PJB

REPORT

# *Feasibility Study Bern Metal/Universal Sites Buffalo, New York*

Technical Committee
Participating Potentially Responsible Parties

March 1996

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

BBL
BLASLAND, BOUCK & LEE, INC.
*engineers & scientists*



*Transmitted Via U.S. Mail*

March 21, 1996

Mr. Vivek Nattanmai, Project Manager
Hazardous Waste Remediation
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-7010

Re: Feasibility Study Report
Bern Metal/Universal Sites
Buffalo, New York
NYSDEC Site Code #915135
Project #: 0778-0778.01 #2

Dear Mr. Nattanmai:

Please find enclosed six copies of the Feasibility Study (FS) Report for the Bern Metal/Universal Sites, Buffalo, New York dated March 1996, prepared by Blasland, Bouck & Lee, Inc. (BBL) on behalf of the Bern Metal/Universal Sites Potentially Responsible Parties Group (PRP Group). This FS Report fulfills the feasibility study requirements, as specified in Paragraph 6 (III)(B) of the Order on Consent, Index No. B9-0371-91-05, dated February 1, 1994.

If you have any questions or comments, please do not hesitate to contact me at (716) 292-6740.

Very truly yours,

BLASLAND, BOUCK & LEE, INC.

Thomas P. Hasek
Project Manager

TPH/brd
u:\brd\84961457.a
Enclosures

cc: NYSDEC, Engineer, Regional Hazardous Waste Remediation, Region 9
NYSDOH, Director, Bureau of Environmental Exposure Investigation
NYSDEC, Director, Division of Hazardous Waste Remediation
NYSDEC, Division of Environmental Enforcement
Mr. Kevin Matheis, USEPA
Bern Metal/Universal Sites PRP Technical Committee
Mr. William B. Popham, Blasland, Bouck & Lee, Inc.

30 Corporate Woods • Suite 160 • Rochester, NY 14623-1477 • Tel (716) 292-6740 • Fax (716) 292-6715 • Offices Nationwide

# Report

# *Feasibility Study*
# *Bern Metal/Universal Sites*
# *Buffalo, New York*

Technical Committee
Participating Potentially Responsible Parties

March 1996

**BLASLAND, BOUCK & LEE**
*ENGINEERS & SCIENTISTS*

30 Corporate Woods
Suite 160
Rochester, New York 14623
(716) 292-6740

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# SECTION 1

# 1.0 Introduction

## 1.1 Purpose

This Feasibility Study (FS) report presents the remedy selection process for the remedial alternative to be implemented at the Bern Metal and Universal Sites, collectively identified as a single site by the New York State Department of Environmental Conservation (NYSDEC), and hereinafter, referred to as the "site," located at 22 Bender Street and 993 Clinton Street, respectively, in the City of Buffalo, Erie County, New York. The PRP Group, by reporting on conditions relating to the site, do not waive any of the arguments regarding the legal status of either the Bern Metal or Universal sites. The FS was prepared in accordance with the Order on Consent (Index # B9-0371-91-05, February 1, 1994) entered into between the Bern Metal/Universal Sites Potentially Responsible Party Group (PRP Group) and the NYSDEC. At the request of the Bern Metal/Universal Sites PRP Group, Blasland, Bouck & Lee Engineers, Inc. (BBL) performed the FS activities in accordance with the NYSDEC-approved Remedial Investigation/Feasibility Study RI/FS Work Plan (ERM-Northeast, Inc., October 1993).

The objectives of this report are to:

- Identify site-specific goals for the remedial action:
- Identify and screen technology types and process options for use in developing remedial alternatives;
- Identify disposal requirements for residuals or untreated site-related constituents of concern;
- Develop alternate methods by which the site-specific goals may be reached; and
- Select the alternative best suited to reach these site-specific goals.

The FS was conducted in accordance with the elements required of a FS as set forth in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 U.S.C. 960 et seq.; the National Contingency Plan (NCP); and the United States Environmental Protection Agency (USEPA) guidance document entitled, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," dated October 1988.

## 1.2 Site Background

BBL conducted a RI at the Site to gather sufficient information to support an informed risk management decision regarding identification and evaluation of remedial alternatives. Pertinent data from the RI include a site description and history, definition of the nature and extent of the potential impacts of the chemical constituents of concern, and a baseline health risk assessment. The findings from the RI are summarized below.

### 1.2.1 Site Description

The site, located approximately 1-1/2 miles east of Lake Erie and one mile north of the Buffalo River, occupies an area of approximately 5.2 acres in a mixed industrial and residential neighborhood (Figure 1-1). The site is bordered on the south and west by railroad lines and a perimeter drainage ditch located on the adjacent Conrail property. The perimeter drainage ditch is situated between the railroad lines and the site property boundary. The site is also bordered on the east by the Laub warehouse, and on the north by commercial/industrial properties and ten residences.

The Bern Metal property lies at the terminus of Bender Avenue and occupies an area of approximately 3.7 acres (Figure 1-2). Two single-story concrete block buildings (an office and a warehouse) stand on the Bern Metal property, which is covered by limited grassy vegetation across areas of exposed soil and gravel, with mounded soil and debris piles near the eastern property line. A partial asphalt cap is also present at the northern end of the properties. The Universal Metals (Universal) property lies immediately west of Bender Avenue and occupies 1.5 acres. A single-story concrete block building is present on the Universal property, which is characterized by numerous scattered debris piles and grassy vegetation interspersed with exposed areas of gravel and soil. The entire site is surrounded by fencing consisting of 8-foot chain-link fence with three-strand barbed wire, and a 10-foot wooden stockade fence where the site borders the residential properties.

### 1.2.2 Site History

The general site area within the City of Buffalo has historically been used for various industrial purposes. A review of historical aerial photographs from 1938 to the present indicated that scrap metal recycling operations were conducted at the site as early as 1938. The scrap metal recycling operations continued at the site until 1988, most recently by the Universal Metals Company and the Bern Metal Company.

Based upon the USEPA report, "Soil Sampling - Bern Metal, Buffalo, New York" (October 1990), the facility operations conducted at the Bern Metal property (from 1967 to 1983) included the purchase of and sale of various scrap metal, predominantly lead-acid batteries. A component of the Bern Metal operations involved the recovery of lead cores from lead-acid batteries by forcibly opening the battery casings on the premises. Lead-acid sludge from the batteries was released to the ground, and the lead-contaminated battery casings were crushed and randomly discarded throughout the property. The facility was also used for the storage of lead and copper sulfate in drums, presumably for sale to secondary smelters. A small incinerator was used to recover various metals from insulated wires and circuit boards. The non-incinerated residual wastes were discarded across the site.

As referenced in the USEPA report, "Soil Sampling and Analysis - Universal Metals Site, Buffalo, New York" (September 1991), the Universal property is a former scrap metal reprocessing and recycling facility that operated from 1963 to 1988. The Universal Metals Company bought and sold scrap metal, including aluminum, brass, copper, lead, nickel, and tin. An inspection conducted by the NYSDEC in July 1990 revealed the presence of scrap metal piles, leaking electrical transformers, discarded automobiles, and an underground storage tank. The property is no longer an active recycling facility, but is currently used for the storage of automobiles.

### 1.2.3 Previous Investigations

In March 1987, the NYSDEC investigated the Bern Metal property in response to complaints received by the Erie County Department of Environment and Planning. During the investigation, the NYSDEC collected and analyzed soil samples; analytical results indicated the presence of lead, copper, chromium, cadmium, nickel, antimony, and arsenic in site soils. Based upon the findings of the investigation, the NYSDEC requested that the USEPA conduct additional investigation activities on the property and erect fencing around the perimeter of the property to prevent access to the site.

The USEPA's subsequent investigation included the analysis of:

- Soil samples for the Priority Pollutant List (PPL) metals, polychlorinated biphenyls (PCBs), and base-neutral acid extractables (BNAs);
- Surface-water samples for PPL metals, PCBs, and volatile organic compounds (VOCs); and
- An oil sample for PCBs.

The PPL metals analyses, performed using Atomic Absorption (AA) methods, detected chromium (5,500 milligram per kilogram [mg/kg]), copper (59,000 mg/kg), lead (580,000 mg/kg), and mercury in the highest concentrations among the 14 analytes. Additional site characterization was performed by the USEPA using an x-ray fluorescence (XRF) analyzer to further define the extent of contamination on the property. Based on the low relative percent difference (RPD) between the AA data and XRF data (indicating high correlation) for lead, its property-wide distribution, and its range of concentrations in on-site surface and subsurface soils, the USEPA used lead to represent the overall metals contamination present at the Bern Metal property.

The highest concentration of lead was detected in a surface soil sample collected immediately south and east of the Bern Metal warehouse. Although several metals (i.e., chromium, copper, mercury, and zinc) were detected randomly across the property, none were as continuous in their distribution across the property as lead. The PCB analysis of an oil sample collected from a container located adjacent to an electrical transformer in the northeastern corner of the Bern Metal warehouse indicated the presence of Aroclor-1254 at a concentration of 18,000 micrograms per kilogram (ug/kg). The transformer and container were removed prior to BBL's involvement with the project. No additional information was available regarding their ultimate disposition. PCBs were not detected in the soil or surface-water samples collected during the USEPA investigation.

Based upon the concentrations of metals detected in the surface and subsurface soil at the Bern Metal property, the USEPA initiated an emergency removal action in 1992 to remove on-site soil containing lead in concentrations greater than 10,000 mg/kg. Lead was used as the reference metal to perform the removal action based on the USEPA's ability to plot extent-of-contamination maps for the Bern Metal property. The USEPA excavated surface and subsurface soil for disposal, then regraded the property upon conclusion of the removal action. Soil removed during the removal action was transported to Chemical Waste Management's Model City facility for disposal. During the USEPA removal action, drummed waste and oil were also removed from the Bern Metal property for off-site disposal.

At the request of the NYSDEC, the USEPA performed an extent-of-contamination study at the Universal property in April 1991. The USEPA's investigation focused on sampling and analysis of surface and subsurface soil for chromium, copper, iron, lead, and zinc as the chemical constituents of concern, as well as sampling and analysis of surface and subsurface soils for BNAs and PCBs. The sampling results consistently identified lead in the highest concentrations in surface and subsurface soils, when compared to the results for the other four metals. Additional samples were collected from soil within the debris piles and analyzed for the Toxicity Characteristics Leaching Procedure (TCLP) metals. The results of these analyses indicated that lead concentrations in soils exceeded the USEPA regulatory limit for the toxicity characteristics, indicating the presence of a characteristic hazardous waste as defined in 40CFR 261.24. As a result of these data, during the USEPA removal action at the Bern Metal property, approximately 4,200 cubic yards of soil and waste contaminated with lead were removed from the Bern Metal site (as reported by the NYSDEC in their correspondence to BBL, dated September 5, 1995).

As part of the Universal property investigation, the USEPA also collected eight off-site soil samples for lead analysis to determine background concentrations. The USEPA concluded that the background lead concentrations in the general area of the site range from 448 mg/kg to 1,410 mg/kg.

From October 1992 through June 1993, a removal action was conducted on the residential properties immediately adjacent to the Bern site. The Clinton/Bender removal action was performed under a Unilateral Order issued by the USEPA to the Clinton/Bender PRP Group. This removal action was required based upon review of soil data collected from the residential properties during the USEPA investigation of the Universal property. The requirements of the Unilateral Order specified the removal of lead-impacted soil from the residential properties, based on the lead concentration at a given depth. Specifically, soils exceeding a lead concentration of 500 mg/kg up to a depth of 2 feet were removed for off-site disposal, and soils exceeding a lead concentration of 1,000 mg/kg from a depth of 2 to 4 feet were removed for off-site disposal. The "Removal Action Final Report for the Clinton/Bender Site, Buffalo, New York" (BB&L, July 1994) documents the activities conducted during the removal action.

## 1.3 Nature and Extent of Chemical Constituents of Concern

This section presents a summary of the environmental data collected during the RI. Sampling locations are shown in Figure 1-3 for relevant areas of the site. The specific nature and extent of the chemical constituents of concern in impacted media (i.e., soil , groundwater, surface water, and building materials) are discussed in the following subsections.

### 1.3.1 Surface Soil

#### 1.3.1.1 Background Soil Analytical Results

Samples BG-1 and BG-2 were initially collected at a depth of 0 to 6 inches below ground surface from the surrounding Conrail and adjacent Laub properties, respectively. During analysis of samples BG-1 and BG-2, 21 and 22 semivolatile organic compounds (SVOCs) were detected, respectively. The SVOCs detected in each sample were the same, except for 4-nitroaniline detected in sample BG-2. Six of the 21 SVOCs in common, benzo (a) anthracene, benzo (b) fluoranthene, benzo (k) fluoranthene, benzo (a) pyrene, chrysene, and dibenz (a,h) anthracene, were detected at levels above soil cleanup objectives presented in the NYSDEC Division of Hazardous Waste Remediation, Revised Technical and Administrative Guidance Memorandum (TAGM) No. 4046:

Determination of Soil Cleanup Objectives and Cleanup Levels (January 24, 1994). Lead concentrations for samples BG-1 (Conrail property) and BG-2 (Laub property) were detected at 2,530 mg/kg and 2,670 mg/kg, respectively. As a result of the lead concentrations detected at the Laub site (i.e., BG-2), BBL is currently conducting further evaluation of the Laub property in an attempt to determine if past Laub operations contributed to the elevated lead levels.

Two VOCs, toluene and xylene, were reported at estimated concentrations of 13 ug/kg in sample BG-1, and one VOC, 2-butanone, was reported at an estimated concentration of 14 ug/kg in sample BG-2. The three VOCs were detected below the NYSDEC TAGM No. 4046 soil cleanup objectives.

Concentrations of the seven pesticide compounds detected in sample BG-1, and the four compounds detected in sample BG-2 were reported below the NYSDEC TAGM No. 4046 soil cleanup objectives. Aroclor-1260 was detected in background samples BG-1 and BG-2 at concentrations of 210 ug/kg and 300 ug/kg, respectively, which are below the NYSDEC TAGM No. 4046 soil cleanup objectives.

To address comments from the NYSDEC regarding the possible biasing of these background soil samples, two additional background soil samples (BG-3 and BG-4) collected during the supplemental RI were analyzed for total lead to determine background concentrations in the area. These latter two background sampling locations were approved by the NYSDEC as representative of background concentrations in the area, since they were located upwind of the site in areas determined to be unaffected by activities conducted at the site, and were minimally affected by vehicle exhaust emissions. The lead concentrations for these background samples (including a duplicate) were reported at 262 mg/kg, 270 mg/kg, and 633 mg/kg, respectively. These lead concentrations are in the same range (448 mg/kg to 1,410 mg/kg) reported by the USEPA during the USEPA removal action at the Bern Metal property.

### 1.3.1.2 On-Site Soil Analytical Results

During the RI, a total of 31 surface soil samples were collected from the site for total lead analysis, and three soil samples were collected from the Bern Metal property for asbestos analysis. The total lead concentrations reported for the 23 soil samples collected on the Universal property ranged from 102 mg/kg (soil boring U-5) to 27,000 mg/kg (soil boring U-7). On the Bern Metal property, total lead concentrations ranged from 88.8 mg/kg to 49,500 mg/kg. As presented in the RI, 27 of the 31 surface soil samples contained lead in concentrations greater than 1,000 mg/kg. The distribution of the lead concentrations appears to be random, based on past operations performed at the Bern Metal property and the activities associated with the removal action. Asbestos was not detected above the instrument detection limit.

### 1.3.1.3 Off-Site Soil Analytical Results

A total of 25 off-site surface soil samples were collected during the RI from the Laub and Conrail properties, located immediately east and south of the Bern Metal property. Ten soil samples were collected immediately adjacent to the Bern Metal property during the initial RI, and 15 soil samples were collected during the supplemental sampling activities from the southern side of the Conrail tracks (south of the Bern Metal property). In addition, twenty-eight soil samples (including two duplicates) were collected from the portion of the Laub property adjacent to the southern corner of the site.

Total lead concentrations in the off-site samples collected immediately adjacent to the Bern Metal property ranged from 1,360 mg/kg to 82,600 mg/kg. Total lead concentrations in the samples collected from the Conrail property ranged from 56.8 mg/kg to 7,670 mg/kg. Total lead concentrations in the samples collected from the Laub property ranged from 35.2 mg/kg to 1,840 mg/kg. In general, the concentration of lead in the off-site surface soil tended to decrease with distance from (south of) the Bern Metal property.

Based on the elevated lead concentrations detected during the RI surface soil sampling, an Interim Remedial Measure (IRM) was implemented at the southern end of the Bern Metal property. The IRM involved the relocation of approximately 290 feet of perimeter fence to enclose the area.

#### 1.3.1.4 Sub-Floor Analytical Results

Soil samples were obtained at three locations from immediately beneath wooden flooring in the Bern Metal warehouse and analyzed for total lead. The lead concentrations detected in these samples, 36,600 mg/kg, 3,900 mg/kg, and 1,310 mg/kg, indicate that sub-floor soil has been impacted by past operations at the Bern Metal warehouse.

### 1.3.2 Sub-Surface Soil

To supplement the subsurface metals ( lead) distribution study conducted by the USEPA, and to assess the effectiveness of the USEPA removal action, 40 subsurface soil samples were collected from soil borings on the site and submitted for total lead analysis. Lead concentrations in subsurface soil samples on the Universal property ranged from 45.3 mg/kg (collected from a top-of-clay sample) to 10,800 mg/kg (collected at the one-foot depth). On the Bern Metal property, lead concentrations in the subsurface soil ranged from 35.7 mg/kg (at the one foot depth) to 196,000 mg/kg (at the 2-foot depth). This wide variance in reported lead concentrations is due to past activities at the Bern Metal property, which included the scattering of waste materials across the property, creating the heterogeneous character of the fill, as well as the activities associated with the removal action conducted by the USEPA.

In soil samples collected at a depth of one foot at the site, lead concentrations ranged from 35.7 mg/kg to 55,200 mg/kg, which was detected in the general area where lead-bearing acid sludge was released to the ground surface by the Bern Metal Company. Lead concentrations in subsurface soil samples collected from the fill material situated immediately above the top of the lacustrine clay layer ranged from 45.3 mg/kg to 4,650 mg/kg. Of the 14 top-of-clay samples collected, lead concentrations were below 1,000 mg/kg in 11 of the samples. In general, the subsurface soil data indicate that lead concentrations decrease with depth. Figure 1-4 presents the horizontal and vertical distribution of lead in on- and off-site soils (Conrail property). Figure 1-5 presents the horizontal and vertical distribution of lead in the Laub property.

In accordance with the RI/FS Work Plan, nine subsurface soil samples were collected from six borings and analyzed for Target Compound List/Target Analyte List (TCL/TAL) parameters. Two duplicate samples were also collected from these locations. An additional soil boring was installed on the Bern Metal property at location BB-4 to collect a sample of fill from a depth of 5 feet for TAL metals analysis, based upon visual observation during field drilling.

Six VOCs were detected in four of the six soil borings in concentrations below the NYSDEC TAGM No. 4046 soil cleanup objectives. 2-Butanone was the most frequently detected VOC, identified in four soil samples in concentrations ranging from 7 ug/kg to 12 ug/kg. Acetone was detected in three soil samples in concentrations ranging from 39 ug/kg to 83 ug/kg. The remaining VOCs (carbon disulfide, methylene chloride, toluene, and total xylenes) were detected randomly in one or two soil samples. Based on review of the analytical results, VOCs do not appear to have significantly impacted subsurface soil quality.

A total of 32 SVOCs were detected in the nine subsurface soil samples; seven of the SVOCs were detected in all of the soil samples. The seven SVOCs detected in each sample included:

- Benzo (a) anthracene (220 ug/kg to 19,000 ug/kg);
- Benzo (b) fluoranthene (310 ug/kg to 18,000 ug/kg);
- Benzo (a) pyrene (230 ug/kg to 13,000 ug/kg);
- Chrysene (230 ug/kg to 15,000 ug/kg);
- Fluoranthene (570 ug/kg to 23,000 ug/kg);
- Phenanthrene (360 ug/kg to 31,000 ug/kg); and
- Pyrene (410 ug/kg to 33,000 ug/kg).

Of the 32 SVOCs, 12 were detected at levels above NYSDEC TAGM No. 4046 soil cleanup objectives. The SVOCs exceeding the NYSDEC TAGM No. 4046 soil cleanup objectives and the frequency of exceedance include:

- Benzo (a) anthracene (10);
- Benzo (b) fluoranthene (8);
- Benzo (k) fluoranthene (6);
- Benzo (a) pyrene (11);
- Chrysene (9);
- 4-chloroaniline (1);
- Dibenz (a,h) anthracene (6);
- Hexachlorobenzene (2);
- Indeno (1,2,3-cd) pyrene (2);
- 4-nitrophenol (4);
- Pentachlorophenol (2); and
- Phenol (1).

Subsurface soil samples were collected from five locations on the Universal property and analyzed for the full TCLP parameters list. The TCLP parameters detected were barium, cadmium, lead, mercury, selenium, and silver. Of the six metals detected, only lead was reported above its regulatory limit of 5 milligrams per liter (mg/L) for determination of hazardous waste characteristics. Subsurface soil samples from three locations contained had TCLP lead concentrations of 5.90 mg/L, 142 mg/L, and 54.6 mg/L, respectively, signifying the presence of a characteristic hazardous waste.

### 1.3.3 Groundwater

Groundwater samples were analyzed for TCL/TAL parameters during the initial RI, and for total lead during the supplemental RI. Five groundwater monitoring wells (MW-1 through MW-5) were sampled for the TCL/TAL parameters. Monitoring wells MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, and MW-8 were subsequently sampled for lead.

The analysis of the groundwater samples indicated that the only VOCs detected, benzene and vinyl chloride, were detected in the groundwater sample collected from monitoring well MW-4 in concentrations of 9.0 ug/L and 2.0 ug/L, respectively. The concentration reported for benzene was above the USEPA-established Maximum Contaminant Level (MCL) and the NYSDEC Ambient Water Quality Standard or Guidance Values (AWQSGV) (October 1993) of 5 ug/L and 0.7 ug/L, respectively, while vinyl chloride was detected below its guidance values.

Two SVOCs, bis (2-ethylhexyl) phthalate and 4-chloroaniline, were detected in the groundwater samples collected from the five monitoring wells in concentrations ranging from 1.0 ug/L to 10.0 ug/L. Also, diethylphthalate was detected in the groundwater sample collected from monitoring well MW-2 in a concentration of 1.0 ug/L. The concentrations reported for these compounds were below the USEPA MCLs and the AWQSGVs.

Four pesticide compounds (alpha-BHC; beta-BHC; delta-BHC; and 4,4'-DDE) were detected in groundwater samples collected from monitoring wells MW-1, MW-3, and MW-4. Alpha-BHC and 4-4'-DDE were detected in the three monitoring wells in concentrations of 0.046 ug/L, 0.075 ug/L, and 0.1 ug/L, respectively. Beta-BHC was detected in a concentration of 0.083 ug/L in MW-4, and delta-BHC was detected in a concentration of 0.05 ug/L in MW-2 and MW-5. Due to insufficient recharge during sample collection, groundwater samples from monitoring wells MW-1 and MW-3 were not analyzed for pesticides.

In only one of the groundwater samples collected, the sample from monitoring well MW-2, the PCB compound Aroclor-1260 was detected in a concentration of 1.9 ug/L, which is above the USEPA MCL of 0.5 ug/L and the AWQSGV of 0.1 ug/L.

The inorganic groundwater quality data collected during the initial RI indicate that 10 metals were detected in concentrations exceeding the USEPA MCLs or the AWQSGVs. Four of the metals (antimony, cadmium, copper, and mercury) were detected at elevated levels at only one location, monitoring well MW-3. The highest reported concentrations of other metals (lead, magnesium, manganese, and zinc) were in groundwater samples collected from monitoring well MW-3.

Based upon review of the initial RI groundwater quality data, the NYSDEC recommended that additional monitoring wells be installed to more fully characterize the extent of lead-impacted groundwater at the site. Consequently, the supplemental RI groundwater samples were collected from the seven on-site monitoring wells and analyzed for total lead. The lead data from this sampling event showed lead concentrations in groundwater ranging from 0.70 ug/L ( MW-1 and MW-7) to 291 ug/L (MW-3). The lead concentrations in groundwater exceeded the MCL and AWQSGV at monitoring wells MW-3 (291 ug/L), MW-2 (77.6 ug/L), and MW-8 (25.2 ug/L and 72.2 ug/L [duplicate]). Comparing the initial RI and supplemental RI data, the concentrations of lead in groundwater decreased at monitoring wells MW-3 and MW-2 from 2,770 to 291 ug/L, and from 222 to 77.6 ug/L, respectively. Groundwater quality results are presented in Figure 1-5.

These data indicate that elevated levels of lead in groundwater exist in the area of monitoring well MW-3 (291 ug/L and 2,770 ug/L) and MW-2 (77.6 ug/L and 222 ug/L). Lead was detected at 25.2 ug/L (72.2 ug/L in the duplicate sample) in the groundwater sample collected from MW-8, which is located in the downgradient portion of the site.

### 1.3.4 Soil/Sediments

As required in the RI/FS Work Plan, 24 soil/sediment samples were collected from 12 sampling locations in the adjacent Conrail perimeter drainage ditch, located immediately to the west and south of the site. The soil/sediment samples were collected from material immediately beneath the stone lining the ditch and from a depth of one foot below the stone lining. The lead concentrations ranged from 78.8 mg/kg to 1,530 mg/kg in samples collected from the 0- to 6-inch depth interval below the stone fill, and from 41.1 mg/kg to 341 mg/kg in the samples collected from a depth of one foot below the stone fill.

### 1.3.5 Building Surfaces

Wipe samples were collected from 15 locations on the interior vertical walls of the Bern Metal warehouse building and analyzed for lead. The wipe sample analytical results ranged from 1.76 micrograms per square centimeter ($ug/cm^2$) to 101 $ug/cm^2$.

## 1.4 Exposure Assessment

As part of the RI, an exposure assessment (EA) was performed to evaluate the existing and potential human health risks posed by the site-related chemical constituents of concern identified in the soil and groundwater at the site. Evaluation of these risks was made based upon existing and reasonably foreseeable conditions at the site in the absence of any future remedial measures. The complete results of the EA are presented in the RI Report and are summarized below.

Based upon the available site-specific analytical data obtained during the RI, lead was selected as the metal of concern at the site for performance of the EA. There are no reference toxicity values for lead that would lead to development of a quantifiable risk due to lead exposure. Potential human exposures were identified based upon current site-use patterns, the physical/chemical characteristics of the site, and lead concentrations in soil, as compared with available risk-based cleanup objectives. Estimated lead concentrations in air were compared with the National Ambient Air Quality Standard (NAAQS) and available industrial hygiene criteria for lead.

The exposure pathways identified for the site include the following current scenarios:

- Oral, dermal, and inhalation exposure to on-site surface soils by trespassers; and
- Inhalation exposure to fugitive dust by off-site residents.

In addition, the following hypothetical future exposure pathway was identified:

- Oral, dermal, and inhalation exposure to on-site surface soils by construction workers.

The Conrail property located south of the site included the following current exposure pathway:

- Oral, dermal, and inhalation exposure to Conrail surface soil by trespassers and Conrail employees.

Exposure concentrations at the site were determined for the current exposure pathways described above. The exposure concentrations were compared to USEPA-derived soil cleanup levels and various air quality standards to determine which routes of exposure represent the greatest risk. The 95% confidence limit (CL) concentrations for on-site surface and subsurface lead concentrations were estimated to be 14,945 mg/kg and 7,368 mg/kg, respectively. On the Conrail property, the 95% CL concentrations were estimated to be 2,014 mg/kg. The range of recommended soil cleanup levels derived by USEPA is 500 mg/kg to 1,000 mg/kg, which is based upon a childhood exposure to lead via oral, dermal, and inhalation routes in a residential scenario (OSWER Directive #9355.4-02, September 7, 1989). Quantification of the exposures occurring on site due to the intermittent nature of those potentially affected (e.g., trespassers, Conrail employees) was not considered feasible. These recommended levels therefore represent a conservative estimate for the non-residential exposures associated with this site.

The estimated average air concentration for lead released to air from soil is was estimated to be 0.022 micrograms per cubic meter (ug/m$^3$) and 0.0030 ug/m$^3$ for the site and Conrail property, respectively. The NAAQS air quality standard for lead is 1.5 ug/m$^3$.

## 1.5 Interim Remedial Measures

Several IRMs, as defined in 6NYCRR 375-1.3(n), have been implemented at the site to address site conditions. The IRM activities are discussed in more detail in the RI Report. The following IRM activities have been implemented at the site and adjacent properties:

- An emergency removal action conducted by the USEPA in 1992 to remove significant contamination in soil and waste at the site;
- A removal action conducted in 1992 through 1993 by the Clinton/Bender PRP Group to remove contaminated soils from the adjacent Clinton/Bender properties;
- Installation, repair, and relocation of perimeter fencing around the Bern Metal property by

the Clinton/Bender PRP Group in 1993 to fully enclose the property;

- A removal action conducted in 1994 by the PRP Group to remove contaminated soil from a Bender Avenue curb strip; and
- Installation of additional perimeter fencing at the southern portion of the Bern property to address contaminants found outside the original fenceline during the RI.

## 1.6 Report Organization

The remainder of this report is organized as follows:

Section 2 - Identification of General Response Actions: This section identifies Applicable or Relevant and Appropriate Regulations (ARARs) and New York State Standards, Criteria, and Guidelines (SCGs), from which remedial action objectives (RAOs) are identified. General response actions to satisfy the identified RAOs are also presented for each medium of interest. The extent of remediation for the site is then established.

Section 3 - Identification of Technology Types and Process Options: In this section, potential applicable remedial technology types and processes are identified and briefly described.

Section 4 - Screening of Technology Types and Process Options: Section 4 presents the preliminary screening of technology types and process options. This screening eliminates technologies and process options that are not practicable and/or technically feasible and, when possible, allows for the selection of a single process representative of each remaining technology. Technologies considered practicable and/or feasible are combined into remedial alternatives (based upon their effectiveness and implementability) for further examination in the FS regarding their ability to achieve the RAOs for the site.

