probably 18 months ago about alternatives. One I was talking about was electrogeochemical remediation. It's a technology that the Corps has employed I believe in some sediment work up in Pennsylvania. And he told me at the time that, oh yeah, we're looking at all these. I was just wondering because that seems like a natural -- if you're considering phytoremediation, this seemed to be much more effective as well as cost effective compared to your chosen alternative, which if I remember in reading was probably the most expensive, the excavation and removal. I was just wondering if that or other alternatives like that. It's referred to as both electrochemical and electrogeochemical.

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		Response to David Dragnich by Ed Hughes: I haven't heard about that technology, sir. I can look into that. I would imagine that it would take a period of pilot testing, of application testing here in Spring Valley. And although it may be cheaper if that were to work in the long run, essentially we'd be -- the excavation and removal option, it does appear to be expensive, but taking the time factor into consideration is also something we're real sensitive about. And as I mentioned, in some of the other technologies -- phytoremediation, soil washing, and soil stabilization -- they would require pilot testing. And the time issue is kind of open-ended with those. And I would expect that that would be the -- it's a similar case with that technology, but I can certainly look into that and do an adequate investigation just to see what that's all about. My understanding is that it's on par or less expensive (than soil washing). And throwing the time factor into the equation, given the uncertainty that with soil washing, we'd have to do a pilot study, which is X-amount of time, before anybody gets done. And then at the end of that period, you still have the question as to whether or not it's going to work or not. **Follow-up for Responsiveness Summary:** The EE/CA process is based on the concept that the problem to be addressed, in this case, arsenic in soil, is not uncommon or does not involve many unknowns in terms of the removal methodologies. To that end, USEPA publishes a "Presumptive Remedy for Metals-in-Soil Sites" Guidance document (referenced in the EE/CA). The intent is to streamline remedy selection by narrowing the universe of alternatives to be evaluated. As described in the EE/CA, this Guidance was used to select the remedies evaluated for Spring Valley. The USACE acknowledges that there may be hundreds of other specialized remedies, but typically these have not been validated over a long time period. The specific technology referenced by Mr. Dragnich as electrochemical or electrogeochemical is not contained in the USEPA Presumptive Remedy Guidance. Research indicates that electrochemical remediation is a general term for several different approaches to remediating soil by mobilizing metals with electrical current to electrodes, where they are deposited and removed with the electrodes. This technology

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	Response Continued	would likely require pilot testing at each property because it is sensitive to soil type and arsenic species. The research suggests that this technology is still being field tested in the U.S.; that is, it is not one of the standard or presumptive methods for remediating soil and documented success stories may not be readily available.
8.	**Audience Member (Not Identified)**	Back some time ago when we had another meeting you elaborated a little bit more on the soil washing. And if it was just to clean the soil, there would be no advantage at all because, heck, put dirt in from somewhere else is easy as clean the dirt that came out of the hole. But one of the advantages was that it was done in a manual fashion where you could take shovelfuls at a time rather than bring in a backhoe and excavate all at once. And that was one of the advantages of that technology. Let me just add one point to what I said earlier, and that has to do with the neighbors of properties that are being remediated. In other words, if you think that the problem is arsenic in the form of dust and somebody's digging in the yard, that's not much of a problem. But if the problem is lewisite in the form of a chemical which turns into a gas when the soil is disturbed, then when they come in to remediate the property it seems to me that some of that would go up into the air.' Now, they did have these sensors around checking for things while they were digging, but I also advised my neighbors of my theory, which is that you get exposed to it when it comes up into the air. And I urged them to not be around as much as possible during the time that the property is being remediated, at least during the period when they're digging it up. When they're putting the soil back it's okay. And I think that's important. **Response:** Noted. **Follow-up for Responsiveness Summary:** Unless Lewisite is containerized and has only recently leaked, it is highly unlikely to still be present in soil after eight decades. Lewisite hydrolizes (decomposes) rapidly in the presence of moisture (as would be present in soil) and would have broken down to other chemicals long ago. Thus, volatilization of Lewisite in soil is unlikely to occur, unless there is a buried container that is leaking or could leak in the future. The soil removal operations have several layers of safety procedures to ensure that the USACE is prepared to respond and mitigate any possible releases due to buried containers before the public is impacted.

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	Response Continued	Because breakdown products of Lewsite might be present, they were included in specific sampling plans conducted during the OU-5 investigation. However, no detections of Lewisite breakdown products were found during these sampling efforts.
9.	**Janet Bohlen**	On the eight sampled properties, you said eight sampled properties in AU were tested for other chemicals, and there were four of those that I know of that do have a lot of other chemicals that were AUES chemicals. And I'm just wondering if you plan to sample other properties having -- that might show up. And if so, how do you plan to deal with it? I mean, if -- remediating for arsenic, will that solve the problem or are we going to worry about these other chemicals at all? **Response to Janet Bohlen by Gary Schilling:** The question is, I referred to the properties that were sampled for the AUES list sampling, the 177 compounds. The question is, are we going to sample any additional properties for those compounds and will remediation for arsenic take care of those compounds? We are at a process here with the AUES-specific compounds that is ongoing. The results from the sampling event have been reported in this EE/CA document. We're going to continue with this study, and if there is activity that's required based on the continuation of this study, it'll have to be undertaken differently from this arsenic removal activity. **Follow-up for Responsiveness Summary:** The AUES List currently contains 177 chemicals or compounds. However, it was not possible to analyze for every compound on the list because no accepted analytical method exists for some of the compounds. Beyond the AUES List, several other sources have been identified regarding chemicals used at the American University Experiment Station. Discussion of these lists and the associated uncertainties can be found in the AUES Work Group minutes available on the project's web site. These various sources of information are considered in planning any additional sampling efforts under the Spring Valley project. Discussions of these issues with the USEPA, DCDOH, and the USACE can be reviewed through Partnership meeting minutes, which are also available on the web site: www.nab.usace.army.mil/projects/WashingtonDC/springvalley.htm