Section 5 - Detailed Evaluation of Alternatives and Selection of a Remedy: In this section, the remedial alternatives are subjected to a detailed analysis against the Superfund evaluation criteria and compared against each other, using the matrix scoring system presented in NYSDEC Revised TAGM No. 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites. An alternative is selected, and justification for the selection is presented.

Section 6 - Conceptual Design for Preferred Alternative: Section 6 presents a conceptual design and preliminary cost estimate for implementation of the preferred alternative. Also included is a list of additional studies required prior to or during the design phase of the Remedial Action.

# SECTION 2

# 2.0 Identification of General Response Actions

## 2.1 Remedial Action Objectives

RAOs are based upon media-specific and general requirements. The media-specific RAOs for the site are focused upon addressing potential health risks associated with the presence of metals-impacted media at the site, which in this case include soil, debris (battery casings, slag, metal scrap, etc.), groundwater, sediments, and on-site structures. For the purposes of this study, the soil, debris, and sediments located in the perimeter drainage ditches located along the southern and western edges of the site will be considered the same medium, and will be referred to as "soils".

The following RAOs have been established for the site:

- Limit human contact with the metals-impacted soil above risk-based levels;
- Limit the contribution of metals from soil to the groundwater;
- Prevent on-site human contact with metals-impacted groundwater;
- Minimize off-site migration of metals-impacted groundwater;
- Limit off-site migration of metals-impacted soils and surface water via stormwater runoff; and
- Minimize human contact with lead-impacted building structures.

## 2.2 General Response Actions

General response actions are medium-specific actions that must be taken to satisfy the RAOs for the site. These actions are categorical approaches to remediation that comprise various technologies and process options. The following general response actions have been identified for each of the metals-impacted media at the site:

<u>SOIL</u>

- No Action;
- Institutional Action;
- Capping;
- Excavation and Off-Site Disposal;

- Excavation and On-Site Treatment; and
- In-Situ Treatment.

Groundwater

- No Action;
- Institutional Action;
- Vertical Barriers;
- Capping;
- Groundwater Collection; and
- Groundwater Treatment.

ON-SITE STRUCTURES

- No Action;
- Institutional Action;
- Decontamination;
- Surface Coating;
- Demolition;
- On-Site Treatment; and
- Off-Site Treatment/Disposal.

Applicable remedial technologies and process options for each of the general response actions are identified and screened in Sections 3 and 4 of this document.

## 2.3 Extent of Remediation

The extent of remediation necessary is determined by the extent of contamination present at the site, the risk, if any, posed by that contamination, and the RAOs identified for the site. For this site, inorganics are the primary site-specific constituents of concern, with lead being the most prevalent. In areas where other metals and compounds were detected, lead was also generally found in concentrations exceeding the media-specific cleanup criteria. The site media to be addressed include soil, debris, groundwater, and interior building surfaces. Essentially, the entire site exhibits elevated concentrations of lead and other metals.

### 2.3.1 Soil

Analysis of soils across the site has indicated elevated concentrations of lead in the surface soil at depths from 0 to 2 feet. Lead has been detected in concentrations ranging from 102 mg/kg to 82,600 mg/kg in surface soils extending over essentially the entire site. Lead concentrations in the subsurface soils generally decrease with depth, but have been detected in exceedance of 1,000 mg/kg at depths of up to 7 feet below grade.

### 2.3.2 Groundwater

Impacts to groundwater have been identified in the shallow water table, primarily in monitoring wells MW-2, MW-3, and MW-8, as discussed in Section 1.3.3.

### 2.3.3 On-Site Structures

Wipe samples collected from areas of visible staining or discoloration on the interior walls of the Bern Metal warehouse building exhibited the presence of lead as discussed in Section 1.3.5.

## 2.4 Standards, Criteria, and Guidelines

Potential Standards, Criteria, and Guidelines (SCGs) for the site were identified from the NYSDEC index of SCGs (July 28, 1995). SCGs are divided into the following categories:

- **Chemical-Specific Requirements**: Health- or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or chemicals. These limits may take the form of cleanup levels, discharge levels, and/or maximum intake levels (such as for drinking water for humans);

- **Location-Specific Requirements:** Restrictions on remedial activities that are based on the characteristics of a site or its immediate surroundings. An example would be restrictions on wetlands development; and

- **Action-Specific Requirements:** Controls or restrictions on particular types of remedial activities in a related area, such as hazardous waste management or wastewater treatment.

### 2.4.1 Chemical-Specific Requirements

The state and federal governments have not published chemical standards that apply to soil, but they have promulgated the use of specific tests to determine if the soil is to be characterized as a hazardous waste. For purposes of disposal, the Toxicity Characteristics Leaching Procedure (TCLP) test is used to determine characteristically hazardous waste. The USEPA maximum TCLP concentration level for lead is 5 mg/L.

The USEPA has promulgated soil cleanup guidance values for total lead in the Office of Solid Waste and Emergency Response (OSWER) Directive #9355.4-02, "Interim Guidance Establishing Soil Lead Cleanup Levels at Superfund Sites", September 7, 1989. This Directive states that a cleanup level of 500 mg/kg to 1,000 mg/kg in soil is considered protective of direct contact exposures for residential settings, which represent the most conservative exposure scenarios. This directive is based upon guidance for residential areas, and although it was not designed for industrial settings, it is still considered applicable and relevant for this site.

In addition, the NYSDEC has published guidance values for soil cleanup (NYSDEC TAGM No. 4046, "Determination of Soil Cleanup Objectives and Cleanup Levels", January 24, 1994). These cleanup levels are based upon the following:

(1) Human-health-based levels that correspond to excess lifetime cancer risks of one in one million for Class A and Class B carcinogens, or one in 100,000 for Class C carcinogens (Class A are

proven human carcinogens, Class B are probable human carcinogens, and Class C are possible human carcinogens);

(2) Human-health-based levels for systemic toxicants, calculated from Reference Doses (RfDs). RfDs are estimates of the daily exposure an individual (including sensitive individuals) can experience without appreciable risk of health effects during a lifetime;

(3) Environmental concentrations that are protective of groundwater/drinking-water quality, based on promulgated or proposed New York State standards;

(4) Background values for site-related chemical constituents of concern; and

(5) Detection limits.

The most stringent of (1), (2), and (3) are used for organic chemicals, and the most stringent of (1), (2), and (4) are used for heavy metals. These recommended guidance values will be applied to all soils, other than those beneath the building or supporting the building, which will be isolated from the groundwater to the extent practicable. For this site, lead has been found to be the most prevalent contaminant, with the highest number of occurrences and detected concentrations. It will therefore be used as the basis for identifying chemical-specific SCGs for soil for this site. For lead, the NYSDEC recommended soil cleanup level is site background.

It should be noted that the USEPA is currently developing a risk-based model for establishing lead-based cleanup levels, entitled "Cleanup Levels Generic Methodology". This model will incorporate the adult exposure pathway, exposures to trespassers, more realistic ingestion rates, and future uses of the site. Use of this model on a USEPA site in Leadville, Colorado has resulted in higher cleanup levels than would be established by current methodology. It is anticipated that guidance on this model will be forthcoming from the USEPA in the spring of 1996 (Conversation with USEPA On-Scene Coordinator, September, 1995). Although this model has not been adopted by USEPA, it is anticipated that it may soon be adopted by USEPA in the form of an Office of Solid Waste and Emergency Response (OSWER) Directive or Guidance, and would, therefore, be considered a potentially applicable or relevant requirement.

Ambient Water Quality Standards and Guidance Values (AWQSGVs) are based on the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1, *Ambient Water Quality Standards and Guidance Values,* dated November 15, 1991 (which includes the updated 6 NYCRR Part 703.5, Table 1, effective September 1, 1991). These standards are based upon the utilization of the groundwater as a source of drinking water. For lead, the groundwater standard is 25 ug/L.

A National Ambient Air Quality Standard (NAAQS) of 1.5 ug/m$^3$ has been promulgated for lead (40 CFR 50.12) as both a primary and secondary standard, considered protective of health and public welfare, respectively. The lead standard is based upon a three-month average. New York State has not promulgated an ambient air quality standard for lead at this time.

### 2.4.2 Location-Specific Requirements

The results of the Fish and Wildlife Impact Analysis (FWIA) conducted by BBL indicate that the site and the perimeter drainageway are not considered a regulated wetland or in the buffer area of any regulated wetlands. Three regulated wetlands (BU-1, BU-7, and BU-15) were identified within 2 miles of the site. They are identified in Figure 2-1. However, based upon their location and distance from the site, there is no potential for surface waters from the site to be transported to any downstream wetland areas, since the drainageway configuration provides hydrologic barriers to surface water flow.

As part of the FWIA, a review of Natural Heritage Program information files was conducted to identify threatened/endangered species and critical habitats within a 2-mile radius of the site. This review identified two plant species with historic occurrences and S1 ratings within a 2- mile radius of the site. The S1 rating indicates that there are five or fewer historic occurrences throughout the state. State Managed Area C is also within the 2-mile radius and closely approximates the location of the above-listed wetlands. Based upon the available information, the site does not contain or potentially affect any known or significant habitats or threatened or endangered species.

The City of Buffalo Surveying Department has confirmed that the site is outside the 100-year flood plain. The site is currently zoned as a M2 (industrial) District, which is a heavy industrial zone. According to the City of Buffalo Public Works Department, there are no identified restrictions associated with this zoning that may impact any remedial actions. A demolition permit would be required by the City of Buffalo prior to commencing any on-site facilities demolition activities.

These requirements may be considered ARARs in the selection of a remedial alternative.

### 2.4.3 Action-Specific Requirements

Action-specific ARARs pertaining to remedial technologies at the Bern Metal/Universal Site define the regulatory framework within which the technologies may be developed and executed. Federal regulations that must be considered in technology screening include CERCLA and its amendments under the Superfund Amendments and Reauthorization Act (SARA), the Federal Clean Air Act and its amendments, the Clean Water Act and its amendments, and RCRA (40 CFR 262 & 264). The Hazardous and Solid Waste amendments to RCRA, including Land Disposal Restrictions, provide an action-specific ARAR. New York State has promulgated the RCRA mandates through the State Hazardous Waste Management System, 6 NYCRR Parts 370 through 374.

RCRA requirements include groundwater protection, landfill standards, and standards for waste piles and surface impoundments. Specific ARARs of concern depend upon the remedial alternative selected. For example, if hazardous wastes are transported off site, regulations applicable to transporters of hazardous waste (40 CFR 263 and 6 NYCRR Part 364) would be relevant. Transporters must obtain a USEPA identification number and comply with the manifest system, which documents the shipment and delivery of hazardous wastes, in accordance with 40 CFR 262, and the state promulgated requirements associated with off-site waste transportation.

Remedial activities at the site may include capping, excavation and treatment, in-situ treatment, sheet-piling, and groundwater collection and treatment. Capping of wastes in place will not trigger applicability of RCRA requirements for landfills [40 CFR 264.310 (a)], but they may be relevant and appropriate. These requirements include: preventing migration of liquids through the cap, minimizing erosion, preventing settling, minimum permeability in liners and caps, restricting access, conducting 30-year post-closure care, and groundwater monitoring. In-situ treatment of the wastes does not trigger RCRA applicability, since it is not considered placement (disposal) of wastes. However, the design of and operating standards for the waste treatment unit may be relevant and appropriate (40 CFR 264.601). Groundwater monitoring requirements are covered in 40 CFR 264, Subpart F.

Remediation of any on-site structures may include demolition, which will generate debris. Off-site management of debris generated would trigger the hazardous debris treatment standard under 40 CFR 268.45, if the debris is characteristically hazardous. On-site management would not trigger these requirements. The hazardous debris treatment standards identify several alternative treatment technologies for the treatment of debris prior to land disposal. Decontamination of the structures without subsequent demolition will not trigger the hazardous debris management requirements, but the treatment standards presented in 40 CFR 268.45 may be relevant and appropriate. Decontamination wastes generated during building decontamination may be considered characteristically hazardous, and would require management as a hazardous waste.

Discharges to publicly-owned treatment works (POTWs) must not include pollutants that: create a fire or explosion hazard, cause corrosive damage, obstruct flow, or increase the temperature of the wastewater so as to cause interference with the treatment plant. Discharges must also comply with both the local POTW pretreatment programs as well as any site-specific facility discharge requirements. An Authorization to Discharge under the Buffalo Pollutant Discharge Elimination

System (BPDES Permit No. 94-11-BU010) exists for the site. Under this discharge permit, releases to the Buffalo sewer system must meet the following pretreatment discharge limitations:

| Analyte | BPDES Permit No. 94-11-BU010 Discharge Limit | Maximum Allowable Instantaneous Discharge Limit |
|---|---|---|
| Lead | 5.0 mg/L | 65.0 mg/L |
| pH | 5.0 - 12.0 | 5.0 - 12.0 |
| Turbidity | 100 | --- |
| TPH | 100 mg/L | 100 mg/L |

# SECTION 3

# 3.0 Identification of Remedial Technology Types & Process Options

## 3.1 General

This section discusses the potential remedial technologies identified for the site, based on the general response actions for this site identified in Section 2, the affected media, and associated chemical constituents of concern. Remedial technologies identified for each medium are presented below. Corresponding process options are presented with the discussion of each remedial technology. The screening of potential remedial technologies was first presented to the NYSDEC in the Preliminary Technology Screening Summary, Bern Metal/Universal Sites Feasibility Study (BB&L, September 1995). The preliminary screening discussion presented in this section incorporates comments received from the NYSDEC in their correspondence to BBL dated September 26, 1995.

## 3.2 Remedial Technologies for Soil

The following selected technologies have been identified as being capable of remediating lead-impacted soil at the site. Table 3-1 summarizes the potential remedial technologies for soil.

### 3.2.1 No Action

The "No Action" alternative must be examined, as required by the NCP. Under this "technology", existing conditions would be maintained at the site, including the current levels of maintenance and control, and no additional remedial actions would be conducted.

### 3.2.2 Institutional Action

Institutional actions to restrict direct human contact with site soils include permanent deed restrictions, controlling the use and development of the site, implementing site access controls, and long-term monitoring of the various environmental media.

### 3.2.3 Capping

Containment of chemical constituents of concern by placement of a cap would prevent exposure at the surface, enhance runoff of clean water, and minimize groundwater recharge. Capping options are often the most appropriate for sites containing substantially immobile wastes, wastes dispersed over a large area, and wastes where a treatment-based remedy would increase overall risk to human health and the environment due to risks posed to workers, the community, or the environment during implementation. This option is often cost-effective when large volumes of wastes are encountered or compared to other potential remedial alternatives. A variety of capping options are feasible for implementation at the site. Capping options include the following:

- RCRA cap;
- 6 NYCRR Part 360 cap;
- Asphalt cap;
- Multi-layered cap with synthetic geomembrane (MSG); and
- Soil cap.

All capping options would include grading and provisions for addressing surface-water drainage. All options except the asphalt cap would include vegetative cover.

Capping systems must meet the following objectives:

- Reduce surface-water infiltration into the area(s) containing chemical constituents of concern, thus minimizing groundwater recharge to the area and minimizing off-site migration; and

- Reduce or eliminate the potential for direct human contact with lead-impacted soils. Health risks due to dermal contact, inhalation, and ingestion would be reduced or eliminated.

### 3.2.4 Excavation and Off-Site Disposal

This technology involves the excavation, transportation, and disposal of some or all of the soils containing constituents in concentrations above the levels of concern. Waste would be taken to an approved commercial treatment or disposal facility (e.g., a RCRA facility or a 6NYCRR Part 360 solid waste facility) for treatment and/or disposal. This technology may be applied to any of the media of concern at the site. However, as the amount of soil/material to be handled increases, the less cost-effective this option becomes.

The results of the TCLP testing performed as part of the RI indicated that a portion of the excavated soils, if removed off site, would be classified as hazardous waste; however, the amount of soils that would be classified as a characteristic hazardous waste cannot be determined based upon the limited TCLP testing conducted. If TCLP limits are exceeded, the soils would be subject to RCRA Land Ban Restrictions and could not be disposed of off site without treatment, unless a treatment variance were in effect.

### 3.2.5 Excavation and On-Site Treatment

This technology involves the excavation, treatment, and replacement of treated soils at the site. Treatment technologies potentially applicable to the site include solidification/fixation, thermal treatment, and chemical treatment.

- Solidification, stabilization, and fixation technologies consist of the excavation and mixing of soils with additives to reduce the mobility of the site-related metals and chemical constituents of concern. With the proper formulation of additives, as determined by treatability studies, the mobility of the site-related chemical constituents of concern can be reduced so that they cannot be released or leached from the resultant product.

- Thermal treatment technologies typically used for remedial actions include incineration, thermal desorption, and vitrification. Of these, only vitrification is an appropriate technology for remediation of metals-impacted soils. Vitrification is a process in which contaminants are immobilized in an inert, chemically stable, glass-like mass. Soils are heated to extremely high temperatures, at which soils are melted and organics are destroyed by pyrolysis. As the molten mass is cooled, inorganic constituents are immobilized within the resulting vitrified mass, which is strong and resistant to leaching.

- Chemical treatment can refer to any of several technologies that utilize processes to chemically separate the chemical constituents of concern from the soil or to chemically modify the site-related chemical constituents of concern. The only chemical treatment options potentially applicable to the site include soil washing and oxidation/reduction reactions.

- Soil washing is a process in which impacted soil is subjected to a physical/chemical extraction procedure that consists of a combination of screening and washing processes that separate soils by particle size or density. Contaminated fractions are typically subjected to a leaching procedure to release contaminants into solution, or they may be treated using a different process. For the site chemical constituents of concern, this leachant would most probably be an acidic solution, although chelating agents, surfactants, and water may also be appropriate. The contaminants can be removed from the leachant, allowing for re-use. The soil is excavated and, if necessary, pre-treated before being passed into one or more treatment units. Many soil washing technologies utilize separation of coarse- and fine-grained materials as the sole treatment, or in conjunction with a washing or leaching fluid.

- In oxidation/reduction reactions, a chemical reaction is used to alter the chemical constituents of concern and produce a less toxic or less mobile form of the metal or compound. For ex-situ (out-of-ground) processing, the soil is excavated and processed using a catalytic oxidizing or reducing agent to alter the chemical constituents of concern. This process may change the metals and/or compounds to a non-toxic state, or reduce their leachability (mobility).

### 3.2.6 In-Situ Treatment

A number of in-situ (in place) treatment technologies are potentially applicable to the site. None of these technologies involves full-scale excavation of site soils.

- Soil flushing involves the injection of a chemical treatment, such as a solvent, surfactant, or water, into soils across the site. The use of oxidizers or reductants results in an in-situ transformation of the constituents of concern into a less toxic and/or less mobile form. The spent treatment chemical is recovered downgradient, treated, and either discharged or recycled/reinjected.

- In-situ solidification (or stabilization or fixation) involves the principles described under excavation and on-site treatment, except that a soil mixing technique is used for the direct application of the fixing agent to the soil. The agents and soil are blended with augers and mixers, which inject the additives as the soil is mixed in place.

- In-situ vitrification involves conversion of the constituents of concern, along with the soil, into a chemically inert, stable, glass-like product by using electrical currents to create extremely high temperatures in the soil. During the process, organic compounds are destroyed by pyrolysis, and inorganics are retained in the soil, with reduced mobility. Upon cooling, the soil is transformed into a glass-like mass, which is left in place. This process works best at shallow depths in unsaturated soils.

## 3.3 Remedial Technologies for Groundwater

The following technologies have been identified as being capable of remediating or controlling lead-impacted groundwater. Table 3-2 summarizes the potential remedial technologies for groundwater.

### 3.3.1 No Action

The "No action" alternative is included, as required by the NCP. Under this "technology", the existing conditions at the site would be maintained, and a groundwater monitoring program would be implemented.

### 3.3.2 Institutional Action

Institutional action would allow future use of the site; however, the use of groundwater would be prohibited. For this site, the current and future potential use of the groundwater are extremely limited. However, to ensure the groundwater is not used, permanent deed restrictions would be established and access to groundwater would be severely restricted. In addition, a long-term environmental monitoring program would be developed in conjunction with the appropriate regulatory agencies.

### 3.3.3 Vertical Barriers

Low-permeability vertical subsurface barriers would reduce or eliminate the migration of constituents of concern from the site and/or reduce the amount of groundwater that would be collected and/or treated, by interrupting the flow of water to and from the area of the site containing constituents of concern. Available barrier options include sheet piles (with or without partial or complete grouting), slurry walls (soil-bentonite or cement-bentonite), and soil/liner barrier walls. Vertical barriers can be implemented in conjunction with a capping system, described below, to more effectively reduce and/or eliminate the migration of constituents of concern from the site.

### 3.3.4 Capping

The capping options presented in Section 3.2.3 would also serve to reduce or eliminate the migration of groundwater containing constituents of concern from the site and/or reduce the amount of groundwater that would require collection and/or treatment, by interrupting the contribution of precipitation to the volume of site groundwater. The primary source of the shallow groundwater at the site appears to be localized infiltration of precipitation and surface runoff, which is supported by the seasonal variations of the groundwater levels. The shallow groundwater at the site is vertically confined by the underlying till layers. A capping system would result in the minimization of percolating rainfall and snow melt by redirecting this water off the surface through surface runoff and increased evapotranspiration from the area. The minimization of percolation through the site would prevent further lead from mobilizing into the groundwater. In addition, the relatively thin saturated thickness of the shallow groundwater would be reduced, minimizing the volume of impacted groundwater. Although groundwater standards would probably not be achieved immediately, the concentrations and volume of groundwater which could migrate from the site would be expected to decrease over time.

in thickness between 0 to 3 feet across the site. The groundwater at the site is not considered a significant flow system, and recharge rates for the monitoring wells have been very low. The upper water-bearing zone is underlain by a thick, uniform, low-permeability lacustrine clay layer, so releases of constituents of concern into groundwater from the site are confined to this layer. Site-related chemical constituents of concern appear to be primarily limited in extent to the area of three of the five monitoring wells (MW-1, MW-2, MW-3); only minor traces of site-related chemical constituents of concern were detected in monitoring wells MW-4 and MW-5. Groundwater in the upper water-bearing zone tends to flow toward the center of the site from both the north and south. Therefore, withdrawal of groundwater downgradient of areas containing site-related chemical constituents of concern may be applicable, but is considered impractical due to the limited extent of groundwater impacts, limited saturated thickness of the upper water-bearing zone, and poor hydraulic properties of this flow system.

The collection of groundwater may be accomplished by one of two methods: groundwater extraction wells and/or interception trenches.

- Groundwater extraction wells installed at appropriate intervals at and/or downgradient of the source of the constituents of concern can be used to collect impacted groundwater and to redirect groundwater flow.

- Installation of a groundwater interception trench downgradient of the contaminant plume can be an effective means of containing groundwater. Groundwater collection trenches can also be utilized to intercept upgradient groundwater flowing onto the site and to divert it around the plume, minimizing flow through the plume.

### 3.3.6 Groundwater Treatment

Groundwater collected from the site can be treated on site, off site, or a combination of both. On-site pre-treatment may be required if the water is to be sent to a POTW. If groundwater collection rates are not sufficiently high to warrant installation of an on-site pre-treatment system, the groundwater may be stored on site for transport to a permitted commercial treatment facility.

### 3.3.7 Passive Treatment Walls

Passive treatment walls are subsurface, permeable, reaction walls installed across the flow path of a contaminant plume. The walls are designed to allow the passage of water, while prohibiting the movement of constituents beyond the wall. Various treatment options, such as chelating agents, sorbents, precipitating agents, microorganisms, and other agents are used to retain constituents within the wall.

## 3.4 Remedial Technologies for On-Site Structures

The following technologies have been identified as being capable of remediating lead-impacted building surfaces at the site. Table 3-3 summarizes the potential remedial technologies for building surfaces.

### 3.4.1 No Action

The "No Action" alternative is included, as required by the NCP. Under this "technology", existing conditions at the site would be maintained, including the current levels of maintenance and control, and no additional remedial actions would be conducted.

### 3.4.2 Institutional Action

Institutional actions for the prevention of direct human contact include permanent deed restrictions, controlling the use and development of the site, and site access controls.

### 3.4.3 Decontamination

Decontamination of impacted surfaces could be implemented to remove surficial contamination. Several technologies exist for surface decontamination, including high-pressure-water/steam cleaning; solvent, acid, or surfactant rinsing; shot blasting; and spalling. Decontamination of the interior building surfaces could potentially be conducted either in lieu of, or in conjunction with building demolition.

### 3.4.4 Demolition and Off-Site Treatment/Disposal

Demolition and subsequent off-site treatment and/or disposal of the building materials would involve the evaluation of the hazardous characteristics of the generated waste/debris. No TCLP sampling of the building surfaces was conducted during the RI; waste characterization sampling would be required to evaluate the required treatment/disposal options, demolition activities could be conducted after decontamination, as discussed in Section 3.4.3.

### 3.4.5 Demolition and On-Site Placement

Demolition and subsequent on-site placement of the building structures would involve demolishing the building structures and using the material generated during building demolition activities as fill material, which may be required for implementation of one or more of the soil remedies (e.g., for obtaining the required grades for capping).

## 3.5 Selection of Remedial Technologies

A preliminary identification of selected remedial technologies and process options was presented in the preceding section. The selected technologies for metals-impacted media at the site were identified as being potentially applicable to this site, based upon the potential effectiveness of these technologies in remediating impacted media at the site. In the next section, each of the identified technologies will be evaluated for short and long-term effectiveness and implementability, to identify the most appropriate alternatives for this site, and to assemble remedial alternatives. The following is a summary of those technologies which have been selected for each of the impacted media at the site; the basis for their selection is described in detail in Section 4.

### 3.5.1 Soil

The following options are considered feasible for portions of the soil at the Site:

- No Action;
- Institutional Action;
- Containment;
- Excavation and Off-Site Disposal;
- Excavation and On-Site Treatment; and
- In-Situ Treatment.

### 3.5.2 Groundwater

The following options are considered potentially feasible for the groundwater at the site:

- No Action;
- Institutional Controls;
- Containment;
- Collection; and
- Treatment.

### 3.5.3 On-Site Structures

The following options are considered feasible for the on-site structures:

- No Action;
- Institutional Action;
- Decontamination;
- Demolition and Off-Site Disposal; and
- Demolition and On-Site Placement.

# SECTION 4

SECTION 4

# 4.0 Screening of Remedial Technology Types and Process Options

## 4.1 General

Documentation of the selection of remedial technologies and process options was first presented to the NYSDEC in the Preliminary Technology Screening Summary, Bern Metal/Universal Sites Feasibility Study (BB&L, September 1995). This section incorporates comments received from the NYSDEC in their correspondence to BBL dated September 26, 1995.

Criteria for the screening of remedial technologies and process options are based in part on selection of remedial actions that, in whole or in part, result in a permanent and significant decrease in the toxicity, mobility, or volume of constituents of concern to the maximum extent practicable. Specifically, the criteria to be used are based upon a hierarchy of remedial technologies (NYSDEC Revised TAGM No. 4030, "Selection of Remedial Actions at Inactive Hazardous Waste Sites," May 1, 1990), in which the order of preferable technologies, from the most desirable to the least desirable, is:

- Destruction: An irreversible destruction or detoxification of all or most of the constituents of concern to levels satisfying the RAOs and resulting in no residue containing unacceptable levels of hazardous constituents. Destruction will achieve a permanent reduction in the toxicity of all or most of the constituents of concern.

- Separation/Treatment: Separation of the hazardous from non-hazardous constituents, resulting in two waste streams: one containing levels of constituents of concern that meet the RAOs and the other, a concentrated waste stream with high levels of constituents of concern requiring treatment. Separation/Treatment will achieve a permanent and significant reduction in the volume of constituents of concern.

- Solidification/Chemical Fixation: Solidification/chemical fixation will produce a significant and permanent reduction in the mobility of the constituents of concern; it may or may not significantly reduce the toxicity or volume of the material.

- Control and Isolation: Control and isolation produces a significant reduction in the mobility of the constituents of concern, but with no significant reduction in toxicity or volume. This term may refer to capping, physical barriers used to control the migration of groundwater, and the extraction and treatment of groundwater.

- Off-Site Land Disposal: This remedy involves removal of impacted media and land disposal of the wastes at an off-site, permitted facility.

Preference will be given to those remedial technologies that have been successfully demonstrated on a full scale or pilot scale under one or more of the following:

- Superfund Innovative Technology Assessment (SITE) Program;
- At a federal or state Superfund site;
- At a federal facility;
- At a PRP site overseen by a state environmental agency or the USEPA; or
- At a site currently operating under a RCRA Part B Permit or a RCRA Research and Development Permit.

A remedial technology that has a documented history of successful treatment will also be given preference.

The evaluation of process options for effectiveness and implementability focuses on the following:

- Their potential effectiveness in handling the estimated areas or volumes of adversely impacted media;
- Their potential for meeting the site-specific RAOs;
- The potential for impacts to human health and the environment during construction and implementation;

- The estimated level of success of the option and its reliability when applied to the conditions at the site; and
- The cost effectiveness of the remedial option.

## 4.2 Technology Screening For Soils

The screening of technologies for soils, based upon effectiveness and implementability, is presented in Table 4-1. The following narrative presents a more detailed discussion of the effectiveness and implementability evaluation, and presents those remedial technologies for soils which will be retained for further analysis, either alone or as a component of a combination of remedial alternatives.

### 4.2.1 Soil Capping

#### 4.2.1.1 Capping Scenarios

Capping options include those designed to prevent surface exposure, enhance runoff of clean water, and minimize groundwater recharge. Capping options are often the most appropriate for sites containing substantially immobile wastes, or wastes dispersed over a large area. In addition, another primary advantage to capping is a reduction in short-term risks, as compared to ex-situ treatment based remedies, which require excavation of soils and potential release of site-related chemical constituents of concern. This option is often cost-effective when large volumes of wastes are encountered or compared to other potential remedial alternatives.

Various potential cap designs are discussed below. Implementation of a capping remedy may include the following strategies:

1) Installation of a cap over all impacted soils, on and off site;

2) Consolidation of metals-impacted soils from adjacent properties onto the site prior to cap installation;

3) Consolidation of metals-impacted soils from the Universal property and off-site properties to the Bern Metal property prior to cap installation; and

4) Consolidation of the upper one-foot of metals impacted soils from off-site locations, and the Universal property prior to the Bern Metal site cap installation.

Evaluation of these strategies and selection of an appropriate cap design were conducted independently. Evaluation of the various capping scenarios for implementability and effectiveness was conducted prior to selection of an appropriate cap design.

Containment Strategy 1: This option would involve limited excavation of impacted sediments and soils in the vicinity of the cap footprint to meet the final grading requirements. Two caps would be installed: one on the Conrail property, and one on the entire Bern Metal/Universal site and the impacted areas of the Laub property. Due to the administrative difficulty associated with installation of a cap on the Conrail and Laub property, which would require long-term deed restrictions and operation and maintenance, this strategy was not considered further.

Containment Strategy 2: This option involves limited excavation of impacted sediments and soils from the adjacent parcels, and consolidation of these soils on-site prior to installation of a cap over the majority of the Bern Metal/Universal site. The detected concentrations of site-related chemical constituents of concern in the impacted soils, coupled with the relatively limited anticipated volume of soil and the distance of these areas from residential areas, makes the excavation and consolidation of these soils feasible with respect to minimizing short-term impacts to the community (i.e., particulate matter and metals emissions associated with excavation, loading/unloading, and movement of impacted soils are minimized). Access to the Conrail and Laub properties to remove these soils is anticipated to require a great deal of administrative work, but no more so than associated with any of the soil treatment remedies.

Limited excavation of soils located in the vicinity of the cap footprint will be required to ensure that final grading requirements can be met and that the cap footprint remains within the site perimeter, which is of special concern in the northern half of the site, which is adjacent to Clinton Street, Bender Avenue, and several residences. Although excavation of soil in this area poses a potential short-term risk to the community, the risks are less than those related to other potential remedies that incorporate whole-scale excavation of impacted soils on the entire site or portions of the site. Due to the small volume of soil to be excavated, engineering controls required for dust suppression (i.e., foam, misting, etc.) could be anticipated to be much more effective than for large-scale excavation activities.

Containment Strategy 3: This option involves excavation of off-site impacted soils and sediments, and excavation of impacted soils on the Universal Site for consolidation onto the Bern Metal site prior to installation of a cap on the Bern Metal site. A soil cap would be placed over the Universal site. Consolidation of soils onto the Bern Metal Site would limit the areal extent of impacted soils. The limitations associated with gaining access to the Conrail and Laub properties are the same for this strategy as for Containment Strategy 2. However, the potential short-term risks to the community are greater with this option due to the increased volume of soil to be excavated from the Universal Site, located adjacent to Clinton Street and Bender Avenue. An estimated average depth of 3 feet across the Universal Site would require excavation and consolidation of soils onto the Bern Metal site. The three-foot average depth represents the anticipated volume of impacted soils. However, impacted soils have been detected at depths of up to five feet on the Universal property. The potential risk to the community associated with excavation of impacted soils (i.e., particulate emmissions) are greater with this strategy than with Containment Strategy 2 because the volume of impacted soils to be handled is much larger.

Containment Strategy 4: This option involves excavation of the upper one foot of impacted soils and sediments from the Universal and Conrail properties for consolidation onto the Bern

Metal site prior to installation of a cap on the Bern Metal site. This option is very similar to Containment Strategy 3, except impacted soils below the one foot depth would be left in place and covered with a soil cover. Consolidation of impacted surface soils would probably limit the areal extent of impacted soils on the Conrail property and portions of the Universal property. This option has the same limitations associated with gaining access to the Conrail and Laub properties as the above options. The potential short-term risks to the community (i.e., particulate emmissions) are also greater with this option due to the increased volume of soil to be excavated from the Universal site, although these risks are not as great as for Containment Strategy 3. This option would effectively eliminate direct human contact with impacted soil. However, continued impacts to groundwater may occur from the higher rate of surface infiltration through impacted soils in soil capped areas.

Containment Strategy 2 was selected as the preferred strategy. This option presents a lower potential short-term risk to the community associated with emissions of total respirable particulates and lead-impacted particulates, and potential administrative coordination requirements similar to those associated with the other soil treatment remedies. Details related to Containment Strategy 2 are presented in Table 4-1. The following text discusses the selection of a potential capping design for Containment Strategy 2.

#### 4.2.1.2 Potential Capping Designs

RCRA Cap

The components of a RCRA cap include 24 inches of low-permeability clay, a 20-mil (minimum) membrane liner, a 12-inch sand drainage layer, and 24 inches of topsoil. Side slopes are typically a minimum of 4%, to promote runoff and reduce infiltration. A RCRA cap would permanently and significantly decrease infiltration of surface water into the soil, and thus would reduce the mobility of the constituents of concern. With proper operation and long-term maintenance, a RCRA cap would also provide long-term protection to human health and the environment against the risks associated with contact with the soil containing chemical constituents of concern, and off-site migration of the constituents of concern.

Although they can provide long-term protection to human health and the environment, capping options are not considered permanent by NYSDEC, as defined in NYSDEC TAGM No. 4030. RCRA caps are required for hazardous waste landfills, and they are considered a proven and effective containment option. However, in comparison with the other capping options presented below, a RCRA cap would require the most intensive construction effort. In particular, the low-permeability (recompacted) clay layer must meet the stringent quality assurance/quality control (QA/QC) requirements applied to this layer. The soil barrier protective layer in a RCRA cap is thicker than that for typical landfills to minimize the chance of subsidence or settlement. Because of these requirements, a RCRA cap is significantly more expensive than the other capping options, and the additional degree of protection provided by a RCRA cap at this site would not justify its higher cost. The confinement of the groundwater in the area immediately overlying the low-permeability clay barrier at the site and the relative insignificance of the limited groundwater table also contribute to the potential for "overdesign" of the capping system when compared to other alternatives that would provide similar levels of protection. Therefore, this alternative will not be considered any further.

<u>6 NYCRR Part 360 Cap</u>

A New York State Part 360 Cap, considered to be a New York State SCG, consists of a 12-inch gas-venting layer of sand or gravel; a minimum 18-inch low-permeability layer (or High Density Polyethylene [HDPE]); a minimum 30-inch soil protection layer, which serves to minimize subsidence and settlement; and 6 inches of topsoil. To reduce the cap thickness, the gas-venting layer may consist of a geosynthetic drainage layer capable of performing the same function as 12 inches of sand (this design has previously been approved by the NYSDEC). The total thickness of this cap would be 4.5 feet. Side slopes are typically a minimum of 4% to promote runoff and reduce infiltration into the cap. Due to the nature of the primary constituents of concern (inorganics), the inclusion of venting layers in the cap design is not required. In addition, the primary organics at the site consist of SVOCs, which are not as amenable to biodegradation (and associated gas generation) as simpler organic compounds.

With proper maintenance, the Part 360 cap would permanently and significantly decrease infiltration into the fill and thereby reduce the mobility of the constituents of concern. If implemented in conjunction with a long-term operation and maintenance program, this type of cap would provide long-term protection to human health and the environment against the risks associated with contact with the soils containing constituents of concern and migration of the constituents of concern.

Although they can provide long-term protection to human health and the environment, capping options are not considered permanent by NYSDEC, as outlined in NYSDEC TAGM No. 4030. However, a Part 360 cap is recommended by the NYSDEC as an effective environmental control for sanitary landfills, and is, thus considered a proven capping option. Like the RCRA cap, a Part 360 cap is significantly more expensive than the other capping options. In addition, the confinement of the groundwater to the area immediately overlying the low-permeability clay barrier at the site and the relative insignificance of the limited groundwater table also contribute to the potential for "overdesign" of the capping system when compared to other alternatives that would provide similar levels of protection. Therefore, this alternative will not be evaluated further.

<u>Asphalt Cap</u>

An asphalt cap would consist of a minimum of 6 inches of asphalt on a 6 inches of prepared subgrade or existing asphalt. Therefore, the total depth of this cap would be a maximum of 12 inches. Significantly less grading of side slopes would be required for an asphalt cap than for a RCRA or Part 360 cap, due to the efficient drainage provided by an asphalt surface.

An asphalt cap would have the necessary characteristics to permanently and significantly decrease infiltration into the fill and thereby reduce the mobility of the constituents of concern. If implemented in conjunction with a long-term operation and maintenance program, an asphalt cap would provide long-term protection to human health and the environment against the risks associated with direct contact with the constituents of concern in the soils and would serve to minimize infiltration of surface water into the soils and migration of the constituents of concern. Asphalt caps have been successfully used at Superfund and PRP Group Sites, so they are a proven capping option. In addition, the asphalt cap will not significantly change the grade or aesthetics of the surrounding topography and this industrial surrounding. Construction methods for asphalt are well known, and labor will be readily available for the construction and maintenance of such a cap. Although they can provide long term protection to human health and the environment, capping options are not considered permanent by NYSDEC, as outlined in NYSDEC TAGM No. 4030. The maintenance of an asphalt cap is much more labor-intensive and costly due to the anticipated greater frequencies of breaches in the cap integrity from differential settlement, frost heave, and cracking. Maintenance would require sealing and possibly replacement of portions of the cap on a much more frequent basis than anticipated for the other capping options. Finally, the volume of runoff that would be generated over the large area of the site could exceed the storm sewer capacity in the area without proper drainage retention facilities. The available space on-site for installation of a drainage retention facility is extremely limited. Therefore, this option will not be considered further.

Multi-Layered Cap with Synthetic Geomembrane Layer

A MSG cap would consist of general fill as required for grading; a geotextile cushioning layer (e.g., filter fabric); a 60-mil HDPE liner (or equivalent); a 12-inch-thick soil barrier protective layer; 6 inches of soil suitable for vegetation; and vegetative cover. Side slopes are typically a minimum of 4% to promote runoff and reduce infiltration into the cap. Because inorganics represent the primary chemical constituents of concern at the site, the MSG cap would not require a gas-venting layer. This cap design would be equivalent in performance to a 6NYCRR Part 360 cap utilizing a geomembrane, as per 6NYCRR 360-2.13(r), except for the thickness of the soil barrier layer. The topsoil layer and vegetative cover requirements are the same as for Part 360 requirements.

To reduce the thickness of the soil barrier layer, a variance must be obtained, which can be achieved if all of the following conditions are met:

- A written affirmation by a soil scientist, agronomist, or local Soil and Water Conservation District is submitted to affirm that the topsoil and barrier protection layer will, acting together, continually support growth of the proposed vegetative cover and will not result in root damage to the barrier layer;

- There should be a geomembrane layer and the soil under the geomembrane should be sufficiently well drained to prevent frost heave impacts on the geomembrane.

When properly maintained, a MSG cap would permanently and significantly decrease infiltration into the fill and thereby reduce the mobility of site-related constituents of concern. If implemented with a long-term operation and maintenance program, this type of cap would also provide long-term protection to human health and the environment against the risks associated with contact with the constituents of concern in the soils and reduce the migration of constituents of concern from the site.

Although they can provide long-term protection to human health and the environment, capping options are not considered permanent by NYSDEC, as outlined in NYSDEC TAGM No. 4030. This cap is not as thick as the RCRA or Part 360 caps, and could therefore be matched more closely with the existing grade. The HDPE is also more quickly and easily installed than the low-permeability clay or soil layers, and is less expensive. For these reasons, the MSG cap will be evaluated further.

<u>Soil Cap</u>

A soil cap would consist of a minimum of 12 inches of general fill material soil and a 6-inch layer of top soil suitable for sustaining vegetative cover. Grading requirements would be similar to those required for a RCRA, Part 360 or MSG cap.

Installation of a soil cap and site regrading would provide protection to human health and the environment against the risks associated with direct contact with the soils containing constituents of concern and off-site migration via surface water. However, a soil cap would not provide sufficient impermeability to ensure that infiltration would be permanently and significantly reduced, and would therefore be the least effective capping option in reducing migration of the constituents of concern from the site. Soil caps are typically used in conjunction with soil treatment remedies as a final cover system. Therefore, a soil cap could be effective at this site when used in conjunction with other technologies that provide treatment of the soils containing constituents of concern. For these reasons, the soil cap option will be retained for further consideration, as a component of the soil treatment remedies.

### 4.2.2 Excavation and Off-Site Treatment/Disposal

This option would include the excavation of all or part of the soils containing constituents of concern at the site, loading of the soils into a transport vehicle, and transportation and disposal of the soils at an approved treatment or disposal facility. Potential facilities include secure landfills and sanitary landfills. The excavation of all of the soils containing constituents of concern would be technically feasible. However, potential short-term impacts to the community in the form of total respirable and lead-impacted particulate emissions would be anticipated due to the volume of material to be handled, and the proximity of the site to adjacent residences. Dust suppression would be required to reduce the potential short-term impacts to the community. In addition, the presence of nearby rail lines may introduce restrictions or requirements on excavations performed off site or adjacent to rail lines. There are no restrictions regarding on-site facilities or structures (assuming any buildings would be demolished prior to excavation). The main restriction associated with excavation of all on-site soils is the large volume of soils that would require off-site disposal under this option. Essentially all of the site surface soils contain lead in excess of 1,000 mg/kg, indicating that the majority of soils may require excavation and off-site disposal. A NYSDEC-approved borrow source capable of supplying back-fill material of similar characteristics to those removed would also need to be identified.

Under this option, impacted soils would be excavated and hauled to secure and/or sanitary landfills for disposal. Limited TCLP sampling of surface soils has indicated that some of the soils would be considered characteristically hazardous under USEPA regulations. The TCLP testing was conducted in a limited area, and further TCLP testing would be required during pre-design activities. The actual amount of soil requiring treatment/disposal as hazardous waste will have a large impact on costs, due to the cost differences associated with solid and hazardous waste disposal. In addition, proper segregation of hazardous and non-hazardous soils would require a more intensive characterization effort.

Soils that are below all of the USEPA maximum concentration levels may be permitted for acceptance at a solid waste landfill as a "special waste." If not, additional treatment may be required. Depending on which site-related compound(s) and analyte(s) of concern are present in concentrations that cause the soils to fail to meet these requirements, treatment standards that would allow the waste to be treated and then handled by a solid waste facility may apply (e.g., soils that fail to meet the USEPA guidelines for lead may be stabilized prior to disposal at a solid waste facility). Otherwise, the excavated soils must be handled as a hazardous waste, treated to meet Land Ban requirements, and disposed of at a secure landfill (e.g., a RCRA facility). The volume of soils that require excavation will be determined as part of a pre-design investigation.

Excavation and off-site disposal of metals-impacted soils containing constituent concentrations exceeding cleanup criteria would permanently and significantly reduce the volume of constituents of concern at the site. Reduction of the volume of impacted soils will result in a reduction of toxicity, in addition to reduction in the volume of chemical constituents that can be mobilized. For these reasons, excavation and off-site disposal is considered feasible for a portion of the site soils and will be retained for further evaluation.

### 4.2.3 Excavation and On-Site Treatment

Excavation and on site treatment would incorporate the excavation of the soils containing constituents of concern on the site and the on site treatment of these soils. After treatment, the soils would be placed back on the site. As with excavation and off-site treatment/disposal, the following excavation-intensive on-site treatment processes, would be anticipated to have short-term impacts, in the form of emissions of total respirable particulates, and lead-impacted particulatesto the nearby community, due to the volume of materials to be excavated and treated, and the proximity of the site to the adjacent residences. Dust suppression would be required to reduce potential short-term impacts to the community.

#### 4.2.3.1 Solidification/Stabilization

Ex-situ solidification/stabilization would involve the excavation of all or part of the accessible soils containing constituents of concern, treatment with a solidifying agent, and replacement of the solidified materials back into the ground. This type of processing relies on proven technologies adapted from the chemical and commodities manufacturing industries.

The feasibility of this option depends upon the selection of appropriate stabilizing additives that can successfully immobilize the constituents of concern. Treatability testing must be performed during pre-design activities to determine soils characteristics and the presence of any substances that may affect either the integrity of the final treated product or the setting/curing time. Other concerns regarding ex-situ stabilization are emissions control for particulates.

Solidification/stabilization would permanently and significantly reduce the mobility of the constituents of concern, as well as provide protection to human health and the environment against the risks associated with contact with the soils containing constituents of concern and the off-site migration of constituents of concern. Ex-situ stabilization has been selected as a primary component for Records of Decision (RODs) issued at similar sites; in addition, it is a proven technology for successful treatment of inorganics. It will, therefore, be retained for further evaluation.

#### 4.2.3.2 Vitrification

Vitrification of the soils containing constituents of concern would involve the excavation of the soils, particle-size reduction or screening (as necessary), and placement of soils in a furnace.

Vitrification would require proper disposition of the resultant slag, in addition to control of off-gases/vapors and particulates during thermal destruction and excavation. Ex-situ vitrification of soils has not been demonstrated on a full scale. In addition, the costs associated with vitrification are typically much greater than those associated with other proven technologies. Therefore, this technology will not be further evaluated.

#### 4.2.3.3 Soil Washing/Soil Leaching

Soil washing/soil leaching would involve excavating all or part of the soils containing constituents of concern and placing the soils in a processor containing a washing fluid. This fluid, formulated with surfactants, emulsion breakers, solvents, or acids would leach the constituents of concern from the soil into the liquid phase. The soils would then be dried and replaced into the ground. Some soil washing technologies incorporate solids separation as the primary treatment, in conjunction with use of a washing fluid to separate fine-and coarse- grained materials.

Soil washing would significantly and permanently reduce the toxicity and volume of soils containing constituents of concern at the site, and lead removed from the soil could potentially be recovered and sold to a secondary lead smelter. Soil washing has been demonstrated to be effective on soils containing SVOCs, PCBs, and heavy metals, so it could serve to remove constituents of concern from soils, minimizing the required level of future access restrictions and allow the potential future re-use of the site. In addition, the volume of clean fill required to be brought on site would be minimized due to the reuse of the decontaminated soils for filling activities. Therefore, soil washing will be retained for further evaluation.

#### 4.2.3.4 Chemical Treatment

This process option would involve the excavation of all or part of those soils containing constituents of concern, treatment using a reducing or oxidizing (redox) agent, and replacement of the treated soils back into the ground. The redox agent may take either solid or liquid/gas form (e.g., solid [ferrous chloride] or liquid/gas [ozone]).

The physical treatment of the soils would permanently and significantly reduce the toxicity of the constituents of concern in soils at the site. The redox reaction may also reduce the volume of constituents of concern by chemically changing the compounds or analytes to a non-toxic state and may reduce the mobility of the constituents by changing them to a less soluble form. The single-step handling of the soils makes this option more cost-effective than processes that produce by-products that must be treated. In addition, the incorporation of excess additives (greater than stoichiometric proportions) will allow the redox agent to continuously treat the constituents of concern that may enter the treated area through groundwater migration. Although chemical oxidation of SVOCs may be an effective treatment, this option is not considered feasible for the primary constituent of concern, lead. Unlike other heavy metals (e.g., chromium), lead does not have different toxicity characteristics associated with its varying redox states. Therefore, this option will not be evaluated further.

### 4.2.4 In-Situ Treatment

Under the in-situ treatment alternatives, the off-site impacted soils would be excavated and consolidated on-site prior to treatment. Because the in-situ treatment alternative will involve some disturbance (i.e., mixing) of soils, the off-site soils could easily be incorporated into the overall in-situ treatment alternatives with no anticipated impacts on the effectiveness of the remedy.

### 4.2.4.1 Soil Flushing

In-situ physical/chemical treatment of the soils would involve the injection, collection, chemical treatment, and reinjection of water, solvents, surfactants, and/or oxidizing/reducing agents across the areas of the site containing the constituents of concern. Use of insitu physical/chemical treatment processes requires identification of well-defined upgradient and downgradient locations at the site from which to withdraw and inject the water; the process would be enhanced by the use of a withdrawal-injection system. Collected waters would be treated by removing contaminants/reagent and recycling of the water and (if applicable) reagents to the injection point. By passing the treated water through the area containing constituents of concern, the compounds and analytes of concern may be physically altered to produce less toxic, less mobile by-products.

The soil flushing process is not considered feasible for the in-situ treatment of the primary constituent of concern, lead. Lead is generally fairly immobile in soil, so application of a technology to enhance its release could be counter-productive unless sufficient control over the hydrodynamics of the site were in place. In addition to the high operation and maintenance costs associated with this process, extended timeframes are required for remediation. Therefore, this option will not be evaluated further.

### 4.2.4.2 In-Situ Solidification/Stabilization

The in-situ solidification/stabilization process would consist of the introduction and in-situ mixing of solidifying agents in the soil, and encapsulation and/or chemical binding of the constituents of concern within the soil. With the formulation of a proper binding agent(s) and additives for the compounds and analytes of concern at the site, in-situ stabilization would be an effective means of limiting the mobility of the constituents of concern. In most cases, particulate air emissions are reduced when compared to excavation-intensive processes, such as ex-situ solidification/stabilization. However, dust suppression would be anticipated for implementation of this remedy.

With in-situ systems, the mixing and ratios of all components, soil, binding agent, additives, and water, must be strictly controlled. Drawdown of the water table may be required in limited areas given the relatively shallow depth to groundwater at the site and the potential for improper formulations at lower depths due to increased volumes of water.

In-situ stabilization of all or part of the contaminated waste would permanently and significantly reduce the mobility of the constituents of concern in the areas treated. In addition, this technology has been successfully demonstrated to immobilize inorganics. In-situ stabilization will also provide protection to human health and the environment from the risks associated with contact with the soils containing the constituents of concern and the migration of the constituents of concern. For these reasons, in-situ stabilization is considered a feasible alternative and will be carried forward for further consideration.

#### 4.2.4.3 In-Situ Vitrification

Through in-situ vitrification, contaminated soil is converted into a stable, glass-like form, and the constituents of concern are held within this highly impermeable product. Dewatering of the site prior to vitrification would be required.

While vitrification would permanently and significantly reduce the mobility of the constituents of concern, vitrification is a highly specialized and costly process. The expense associated with this technology would be prohibitive relative to other proven techniques (e.g., in-situ stabilization). For this reason, vitrification is not considered feasible and will not be carried forward for further consideration.

### 4.3 Technology Screening for Groundwater

The screening of technologies for groundwater based upon effectiveness and implementability is outlined in Table 4-2. The following narrative presents a more detailed discussion of the effectiveness and implementability evaluation, and presents the remedial technologies for groundwater. As discussed below, the technologies for groundwater containment, collection, and treatment are not considered appropriate or practical for this site. The RAOs for the site groundwater are to prevent direct human contact and to prevent further releases from soil into groundwater. Due to the very limited saturated thickness, localized areas of elevated levels of constituents of concern, the seasonal fluctuations in groundwater, and the lack of any discernible uses of site groundwater, direct human contact is not a likely exposure, and the selected soil remedy for the site will serve to prevent further releases into groundwater. These remedies are discussed in Section 4.2.

### 4.3.1 Vertical Barriers

Vertical barriers may serve to permanently and significantly reduce the mobility of site-related chemical constituents of concern. However, because the extent of the groundwater saturated fill zone impacted by site constituents of concern is limited, technologies associated with the containment of groundwater will not be carried further into the technology evaluation process.

Although installation of vertical barriers would be implementable, the additional effectiveness gained by containing on-site groundwater does not warrant further consideration. The thickness of the shallow groundwater table ranges from 0 to 3 feet, and the thickness of the saturated fill appears to vary seasonally based on the infiltration of precipitation. The limited thickness of the saturated fill, coupled with the shallow water-bearing zone at the site, appears to indicate that the groundwater is not a significant flow system. The shallow water-bearing zone overlies a uniformly low-permeability lacustrine clay unit, with vertical permeabilities ranging from $6.5 \times 10^{-8}$ centimeters per second to $2.5 \times 10^{-8}$ cm/sec. Groundwater containing elevated levels of constituents of concern are localized to a limited area in the site. In addition, the low-permeability lacustrine clay confining layer limits the downward movement of the limited amount of impacted groundwater. As determined in the EA, there are no exposure routes associated with the use of groundwater at the site. In addition, the remedy for the soil will serve to limit the mobility, toxicity, and/or volume of constituents of concern, thus minimizing further infiltration into groundwater.

### 4.3.2 Groundwater Collection

Groundwater collection may serve to permanently reduce the volume of impacted groundwater containing constituents of concern at the site. However, because the extent of the groundwater saturated fill zone impacted by site constituents of concern is limited, technologies associated with the collection of groundwater will not be carried further into the technology evaluation process. These technologies, which would include vertical extraction wells and collection trenches, are even more limited in effectiveness due to the insignificance of the overburden groundwater. Due to the limited saturated thickness in the overburden, anticipated yields from a groundwater collection system would be minimal, and vertical wells would have an extremely limited zone of influence.

### 4.3.3 Groundwater Treatment

Treatment of groundwater, either for discharge to the POTW or at a commercial wastewater treatment plant, would serve to reduce the volume of groundwater containing constituents of concern at the site. However, because the limited extent of the groundwater saturated fill zone impacted by site constituents of concern is limited, technologies associated with the treatment of groundwater will not be carried further into the technology evaluation process.

### 4.3.4 Institutional Controls

As determined in the EA, there are no exposure routes associated with the use of groundwater at the site. In addition, the remedy for the soil will serve to limit the mobility, toxicity, and/or volume of site-related chemical constituents of concern, thus minimizing further infiltration into groundwater.

A groundwater monitoring program will be instituted at the site to monitor the effectiveness of the remedy and the condition of the groundwater. Long-term monitoring of groundwater will therefore be carried into the detailed analysis of alternatives as the means to address groundwater at the site. The following options will be carried into the detailed analysis of alternatives for the site groundwater.

- No Action; and
- Institutional Action.

## 4.4 Technology Screening for Structures

Based upon the condition of the on-site structures and the presence of impacted soils below the Bern Metal warehouse, demolition of structures that interfere with remedial operations will be required. At a minimum, it appears that subfloor soils within the Bern Metal warehouse will require inclusion into the selected remedial option for soils, so the Bern Metal Warehouse would require demolition. For the purposes of this FS, demolition of the Universal warehouse is also assumed to be required; the conditions of the Universal Warehouse are assumed to be equivalent to the Bern Metals warehouse. It should be noted that no investigation of the Universal Warehouse was conducted as part of the RI. Table 4-3 summarizes the screening of remedial technologies for building structures. Each technology is described in detail below:

### 4.4.1 Decontamination

Based upon the wipe sampling analytical results, lead contamination was found on the interior walls of the Bern Metal warehouse. Decontamination of on-site structures would involve cleaning of contaminated surfaces and would result in prevention of direct human contact with building surfaces.

Before implementation of building decontamination, contaminant levels would be further assessed and building materials that may require decontamination would be identified. Building decontamination would result in collection of concentrated wastes, which would require proper management. Implementation of the decontamination option would require that cleanup standards be established. The cleanup standards to be implemented are dependent upon the ultimate disposition of these buildings; different criteria would apply to in-place decontamination versus demolition and disposal. Because the buildings will require demolition in order to access underlying impacted soils, decontamination of building surfaces prior to demolition will no longer be considered as an option for this FS.

### 4.4.2 Surface Coating

Coating of interior surfaces in lieu of decontamination would eliminate the direct contact route of exposure. However, because the building will be demolished due to their lack of structural integrity and due to the elevated concentrations of lead found in sub-floor samples, this technology will not be evaluated further.

### 4.4.3 Demolition and Off-Site Disposal

Demolition of building materials and subsequent off-site disposal of building materials will require further analysis of the materials to evaluate possible hazardous characteristics. Three off-site disposal options are available; their use depends upon the levels and types of contamination. The first option is treatment of the materials before or following demolition and disposal at an off-site landfill, as per the Alternative Debris Treatment Standards found in 40CFR 268.45. Depending upon the alternative treatment technology selected, the required disposal option would be either at a secure landfill or sanitary landfill. The second option is disposal of these materials without treatment at an off-site secure landfill. This option could be implemented only if it can be demonstrated that the debris is not a RCRA characteristic waste requiring treatment. The third option would be disposal at an approved Part 360 off-site demolition and debris landfill. This option could only be implemented on building materials that do not contain hazardous wastes.

### 4.4.4 Demolition and On-Site Placement

Demolition and on-site placement could be implemented if capping were selected as an option. The resultant debris could be used to maintain required grades for cap installation. This option will be evaluated in the next section, as a component of the capping alternative.

## 4.5 Estimated Volumes

The extent of remediation is determined by the extent and location of the site- specific constituents of concern and the RAOs identified for the site. Several inorganics were detected at the site in concentrations exceeding their associated Soil Clean-Up Guidance levels (NYSDEC Revised TAGM No. 4046). However, lead is the primary constituent of concern; its presence is generally associated with other inorganic species detected in somewhat lower concentrations. Lead will therefore serve as the basis for determining the extent of remediation required at the site. The recent NYSDEC draft recommended Soil Clean-Up Guidance

(TAGM No. 4046) for lead is site background. Off-site background surface-soil samples collected during the RI and the USEPA's March 1991 investigation of the Universal property indicated lead in concentrations of 262 mg/kg to 1,410 mg/kg.

The extent of remediation for this site is limited to surface and subsurface soils within the site boundaries, surface soils outside the immediate property boundaries, where former operations reportedly occurred, and drainage ditech sediments, as described below. Based on groundwater analytical results and the limited usage of the site groundwater, no remediation of groundwater is recommended at the site. Wipe sampling of interior building surfaces indicated that remediation of the lead in the building materials will be required.

### 4.5.1 Soil

Soil requiring remediation includes surface soils and subsurface soils located on the Bern Metal and Universal properties and on the adjacent Conrail and Laub properties. In addition, sediments along a portion of the drainage ditch along the southwestern portion of the property will require remediation. Several inorganic species were detected in soil samples collected from the Bern Metal and Universal sites. Essentially all of the surface soil samples collected indicated the presence of lead in exceedance of the 1,000 mg/kg level. Subsurface soils in exceedance of this level were detected at depths of up to 7 feet.