RESPONSES TO COMMENTS AND QUESTIONS ON THE DRAFT-FINAL *SPRING VALLEY EE/CA FOR ARSENIC AND OTHER SELECTED CHEMICALS IN SOIL (July 18, 2003)*

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10.	**Kent Slowinski**	I'm a member of the Restoration Advisory Board. I have a question regarding the soil sampling. The AUES list sampling on the four properties detected more than 100 chemicals other than arsenic. If a resident has health concerns or concerns about the adequacy of the soil sampling, how can they get their property tested for the AUES list? Can they go through a private contractor to do that, or what is the process for getting the Army Corps to do the AUES list sampling on their property? **Response to Kent Slowinski by Gary Schilling:** The answer to the second part is, certainly, a resident can hire a private contractor to do whatever sampling they think their property needs. And we, of course, would consider any of that information helpful. The answer to the first question is that we are evaluating the AUES-specific data. We have Army agency and a private contractor evaluating that data to try to determine -- it's basically an operation that borders on research -- to determine how we can tell for sure whether or not the 40 or so compounds without methods are present. Our regulatory partners and the Corps of Engineers will meet and determine what the next steps are in this investigation. This investigation proceeds at a different pace. It's separate from this EE/CA.
11.	**Audience Member (Not Identified)**	Approximately how much does it cost to sample each property for the AUES list? **Response to Audience Member by Gary Schilling:** The question was, what is the cost for the AUES sampling? The analytical costs alone are about $4,000 per sample.
12.	**Audience Member (Not Identified)**	Recently, EPA came out with a new document. Actually, it was March of 2003. It's called the "Framework for Cumulative Risk Assessment." In light of the fact that there are more than 100 chemicals detected on these AUES list sample properties, what's the likelihood of conducting a cumulative risk assessment? **Response to Audience Member by Drew Rak:** The document that you are talking about, the EPA document, was primarily released to help EPA deal with its regulatory programs revolving around food additives and pesticides regulation. It doesn't necessarily affect the cleanup program because we already do cumulative risk assessments.

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	Response Continued	For example, in the pesticide regulation program historically EPA would regulate one pesticide at a time, although there may have been more than one pesticide used at a time. In the cleanup program historically, we continue to do this, we look at all of the chemicals that are found and detected. As Ed mentioned during his presentation, we take the EPA's risk-based screening concentrations and we actually divide those by a factor of 10 to account for the multiple effects of non-carcinogenic chemicals, or chemicals that have non-carcinogenic effects. We also keep note while we are going through and looking at chemicals, ones that would have either synergistic or potentiation types of effects. Also, as Ed pointed out, in the EE/CA there is what is called a streamlined risk evaluation that basically supports the removal action. The streamlined risk evaluation does take into account multiple chemical effects. And as Gary has pointed out, the AUES list sampling, that particular aspect of the overall investigation continues, but we found nothing in the AUES list sampling from those four homes or the CDC that would -- Child Development Center at AU -- that would indicate that there is any other problem but the arsenic. But we're continuing to evaluate that data right now.
13	**Lou Saul**	My house was sampled and there was, according to the report, no problem, no difference from other houses in known affected area. But I just now discovered that the house just behind mine and confronting with me was grid tested. And this -- I was not aware of that at all. So, how can -- first, I mean, what are the results -- how can I know the results of that grid testing? And since the house is immediately adjacent to mine, I wonder if my testing is sufficient. **Response to Lou Saul by Gary Schilling:** The answer to the first part of the question, you'll be able to find out what the levels are of the house adjacent to yours in this EE/CA document. If you wish to receive an electronic copy, if you wish to receive a hard copy, it's available. We can get it to you. The information is also on our web site. You can see either Danielle or Ben and get that information. I don't think it's uncommon. And as you look around that map, there are a lot of homes that are singles. They're not all in clusters. I'll have to ask you to keep in mind that a lot of the soil here at Spring Valley has been moved. We've generated cut-and-fill maps, we've generated -- or we have the contour maps from the

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	Response Continued	1918 time frame and today, and there's been a good deal of soil removal throughout the neighborhood. There are also, as Ed mentioned in his presentation, many different man-made causes of arsenic in the neighborhood. So, you know, there's certainly no way to tell for sure that your neighbor's arsenic came from the American University Experiment Station activities. The data at your house, the data that was collected at your house was collected in accordance with the EPA procedures and the data has been validated. I think there's a good deal of confidence that the field work and laboratory work done on your property is good.