The USEPA derived a soil clean-up level of 500 mg/kg to 1,000 mg/kg for lead in soil (USEPA 1989; OSWER Directive #9355.4-02), because there is no reference toxicity value for lead. This range for soil cleanup levels is based on childhood risks of exposure to lead via oral, dermal, and inhalation pathways in a conservative residential exposure scenario, and hence, is not appropriate for use in assessing risks associated with non-residential exposures. A more realistic exposure scenario involves dermal exposure by trespassers and future workers at the site. A cleanup level of 1,000 mg/kg would therefore represent an extremely conservative value for an industrial setting, with potential exposures to trespassers and workers who would be on site only for intermittent periods. In addition, the use of the 1,000 mg/kg cleanup level for soil lead concentrations has served as a cleanup level on several

USEPA-led remedial actions at metals scrap and battery reclamation facilities (USEPA RODs, various). The extent of soils impacted by lead has been estimated based on a cleanup level of 1,000 mg/kg, which would be protective of the intermittent exposure scenarios at the site and which represents selected cleanup levels at similar sites.

As discussed in Section 2.4.1, the USEPA is currently developing a risk-based model for establishing lead-based cleanup levels, entitled "Cleanup Levels Generic Methodology". This model will incorporate the adult exposure pathway, exposures to trespassers, more realistic ingestion rates, and future uses of the site. Use of this model on a USEPA site in Leadville, Colorado has resulted in higher cleanup levels than would be established by current methodology. It is anticipated that guidance on this model will be forthcoming from the USEPA in the spring of 1996 (Conversation with Kevin Matheis of USEPA, September, 1995).

### 4.5.2 Groundwater

Lead-impacted groundwater is present on the site; the highest concentrations were detected at monitoring well MW-3 (2,770 ug/L and 291 ug/L), which is located in the center of the Bern Metal property. The lead concentrations detected in samples from the other monitoring wells were an order of magnitude lower than those detected in MW-3. The New York State Ambient Water Quality Standard and Guidance Value for lead in Class GA waters is 25 ug/L.

The groundwater saturated flow zone in the fill material at the site ranges in thickness from 0 feet to approximately 3 feet; the saturated fill thickness appears to vary seasonally based on the infiltration of precipitation. The limited thickness of the saturated fill, coupled with the shallowness of the water-bearing zone at the site, would indicate that the groundwater is not a significant flow system. The shallow water-bearing zone overlies a uniformly low-permeability lacustrine clay unit, with vertical permeabilities ranging from $6.5 \times 10^{-8}$ cm/sec to $2.5 \times 10^{-8}$ cm/sec. The low permeability of the lacustrine clay limits the downward movement of impacted groundwater.

Based upon the limited extent of contamination in the shallow aquifer, no groundwater remediation will be necessary. It is anticipated that remediation of the soil, in conjunction with groundwater monitoring, will serve to address future releases into the groundwater and to monitor the effectiveness of the selected remedial alternative.

### 4.5.3 Structures

Although the potential presence of lead contamination in the Universal warehouse was not addressed as part of the RI, the demolition of the on-site structures will be required due to their poor structural integrity and to address contamination in sub-floor soils underneath the Bern Metal warehouse. The analytical results of the wipe samples collected from the interior surfaces of the Bern Metal warehouse indicated that the surfaces had been impacted by lead.

# SECTION 5

SECTION 5

# 5.0 Detailed Analysis of Alternatives

## 5.1 General

The following remedial alternatives will be carried through the detailed analysis of alternatives for the site remedy selection. Each of these alternatives will address impacted soils and debris. The estimated extent of impacted soils is presented in Figure 5-1. Contaminated debris includes building materials, spent battery casings, and slag on the surface of the site. In each alternative, with the exception of Alternative 1, a groundwater monitoring program will be established to monitor the effectiveness of the selected remedy.

| Alternative No. | Remedial Alternative |
|---|---|
| 1 | No Further Action |
| 2 | Institutional Controls |
| 3 | Capping |
| 4A | Ex-Situ Solidification/Stabilization |
| 4B | In-Situ Solidification/Stabilization |
| 5 | Soil Washing/Soil Leaching |
| 6 | Excavation and Off-Site Disposal |

Alternative 1 - No Further Action

The No Further Action alternative is required to be evaluated under NCP and includes continuation of current access restrictions (fencing and monthly inspection/repair). This alternative represents the basis by which other alternatives are measured.

Alternative 2 - Institutional Controls

This alternative involves deed restrictions on future land and groundwater uses, and will include establishment of a long-term groundwater monitoring program. The continuation of current access restrictions (fencing and monthly inspection/repairs) are also included under this remedy. The groundwater monitoring program will involve the following components:

- Collection and analysis of groundwater samples from existing monitoring wells;

- Installation of new monitoring wells, if necessary; and
- Reporting of results to the NYSDEC.

Alternative 3 - Capping

As shown on Figure 5-2, this option involves consolidation of impacted soils on the site, and installation of a MSG cap over the majority of the site. Installation of a cap on the site will serve to prevent human contact with contaminated soil and to reduce infiltration into the groundwater. A MSG cap, consisting of six inches of soil capable of sustaining vegetative cover, a 12-inch thick soil barrier protective layer, a cushioning geotextile, and a 60-mil HDPE liner overlain by a geotextile, will be placed over the entire site. Excavation and consolidation of surface/subsurface soils and sediments from the adjacent properties exceeding clean-up criteria onto the Bern Metal and Universal properties will be required. The soil barrier protective layer will serve to protect the geomembrane liner from penetration from the underlying debris and wastes. In addition, the entire site will be overlain by select fill material to establish required grades for drainage.

The following components are included in this alternative:

- Building demolition;
- Placement of building debris on site;
- Removal of large pieces of debris (e.g., metal scrap) to protect the cap;
- Hauling and placement of select fill material prior to cap installation;
- Grading of site;
- Installation of a MSG cap;
- Installation of soils suitable for vegetation and vegetative cover over the cap;
- Installation of a perimeter drainage control system;
- Establishment of a groundwater monitoring program; and
- Establishment of a maintenance program for the cap and fence line.

Alternative 4A - Ex-Situ Solidification/Stabilization

This alternative involves the excavation and addition/mixing of chemical reagents (Portland cement, fly ash, soluble silicates, etc.) with impacted soil containing lead in exceedance of the 1,000 mg/kg cleanup level to reduce the leachability of the constituents of concern. The volume of soils requiring treatment is estimated to be 25,260 c.y. Excavated soils/debris will be screened/crushed and mixed with the chemical reagents in an on-site treatment system. With cement-based systems, constituents are physically and chemically bound into a cementitious monolith. With other systems (i.e., soluble silicates, various proprietary reagents), the constituents are chemically bound into relatively insoluble forms. The treated soils would placed into a disposal "cell," which is essentially a 7-to 8-foot-deep excavation approximately 2.5 acres in area. An 18-inch-thick soil cap would placed over the treated soil, and a vegetative cover would be placed over the cap. This cell would be slightly mounded, and would be graded to promote runoff and to match with the surrounding contours. A treatability study would be required with this option. This option is illustrated in Figure 5-3.

Alternative 4B - In-Situ Solidification/Stabilization

This alternative involves processes similar to alternative 4A, above, except materials would be treated in place. Due to the limited depths of impacted soils, it is anticipated that the majority of soils would be mixed with chemical reagents in place with a backhoe, chisel plow, or other soil-mixing equipment. Treated soils would remain in place. The reagents/system chemistry that may be utilized are the same as for alternative 4A. Certain proprietary processes may be capable of treating contaminated debris without removal or processing; a treatability study would be required with this option. This option is illustrated in Figure 5-4.

Alternative 5 - Soil Washing/Soil Leaching

This alternative involves a combination of physical and chemical separation of constituents from the soil/debris matrices. These methods include coarse screening and/or crushing of excavated materials, physical separation of "clean" and "contaminated" fractions by further screening and/or density separation, mixing of impacted fractions with a leachant solution (water, acid, or chelating agents), separation of treated soil from the leachant solution, recovery of constituents from the leachant, and recycling of leachant. Treated soil may be dewatered and/or pH adjusted prior to return to the excavation. Lead and plastic battery casings would be recovered and recycled off site, if possible. A layer of soil suitable for vegetative cover would be placed over the treated soil. A treatability study could be required with this option. This option is illustrated in Figure 5-5.

Alternative 6 - Excavation and Off-Site Disposal

This alternative involves the excavation of contaminated soils and debris and off-site transport to a treatment/disposal facility. Treatment/disposal options may include:

- Disposal in a Subtitle D solid waste landfill as a "special waste";
- Stabilization and disposal in a Subtitle D solid waste landfill; and
- Treatment/disposal in a Subtitle C secure landfill.

Approximately 25,260 c.y. of contaminated soil in exceedance of the 1,000 mg/kg cleanup level have been estimated to require removal. For purposes of cost estimation, 25% of excavated soil will be classified as RCRA characteristic hazardous waste, which requires treatment prior to landfilling, and 75% of the soil will be classified as non-hazardous waste. Clean backfill will be brought onto the site to replace excavated soils. In addition, a 6-inch layer of soils suitable for vegetation will be placed onto the site, graded, and seeded. This option is illustrated in Figure 5-6.

All alternatives, with the exception of No Further Action, include a long-term maintenance and groundwater monitoring program.

The detailed evaluation of alternatives consists of three steps. The first step involves a determination of an individual alternative's effectiveness in meeting the following requirements:

- Protection of human health and the environment;
- Attainment of Federal ARARs and New York State SCGs;

- Short- and long-term impacts, effectiveness and implementability; and
- Provisions for the designed treatment to significantly and permanently reduce the toxicity, mobility, or volume of hazardous wastes at the site.

## 5.2 Weighted Matrix Scoring System

### 5.2.1 General

The selection of a site remedy based upon a scoring system approach involves the quantitative evaluation of the alternatives using the following criteria, with weighing factors, and a simple numerical scoring system:

- Short-term impacts and effectiveness (Relative Weight: 10/100);
- Long-term effectiveness and permanence (Relative Weight: 15/100);
- Reduction in the toxicity, mobility, or volume of hazardous wastes (Relative Weight: 15/100);
- Implementability (Relative Weight: 15/100);
- Compliance with Federal ARARs and NYS SCGs (Relative Weight: 10/100);
- Overall protection of human health and the environment (Relative Weight: 20/100); and
- Cost (Relative Weight: 15/100).

In this scoring system, each alternative is numerically rated against the factors developed for each criterion. This weighted-matrix scoring system is based upon the NYSDEC TAGM No. 4030, on the Selection of Remedial Actions at Inactive Hazardous Waste Sites, dated May 15, 1990. The results of the weighted-matrix scoring analysis are presented in Table 5-1, and are discussed below in detail.

### 5.2.2 Alternative 1 - No Further Action

A. Short-Term Impacts and Effectiveness (Score 10 out of 10). Since no construction is required to implement this alternative, there are no associated short-term risks to the community, environment, or workers.

B. Long-Term Effectiveness and Permanence (Score 0 out of 15). This alternative is neither an effective nor permanent remedy to the risks posed by the contaminants of concern at the site. The current levels of protection offered by the perimeter fencing serve to limit direct contact with on-site soils; direct contact with adjacent off-site soils on the Conrail property is not prevented by the current conditions. The perimeter fencing may serve to limit direct contact with surface soils, but would not be effective in limiting potential future routes of exposure, nor exposure to off-site soils via direct contact. The current environmental and health effects may worsen due to deterioration of the existing soils with increased off-site migration of contaminants of concern via wind erosion and surface water migration. Extensive long-term maintenance and monitoring would be required.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 0 out of 15). Since no on-site contaminants are destroyed, treated, or contained, the mobility and volume of the contaminants of concern will remain essentially unaltered under this alternative.

D. Implementability (Score 14 out of 15). The No Further Action alternative is easily implemented compared to the other alternatives. Although it fails to provide a long-term remedy, future remedial actions to supplement this alternative may be instituted without interfering with existing controls.

E. Compliance with Federal ARARs and NYS SCGs (Score 3 out of 10). Implementation of this alternative would not result in compliance with any chemical-specific ARARs or SCGs, or any appropriate agency advisories, guidelines, or objectives. It would however, be in compliance with location-specific ARARs. The action-specific standards (e.g., technology standards) would not be addressed.

F. Overall Protection to Human Health and the Environment (Score 5 out of 20). This alternative provides no additional protection to human health or the environment, and the risks posed by the contaminants of concern would continue due to lack of on-site control. Although current site conditions pose little risk via air or surface water migration, continued deterioration of site conditions may cause these exposure pathways to result in increased risk to off-site receptors. The current site conditions may pose a potential route of exposure to trespassers entering the site and to Conrail employees. Residual environmental risk would be greater than acceptable, since current contaminants of concern may eventually leave the site.

G. Cost (Score 15 out of 15). This is the lowest-cost alternative; the costs are associated with long-term maintenance of fencing and signage.

**TOTAL WEIGHTED SCORE: 47.0**

### 5.2.3 Alternative 2 - Institutional Action

A. Short-Term Impacts and Effectiveness (Score 10 out of 10). There is no construction required in areas or media containing contaminants of concern during implementation of this alternative. There would be no significant short-term risks or impacts to the community, environment, or workers associated with implementation. It is anticipated that no site work would be required under this alternative, so it would therefore be implemented in less than two years.

B. Long-Term Effectiveness and Permanence (Score 0 out of 15). This alternative is neither an effective nor permanent remedy to the risks posed by the contaminants of concern at the site. The current levels of protection offered by the perimeter fencing serve to limit direct contact with on-site soils; however, direct contact with off-site soils on the Conrail property is not prevented by current conditions. Implementation of a groundwater monitoring program would serve to monitor the groundwater quality, but would offer no additional protection to any potential worsening of environmental conditions. The perimeter fencing may serve to limit direct contact with on-site surface soils, but offers no additional protection from off-site impacted soils. Deed restrictions would not further limit exposures to trespassers, but would be effective in offering additional protection from potential future routes of exposure that may be associated with use of the site. The current environmental and health effects may worsen due to deterioration of the existing soils with increased off-site migration of contaminants of concern via wind erosion and surface water migration.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 0 out of 15). Since no on-site contaminants are destroyed, treated, or contained, the mobility and volume of the contaminants of concern will remain essentially unaltered under this alternative.

D. Implementability (Score 14 out of 15). The Institutional Action alternative is easily implemented when compared to the other alternatives, since no technical or administrative difficulties are posed by the continuation of the monitoring program. Although it fails to provide a long-term remedy, future remedial actions to supplement this alternative may be instituted without interfering with existing controls.

E. Compliance with Federal ARARs and NYS SCGs (Score 3 out of 10). Implementation of this alternative would not result in compliance with any chemical-specific ARARs or SCGs, or any appropriate agency advisories, guidelines, or objectives. It would, however, be in compliance with location-specific ARARs. The action-specific standards (e.g., technology standards) would not be addressed.

F. Overall Protection to Human Health and the Environment (Score 9 out of 20). This alternative provides no additional protection to human health or the environment, and the risks posed by the chemical constituents of concern would continue due to lack of on-site control. Although current site conditions pose little risk via air or surface water migration, continued deterioration of site conditions may cause these exposure pathways to result in increased risk to off-site receptors. The current site conditions may pose a potential route of exposure to trespassers entering the site and Conrail employees. Residual environmental risk would be greater than acceptable, since current contaminants of concern may eventually leave the site. The implementation of a groundwater monitoring program will offer no additional protection to human health and the environment.

G. Cost (Score 14.7 out of 15). This is the second lowest-cost alternative; only the costs associated with implementation of a groundwater monitoring program would be added to the long-term maintenance costs associated with Alternative 1.

**TOTAL WEIGHTED SCORE: 50.7**

### 5.2.4 Alternative 3 - Capping

A. Short-Term Impacts and Effectiveness (Score 8 out of 10). This alternative offers some short-term risks to the community during excavation and consolidation of soils from off-site locations, anchor-trench installation, building demolition and management of resultant debris, and placement and grading of fill material. Installation of the cap over the site will only involve limited disturbance of on-site soils, limiting the risks associated with excavation of impacted soils adjacent to residential areas. Because less impacted soils will be disturbed as part of this remedy, the risks associated with this alternative can be more easily controlled with minimal impacts to the community or environment using standard dust-suppression methods. This alternative and associated mitigative efforts can be implemented within two years.

B. Long-Term Effectiveness and Permanence (Score 8 out of 15). This alternative does not treat contaminants of concern, as defined in Table 5.5 of TAGM No. 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, May 15, 1990, nor is it considered a permanent remedy, as defined in Section 2.1 (a, b, or c) of this TAGM. The expected lifetime or duration of effectiveness is estimated at 25 to 30 years. Operation and post-maintenance activities are required for 30 years. The environmental controls required with this alternative will be required for a period of greater than 5 years. A moderate degree of long-term monitoring is required, using environmental controls with moderate to high degrees of confidence.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 5 out of 15). Under the capping alternative, no contaminants are destroyed or treated, as defined in Table 5.6 of the revised TAGM No. 4030. The capping option would serve to reduce the mobility of impacted soils by minimizing infiltration into groundwater and by eliminating the direct contact hazards, which is the primary route of exposure for contaminants of concern. A reduction in surface water infiltration into groundwater would serve to reduce, if not eliminate, the volume of impacted groundwater. Additional, future routes of exposure that may potentially increase over time (i.e., surface water runoff and wind erosion) would also be eliminated under the capping alternative. The capping option is considered irreversible for most of the hazardous waste constituents of concern at the site. The capping alternative would effectively reduce the mobility of the contaminants of concern, and would eliminate the critical routes of exposure associated with impacted soils.

D. Implementability (Score 12 out of 15). Construction of this alternative presents some minor difficulties and uncertainties, primarily associated with the volume of impacted soils requiring removal and consolidation on the site and management of run-off from the cap surface. Construction techniques are very effective in meeting their performance goals. Delays due to technical problems are generally unlikely. Some future remedial actions may be necessary, but are not anticipated. As with all the treatment based alternatives, an extensive coordination effort will be required to obtain the necessary access agreements with Conrail. The technologies, vendors, equipment, and specialists should all be readily available without significant delay.

E. Compliance with Federal ARARs and NYS SCGs (Score 6 out of 10). Because infiltration of precipitation into site soils represents the primary source of contaminant to overburden groundwater, this alternative would serve to reduce, if not completely dewater, the groundwater volume, probably eliminating groundwater as an impacted media at the site. This would in turn eliminate the applicability of the chemical-specific ARARs and SCGs for groundwater. However, the chemical-specific ARARs and SCGs addressing soil cleanup guidelines, as they currently exist, would not be met. Because this alternative does not require extensive excavation, dust and metals emissions, and associated impacts to the community, would be minimized. Due to the potential risks posed to the community, a waiver to obtaining all ARARs would be required. The applicability of an ARARs waiver for this site, includes the following two conditions upon which a waiver may be granted, as established in the NCP:

- Compliance with such requirement at that facility will result in greater risk to human health and the environment than alternative options; and

- The remedial action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation, through use of another method or approach.

Action-specific ARARs and SCGs are met by this alternative, as are the location-specific (technology) ARARs and SCGs.

F. Overall Protection to Human Health and the Environment (Score 20 out of 20). This alternative is protective to human health and the environment, and reduces the risks posed by the constituents of concern, through reduction in their mobility. Under this alternative, the potential exposure to contaminants via the air route, groundwater, surface water, and soil sediments is acceptable. Determination of a quantifiable risk for this site during the RI was not possible, due to the lack of reference toxicity values for lead. The identified routes of exposure that pose a potential increased risk identified for current conditions at the site (i.e., Conrail employees and trespassers coming into direct contact with impacted soils) would be all but eliminated. In addition, potential exposure pathways such as releases to air via wind erosion, and releases to surface water would also be eliminated.

G. Cost (Score 11.3 out of 15). This is the lowest (present worth) alternative of those involving treatment and/or removal of impacted soils from the site, and it offers the lowest amount of uncertainty regarding its implementation.

**TOTAL WEIGHTED SCORE: 71.3**

### 5.2.5 Alternative 4A - Ex-Situ Solidification/Stabilization

A. Short-Term Impacts and Effectiveness (Score 5 out of 10). This alternative uses on-site solidification/stabilization treatment. There are significant short-term risks associated with generation of fugitive dust and metals emissions during excavation, demolition, hauling, treatment, and placement of wastes. The volume of soil handled under this option, coupled with the proximity of adjacent residences, makes control of emissions difficult. The community lifestyle may be impacted by this remedy. Due to the volume of impacted soil being handled and the proximity of residences to the site, mitigative efforts to control emissions may impact the community lifestyle. Both the remedial action and the efforts to control the aforementioned risks are not anticipated to extend past two years.

B. Long-Term Effectiveness and Permanence (Score 8 out of 15). The remedy is considered permanent in accordance with Section 2.1 of the revised TAGM No. 4030. This remedy will serve to minimize subsequent infiltration of contaminants of concern into groundwater, but will not serve to treat groundwater directly. The quantity of untreated hazardous waste is therefore estimated to be less than 25%. The treated soils (or residuals) left at the site will still be toxic, but will be immobilized. The controls required with this alternative will be required for a period of greater than five years and there is a moderate degree of confidence that the environmental controls can adequately handle potential problems. A moderate degree of long-term monitoring is associated with this alternative.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 8 out of 15). No hazardous wastes will be destroyed as part of this remedy. However, approximately 90-99% of the hazardous wastes are treated by solidification/stabilization, and thus are reduced in toxicity and mobility. Although groundwater is not directly treated, it will be monitored to evaluate the effectiveness of the soil remedy in preventing future releases into groundwater via infiltration. This remedy will minimize subsequent releases of contaminants of concern to groundwater. Debris generated from building demolition will be managed off site.

It is anticipated that almost all (90% - 100%) of the wastes will be treated with a combination of solidification and containment via soil capping. The mobility of the contaminants of concern is reduced through a combination of the soil treatment and soil cap. Although little information exists regarding the long-term performance of solidified wastes, solidification/stabilization is considered irreversible for most of the hazardous waste constituents associated with this site.

D. Implementability (Score 9 out of 15). Because of the uncertainties associated with the volume of impacted soils requiring treatment, construction of this alternative is anticipated to have present significant difficulties and uncertainties. An extensive pre-design investigation will be required to more fully delineate the amount of soil requiring treatment. In addition, treatability testing will be required to determine the most effective types and quantities of binders/reagents. The techniques utilized in implementing this technology are effective in meeting their performance goals. Delays due to technical problems would be anticipated due to uncertainties associated with the remedy. Future remedial actions would not be anticipated. As with all the treatment based alternatives, an extensive coordination effort will be required to obtain the necessary access agreements with Conrail.

Due to the nature of the chemical constituents of concern, it is anticipated that a simple, Portland cement-based solidification/stabilization method could be used for treatment of impacted soils. Most Portland cement-based solidification/stabilization methods utilize readily available treatment reagents, mixing technologies, and equipment, for which vendors are readily available to provide competitive bids. The heterogenous nature of the fill material will make treatment more difficult and may require use of alternative additives. In addition, certain solidification/stabilization methods that utilize proprietary reagents or methods can be much more specialized and may not be readily available if additional equipment or specialists are required. However, these proprietary methods may prove to be more effective in treating these wastes.

E. Compliance with Federal ARARs and NYS SCGs (Score 10 out of 10) Chemical-specific ARARs and SCGs are met for soil. This alternative results in the reduction of mobility of contaminants of concern and serves to reduce infiltration into groundwater. It is anticipated that chemical-specific ARARs and SCGs for groundwater would be met after treatment of the soils has been completed and further releases of contaminants into groundwater are prevented. All action-specific and location specific ARARs and SCGs are met.

F. Overall Protection to Human Health and the Environment (Score 20 out of 20). This alternative is protective to human health and the environment, and reduces the risks posed by the contaminants of concern, through treatment of these contaminants and reduction in their toxicity and mobility. Determination of a quantifiable risk for this site was not possible during the RI, due to the lack of reference toxicity values for lead, although this remedy would result in a long-term reduction in risks posed by current conditions at the site. The identified routes of exposure that pose a potential increased risk identified for current conditions at the site (i.e., Conrail employees and trespassers coming into direct contact with impacted soils) would be eliminated. In addition, potential exposure pathways such as releases to air via wind erosion, and releases to surface water would also be eliminated.

G. Cost (Score 7.8 out of 15). The cost for this alternative is comparable with Alternative 4B, and is the third highest of all the alternatives. As with Alternatives 4B, 5, and 6, there is a high degree of uncertainty regarding the remedial costs, primarily associated with the volume of soil that will require treatment.

**TOTAL WEIGHTED SCORE: 67.8**

### 5.2.6 Alternative 4B - In-Situ Solidification/Stabilization

A. Short-Term Impacts and Effectiveness (Score 5 out of 10). This alternative uses on-site solidification/stabilization treatment. There are short-term risks associated with generation of fugitive dust and metals emissions during excavation, demolition, hauling, treatment, and placement of wastes. The volume of soil handled, coupled with the proximity to adjacent residences, makes control of emissions very difficult. The community lifestyle may be impacted. Due to the volume of impacted soil being handled and the proximity of residences to the site, mitigative efforts to control emissions may impact the community lifestyle. Both the remedial action and the efforts to control the aforementioned risks are not anticipated to extend past two years.

B. Long-Term Effectiveness and Permanence (Score 8 out of 15). The remedy is considered permanent in accordance with Section 2.1 of the revised TAGM No. 4030. This remedy will serve to minimize subsequent infiltration of contaminants of concern into groundwater, but will not serve to treat groundwater directly. The quantity of untreated hazardous waste is therefore estimated to be less than 25%. The treated soils (or residuals) left at the site will still be toxic, but will have been immobilized. The controls required with this alternative (groundwater monitoring, soil cap, and perimeter fencing) will be required for a period of greater than five years. There is a moderate degree of confidence that the environmental controls can adequately handle potential problems. There is a moderate degree of long-term monitoring associated with this alternative.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 8 out of 15). No hazardous wastes will be destroyed as part of this remedy. However, approximately 90-99% of the hazardous wastes are treated by solidification/stabilization, and thus are reduced in toxicity and mobility. Under the specific soil washing process evaluated, the leachant (washed liquid) is treated to remove the recovered lead. The liquid is then recycled back into the treatment train. No liquid is discharged until the treatment is completed. Based upon full-scale operation results of this process at a similar facility, the wash water remaining at final shutdown should be acceptable for discharge to the sanitary sewer system. This remedy will minimize releases of chemical constituents of concern into groundwater. Debris generated from building demolition will be managed off-site.

It is anticipated that almost all (90% - 100%) of the wastes will be treated with a combination of solidification/stabilization and containment via soil capping. The mobility of the contaminants of concern is reduced through a combination of the soil treatment and soil cap. Although little information exists regarding the long-term performance of solidified wastes, solidification is considered irreversible for most of the hazardous waste constituents associated with this site.

D. Implementability (Score 9 out of 15). Because of the uncertainties associated with the volume of impacted soils requiring treatment, construction of this alternative is anticipated to present significant difficulties and uncertainties. An extensive pre-design investigation will be required to more fully delineate the amount of soil requiring treatment. Treatability testing will be required to determine the most effective types and quantities of binders/reagents. As compared to ex-situ methods, in-situ methodologies for solidification/stabilization can be much more difficult to control in the field due to difficulties associated with ensuring binders/reagents and water are added in the proper formulations and that mixing of wastes with the binder/reagent/water mixture is complete. The techniques utilized in implementing this technology are effective in meeting their performance goals. Delays due to technical problems would be anticipated due to uncertainties associated with the remedy. Future remedial actions would not be anticipated. As with all the treatment based alternatives, an extensive coordination effort will be required to obtain the necessary access agreements with Conrail.

Due to the nature of the contaminants of concern, it is anticipated that a simple, portland cement based solidification/stabilization method could be used for treatment of impacted soils. Most portland cement based solidification/stabilization methods utilize readily available treatment reagents, mixing technologies and equipment, for which vendors are readily available to provide competitive bids. The heterogenous nature of the fill material will make treatment more difficult and may require use of alternative additives. However, certain solidification/stabilization methods that utilize proprietary reagents or methods can be much more specialized and may not be readily available if additional equipment or specialists are required. These proprietary methods may prove to be more effective in treating these wastes.

E. Compliance with Federal ARARs and NYS SCGs (Score 10 out of 10) Chemical-specific ARARs and SCGs are met for soil. This alternative would result in the reduction of the mobility of contaminants of concern and would serve to reduce infiltration into groundwater. It is anticipated that chemical-specific ARARs and SCGs for groundwater would be met shortly after treatment of the soils has been completed. All action-specific and location specific SCGs are met.

F. Overall Protection to Human Health and the Environment (Score 20 out of 20). This alternative is protective to human health and the environment, and reduces the risks posed by the contaminants of concern, through treatment of these contaminants and reduction in their toxicity and mobility. Determination of a quantifiable risk for this site was not possible, due to the lack of reference toxicity values for lead. This remedy would result in a long-term reduction in risks posed by current conditions at the site. The identified routes of exposure that pose a potential increased risk identified for current conditions at the site (i.e., Conrail employees and trespassers coming into direct contact with impacted soils) would be eliminated. In addition, potential future exposure pathways that may pose a concern, such as releases to air via wind erosion and releases to surface water, would also be eliminated.

G. Cost (Score 7.8 out of 15). The cost for this alternative is comparable with Alternative 4B, and is the third highest of all the alternatives.

**TOTAL WEIGHTED SCORE: 67.8**

### 5.2.7 Alternative 5 - Soil Washing/Acid Leaching

A. Short-Term Impacts and Effectiveness (Score 5 out of 10). This alternative uses on-site separation/treatment of impacted soils. There are significant short-term risks associated with generation of fugitive dust and metals emissions during excavation, demolition, hauling, treatment, and placement of wastes. The volume of soil handled under this option, coupled with the proximity of adjacent residences, makes control of emissions difficult. The community lifestyle may be impacted by this remedy. Due to the volume of impacted soil being handled and the proximity of residences to the site, mitigative efforts to control emissions may impact the community lifestyle. Both the remedial action and the efforts to control the aforementioned risks are not anticipated to extend past two years.

B. Long-Term Effectiveness and Permanence (Score 11 out of 15). The remedy is considered permanent in accordance with Section 2.1 of the revised TAGM No. 4030. This remedy will serve to minimize subsequent infiltration of contaminants of concern into groundwater, but will not serve to treat groundwater directly. The quantity of untreated hazardous waste is therefore estimated to be less than 25%; all impacted soils would be treated under this remedy. Treated residuals will include recovered metals, which can be re-used or disposed of in a secure landfill, so there will be no treated residuals left at the site. Because impacted soils will be decontaminated, the only controls required for this remedy will be groundwater monitoring. It is anticipated that this control will be required for a period of less than 5 years to adequately demonstrate the effectiveness of the remedy. There is a moderate to high confidence that the degree of control can adequately handle potential problems. Compared with other alternatives, there is a minimal amount of long-term monitoring associated with this alternative.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 15 out of 15). Approximately 90-99% of the hazardous wastes will be treated, and thus reduced in toxicity, mobility, and volume. As a result of this separation process, concentrated treatment residuals will be generated; they will be disposed of off site, either at a secure landfill or at a secondary lead smelter for potential recovery. Under the specific soil washing process evaluated, the leachant (washed liquid) is treated to remove the recovered lead. The liquid is then recycled back into the treatment train. No liquid is discharged until the treatment is completed. Based upon full-scale operation results of this process at a similar facility, the wash water remaining at final shutdown should be acceptable for discharge to the sanitary sewer system. This remedy will minimize subsequent releases of contaminants of concern to groundwater. Debris generated from building demolition will be managed off site.

It is anticipated that almost all (90% - 100%) of the wastes will be treated with the soil washing/acid leaching process. Because this alternative results in decontamination of soils remaining on site with respect to the constituents of concern, it is considered irreversible for most of the hazardous waste constituents associated with this site.

D. Implementability (Score 7 out of 15). Because of the uncertainties associated with the volume of impacted soils requiring treatment, construction of this alternative is anticipated to present significant difficulties and uncertainties. An extensive pre-design investigation will be required to more fully delineate the amount of soil requiring treatment. In addition, treatability testing will be required to design the treatment train. The techniques are effective in meeting their performance goals. Delays due to technical problems would be anticipated. Although several vendors offer soil washing/acid leaching technologies, it is an extremely specialized treatment process, with delays anticipated in obtaining additional equipment and/or specialists, and obtaining competitive bids from multiple vendors may not be possible. Future remedial actions would not be anticipated. As with all the treatment based alternatives, an extensive coordination effort will be required to obtain the necessary access agreements with Conrail.

E. Compliance with Federal ARARs and NYS SCGs (Score 10 out of 10) Chemical-specific ARARs and SCGs are met for soil. This alternative would result in the removal of contaminants of concern from the site and would therefore serve to prevent further releases of contaminants of concern into groundwater. It is anticipated that chemical-specific ARARs for groundwater would be met after treatment of the soils has been completed. All action-specific and location specific SCGs are met.

F. Overall Protection to Human Health and the Environment (Score 20 out of 20). This alternative is protective to human health and the environment, and reduces the risks posed by the contaminants of concern, through treatment of these contaminants and reduction in their toxicity and mobility. Determination of a quantifiable risk for this site was not possible during the RI, due to the lack of reference toxicity values for lead. However, the remediation will serve to minimize the existing routes of exposure for this site, in addition to eliminating the potential for future exposure pathways to become more of a concern. This remedy would result in a long-term reduction in risks posed by current conditions at the site. The identified routes of exposure that pose a potential increased risk for current conditions at the site (i.e., Conrail employees and trespassers coming into direct contact with impacted soils) would be all but eliminated.

G. Cost (Score 0 out of 15). This is the most expensive of all the alternatives, based upon the assumptions made regarding volumes of contaminants. Like alternatives 4A and 4B, this alternative is extremely dependent upon the volume of soils requiring treatment.

**TOTAL WEIGHTED SCORE: 68.0**

### 5.2.8 Alternative 6 - Excavation and Off-Site Disposal

A. Short-Term Impacts and Effectiveness (Score 5 out of 10). This alternative involves the removal of and off-site disposal of impacted soils from the site. There are significant short-term risks associated with generation of fugitive dust and metals emissions during excavation, demolition, hauling, treatment, and placement of wastes. The volume of soil handled under this option, coupled with the proximity of adjacent residences, makes control of emissions difficult. The community lifestyle may be impacted by this remedy. Due to the volume of impacted soil being handled and the proximity of residences to the site, mitigative efforts to control emissions may impact the community lifestyle. Both the remedial action and the efforts to control the aforementioned risks are not anticipated to extend past two years.

B. Long-Term Effectiveness and Permanence (Score 11 out of 15). This alternative uses off-site land disposal, and therefore is not considered permanent in accordance with Section 2.1 of the revised TAGM No. 4030. By removing contaminants of concern from the site, this remedy will serve to minimize further releases of contaminants of concern into groundwater, but will not serve to treat groundwater directly. The quantity of untreated hazardous waste is estimated to be less than 25%. There will be no treated residuals left at the site.

The expected lifetime or duration of the effectiveness of this remedy is in excess of 30 years. The degree of operation and maintenance required will be minimal, because the contaminants have been removed from the site. Groundwater monitoring will be required for a period of five years, after which it is anticipated that no monitoring will be required.

C. Reduction in Toxicity, Mobility, and Volume of Hazardous Waste (Score 6 out of 15). Approximately 90-99% of the hazardous wastes will be removed from the site, and thus reduced in toxicity, mobility, and volume. As a result of this removal, treatment residuals will be generated and disposed of off site, either at a sanitary or secure landfill. This remedy will minimize subsequent releases of contaminants of concern to groundwater. Debris generated from building demolition will also be managed off site.
It is anticipated that almost all (90% - 100%) of the wastes will be removed from the site. Because this alternative results in decontamination of soils remaining on site with respect to contaminants of concern, it is considered irreversible for most of the hazardous waste constituents associated with this site.

D. Implementability (Score 10 out of 15). Because of the uncertainties associated with the volume of impacted soils requiring treatment, construction of this alternative is anticipated to present significant difficulties and uncertainties. An extensive pre-design investigation will be required to more fully delineate the amount of soil requiring off-site disposal. The investigation must include analyses to characterize soils for the presence of RCRA characteristic wastes. Delays due to technical problems are somewhat likely. The techniques are very reliable in meeting their performance goals. Future remedial actions would not be anticipated. As with all the treatment based alternatives, an extensive coordination effort will be required to obtain the necessary access agreements with Conrail. The availability of landfill space may result in project delays.

E. Compliance with Federal ARARs and NYS SCGs (Score 10 out of 10) Chemical-specific ARARs and SCGs are met for soil. This alternative would result in the removal of contaminants of concern from the site and would therefore serve to reduce further releases into groundwater. It is anticipated that chemical-specific ARARs for groundwater would be met after removal of impacted soils has been completed. All action-specific and location specific SCGs are met.

F. Overall Protection to Human Health and the Environment (Score 20 out of 20). This alternative is protective to human health and the environment, and reduces the risks posed by the contaminants of concern, through removal and proper disposal of the contaminants. Determination of a quantifiable risk for this site was not possible, due to the lack of reference toxicity values for lead. However, the remediation will result in removal of contaminants from the site. This remedy would result in a long-term reduction in risks posed by current conditions at the site. The identified routes of exposure that pose a potential increased risk identified for current conditions at the site (i.e., Conrail employees and trespassers coming into direct contact with impacted soils) would be all but eliminated. In addition, potential exposure pathways such as releases to air via wind erosion and releases to surface water would also be eliminated.

G. Cost (Score 5.3 out of 15). This is the second most expensive of all the alternatives, based upon the assumptions made regarding volumes of contaminants. Like Alternatives 4A, 4B, and 5, this alternative is extremely dependent upon the volume of soils requiring treatment. In addition, the volume of soils requiring management as hazardous wastes will have a large impact on costs, due to the higher costs associated with disposal at a secure landfill.

**TOTAL WEIGHTED SCORE: 67.3**

## 5.3 Economic Evaluation of Alternatives

### 5.3.1 General

To facilitate the evaluation of the cost-effectiveness of each alternative, preliminary capital and annual operation and maintenance costs were developed for individual components (i.e., technologies and process options) selected for the alternatives. Total capital and operation and maintenance costs for each alternative were then determined by combining the costs of the appropriate components.

The quantities associated with the remedial activities as they relate to the media of concern were developed initially to serve as the basis for this economic evaluation. The specific aspects and quantities of each component used as the basis for deriving the capital and annual operation and maintenance costs for the selected remedial technologies are discussed in detail under each technology. The capital and operation and maintenance costs for each component are presented on separate tables. The sources of the estimates include Means Site Work and Landscape Cost Data (1994), past BB&L experience, and quotations from vendors.

Several cost items are estimated as a percentage of the total cost based on past BB&L experience. These percentages include the following:

| | |
|---|---|
| • Mobilization/Demobilization | 10% |
| • Construction Administration and Design Engineering | 25% |
| • Contingencies | 20% |
| • Bonds and Insurance (to reflect construction at sites containing hazardous wastes) | 10% |
| • Escalation of 5 percent per year over two years to account for escalated construction costs at the time construction is anticipated to occur | 10.25% |
| • Contractor markup for overhead and profit | 25% |
| • Provisions for "Level C" Personal Protection Equipment (based on specific task) | 40% |

For the evaluation of each alternatives' cost effectiveness, the capital and annual operation and maintenance costs were converted to their equivalent present worth. A 30-year performance period with a 10 percent annual discount rate is used in the determination of the present worth of alternatives 1, 2, 3, 4A and 4B. A 5-year performance period with a 10 percent annual discount rate is used in the determination of the present worth of alternatives 5 and 6, because these alternatives will result in complete removal and/or decontamination of impacted soils from the site and will only require addressing groundwater monitoring over an estimated period of 5 years to demonstrate the remedy's effectiveness.

Based upon the assumptions made regarding the extent of impacted soils, the accuracy of the estimated costs lies within the range of -30% to +50% of actual construction costs.

### 5.3.2 Estimation of Quantities

The following section presents the basis for estimating the quantities used in the development of remedial costs for the various alternatives. The bases for the estimated quantities are presented in Table 5-2, which presents estimated areas and volumes of impacted soils and sediments requiring either containment (capping) or treatment, and Table 5-3, which presents estimated quantities for process options and technologies. In addition, Figure 5-1 illustrates the estimated extent and average depth of impacted soils.

#### 5.3.2.1 Areal and Volumetric Extent of Impacted Soils and Debris

Current data collected during the RI is not sufficient to accurately quantify the volume of soils outside of the manufacturing building which may exceed the cleanup levels for this site. While additional data will be obtained during the pre-design investigations, an estimate as to the volume of soils adversely impacted by contaminants of concern has been prepared for purposes of this FS, based upon certain assumed depths of impacted soils requiring remediation, as well as an areal estimate of surficial soils that have been impacted. These estimates were calculated based upon a review of the locations, depths, and concentrations of impacted soils reported in the RI. Table 5-2 and Figure 5-1 present the estimated areal extent, the associated average depth, and the volumes of impacted soils for the site. These estimates were used as the basis for developing remedial alternatives and in developing associated cost estimates.

The areal extent of the Bern Metal and Universal sites is approximately 5.2 acres. For purposes of comparing the various remedial options, the total volume of soil and sediments requiring remediation was estimated at 25,010 cubic yards and 20 cubic yards, respectively. However, this volume is based upon the assumed average depths and associated areas of impacted soils for this site. Actual volumes of impacted soils requiring remediation may be much greater, and can be better estimated during a pre-design investigation.

#### 5.3.2.1.1 Surface Soils

As shown in Table 5-2, the estimated areal extent of surface soils containing impacted soils consists of essentially the entire Bern Metal and Universal properties and a portion of the adjacent Conrail property. The areal extent of the Bern Metal and Universal properties is 5.2 acres. An estimated 0.6 acres of the Conrail property located immediately south of the Bern Metal property appears to have been impacted by past operations at Bern Metal. In addition, an estimated 0.25 acres of the Laub property, located immediately east of the southern portion of the Bern Metal property, also appears to have been impacted by past operations at Bern Metal. Surface soil samples collected in these areas indicated the presence of lead in the upper 6 inches of soil.

A more extensive sampling/analysis program will be incorporated into the remedial action to more fully delineate the extent of lead-impacted soils requiring remediation. In addition, two of 24 samples collected from bottom of the ditch between the Bern Metal site and Conrail properties contained lead in exceedance of the 1,000 mg/kg cleanup level. Other areas that may have been impacted include the Conrail property located immediately west of the Bern Metal and Universal property lines, between the Bern Metal and Universal property fence line and the Conrail railroad line.

#### 5.3.2.1.2 Subsurface Soils

The remedial investigation indicated the presence of lead in exceedance of site background in subsurface soils. The total volume of impacted soils containing lead in concentrations exceeding 1,000 mg/kg has been estimated at 25,260 cubic yards (in place) for surface/subsurface soils at the Bern Metal and Universal Sites. This volume was estimated for the purpose of estimating the cost of potential remedial alternatives only. Based upon the limited subsurface data collected during the RI, a pre-design investigation may be required to more fully delineate the extent of subsurface impacts in those areas where subsurface data is limited.

#### 5.3.2.1.3 Contaminated Surficial Debris

Contaminated debris existing on the site includes broken battery casings, scrap metal, slag, and broken pieces of concrete. Various waste piles at this site were previously removed by the USEPA. No samples of debris were collected during the RI or previous investigations. Pieces of spent battery casings are scattered throughout the Bern Metal property and are also found in those off-site properties which were (reportedly) formerly used for on-site operations by either Bern Metal or other tenants of the site. Spent battery casings and other debris related to former operations (i.e., slag) may have contributed to the deposition of lead in the soils and will require remediation. The remedial technologies selected for further analysis are all capable of treating most of the contaminated debris left on-site, with limited pre-treatment required (i.e., size reduction). Future treatability testing may demonstrate that a portion of the debris is not suitable for on-site treatment and may require separate management.

#### 5.3.2.2 Fencing and Signage

All alternatives will utilize existing fencing and signage around the site as a means of restricting access. This would include inspections and repair, as needed, of fencing and signage located around the site, in order to restrict access to the Site. It is anticipated that the existing fencing and signage are sufficient to maintain access restrictions at the Site for all of the chosen remedies. For Alternative 3, it is anticipated that fencing would require removal and reinstallation to allow for installation of the perimeter anchor trench.

#### 5.3.2.3 MSG Cap

A MSG cap would be constructed over the areal extent of the Bern Metal and Universal sites, including the area currently containing an asphalt cap. The areal extent of the Bern Metal and Universal Sites is 5.2 acres. This option would include the excavation and placement of an estimated 970 cubic yards of additional impacted soil and sediments prior to cap installation. Limited excavation of perimeter soils would be required for drainage, to install the anchor trench and to blend final grades with surrounding topography.

#### 5.3.2.4 Treated Soil Volumes

For each of the alternatives involving on-site treatment of soils (Alternatives 4A, 4B, and 5), treated soils would be replaced on site. The volume of treated soil, with respect to the original volume of impacted soil, is anticipated to remain constant, with the exception of Alternative 4A, in which treated soil volumes have been assumed to have a volume increase (swell) of 20%.

### 5.3.2.5 Soil Cap

A soil cap, which incorporates a soil layer for vegetative cover, will be installed over areas which have been stabilized using either ex-situ or in-situ methods. The area of the soil cap will differ for the ex-situ and in-situ solidification/stabilization remedies. The areal extent of the soil cap for the in-situ solidification/stabilization option will consist of the entire 5.2 acres of the site. The areal extent of the soil cap for the ex-situ solidification/stabilization option will consist of the extent of the cell in which treated soils will be placed, which is estimated to be 2.5 acres.

### 5.3.2.6 On-Site Structures

The Bern Metal warehouse will require demolition. For the purposes of estimation, a volumetric estimate of the materials to be demolished has been prepared. In addition, the Universal warehouse was also included in this estimate. For the purposes of cost estimation, the materials that will be demolished at the two buildings consist of the concrete masonry walls, structural steel, and corrugated steel. The dimensions of the Bern Metal warehouse have been estimated to be 100 feet long x 75 feet wide x 20 feet high; the dimensions of the Universal warehouse have been estimated to be 125 feet long x 35 feet wide x 25 feet tall. The estimated volume of debris to be generated from demolition of the Bern and Universal warehouses is 722 cubic yards, which assumes 12-inch thick masonry block walls and a swell factor of 30%. This is the volume of debris requiring management used for preparing the cost estimate.

### 5.3.2.7 Backfill Material

Alternatives 3 through 6 each involve a certain degree of excavation. For each alternative, clean soil fill material from a NYSDEC-approved borrow source will be required to replace either all or a portion of excavated soils. The required volume of soil fill material for each alternative is dependent upon the volume of treated soil to be returned to that area as part of the alternative. Alternatives 3, 4B, and 5 involve the lowest required volume of fill material to be brought onto the site; Alternative 6 involves the highest volume. In estimating the required volumes, a swell and loss factor of 30% was used.

#### 5.3.2.8 Monitoring Wells

It is anticipated that the remedies requiring excavation of on-site soils and capping will require abandonment of existing groundwater monitoring wells and installation of new groundwater monitoring wells. Based upon the estimated depths of excavation, it is anticipated that all monitoring wells will require abandonment during excavation activities due to the presence of elevated lead soil concentrations at depth, and the shallow depth at which these wells are screened. For the purposes of cost estimation, it is anticipated that each abandoned well will be replaced with a new monitoring well following completion of the work, although the replacement wells would be relocated to better monitor the performance of the selected remedy.

Installation of a cap on the site will require abandonment of all groundwater monitoring wells, in addition to installation of new groundwater monitoring wells located along the perimeter of the facility to monitor the effectiveness of the capping remedy. It is anticipated that seven groundwater monitoring wells will be located around the site perimeter.

## 5.4 Cost Estimates for Individual Technologies

Detailed cost estimates are presented in this section for the individual technologies that compose the various alternatives being evaluated. A summary of design parameters required to estimate the costs for each technology is presented in Table 5-3.

### 5.4.1 Fencing & Signage

Fencing and signage has been installed to prevent site access and contact with on-site impacted soils. Under the Institutional Action alternative, Alternative 2, an operation and maintenance program for the perimeter fencing will be required. For Alternatives 1, 2, 3, 4A, and 4B, it is assumed that operation and maintenance will be performed for a period of 30 years. For Alternatives 5 and 6, it is assumed that operation and maintenance will be performed for a period of 5 years. Operation and maintenance costs include monthly inspection of the fence, and required maintenance and repair. The annual operation and maintenance costs for fencing and signage are presented in Table 5-4.

### 5.4.2 Pre-Design Investigation

Performance of a pre-design investigation would be required to more fully delineate the lateral and vertical extent(s) of on- and off-site impacted soils requiring remediation. The scope of the investigation would be based upon the selected remedy. For those remedies involving soil treatment or removal, the investigation would require delineation of both on- and off-site soils. For the capping alternative, the investigation would require delineation of the extent of off-site impacts to soils to determine the required volume of soils requiring on-site consolidation. In addition, for the off-site disposal alternative, the investigation must include an evaluation of the hazardous characteristics of the soil using TCLP analysis in addition to total metals analysis.

The pre-design investigation would involve collection of soil borings along a grid system at varying depths. The extent of required excavation could be estimated based on interpretation of the locations and depths of soil lead concentrations. For the purposes of cost estimation, the pre-design investigation has been broken down into three components:

1) Investigation of impacted on-site soils to determine total lead concentrations;
2) Investigation of impacted off-site soils to determine total lead concentrations;

3) Investigation of impacted soils for the presence of RCRA-characteristic wastes.

Soil borings would be initially be installed on a 100-foot x 100-foot grid for on-site locations, and samples would be collected at depths of 2 feet, 4 feet, 6 feet and 8 feet. It is assumed that 50% of the collected samples would be analyzed for total lead. A total of approximately 50 samples from 23 locations (including 10% QA/QC samples) would be analyzed. At off-site locations, soil borings would be initially installed on a 50-foot x 50-foot grid, and sample depths at 2 feet and 4 feet below ground surface. An estimated 11 samples would be analyzed. Samples will be analyzed only if the analytical results from the sample collected from the same borehole at the adjacent, shallower depth indicate lead in concentrations exceeding soil cleanup criteria for the site. For disposal characterization purposes, it is assumed that composite samples, collected at a 20% frequency of total lead analyses, will be collected from the same locations and analyzed for the entire suite of TCLP analytes. A capital cost estimate for a pre-design investigation for Alternatives 3, 4A, 4B, 5, and 6 is included in Table 5-5. For each alternative, the estimated costs vary, depending upon the scope of the associated tasks.

### 5.4.3 Building Demolition

Demolition of the on-site structures will be required for Alternatives 3 through 6. It is anticipated that the Bern Metal warehouse and the Universal warehouse will require demolition. For Alternative 3, the building debris will be consolidated onto the site, for use as general fill material to achieve the desired grades. Because no TCLP testing of the building materials was conducted during the RI, prior to disposal of this material, proper characterization to determine if the debris would be considered a hazardous waste would be required. For the purposes of this cost estimate, the building materials will be considered to be non-hazardous and disposed of as non-hazardous solid waste. For Alternatives 4A, 4B, 5, and 6, generated building debris will be sent off site and disposed of as solid waste. Table 5-6 presents a capital cost estimate for building demolition and materials management for Alternatives 3, 4A, 4B, 5, and 6.

### 5.4.4 MSG Cap

Installation of a MSG cap over the site is required for Alternative 3. The MSG cap would consist of a subbase material of sufficient thickness to establish required grades and to protect the overlying geomembrane from puncture from surficial debris. Table 5-7 presents a capital cost estimate for the installation of a MSG cap.

The MSG cap would require operation and maintenance activities for 30 years. Operation and maintenance cost items would include monthly inspection of the cap, and maintenance/repair of all cracks or other fractures that may allow infiltration of surface waters into the fill. An annual operation and maintenance cost estimate for the MSG cap is presented in Table 5-8.

### 5.4.5 Ex-Situ Solidification/Stabilization

Alternative 4A includes excavation of adversely impacted soils, solidification/stabilization of the soils, and replacement. The volume of soil to be treated is estimated to be 25,260 cubic yards.

Solidification processes are highly labor- and material-intensive processes. The costs are highly variable, depending on vendor, contractor, additive(s), addition ratio, and soil-mixing technique. Because the contaminants of concern for this site are inorganics, primarily lead, several solidification processes could be applied to these soils. These processes range from "standard" systems, consisting of Portland cement, fly ash, and other pozzolanic systems, to highly specialized systems incorporating proprietary additives and reagents. For the purposes of this cost estimate, a standard, Portland cement-based system has been assumed as being capable of effectively treating these soils. A treatability study would be conducted to identify the additive types and required soil:additive ratios. Treated soils will be placed in a 2.5 acre "disposal cell", covered by a soil cap. This cell would be mounded and would be graded to promote runoff and to match with the surrounding contours. The excavated areas would be backfilled with clean backfill. A capital cost estimate for this technology is presented in Table 5-9. The operation and maintenance costs associated with the soil cap included with this remedy are described in Section 5.4.7.

### 5.4.6 In-situ Solidification

Alternative 4B includes in-situ solidification of adversely impacted soil. Off-site impacted soils would be excavated and consolidated onto the site.

Solidification processes are highly labor- and material-intensive processes. In-situ solidification costs are highly variable, depending on vendor, contractor, additive(s), soil: additive ratio, and soil-mixing technique. Several methods of in-situ soil mixing are available, ranging from direct applications of reagent to the ground to deep soil mixing with augers that directly inject and mix additives with soil. For this site, readily available shallow soil mixing equipment, such as backhoes and tilling equipment, is assumed to be capable of adequately mixing the soil and additives, to the required depths (less than 7 feet).

A soil cap would be installed on the treated soil, over the 5.2 acre site. A capital cost estimate for in-situ solidification is presented in Table 5-10.

### 5.4.7 Soil Cap

Installation of a soil cap in the area adjacent to the manufacturing building is included in alternatives 4A and 4B. The soil cap is used when treated soils are placed back into the ground in this area. The soil cap is a two-layered system that consists of 18 inches of general fill material over the regraded site soils. An uppermost layer of 6 inches of topsoil with vegetative cover comprises the second layer. There should be no difficulty in locating a borrow source for the general fill component, since general fill may consist of a wide variety of materials. The capital cost estimate for the installation of a soil cap is included in the capital cost estimates for Alternatives 4A and 4B (Tables 5-9 and 5-10, respectively).

The soil cap would require operation and maintenance activities for a period of 30 years. operation and maintenance cost items would include monthly inspection of the cap, and maintenance/repair of any of the cost items identified above. An annual operation and maintenance cost estimate for a soil cap, associated with Alternatives 4A and 4B, is presented in Table 5-11. The operation and maintenance costs associated with the soil cap included with this remedy are described in Section 5.4.7.

### 5.4.8 Soil Washing/Acid Extraction

Alternative 5 consists of excavation, treatment of soils using a soil washing/acid extraction process, and replacement of "decontaminated" soils. A treatability study is required under this option. This treatment technology is extremely specialized and associated costs are highly variable, depending on vendor, contractor, particle size and density distributions, contaminant distribution (among particle sizes), and required equipment. Many variations of this technology exist, including those that solely utilize particle-size separation techniques, those that solely utilize chemical leaching, and those that utilize a combination of separation and leaching. Because much of the contamination at this site is anticipated to be found in the fine particles and broken battery casings, a technology that utilizes a combination of separation by particle size and density, and leaching of only the highly contaminated fractions was selected for this cost estimate. This type of technology will result in an optimum amount of leachant used, resulting in a highly concentrated product that can possibly be utilized for subsequent recovery of metals. Leachant will be recycled throughout the process, and minimal waste (other than recovered contaminants) will be generated. Treated soil will be placed back onto the site, so no soil cap will be required. Table 5-12 includes a capital cost estimate for soil washing/acid extraction.

### 5.4.9 Excavation and Off-Site Disposal

Alternative 6 includes excavation and off-site disposal of adversely impacted soils. The limited amount of TCLP testing of soil samples collected during the RI indicates that some of the on-site soils would require management as a RCRA-characteristic hazardous waste (for lead), if removed from the site prior to treatment. For the purposes of cost estimation, it is assumed that the excavated material will require management as both hazardous (25%) and non-hazardous (75%) waste. Table 5-13 includes a capital cost estimate for excavation and off-site disposal of impacted soils.

### 5.4.10 Groundwater Monitoring

During implementation of the RI, a network of groundwater monitoring wells was installed at the site. This monitoring network is sufficient for the implementation of a long-term groundwater monitoring program, with the exception that certain wells will require abandonment and replacement during implementation of the various remedies. Therefore, there are limited additional capital costs associated with long-term groundwater monitoring. Capital costs for monitoring well abandonment and installation, which is associated with Alternatives 3, 4A, 4B, 5, and 6, are presented in Table 5-14.

It is assumed that semi-annual sampling will be required for a period of 5 years, followed by an annual sampling program over 25 years thereafter in all alternatives except alternatives 1, 5, and 6. The number of samples collected from the monitoring wells will be dependent upon the final number of monitoring wells at the site. Samples will be analyzed for total lead. In addition, one duplicate sample will be analyzed for QA/QC purposes during each sampling event. Table 5-15 includes an annual operation and maintenance cost estimate for groundwater monitoring for each of the alternatives. For Alternatives 5 and 6, a performance period of five years was assumed.

## 5.5 Cost Estimates for Alternatives

Table 5-16 summarizes the capital and annual operation and maintenance costs for each alternative based upon the component costs developed in the previous subsection. For the economic evaluation of alternatives, the total cost (i.e., capital and annual operation and maintenance costs) of an alternative is converted to its present-worth cost based upon the performance period of the alternative or technologies (5 to 30 years), and a 10 percent rate of return. The present worth of each alternative is also presented in Table 5-20. These costs are discussed below.

## 5.6 Comparison of Alternatives

This analysis involves a comparative analysis of the alternatives to determine which alternative best meets the objectives of this FS. Specifically, the results of the two previous analyses (namely, the weighted matrix scoring system and cost estimates) are used.

Alternatives 1 and 2 are considered to be ineffective, since the contaminants of concern and their associated risks would remain unchanged following the implementation of either alternative. As shown in the EA, current conditions are such that estimated exposures via off-site migratory routes are within acceptable limits. Direct contact with on-site soils represents the exposure pathway of the greatest concern, although the exposure is not quantifiable due to the intermittent nature of the exposure (trespassers and Conrail employees who are potentially exposed periodically). The chemical-specific ARARs and SCGs are exceeded on site, and the contaminants of concern may eventually move off site, increasing the levels of risk to human health and the environment.

Under alternatives 3, 4A, 4B, 5 and 6, all impacted soils would be addressed through either treatment, containment, and/or removal from the site. These alternatives all serve to minimize the direct contact hazard and further infiltration of contaminants of concern into the groundwater. Future risks would be minimized by eliminating potential future releases from the site via wind erosion, surface water runoff, or infiltration into groundwater. Implementation of operation and maintenance programs, where required, would serve to ensure these alternatives all offer long-term effectiveness and permanence. These alternatives all ensure additional protection to human health and the environment, as compared to existing conditions.

Alternative 3, the capping option, does not serve to alter the toxicity or volume of hazardous waste at the site, except by minimizing the volume of groundwater through minimization of infiltration into the overburden. Prevention of infiltration also will serve to reduce the mobility of the constituents of concern at the site. Alternatives 4A and 4B also reduce the mobility of constituents of concern at the site. Alternative 5, which is a separation process, serves to completely reduce the toxicity, mobility, and volume of constituents of concern.

In terms of implementability, alternatives 1 and 2 would be the least difficult to construct. Short-term risks to the community and environment would be minimal, since no constituents of concern would be disturbed. After these two, Alternative 3 would be the next easiest to implement, in that the uncertainties involving delineation of the extent of impacted soils would be limited to only off-site soils. Excavation and soil handling activities would be minimal, as compared to alternatives 4A, 4B, 5, and 6. In addition, the short term risks to the community and environment would be less for alternative 3 than for alternatives 4A, 4B, 5, and 6, all of which involve the potential for higher dust and metals emissions and impacts to the nearby community because of the larger amount of excavation and soil-handling activities.

An examination of the matrix scoring chart (Table 5-1) shows that Alternative 3 has the highest score (71.3 out of 100).

In conclusion, Alternative 3 would provide protection to human health and the environment in excess of that which is currently present at the site. Excluding alternatives 1 and 2, the other alternatives offer additional long-term protection, but also provide an increase in short-term risks, difficulty in implementation, and increased cost. In addition, alternatives 4A, 4B, 5 and 6 present a higher degree of uncertainty associated with the actual volume of impacted soils requiring remediation, and, for alternative 6, the amount of impacted soils requiring off-site disposal as hazardous waste, versus disposal as solid waste.

Based upon the comparative analysis of the alternatives, and the cost-effectiveness associated with it, alternative 3, Capping, has been selected as the preferred alternative for remediation of the Bern Metal and Universal Site. When implemented in conjunction with a long-term operation and maintenance program, this alternative will offer the same degree of protection to human health and the environment as the other alternatives, and will also be more protective to human health and the environment in the short-term because of the lower risks associated with its implementation.

# SECTION 6

# 6.0 Conceptual Approach of Preferred Alternative

## 6.1 General

This section presents a brief conceptual design for the proposed remedial alternative, including some general design parameters that must be incorporated into the final design and additional data as part of the pre-design investigation that may be required to implement the remedy.

## 6.2 Preliminary Design

### 6.2.1 MSG Cap

The MSG cap will be installed over the entire Bern Metal and Universal sites, as shown in Figure 6-1. General design considerations to be incorporated into the design include:

- Grading: A minimum 4% grade must be incorporated over the area of the cap to divert runoff and minimize surface-water infiltration. The 4% grade is sufficient to allow for diversion of runoff, while minimizing erosion. Because the cap will be approximately 2 feet thick, excavation and trenching along the site perimeter will be required to meet the existing grades surrounding the property.

- The cap will be designed with sufficient structural integrity, as per 6 NYCRR Part 360-2.7 b(6). The pre-design investigation should include an analysis of the load-bearing capacity of the surface to minimize subsidence or settlement of the surface soil.

- Water Diversion: Water will be collected from surficial runoff and from the sand drainage layer underlying the vegetative cover. Collected water will be diverted to the drainage ditch running along the northern and western boundaries of the site, and into the storm sewer located at Bender Avenue. Installation of a drainage channel to convey runoff from the southeastern portion of the cap, to either a sewer or drainage ditch, will be required. The drainage control system will be sized to convey runoff from a 25-year/24-hour storm, per 6NYCRR Part 360.2.7 b(8).
- Cap Design: Figure 6-2 presents a conceptual cross-sectional view of the cap.

- Perimeter Fencing: During cap installation, the perimeter fencing be removed temporarily. The fencing will be replaced in the same approximate location following cap installation.

### 6.2.2 Consolidation of Materials

Prior to excavation and consolidation of soils and sediments onto the site, a pre-design investigation will be required to delineate the lateral and vertical extent of impacted soils on the Conrail property. Based upon the extent of the additional investigatory work conducted at the Laub property, it has been assumed that no pre-design investigation will be required on the Laub property. These areas are depicted in Figure 5-1. Soil borings will be installed on the Conrail property from ground surface to a maximum depth of 8 feet. Soil samples will be collected from the borings and analyzed for lead. The extent of soil containing lead in concentrations above the cleanup level of 1,000 mg/kg will be identified for removal.

Coordination with Conrail and NYSDEC will be required to establish procedures for removal of impacted soils from the areas adjacent to the railroad tracks. This will include engineering controls, such as shoring, and temporary rerouting of train service during construction activities.

Soils from adjacent areas impacted by past operations and demolition debris from on-site buildings will be consolidated on-site for use as subbase material and to achieve the required grades. Clean soil fill material will be brought in from a NYSDEC-approved borrow source to achieve final grades prior to cap installation and to replace soil excavated from off-site locations. A vegetative cover will be required on the off-site locations of clean fill placement.

### 6.2.3 Monitoring Well Abandonment/Replacement

The on-site monitoring wells will probably require abandonment. Seven new monitoring wells will be installed along the perimeter of the cap. The cap will serve to reduce the volume of groundwater, possibly reversing hydraulic gradients onto the site. Therefore, it will not be possible to differentiate between upgradient and downgradient wells prior to cap installation.

## 6.3 Operation and Maintenance

The capping system will require operation and maintenance for 30 years. An operation and maintenance plan for the site will be prepared, and will include an erosion and sedimentation control plan. Operation and maintenance of the MSG cap will include monthly inspections, mowing, revegetation, and removal of deep rooted shrubs and trees. In addition, repairs to the cap will be made in the event of physical damage or subsidence of the cap. In addition, a semi-annual groundwater monitoring program will be instituted for a period of 5 years, followed by an annual monitoring program to be implemented from years 6 through 30.

## 6.4 Preliminary Cost Estimate

The total capital cost required for the implementation of this remedy is $1,458.00. The total annual operation and maintenance costs are $47,000 (years 1-5) and $42,400 (years 6-30). The 1995 present worth of the total cost, using a 30-year performance and 10% rate of return is $1,874,900. A breakdown of these costs is presented in Tables 5-7 and 5-8 for capital and operation and maintenance costs, respectively.

The capital and annual operation and maintenance costs were developed in Section 5; therefore, reference should be made to that section for additional details. The estimates were prepared by using numerous assumptions that are subject to change pending future investigations or developments. However, for purposes of ranking remedial measures and quantitative scoring they are appropriate.

# TABLES

**TABLE 5-1**
**WEIGHTED-MATRIX SCORING SYSTEM FOR REMEDIAL ALTERNATIVES**

**ALTERNATIVE 1: No Action**
**ALTERNATIVE 2: Institutional Action**
**ALTERNATIVE 3: Capping**
**ALTERNATIVE 4A: Ex-situ Solidification/Stabilization**
**ALTERNATIVE 4B: In-situ Solidification/Stabilization**
**ALTERNATIVE 5: Soil Washing/Soil Leaching**
**ALTERNATIVE 6: Removal and Off-site Disposal**

A. SHORT-TERM EFFECTIVENESS (Relative Weight = 15)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4A | 4B | 5 | 6 |
| 1. Protection of community during remedial actions | - Are there significant short-term risks to the community that must be addressed? (if no, go to Factor 2) | Yes: 0<br>No: 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| | - Can the short-term risk be easily controlled? | Yes: 1<br>No: 0 | NA | NA | 1 | 0 | 0 | 0 | 0 |
| | - Does the mitigative effort to control risk impact the community lifestyle? | Yes: 0<br>No: 2 | NA | NA | 2 | 0 | 0 | 0 | 0 |
| 2. Environmental Impacts | - Are there significant short-term risks to the environment that must be addressed? (If no, go to Factor 3) | Yes: 0<br>No: 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| | - Are the available mitigative measures reliable to minimize potential impacts? | Yes: 3<br>No: 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 |
| 3. Time to implement the remedy | - What is the required time to implement the remedy? | < 2 yr: 1<br>> 2 yr: 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | - Required duration of the mitigative effort to control short-term risk. | < 2 yr: 1<br>> 2 yr: 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| SUBTOTAL (MAXIMUM = 10) | | | 10 | 10 | 8 | 5 | 5 | 5 | 5 |

B. LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER 1 | 2 | 3 | 4A | 4B | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| 1. On-site or off-site treatment or land disposal. | On-site treatment:<br>Off-site treatment:<br>On-site or off-site land disposal: | 3<br>1<br>0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 |
| 2. Permanence of the remedial alternative | - Will the remedy be classified as permanent in accordance with Section 2.1(a),(b) or (c) of the NYSDEC TAGM for the "Selection of Remedial Actions at Inactive Hazardous Waste Sites", May 15, 1990? (if yes, go to Factor 4) | Yes: 3<br>No: 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 |
| 3. Lifetime of remedial actions | - Expected lifetime or duration of effectiveness of the remedy | 25-30 yr: 3<br>20-25 yr: 2<br>15-20 yr: 1<br><15 yr: 0 | 0 | 0 | 3 | -- | -- | -- | 3 |
| 4. Quantity and nature of waste or residual left at the site after remediation | i. Quantity of untreated hazardous waste left at the site | None: 3<br><25%: 2<br>25-50%: 1<br>>50%: 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 |
| | ii. Is there any treated residual left at the site? (if no, go to Factor 5) | Yes: 0<br>No: 2 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| | iii. Is the treated residual toxic? | Yes: 0<br>No: 1 | 0 | 0 | 0 | 0 | 0 | -- | -- |
| | iv. Is the treated residual mobile? | Yes: 0<br>No: 1 | 0 | 0 | 1 | 1 | 1 | -- | -- |
| 4. Adequacy and reliability of controls | i. Operation and maintenance required for a period of: | < 5 yr: 1<br>> 5 yr: 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | ii. Are environmental controls required as a part of the remedy to handle potential problems? (if no, go to "iv") | Yes: 0<br>No: 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | iii. Degree of confidence that controls can adequately handle potential problems | Moderate to very confident: 1<br>Somewhat to not confident: 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| | iv. Relative degree of long-term monitoring required (compare with other alternatives) | Minimum - 2<br>Moderate - 1<br>Extensive - 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 |
| SUBTOTAL (MAXIMUM = 15) | | | 0 | 0 | 8 | 8 | 8 | 11 | 11 |

C. REDUCTION OF TOXICITY, MOBILITY OR VOLUME (Relative Weight = 15)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER 1 | 2 | 3 | 4A | 4B | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Volume of hazardous waste reduced (reduction in volume or toxicity) | i. Quantity of hazardous waste destroyed or treated | 99-100%: 8<br>90-99%: 7<br>80-90%: 6<br>60-80%: 4<br>40-60%: 2<br>20-40%: 1<br><20%: 0 | NA | NA | NA | NA | NA | 7 | NA |
| (If Factor 1 is not applicable, go to Factor 2). | ii. Are there any concentrated hazardous wastes produced as a result of (i)? (if no, go to Factor 2) | Yes: 0<br>No: 2 | NA | NA | NA | NA | NA | 0 | NA |
| (If subtotal = 10, go to factor 3) | iii. After remediation, how is the concentrated hazardous waste stream disposed? | On-site land disposal: 0<br>Off-site secure land disposal: 1<br>Off-site destruction or treatment: 2 | NA | NA | NA | NA | NA | 1 | 1 |
| 2. Reduction in mobility of hazardous waste | i. Quantity of wastes immobilized after destruction / treatment. | 90 - 100%: 2<br>60 - 90%: 1<br>< 60%: 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 |
| | ii. Method of Reduction<br>- Reduced mobility by containment:<br>- Reduced mobility by alternative treatment technology: | <br><br>0<br><br>3 | NA | NA | 0 | 3 | 3 | 3 | 0 |
| 3. Irreversibility of the destruction or treatment of hazardous waste | o Completely irreversible:<br>o Irreversible for most of the *hazardous waste constituents:*<br>o Irreversible for only some of the hazardous waste constituents:<br>o Reversible for most of the hazardous waste constituents: | 5<br>3<br>2<br>0 | 0 | 0 | 3 | 3 | 3 | 5 | 3 |
| SUBTOTAL (MAXIMUM = 15) | | | 0 | 0 | 5 | 8 | 8 | 15 | 6 |

tab5-2.wb2

D. IMPLEMENTABILITY (Relative Weight = 15)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4A | 4B | 5 | 6 |
| 1. Technical Feasibility | | | | | | | | | |
| a. Ability to construct technology | i. Not difficult to construct. No uncertainties in construction<br>ii. Somewhat difficult to construct. No uncertainties in construction<br>iii. Very difficult to construct and/or significant uncertainties in construction | 3<br>2<br>1 | 3 | 3 | 2 | 1 | 1 | 1 | 1 |
| b. Reliability of technology | i. Very reliable in meeting the specified process efficiencies or performance goals<br>ii. *Somewhat reliable in meeting* the specified process efficiencies or performance goals | 3<br>2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| c. Schedule of delays due to technical problems | i. Unlikely<br>ii. Somewhat likely | 2<br>1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| d. Need of undertaking additional remedial action, if necessary | i. No future remedial action may be anticipated<br>ii. Some future remedial actions may be necessary | 2<br>1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| 2. Administrative Feasibility (Coordination with other agencies) | i. Minimal coordination is required<br>ii. Required coordination is normal<br>iii. Extensive coordination is required | 2<br>1<br>0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| 3. Availability of Services and Materials | | | | | | | | | |
| a. Availability of prospective technologies | i. Are technologies under consideration generally commercially available for the site-specific application? | Yes - 1<br>No - 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | ii. Will more than one vendor be available to provide a competitive bid? | Yes - 1<br>No - 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| b. Availability of necessary equipment and specialists | i. Additional equipment and specialists may be available without significant delay | Yes - 1<br>No - 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| SUBTOTAL (MAXIMUM = 15) | | | 14 | 14 | 12 | 9 | 9 | 7 | 10 |

E. COMPLIANCE WITH ARARS (Relative Weight = 10)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4A | 4B | 5 | 6 |
| 1. Compliance with chemical-specific ARARs | Meets chemical-specific ARARs | Yes: 4<br>No: 0 | 0 | 0 | 0 | 4 | 4 | 4 | 4 |
| 2. Compliance with action-specific ARARs | Meets action-specific ARARs | Yes: 3<br>No: 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 |
| 3. Compliance with location-specific ARARs | Meets location-specific ARARs | Yes: 3<br>No: 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| SUBTOTAL (MAXIMUM = 10) | | | 3 | 3 | 6 | 10 | 10 | 10 | 10 |

F. PROTECTION OF HUMAN HEALTH & THE ENVIRONMENT (Relative Weight = 20)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4A | 4B | 5 | 6 |
| 1. Use of site after remediation | Unrestricted use of the land and water (if yes, go to end of table) | Yes - 20<br>No - 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2. Human health and the environment exposure after the remediation | i. Is the exposure to contaminants via air route acceptable? | Yes - 3<br>No - 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 |
| | ii. Is the exposure to contaminants via groundwater/surface water acceptable? | Yes - 4<br>No - 0 | 0 | 4 | 4 | 4 | 4 | 4 | 4 |
| | iii. Is the exposure to contaminants via sediments/ soil acceptable? | Yes - 3<br>No - 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 |
| 3. Magnitude of residual public health risks after the remediation | i. Health risk<br>ii. Health risk | <1 in 1,000,000 - 5<br><1 in 100,000 - 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 |
| 4. Magnitude of residual environmental risks after the remediation | i. Less than acceptable<br>ii. Slightly greater than acceptable<br>iii. Significant risk still exists | 5<br>3<br>0 | 3 | 3 | 5 | 5 | 5 | 5 | 5 |
| SUBTOTAL (MAXIMUM = 20) | | | 5 | 9 | 20 | 20 | 20 | 20 | 20 |

G. COST (Relative Weight = 15)

| FACTOR | BASIS FOR EVALUATION | WEIGHT | ALTERNATIVE NUMBER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4A | 4B | 5 | 6 |
| Overall (MAXIMUM = 15) | Scored on a linear scale with 0 and 15 assigned to the highest and the least cost alternatives respectively. | Lowest - 15<br>Others - Relative | 15 | 14.7 | 12.3 | 7.6 | 7.8 | 0.0 | 5.3 |

SUMMARY

| CATEGORY | ALTERNATIVE NUMBER | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4A | 4B | 5 | 6 |
| A. SHORT-TERM EFFECTIVENESS (Relative Weight = 15) | 10 | 10 | 8 | 5 | 5 | 5 | 5 |
| B. LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15) | 0 | 0 | 8 | 8 | 8 | 11 | 11 |
| C. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15) | 0 | 0 | 5 | 8 | 8 | 15 | 6 |
| D. IMPLEMENTABILITY (Relative Weight = 15) | 14 | 14 | 12 | 9 | 9 | 7 | 10 |
| E. COMPLIANCE WITH ARARS (Relative Weight = 10) | 3 | 3 | 6 | 10 | 10 | 10 | 10 |
| F. PROTECTION OF HUMAN HEALTH & THE ENVIRONMENT (Relative Weight = 20) | 5 | 9 | 20 | 20 | 20 | 20 | 20 |
| G. COST (Relative Weight=15) | 15 | 14.7 | 12.3 | 7.6 | 7.8 | 0 | 5.3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TOTAL SCORE (Maximum = 100) | 47.0 | 50.7 | 71.3 | 67.6 | 67.8 | 68.0 | 67.3 |

NOTES:

Alt 1 - No Action
Alt 2 - Institutional Action
Alt 3 - Capping
Alt 4A - Ex-Situ Solidification/Stabilization
Alt 4B - In-Situ Solidification/Stabilization
Alt 5 - Soil Washing/Acid Extraction
Alt 6 - Excavation/Off-Site Disposal

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**Table 5-2 - Estimated Extent of Remediation, Soil**
**Bern Metal/Universal Site**
**Feasibility Study**

| Area Description | Surface Area (acres) | Estimated Average Depth (ft.) | Estimated Impacted Volume (cu.yd.) |
|---|---|---|---|
| Universal Site | 1.5 | 3.0 | 7260 |
| Bern Site (Northern)[1] | 1.5 | 4.0 | 9680 |
| Bern Site (Southern)[2] | 2.2 | 2.0 | 7099 |
| Conrail, Off-Site[3] | 0.6 | 1.0 | 970 |
| Laub, off-site4 | 0.25 | 0.5 | 230 |
| Sediments, off-site[5] | 1,000 s.f. | 0.5 | 19 |
| Totals[6] | 5.2 | -- | 25,258 |

Notes:

1. This portion of the Bern property was estimated as the northern half of the property extending to MW-3.

2. This portion of the Bern property is the southern half of the property extending from MW-3 to the fenceline.

3. This is the portion of the Conrail property located immediately south of the Bern property, and was sampled during the supplemental RI.

4. This is the portion of the Laub property located immediately east of the southern corner of the Bern Metal property, and was sampled after the supplemental RI.

5. The volume of the impacted sediments was delineated from analytical data gathered in the RI.

6. For the purposes of estimating capping costs, the total surficial area estimate did not include the Bern (off-site) Conrail, or Laub properties. The total volumetric estimate includes on- and off-site impacted soils and sediments.

**Table 5-3: Design Paramters/Estimated Quantities**
**Bern Metal/Universal Site**
**Feasibility Study**

| Item No. | Design Item | Alternative Nos. | Design Parameters/ Estimated Quantities |
|---|---|---|---|
| 1 | MSG Cap | 3 | 5.2 acres, consisting of:<br>• Select Fill material<br>• Cushioning Geotextile<br>• 60-mil HDPE liner or equivalent<br>• Drainage Layer<br>• Soil Barrier Protective Layer<br>• Soil capable of sustaining vegetation |
| 2 | Backfill Material | 3 | 34,170 cu. yd. |
| | | 4A | 18,440 cu. yd. |
| | | 4B | 17,700 cu. yd. |
| | | 5 | 1,260 cu. yd. |
| | | 6 | 26,300 cu. yd. |
| 3 | Building Demolition (includes air space) | 3 - 6 | 259,000 cu. ft. |
| 4 | Building Debris (for on- or off-site management) | 3-6 | 722 cu. yd. |
| 5 | Soil Cap | 4A | 5.2 acres |
| | | 4B | 2.5 acres |
| 6 | Solidification/ Stabilization (treated volume) | 4A | 30,040 cu. yd. |
| 7 | Soil Washing/ Acid Leaching (treated volume) | 5 | 25,260 cu. yd. |
| 8 | Monitoring Well Abandonment and Installation | 3 - 6 | 7 wells @ 8' average length |

## TABLE 5-4

## ANNUAL OPERATIONS AND MAINTENANCE COST ESTIMATE FOR BERN METAL/UNIVERSAL SITES FENCING REPAIR AND INSPECTIONS

DIRECT COSTS

| TASK | ITEM | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|---|
| 1) INSPECTION | MONTHLY INSPECTION | $70 | HR. | 48 | $3,360 |
| 2) REPAIR FENCE | REPAIR POSTS | $280 | EACH | 6 | $1,680 |
| | REPAIR FENCE FABRIC | $60 | LF | 100 | $6,000 |

| | |
|---|---|
| **SUBTOTAL** | **$11,040** |
| MOBILIZATION/DEMOBILIZATION (5%) | $552 |
| ESCALATION FOR LEVEL C PROTECTION (40% FOR ITEMS 2 AND 3) | $3,072 |
| ADMINISTRATION AND ENGINEERING (15%) | $1,656 |
| BONDS AND INSURANCE (10%) | $1,104 |
| **TOTAL** | **$17,424** |

COSTS.WB2

## TABLE 5-5
## CAPITAL COST ESTIMATE FOR BERN METAL/UNIVERSAL SITES
## PRE-DESIGN INVESTIGATION

**DIRECT COSTS**

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) ON-SITE INVESTIGATION | | | | |
| SOIL BORINGS (1,2) | $172.80 | PER | 23 | $3,914 |
| LEAD ANALYSIS (3) | $40.00 | PER | 50 | $1,993 |
| 2) OFF-SITE INVESTIGATION | | | | |
| SOIL BORINGS (2,4) | $172.80 | L.F. | 10 | $1,728 |
| LEAD ANALYSIS (3) | $40.00 | PER | 22 | $880 |
| 3) HAZ WASTE CHARACTERIZATION (TCLP) (5) | $900.00 | PER | 15 | $13,500 |

| | | |
|---|---|---|
| **SUBTOTALS:** | **ALT. 3** | **$2,608** |
| | **ALT. 4 & 5** | **$8,515** |
| | **ALT 6** | **$22,015** |

| **INDIRECT COSTS** | ALT. 3 | ALT. 4 & 5 | ALT. 6 |
|---|---|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $261 | $852 | $2,202 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $652 | $2,129 | $5,504 |
| CONTINGENCY (20%) | $522 | $1,703 | $4,403 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $391 | $1,277 | $3,302 |
| BONDS AND INSURANCE (10%) | $261 | $852 | $2,202 |

| | **ALT. 3** | **ALT. 4 & 5** | **ALT. 6** |
|---|---|---|---|
| **TOTALS** | **$4,694** | **$15,328** | **$26,128** |

Estimate from vendors and BBL experience.

(1) ASSUMES BORINGS INSTALLED AT 100' SPACING.
(2) INCLUDES 20% FOR ON-SITE OVERSIGHT.
(3) ASSUMES 4 SAMPLES PER BORING + 10% QA/QC., WITH 50% OF SAMPLES ANALYZED
(4) ASSUMES BORINGS INSTALLED AT 50' SPACING.
(5) ASSUMES 20% FREQUENCY OF SAMPLES FOR TCLP ANALYSIS.

## TABLE 5-6

## CAPITAL COST ESTIMATES FOR BERN METALS/UNIVERSAL SITES BUILDING DEMOLITION/DISPOSAL

**DIRECT COSTS**

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) BUILDING DEMOLITION (1) | $0.22 | C.F. | 259,000 | $58,197 |
| 2) DEBRIS: LOAD & HAUL (2) | $14.12 | C.Y. | 722 | $10,201 |
| 3) DEBRIS: DISPOSAL (NON-HAZ) (2) | $50 | C.Y. | 722 | $36,111 |
| 4) DEBRIS: ON-SITE PLACEMENT | $1,355 | DAYS | 1 | $1,355 |

| SUBTOTALS: | | |
|---|---|---|
| | **ALTERNATIVE 3** | **$59,552** |
| | **ALTERNATIVES 4 - 6** | **$104,509** |

| INDIRECT COSTS | ALTERNATIVE 3 | ALTERNATIVES 4-6 |
|---|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $5,955 | $10,451 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $14,888 | $26,127 |
| ESCALATION FOR MIDPOINT OF CONSTRUCTION (5% @ 2 YEARS) | $6,104 | $10,712 |
| CONTINGENCY (20%) | $11,910 | $20,902 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $8,933 | $15,676 |
| BONDS AND INSURANCE (10%) | $5,955 | $10,451 |
| **TOTALS** | **$113,298** | **$198,829** |

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) DEMOLITION COST ESTIMATE BASED ON BUILDING AIR SPACE
(2) ASSUMES 30% SWELL IN BUILDING DEBRIS
TASKS 1 AND 4 FOR ALTERNATIVE 3.
TASKS 1,2, AND 3 FOR ALTERNATIVES 4 - 6.
(3) DEMOLITION COSTS DO NOT INCLUDE DUST SUPPRESSION.

## TABLE 5-7

## CAPITAL COST ESTIMATES FOR BERN METALS/UNIVERSAL SITES
## MSG CAP

**DIRECT COSTS**

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) CLEARING & GRUBBING | $1,027 | ACRE | 5.8 | $5,958 |
| 2) EXCAVATION, BACKFILLING, AND COMPACTION (1) | $6.07 | CU.YD. | 970 | $5,892 |
| 3) ANCHOR TRENCH (2) | $6.00 | LF | 2420 | $14,520 |
| 4) BACKFILL: PURCHASE & HAUL (3) | $5.00 | CU.YD. | 34166 | $170,828 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 34166 | $85,414 |
| 5) CUSHIONING GEOTEXTILE | $1.47 | SQ.YD. | 29110 | $42,792 |
| 6) HDPE LINER: MATERIALS | $0.35 | SQ.FT. | 261992 | $91,697 |
| HDPE LINER: INSTALLATION (4) | $0.23 | SQ.FT. | 261992 | $60,258 |
| 7) BARRIER PROTECTIVE LAYER (3) | | | | |
| PURCHASE AND HAUL | $5.00 | CU.YD. | 10969 | $54,845 |
| PLACE AND COMPACT | $2.50 | CU.YD. | 10969 | $27,423 |
| 8) VERIFICATION SAMPLING (EXCAVATION) (5) | $1,000.00 | EACH | 3 | $2,614 |
| 9) TOPSOIL: PURCHASE & HAUL (3) | $15.00 | CU.YD. | 5485 | $82,268 |
| PLACE AND COMPACT | $2.50 | CU.YD. | 5485 | $13,711 |
| 10) FINE GRADING | $1,250.00 | ACRE | 5.23 | $6,538 |
| 11) MULCH & SEED | $1,000 | ACRE | 5.23 | $5,230 |
| 12) FENCING, REINSTALL | 15 | LF | 2420 | $36,300 |

**SUBTOTAL** **$706,286**

INDIRECT COSTS

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $70,629 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $176,572 |
| ESCALATION FOR MIDPOINT OF CONSTRUCTION (5% @ 2 YEARS) | $72,394 |
| ESCALATION FOR LEVEL C PROTECTION (40% FOR ITEMS 1 , 2, & 3) | $10,548 |
| CONTINGENCY (20%) | $141,257 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $105,943 |
| BONDS AND INSURANCE (10%) | $70,629 |

**TOTAL** **$1,354,258**

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) EXCAVATE 1' OF SOIL FROM OFF-SITE CONRAIL PROPERTY, TRANSFER TO BERN PROPERTY, REGRADE.
(2) EXCAVATE 2' x 2' TRENCH AROUND SITE PERIMETER FOR GRADING AND ANCHOR TRENCH; TRANSFER TO SITE INTERIOR, REGRADE.
(3) ASSUMES 30% SWELL AND LOSS DURING HAULING
(4) INCLUDES 15% ADD-ON FOR SHAPING AND PATCHING HDPE LINER
(5) ASSUMES VERIFICATION SAMPLES COLLECTED FROM EXCAVATION ON 100' SPACING.
(6) EXCAVATION AND SOIL HANDLING COSTS DO NOT INCLUDE DUST SUPPRESSION.

## TABLE 5-8

## ANNUAL OPERATIONS AND MAINTENANCE COST ESTIMATE FOR BERN METAL/UNIVERSAL SITES MSG CAP

DIRECT COSTS

| TASK | ITEM | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|---|
| 1) INSPECTION | Monthly Inspection | $70 | hr. | 36 | $2,520 |
| 2) MAINTENANCE | A) Mowing/Upkeep (1) | $25 | ACRE | 20.8 | $520 |
| | B) Revegetate (1 acre/yr.) | $1,200 | ACRE | 1 | $1,200 |
| | C) Erosion Repaire (1 acre/yr.) | $1,300 | ACRE | 1 | $1,300 |
| 3) REPAIR CAP BREAKTHROUGH (2) | Liner Repairs (Seeps, settlements, etc.) | $3,000.00 | LS | 2 | $6,000 |

**SUBTOTAL $11,540**

| | |
|---|---|
| Mobilization/Demobilizaiton (5%) | $577 |
| Contractor Mark-up for Overhead and Profit (25%) | $2,885 |
| Escalation for Level C Protection (40% for Item 3A) | $2,400 |
| Construction Administration and Engineering (15%) | $1,731 |
| Bonds and Insurance (10%) | $1,154 |

**TOTAL $20,287**

(1) ASSUMES 4 EVENTS PER YEAR
(2) ASSUMES 2 EVENTS PER YEAR

## TABLE 5-9

## CAPITAL COST ESTIMATES FOR BERN METALS/UNIVERSAL SITES
## EX-SITU SOLIDIFICATION/STABILIZATION

DIRECT COSTS

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) CLEARING & GRUBBING | $1,027 | ACRE | 5.8 | $5,958 |
| 2) EXCAVATION, HAUL, AND PLACEMENT | $6.07 | CU.YD. | 25,028 | $152,013 |
| 3) SOLIDIFICATION/STABILIZATION (1) | $50 | TON | 30,033 | $1,501,650 |
| 4) TREATABILITY TESTING | $20,000 | L.S. | – | $20,000 |
| 5) POST-TREATMENT SAMPLING (2) | $2,500 | PER | 30 | $2,500 |
| 6) VERIFICATION SAMPLING (EXCAVATION) (3) | $1,000.00 | EACH | 25 | $25,265 |
| 6) REPLACE TREATED SOIL (4) | $1.43 | CU.YD. | 27,530 | $39,473 |
| 7) BACKFILL: PURCHASE & HAUL (5) | $5.00 | CU.YD. | 18,436 | $92,178 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 18,436 | $46,089 |
| 8) SOIL CAP | | | | |
| BACKFILL: PURCHASE & HAUL (5,6) | $5.00 | CU.YD. | 7,865 | $39,325 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 7,865 | $19,663 |
| TOPSOIL: PURCHASE & HAUL (5,6) | $15.00 | CU.YD. | 5,485 | $82,268 |
| TOPSOIL: PLACE AND COMPACT | $2.50 | CU.YD. | 5,485 | $13,711 |
| 9) FINE GRADING | $1,250.00 | ACRE | 2.50 | $3,125 |
| 10) MULCH & SEED | $1,000 | ACRE | 2.50 | $2,500 |

**SUBTOTAL $2,045,717**

INDIRECT COSTS

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $204,572 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $511,429 |
| ESCALATION FOR MIDPOINT OF CONSTRUCTION (5% @ 2 YEARS) | $209,686 |
| ESCALATION FOR LEVEL C PROTECTION (40% FOR ITEMS 1, 2 & 3) | $663,848 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $306,858 |
| CONTINGENCY (20%) | $409,143 |
| BONDS AND INSURANCE (10%) | $204,572 |

**TOTAL $4,555,826**

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) INCLUDES PROCESSING AND REAGENT COSTS; VENDOR QUOTE.
(2) SAMPLE COLECTION/ANALYTICAL COSTS FOR EACH 1,000 TONS TREATED.
(3) ASSUMES VERIFICATION SAMPLES COLLECTED FROM EXCAVATION ON 100' SPACING.
(4) ASSUMES 10% SWELL IN TREATED SOIL
(5) REPLACE TREATED SOIL WITH CLEAN FILL ONLY; ASSUMES 30% SWELL AND LOSS DURING HANDLING.
(6) COMPONENTS FOR SOIL CAP.
(7) EXCAVATION, TREATMENT, AND SOIL HANDLING COSTS DO NOT INCLUDE DUST SUPPRESSION.

## TABLE 5-10

## CAPITAL COST ESTIMATES FOR BERN METALS/UNIVERSAL SITES
## IN-SITU SOLIDIFICATION/STABILIZATION

DIRECT COSTS

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) CLEARING & GRUBBING | $1,027 | ACRE | 5.8 | $5,958 |
| 2) EXCAVATION, HAUL, AND PLACEMENT | $6.07 | CU.YD. | 2,178 | $13,229 |
| 3) SOLIDIFICATION/STABILIZATION (1) | $50 | TON | 30,033 | $1,501,650 |
| 4) TREATABILITY TESTING | $20,000 | L.S. | – | $20,000 |
| 5) POST-TREATMENT SAMPLING (2) | $3,000 | PER | 30 | $3,000 |
| 6) VERIFICATION SAMPLING (EXCAVATION) (3) | $1,000.00 | EACH | 25 | $25,265 |
| 7) SOIL CAP | | | | |
| BACKFILL: PURCHASE & HAUL (4,5) | $5.00 | CU.YD. | 16,454 | $82,268 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 16,454 | $41,134 |
| TOPSOIL: PURCHASE & HAUL (4,5) | $2.50 | CU.YD. | 5,485 | $13,711 |
| TOPSOIL: PLACE AND COMPACT | $2.50 | CU.YD. | 5,485 | $13,711 |
| 8) SOIL COVER: OFF-SITE AREAS | | | | |
| BACKFILL: PURCHASE & HAUL (4) | $5.00 | CU.YD. | 1,258 | $6,292 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 1,258 | $3,146 |
| TOPSOIL: PURCHASE & HAUL (4) | $15.00 | CU.YD. | 629 | $9,438 |
| TOPSOIL: PLACE AND COMPACT | $2.50 | CU.YD. | 629 | $1,573 |
| 9) GRADING & SEEDING | $641 | ACRE | 5.80 | $3,718 |
| | | | ***SUBTOTAL*** | **$1,744,093** |

INDIRECT COSTS

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $174,409 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $511,429 |
| ESCALATION FOR MIDPOINT OF CONSTRUCTION (5% @ 2 YEARS) | $178,770 |
| ESCALATION FOR LEVEL C PROTECTION (40% FOR ITEMS 1, 2, & 3) | $608,335 |
| CONTINGENCY (20%) | $348,819 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $306,858 |
| BONDS AND INSURANCE (10%) | $204,572 |

**TOTAL $4,101,451**

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) INCLUDES PROCESSING AND REAGENT COSTS; VENDOR QUOTE.
(2) SAMPLE COLECTION/ANALYTICAL COSTS FOR EACH 1,000 TONS TREATED.
(3) ASSUMES VERIFICATION SAMPLES COLLECTED FROM EXCAVATION ON 100' SPACING.
(4) ASSUMES 30% SWELL AND LOSS DURING HANDLING.
(5) COMPONENTS FOR SOIL CAP.
(6) TREATMENT COSTS DO NOT INCLUDE DUST SUPPRESSION.

## TABLE 5-11

## ANNUAL OPERATIONS AND MAINTENANCE COST ESTIMATE
## FOR BERN METAL/UNIVERSAL SITES
## SOIL CAP
## ALTERNATIVES 4A & 4B

DIRECT COSTS

| TASK | ITEM | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|---|
| 1) INSPECTION | Monthly Inspection | $70 | hr. | 48 | $3,360 |
| 2) MAINTENANCE | MOWING/UPKEEP (1) | $25 | ACRE | 20.8 | $520 |
| | REVEGETATE (1 ACRE/YEAR) | $1,200 | ACRE | 1 | $1,200 |
| | EROSION REPAIR (1 ACRE/YEAR | $1,300 | ACRE | 1 | $1,300 |

**SUBTOTAL $6,380**

| | |
|---|---|
| Mobilization/Demobilizaiton (5%) | $319 |
| Contractor Mark-up for Overhead and Profit (25%) | $1,595 |
| Construction Administration and Engineering (15%) | $957 |
| Bonds and Insurance (10%) | $638 |

**TOTAL $9,889**

(1) ASSUMES 4 EVENTS PER YEAR

## TABLE 5-12

## CAPITAL COST ESTIMATES FOR BERN METALS/UNIVERSAL SITES SOIL WASHING/ACID EXTRACTION

DIRECT COSTS

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) CLEARING & GRUBBING | $1,027 | ACRES | 5.8 | $5,958 |
| 2) EXCAVATION | $6.07 | CU.YD. | 25028 | $152,013 |
| 3) TREATABILITY TESTING | $20,000 | EACH | -- | $20,000 |
| 4) SOIL WASHING/ACID EXTRACTION (1) | $150 | TON | 30033 | $4,504,950 |
| 5) POST-TREATMENT SAMPLING (2) | $2,500.00 | EACH | 30 | $75,083 |
| 6) VERIFICATION SAMPLING (EXCAVATION) (3) | $1,000.00 | EACH | 25 | $25,265 |
| 7) REPLACE TREATED SOIL (4) | $1.43 | CU.YD. | 25028 | $35,884 |
| 8) BACKFILL: PURCHASE & HAUL (5) | $5.00 | CU.YD. | 1258 | $6,292 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 1258 | $3,146 |
| 9) TOPSOIL: PURCHASE & HAUL (5) | $15.00 | CU.YD. | 6711 | $100,672 |
| PLACE AND COMPACT | $2.50 | CU.YD. | 6711 | $16,779 |
| 10) GRADING & SEEDING | $641 | ACRE | 5.80 | $3,718 |

**SUBTOTAL** **$4,949,760**

INDIRECT COSTS

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $494,976 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $1,237,440 |
| ESCALATION FOR MIDPOINT OF CONSTRUCTION (5% @ 2 YEARS) | $507,350 |
| ESCALATION FOR LEVEL C PROTECTION (40% FOR ITEMS 1, 2, & 4) | $1,865,168 |
| CONTINGENCY (20%) | $989,952 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $13,827 |
| BONDS AND INSURANCE (10%) | $9,218 |

**TOTAL** **$10,067,691**

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) INCLUDES PROCESSING AND CHEMICAL COSTS; VENDOR QUOTE
(2) SAMPLE COLECTION/ANALYTICAL COSTS FOR EACH 1,000 TONS TREATED.
(3) ASSUMES VERIFICATION SAMPLES COLLECTED FROM EXCAVATION ON 100' SPACING.
(4) ASSUMES NO SWELL IN TREATED SOIL.
(5) ASSUMES 30% SWELL AND LOSS DURING HANDLING.
(6) EXCAVATION, TREATMENT, AND SOIL HANDLING COSTS DO NOT INCLUDE DUST SUPPRESSION.

## TABLE 5-13

## CAPITAL COST ESTIMATES FOR BERN METALS/UNIVERSAL SITES
## EXCAVATION & OFF-SITE DISPOSAL
## (ASSUMES 25% HAZARDOUS, 75% NON-HAZARDOUS)

**DIRECT COSTS**

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) CLEARING & GRUBBING | $1,027 | ACRE | 5.8 | $5,958 |
| 2) EXCAVATION & STAGING (1) | $6.07 | CU.YD. | 25028 | $152,013 |
| 3) DISPOSAL SAMPLING/ANALYSIS (2) | $2,500 | EACH | 30 | $75,083 |
| 3) LOADING & HAULING | $14.88 | CU.YD. | 25028 | $372,502 |
| 4) DISPOSAL (NON-HAZ) | $50.00 | TON | 22525 | $1,126,238 |
| 5) DISPOSAL (HAZ) | $150.00 | TON | 7508 | $1,126,238 |
| 6) VERIFICATION SAMPLING (EXCAVATION) (2) | $1,000.00 | EACH | 25 | $25,265 |
| 7) BACKFILL: PURCHASE & HAUL (2) | $5.00 | CU.YD. | 32536 | $162,679 |
| BACKFILL: PLACE & COMPACT | $2.50 | CU.YD. | 32536 | $81,339 |
| 8) TOPSOIL: PURCHASE & HAUL (3) | $15.00 | CU.YD. | 6082 | $91,234 |
| PLACE AND COMPACT | $2.50 | CU.YD. | 6082 | $15,206 |
| 9) GRADING & SEEDING | $641 | ACRE | 5.80 | $3,718 |

**SUBTOTAL $3,237,471**

INDIRECT COSTS

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $323,747 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $809,368 |
| *ESCALATION FOR MIDPOINT OF CONSTRUCTION (5% @ 2 YEARS)* | $331,841 |
| ESCALATION FOR LEVEL C PROTECTION (40% FOR ITEM 1, 2, & 3) | $242,222 |
| CONTINGENCY (20%) | $647,494 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $485,621 |
| BONDS AND INSURANCE (10%) | $323,747 |

**TOTAL $6,401,511**

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) INCLUDES 15% ADD-ON FOR LOADING INTO ROLL-OFFS OR STAGING AREA.
(2) ASSUMES VERIFICATION SAMPLES COLLECTED FROM EXCAVATION ON 100' SPACING.
(3) ASSUMES 30% SWELL AND LOSS DURING HAULING
(4) EXCAVATION AND SOIL HANDLING COSTS DO NOT INCLUDE DUST SUPPRESSION.

## TABLE 5-14
## CAPITAL COST ESTIMATE FOR MONITORING WELLS ABANDONMENT AND INSTALLATION

**DIRECT COSTS**

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) MONITORING WELL ABANDONMENT (1,2) | $60.00 | L.F. | 70 | $4,200 |
| 2) MONTORING WELL INSTALLATION (1) | $60.00 | L.F. | 70 | $4,200 |

**SUBTOTAL** **$8,400**

**INDIRECT COSTS**

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (10%) | $840 |
| MARK-UP FOR OVERHEAD & PROFIT (25%) | $2,100 |
| CONTINGENCY (20%) | $1,680 |
| CONSTRUCTION ADMINISTRATION/DESIGN ENGINEERING (15%) | $1,260 |
| BONDS AND INSURANCE (10%) | $840 |

**TOTAL** **$15,120**

Estimate from MEANS, 1994 (Escalated 5% for 1995 and 2.0% for Buffalo Index), vendors, and BBL experience.

(1) ASSUMES SEVEN WELLS WILL BE ABANDONED, WITH SEVEN REPLACEMENT WELLS INSTALLED.
(2) WELL CASINGS TO BE FILLED WITH GROUT, AND CASING REMOVED.

# TABLE 5-15

## OPERATIONS AND MAINTENANCE COST ESTIMATES
## GROUNDWATER MONITORING

DIRECT COSTS

| TASK | UNIT COST | UNITS | QUANTITY | TOTAL COST |
|---|---|---|---|---|
| 1) SAMPLING LABOR (1) | $560 | DAY | 2 | $1,120 |
| 2) EQUIPMENT/EXPENSES (1) | $212 | L.S. | 1 | $212 |
| 3) ANALYTICAL COSTS (1,2) | $220 | EACH | 8 | $1,760 |
| 4) MONITORING WELL REPLACEMENT (3) | $480 | EACH | 1 | $480 |
| | | | **SUBTOTAL** | **$3,572** |

INDIRECT COSTS

| | |
|---|---|
| MOBILIZATION/DEMOBILIZATION (5%) | $179 |
| ADMINISTRATION AND ENGINEERING (15%) | $536 |
| BONDS AND INSURANCE (10%) | $357 |
| **TOTAL** | **$4,644** |

(1) SEMI-ANNUAL SAMPLING TO BE CONDUCTED FROM YEARS 1 - 5. ANNUAL SAMPLING TO BE CONDUCTED FROM YEARS 6 - 30 (ALTERNATIVES 3, 4A, AND 4B ONLY).

(2) TOTAL LEAD (NON-ASP) ONLY; 7 WELLS PLUS ONE QA/QC SAMPLE PER EVENT.

(3) ASSUMES ONE MONITORING WELL REPLACED ANNUALLY.

## TABLE 5-16
## BERN METAL AND UNIVERSAL SITES
## COST SUMMARY FOR REMEDIAL ALTERNATIVES

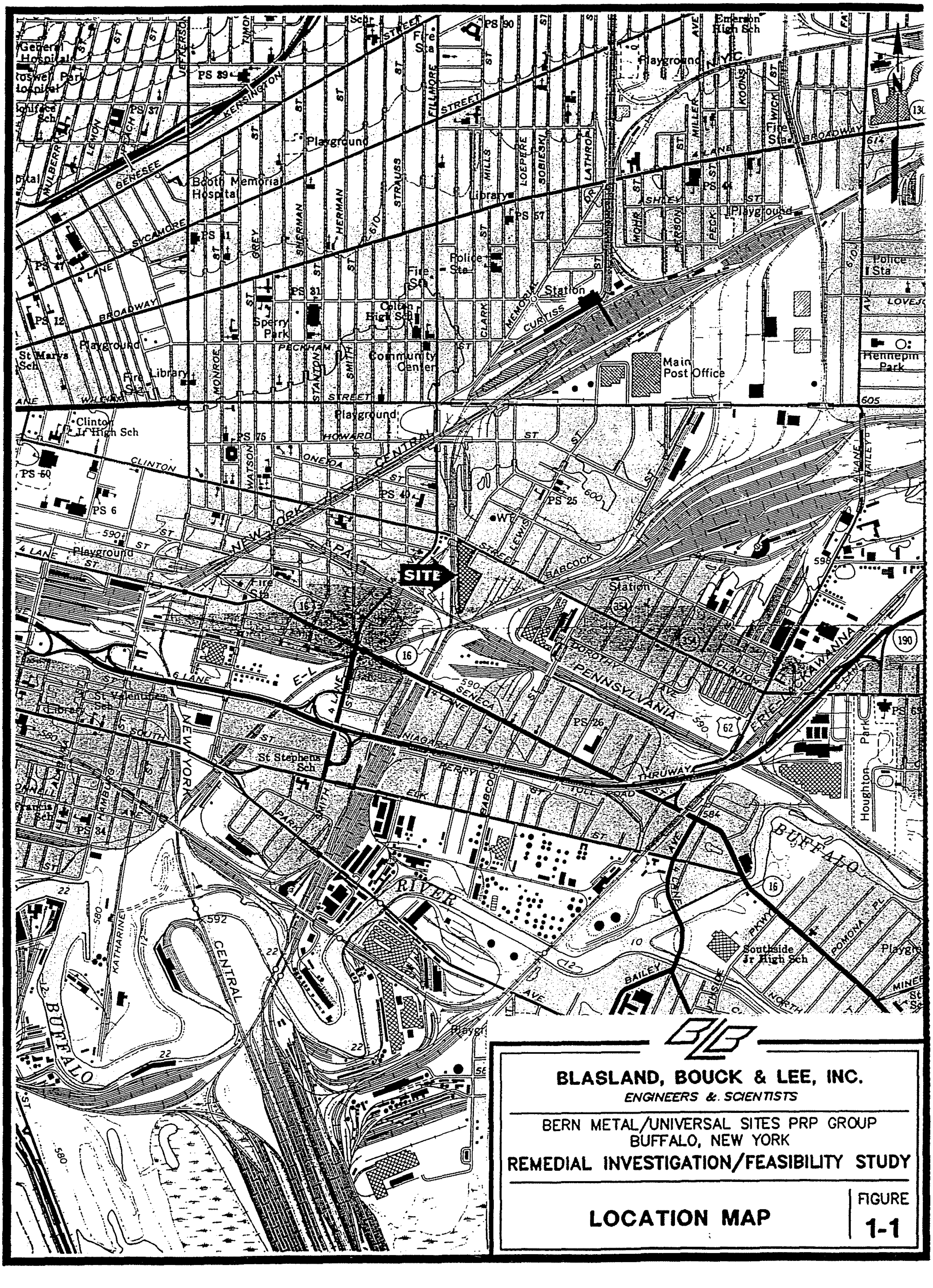
| ITEM | ALT. 1 | ALT. 2 | ALT. 3 | ALT. 4A | ALT. 4B | ALT. 5 | ALT. 6 |
|---|---|---|---|---|---|---|---|
| **ESTIMATED CAPITAL COSTS** | | | | | | | |
| MSG Cap | -- | -- | $1,354,258 | -- | | -- | -- |
| Ex-Situ S/S | -- | -- | -- | $4,555,826 | | -- | -- |
| In-Situ S/S | -- | -- | -- | -- | $4,101,451 | -- | -- |
| Soil Washing/Acid Extraction | -- | -- | -- | -- | | $10,067,691 | -- |
| Off-Site Disposal | -- | -- | -- | -- | | -- | $6,401,511 |
| Building Demolition | -- | -- | $59,552 | $104,509 | $104,509 | $104,509 | $104,509 |
| Monitoring Wells | -- | -- | $15,120 | $15,120 | $15,120 | $15,120 | $15,120 |
| Pre-Design Investigation | -- | -- | $4,694 | $15,328 | $15,328 | $15,328 | $26,128 |
| **Total Capital Costs** | **$0** | **$0** | **$1,433,600** | **$4,690,800** | **$4,236,400** | **$10,202,600** | **$6,547,300** |
| **ESTIMATED OPERATIONS AND MAINTENANCE COSTS** | | | | | | | |
| Groundwater Monitoring | -- | $4,644 | $4,644 | $4,644 | $4,644 | $4,644 | $4,644 |
| Fencing | $17,424 | $17,424 | $17,424 | $17,424 | $17,424 | -- | -- |
| Geomembrane Cap Maintenance | -- | -- | $20,287 | -- | -- | -- | -- |
| Soil Cap Maintenance | -- | -- | -- | $9,889 | $9,889 | -- | -- |
| **Total Annual O&M Costs** | | | | | | | |
| **(Years 1 - 5)** | **$17,424** | **$26,711** | **$46,998** | **$36,600** | **$36,600** | **$9,287** | **$9,287** |
| **(Years 6 - 30)** | **$17,424** | **$22,068** | **$42,355** | **$31,957** | **$31,957** | **$4,644** | **$4,644** |
| **Present Value of O&M Costs** | **$164,300** | **$225,600** | **$416,900** | **$292,700** | **$292,700** | **$35,200** | **$35,200** |
| **Total Costs: Capital + O&M** | **$164,300** | **$225,600** | **$1,850,500** | **$4,983,500** | **$4,529,100** | **$10,237,800** | **$6,582,500** |

Alternative 1 - No Further Action
Alternative 2 - Institutional Controls
Alternative 3 - Capping
Alternative 4 - Solidification/Stabilization
Alternative 5 - Soil Washing
Alternative 6 - Excavation/Off-Site Disposal

Present worth analysis for Alternatives 1, 2, and 3 based upon a 30 year performance at 10% rate of return.
Present worth analysis for Alternative 4 based upon a 5 year performance for groundwater monitoring and a 30 year performance for soil cap and fencing maintenance (both at 10% rate of return).
Present worth analysis for Alternatives 5 and 6 based upon a 5 year performance at 10% rate of return.

# FIGURES

FIGURES




**BLASLAND, BOUCK & LEE, INC.**

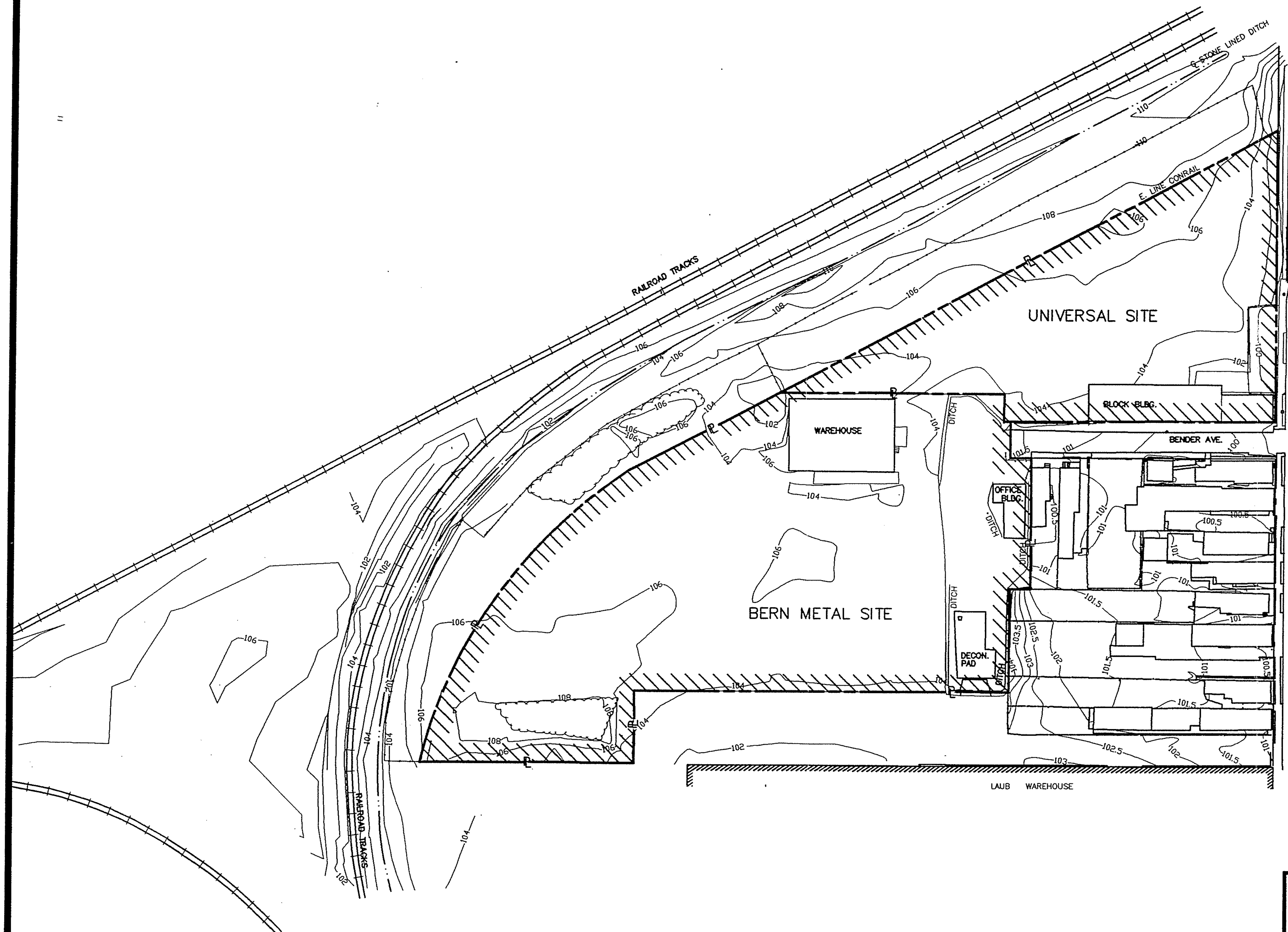
*ENGINEERS & SCIENTISTS*

BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

**LOCATION MAP**

FIGURE **1-1**




NOTES:

1. ELEVATIONS BASED ON AN ASSUMED DATUM.
2. GROUND SURFACE CONTOUR INTERVAL = 2 FOOT ON THE BERN METAL/UNIVERSAL SITE.
3. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF AN ABSTRACT OF TITLE AND IS SUBJECT TO ANY CHANGES THAT AN EXAMINATION OF SUCH MAY REVEAL.
4. SURVEY OF BERN METAL SITE AND CLINTON/BENDER AREA CONDUCTED BY BLASLAND, BOUCK & LEE, INC.
5. SURVEY OF UNIVERSAL SITE AND CONRAIL PROPERTY CONDUCTED BY WENDEL SURVEY.

100' 0 100' 200'

SCALE: 1" = 100'

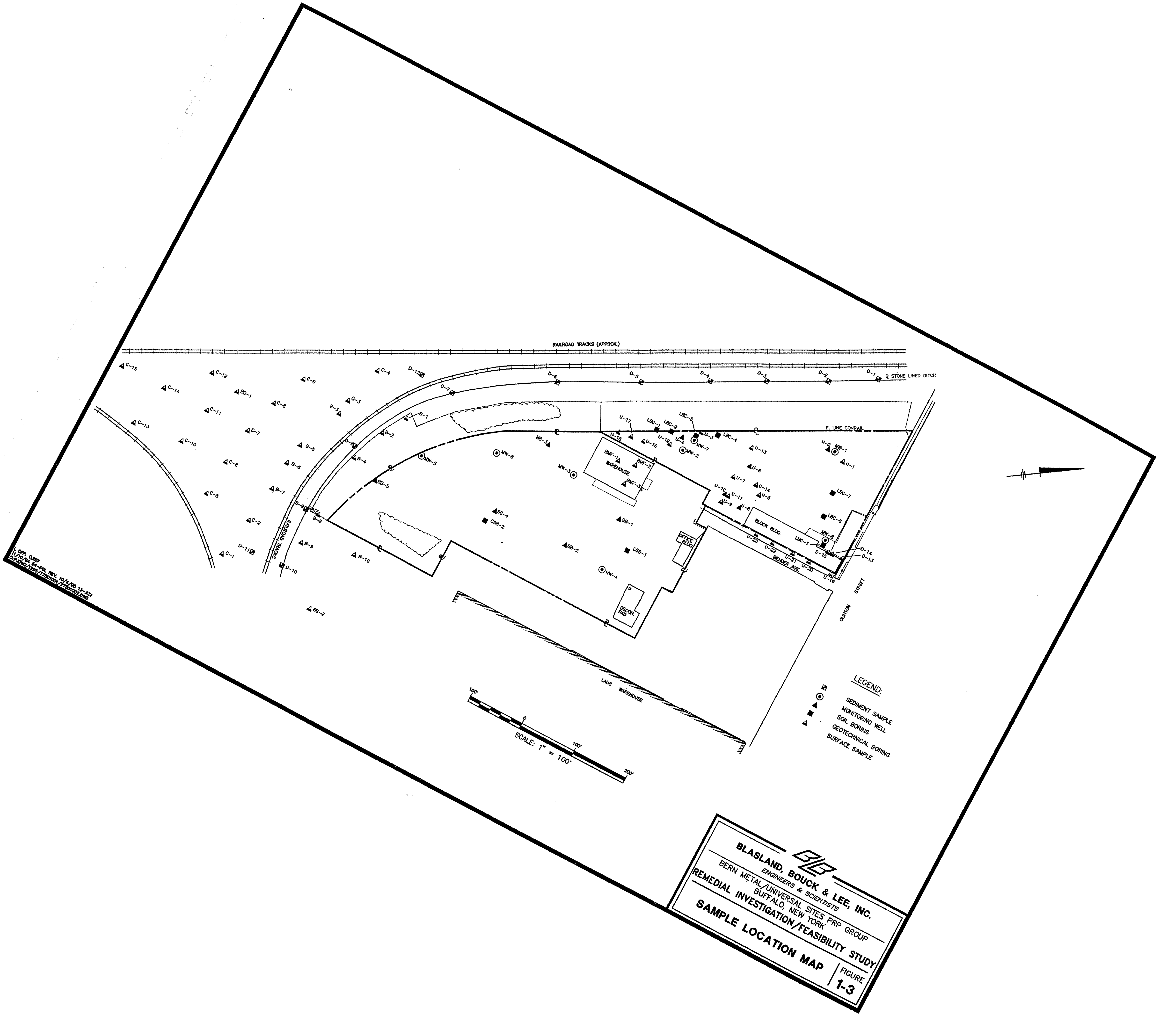
**BLASLAND, BOUCK & LEE, INC.**
*ENGINEERS & SCIENTISTS*

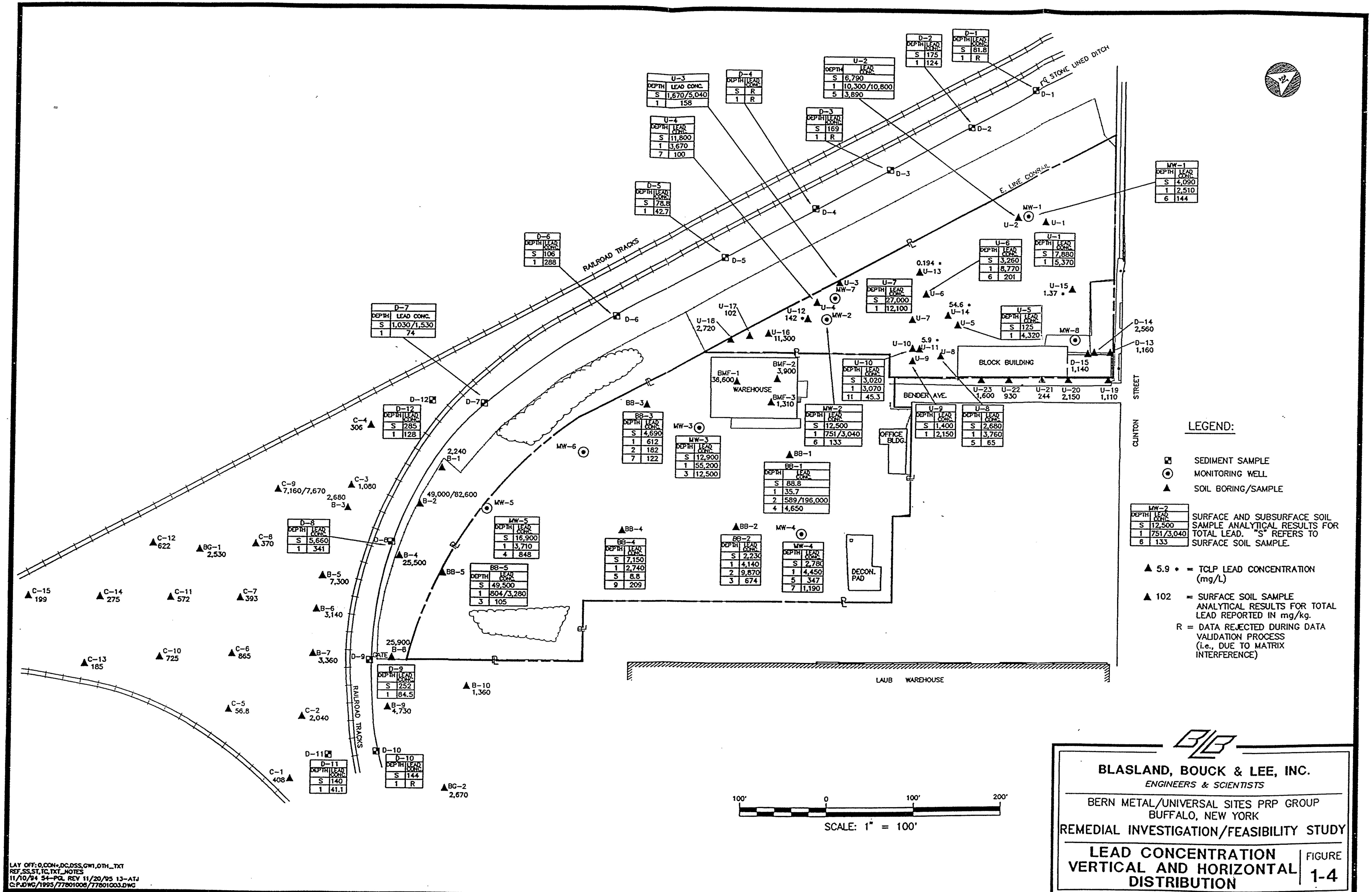
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

**SITE MAP**

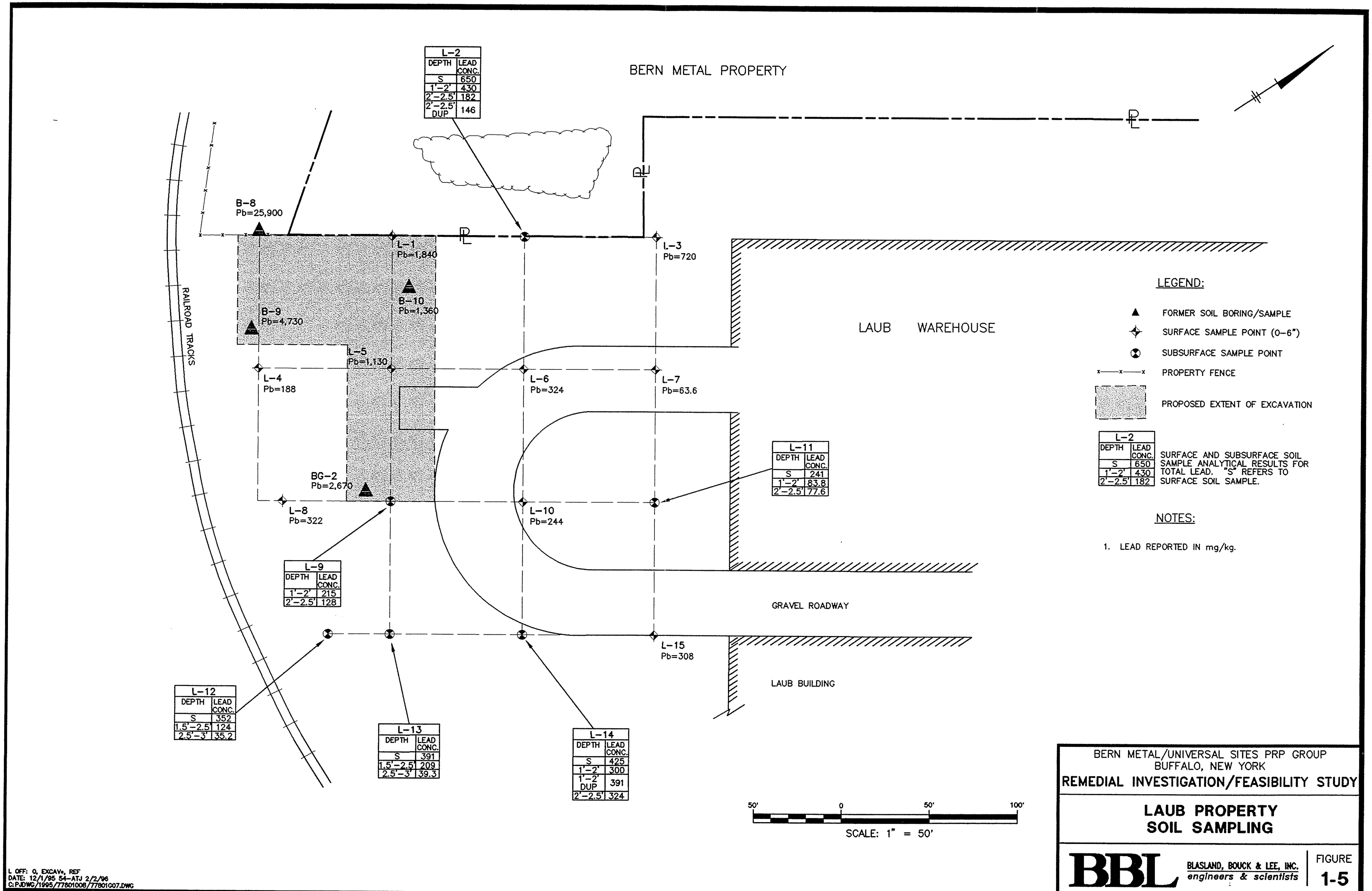
FIGURE **1-2**

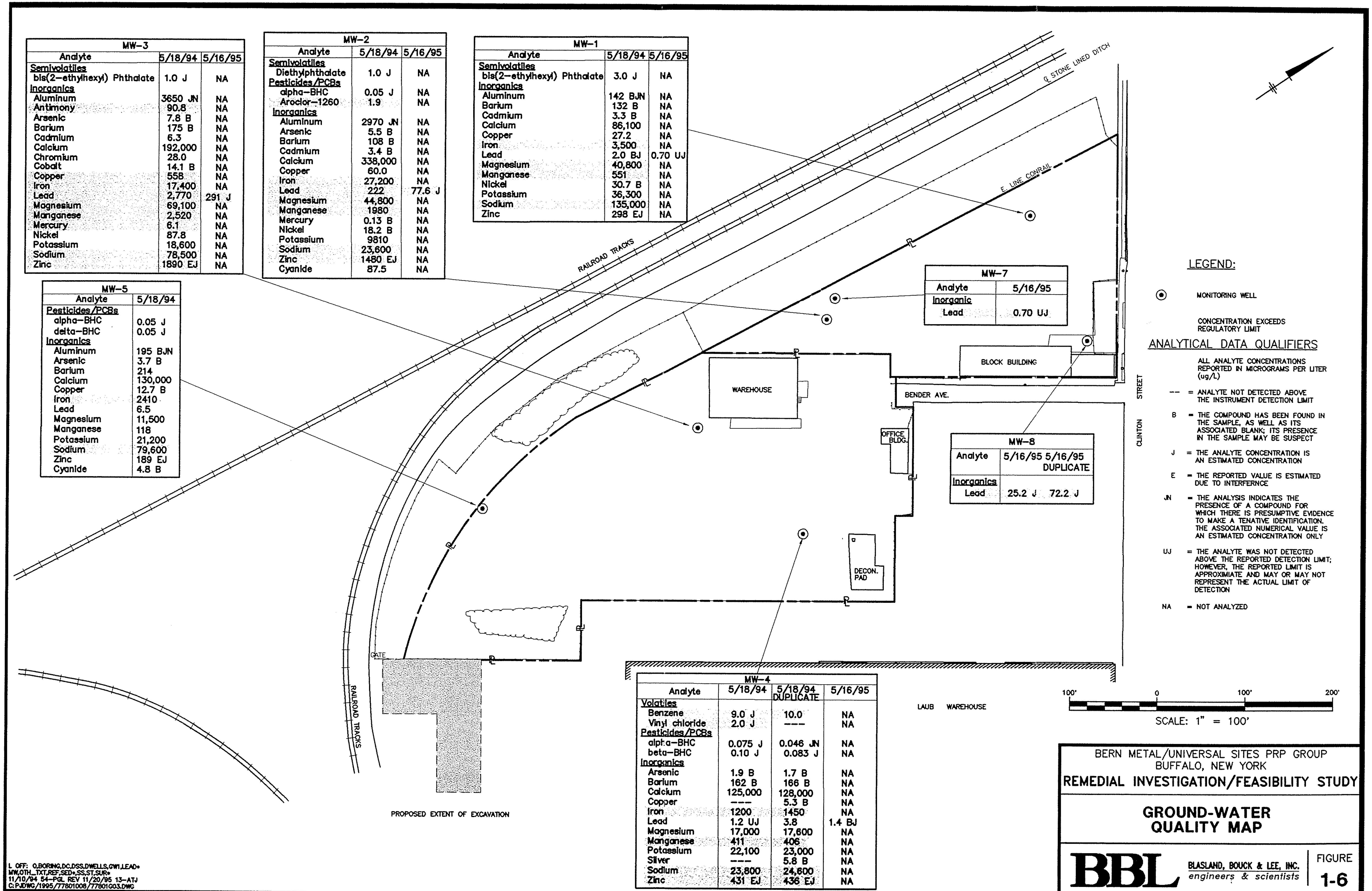
10/24/94 54-PGL REV 6/27/95 13-ATJ
C:PJDWG/1995/77801001/77801BR.DWG


RAILROAD TRACKS (APPROX.)
STONE LINED DITCH
E. LINE CONRAIL
RAILROAD TRACKS
WAREHOUSE
BLOCK BLDG.
OFFICE BLDG.
DECON. PAD
BENDER AVE.
CLINTON STREET
LAUB WAREHOUSE
LEGEND:
SEDIMENT SAMPLE
MONITORING WELL
SOIL BORING
GEOTECHNICAL BORING
SURFACE SAMPLE
SCALE: 1" = 100'
BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAMPLE LOCATION MAP
FIGURE
1-3



STONE LINED DITCH
RAILROAD TRACKS
E. LINE CONRAIL
CLINTON STREET
BENDER AVE.
BLOCK BUILDING
WAREHOUSE
OFFICE BLDG.
DECON. PAD
LAUB WAREHOUSE
GATE
D-1: DEPTH / LEAD CONC.: S 81.8; 1 R
D-2: S 175; 1 124
D-3: S 169; 1 R
D-4: S R; 1 R
D-5: S 78.8; 1 42.7
D-6: S 106; 1 288
D-7: S 1,030/1,530; 1 74
D-8: S 5,660; 1 341
D-9: S 252; 1 84.5
D-10: S 144; 1 R
D-11: S 140; 1 41.1
D-12: S 285; 1 128
U-1: S 7,880; 1 5,370
U-2: S 6,790; 1 10,300/10,800; 5 3,890
U-3: S 1,670/5,040; 1 158
U-4: S 11,800; 1 3,670; 7 100
U-5: S 125; 1 4,320
U-6: S 3,260; 1 8,770; 6 201
U-7: S 27,000; 1 12,100
U-8: S 2,680; 1 3,760; 5 65
U-9: S 1,400; 1 2,150
U-10: S 3,020; 1 3,070; 11 45.3
MW-1: S 4,090; 1 2,510; 6 144
MW-2: S 12,500; 1 751/3,040; 6 133
MW-3: S 12,900; 1 55,200; 3 12,500
MW-4: S 2,780; 1 4,450; 5 347; 7 1,190
MW-5: S 16,900; 1 3,710; 4 848
BB-1: S 88.8; 1 35.7; 2 589/196,000; 4 4,650
BB-2: S 2,230; 1 4,140; 2 9,870; 3 674
BB-3: S 4,690; 1 612; 2 182; 7 122
BB-4: S 7,150; 1 2,740; 5 8.8; 9 209
BB-5: S 49,500; 1 804/3,280; 3 105
U-12 142; U-13 0.194; U-14 54.6; U-15 1.37; U-11 5.9
U-16 11,300; U-17 102; U-18 2,720
U-19 1,110; U-20 2,150; U-21 244; U-22 930; U-23 1,600
D-13 1,160; D-14 2,560; D-15 1,140
BMF-1 38,600; BMF-2 3,900; BMF-3 1,310
B-1 2,240; B-2 49,000/82,600; B-3 2,680; B-4 25,500; B-5 7,300; B-6 3,140; B-7 3,360; B-8 25,900; B-9 4,730; B-10 1,360
BG-1 2,530; BG-2 2,670
C-1 408; C-2 2,040; C-3 1,080; C-4 306; C-5 56.8; C-6 865; C-7 393; C-8 370; C-9 7,160/7,670; C-10 725; C-11 572; C-12 622; C-13 185; C-14 275; C-15 199
LEGEND:
SEDIMENT SAMPLE
MONITORING WELL
SOIL BORING/SAMPLE
SURFACE AND SUBSURFACE SOIL SAMPLE ANALYTICAL RESULTS FOR TOTAL LEAD. "S" REFERS TO SURFACE SOIL SAMPLE.
5.9 • = TCLP LEAD CONCENTRATION (mg/L)
102 = SURFACE SOIL SAMPLE ANALYTICAL RESULTS FOR TOTAL LEAD REPORTED IN mg/kg.
R = DATA REJECTED DURING DATA VALIDATION PROCESS (i.e., DUE TO MATRIX INTERFERENCE)
100' 0 100' 200'
SCALE: 1" = 100'
BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LEAD CONCENTRATION VERTICAL AND HORIZONTAL DISTRIBUTION
FIGURE 1-4
LAY OFF: 0,CON+,DC,DSS,GW1,OTH_TXT
REF,SS,ST,TC,TXT_NOTES
11/10/94 54-PGL REV 11/20/95 13-ATJ
C:PJDWG/1995/77601006/77601003.DWG


BERN METAL PROPERTY
L-2
DEPTH | LEAD CONC.
S | 650
1'-2' | 430
2'-2.5' | 182
2'-2.5' DUP | 146
B-8 Pb=25,900
L-1 Pb=1,840
L-3 Pb=720
B-10 Pb=1,360
B-9 Pb=4,730
RAILROAD TRACKS
L-5 Pb=1,130
L-4 Pb=188
L-6 Pb=324
L-7 Pb=63.6
LAUB WAREHOUSE
BG-2 Pb=2,670
L-8 Pb=322
L-10 Pb=244
L-11
DEPTH | LEAD CONC.
S | 241
1'-2' | 83.8
2'-2.5' | 77.6
L-9
DEPTH | LEAD CONC.
1'-2' | 215
2'-2.5' | 128
GRAVEL ROADWAY
L-15 Pb=308
LAUB BUILDING
L-12
DEPTH | LEAD CONC.
S | 352
1.5'-2.5' | 124
2.5'-3' | 35.2
L-13
DEPTH | LEAD CONC.
S | 391
1.5'-2.5' | 209
2.5'-3' | 39.3
L-14
DEPTH | LEAD CONC.
S | 425
1'-2' | 300
1'-2' DUP | 391
2'-2.5' | 324
LEGEND:
FORMER SOIL BORING/SAMPLE
SURFACE SAMPLE POINT (0-6")
SUBSURFACE SAMPLE POINT
PROPERTY FENCE
PROPOSED EXTENT OF EXCAVATION
L-2
DEPTH | LEAD CONC.
S | 650
1'-2' | 430
2'-2.5' | 182
SURFACE AND SUBSURFACE SOIL SAMPLE ANALYTICAL RESULTS FOR TOTAL LEAD. "S" REFERS TO SURFACE SOIL SAMPLE.
NOTES:
1. LEAD REPORTED IN mg/kg.
50' 0 50' 100'
SCALE: 1" = 50'
L OFF: 0, EXCAV*, REF
DATE: 12/1/95 54-ATJ 2/2/96
C:PJDWG/1995/77801006/77801G07.DWG
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LAUB PROPERTY
SOIL SAMPLING
BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists
FIGURE
1-5




**MW-3**

| Analyte | 5/18/94 | 5/16/95 |
|---|---|---|
| Semivolatiles | | |
| bis(2-ethylhexyl) Phthalate | 1.0 J | NA |
| Inorganics | | |
| Aluminum | 3650 JN | NA |
| Antimony | 90.8 | NA |
| Arsenic | 7.8 B | NA |
| Barium | 175 B | NA |
| Cadmium | 6.3 | NA |
| Calcium | 192,000 | NA |
| Chromium | 28.0 | NA |
| Cobalt | 14.1 B | NA |
| Copper | 558 | NA |
| Iron | 17,400 | NA |
| Lead | 2,770 | 291 J |
| Magnesium | 69,100 | NA |
| Manganese | 2,520 | NA |
| Mercury | 6.1 | NA |
| Nickel | 87.8 | NA |
| Potassium | 18,600 | NA |
| Sodium | 78,500 | NA |
| Zinc | 1890 EJ | NA |

**MW-2**

| Analyte | 5/18/94 | 5/16/95 |
|---|---|---|
| Semivolatiles | | |
| Diethylphthalate | 1.0 J | NA |
| Pesticides/PCBs | | |
| alpha-BHC | 0.05 J | NA |
| Aroclor-1260 | 1.9 | NA |
| Inorganics | | |
| Aluminum | 2970 JN | NA |
| Arsenic | 5.5 B | NA |
| Barium | 108 B | NA |
| Cadmium | 3.4 B | NA |
| Calcium | 338,000 | NA |
| Copper | 60.0 | NA |
| Iron | 27,200 | NA |
| Lead | 222 | 77.6 J |
| Magnesium | 44,800 | NA |
| Manganese | 1980 | NA |
| Mercury | 0.13 B | NA |
| Nickel | 18.2 B | NA |
| Potassium | 9810 | NA |
| Sodium | 23,600 | NA |
| Zinc | 1480 EJ | NA |
| Cyanide | 87.5 | NA |

**MW-1**

| Analyte | 5/18/94 | 5/16/95 |
|---|---|---|
| Semivolatiles | | |
| bis(2-ethylhexyl) Phthalate | 3.0 J | NA |
| Inorganics | | |
| Aluminum | 142 BJN | NA |
| Barium | 132 B | NA |
| Cadmium | 3.3 B | NA |
| Calcium | 86,100 | NA |
| Copper | 27.2 | NA |
| Iron | 3,500 | NA |
| Lead | 2.0 BJ | 0.70 UJ |
| Magnesium | 40,800 | NA |
| Manganese | 551 | NA |
| Nickel | 30.7 B | NA |
| Potassium | 36,300 | NA |
| Sodium | 135,000 | NA |
| Zinc | 298 EJ | NA |

**MW-5**

| Analyte | 5/18/94 |
|---|---|
| Pesticides/PCBs | |
| alpha-BHC | 0.05 J |
| delta-BHC | 0.05 J |
| Inorganics | |
| Aluminum | 195 BJN |
| Arsenic | 3.7 B |
| Barium | 214 |
| Calcium | 130,000 |
| Copper | 12.7 B |
| Iron | 2410 |
| Lead | 6.5 |
| Magnesium | 11,500 |
| Manganese | 118 |
| Potassium | 21,200 |
| Sodium | 79,600 |
| Zinc | 189 EJ |
| Cyanide | 4.8 B |

**MW-7**

| Analyte | 5/16/95 |
|---|---|
| Inorganic | |
| Lead | 0.70 UJ |

**MW-8**

| Analyte | 5/16/95 | 5/16/95 DUPLICATE |
|---|---|---|
| Inorganics | | |
| Lead | 25.2 J | 72.2 J |

**MW-4**

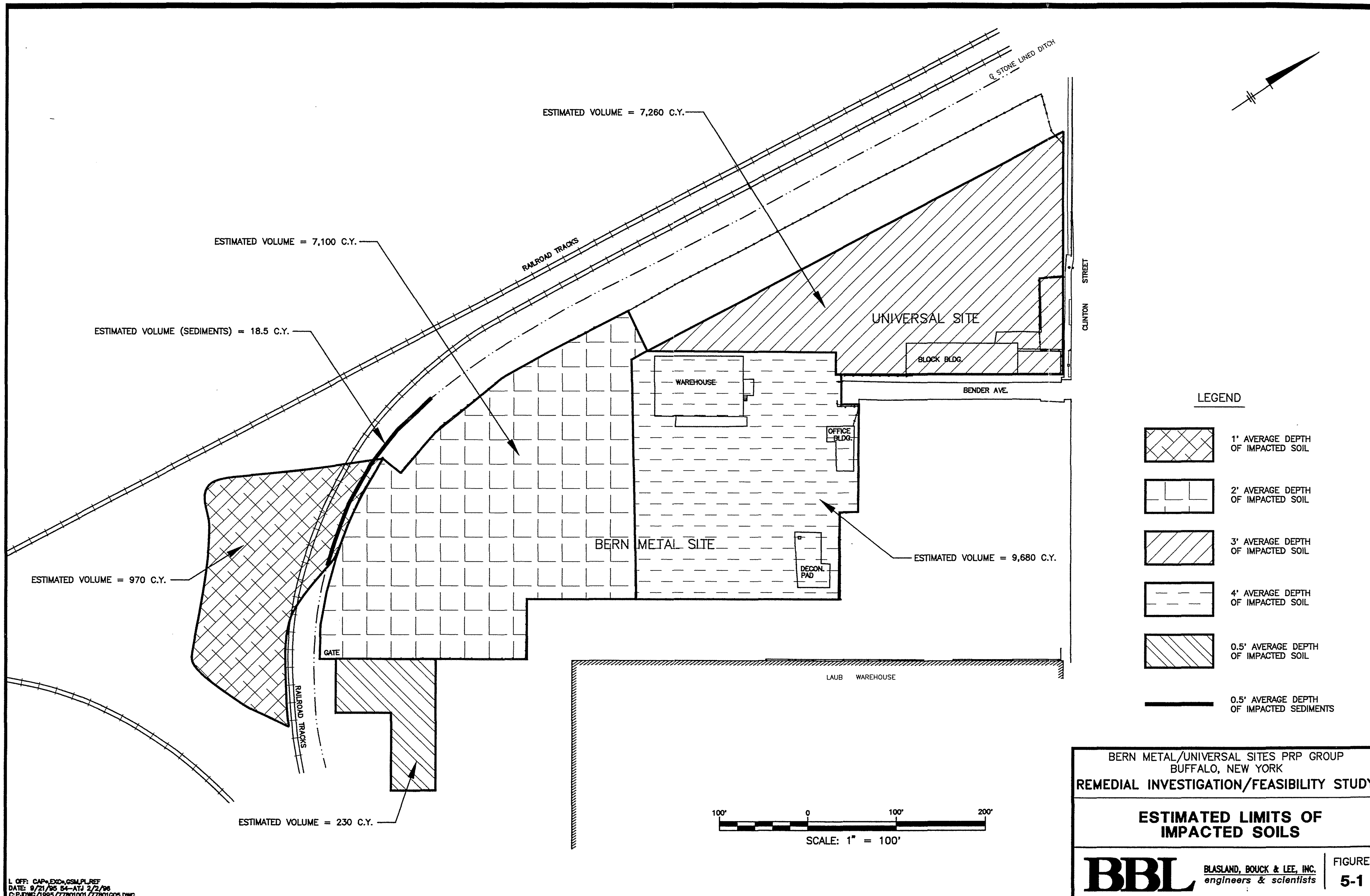
| Analyte | 5/18/94 | 5/18/94 DUPLICATE | 5/16/95 |
|---|---|---|---|
| Volatiles | | | |
| Benzene | 9.0 J | 10.0 | NA |
| Vinyl chloride | 2.0 J | --- | NA |
| Pesticides/PCBs | | | |
| alpha-BHC | 0.075 J | 0.046 JN | NA |
| beta-BHC | 0.10 J | 0.083 J | NA |
| Inorganics | | | |
| Arsenic | 1.9 B | 1.7 B | NA |
| Barium | 162 B | 166 B | NA |
| Calcium | 125,000 | 128,000 | NA |
| Copper | --- | 5.3 B | NA |
| Iron | 1200 | 1450 | NA |
| Lead | 1.2 UJ | 3.8 | 1.4 BJ |
| Magnesium | 17,000 | 17,600 | NA |
| Manganese | 411 | 406 | NA |
| Potassium | 22,100 | 23,000 | NA |
| Silver | --- | 5.8 B | NA |
| Sodium | 23,800 | 24,600 | NA |
| Zinc | 431 EJ | 436 EJ | NA |


BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

BERN METAL/UNIVERSAL SITE PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

**NYSDEC FRESHWATER WETLANDS MAP**

FIGURE 2-1

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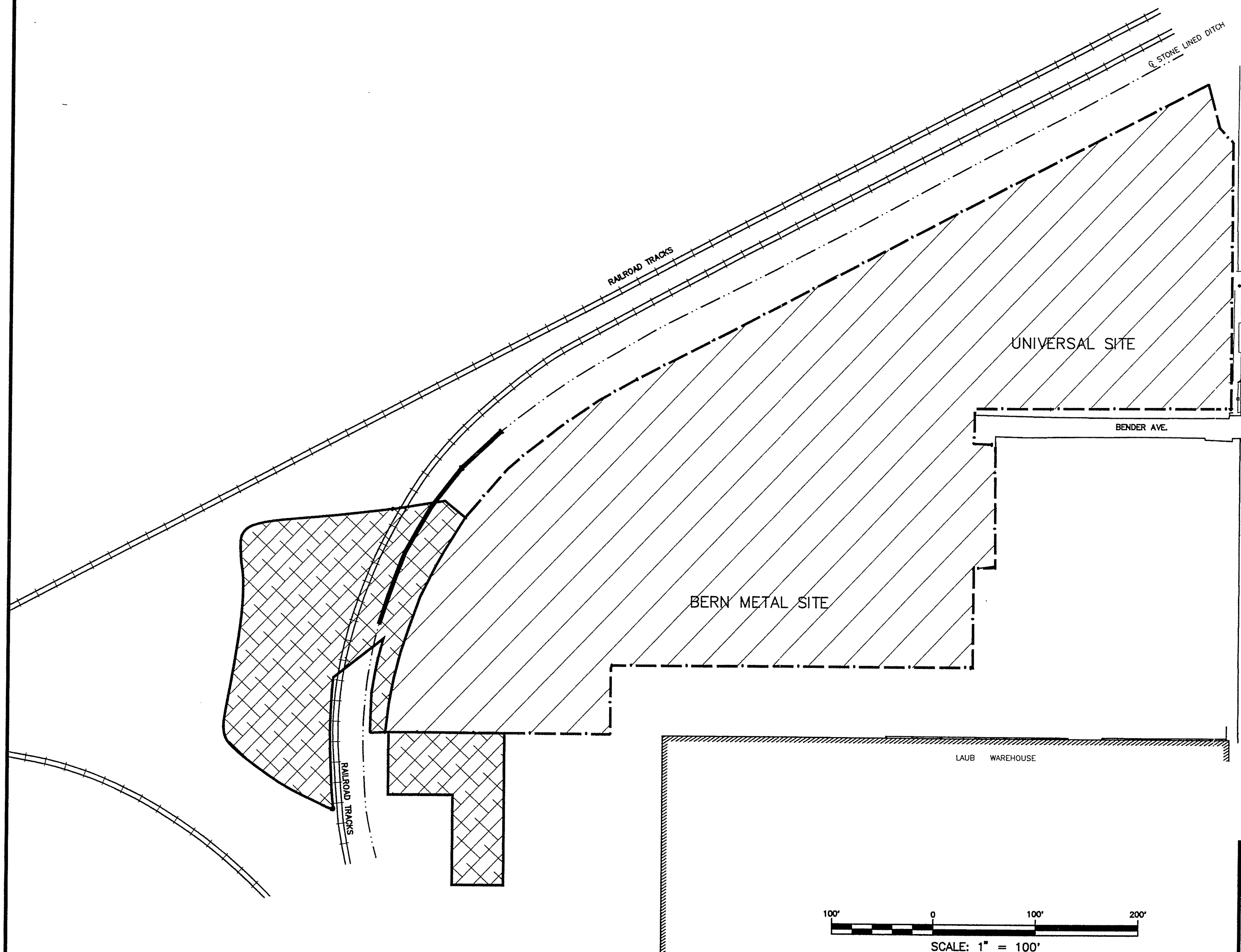
**ESTIMATED LIMITS OF IMPACTED SOILS**

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-1




LEGEND

OFF–SITE SOILS TO BE EXCAVATED, CONSOLIDATED ON–SITE

APPROXIMATE EXTENT OF MSG CAP

0.5' AVERAGE DEPTH OF IMPACTED SEDIMENTS

NOTE:

1. ALL BUILDINGS TO BE DEMOLISHED AND CONSOLIDATED ON–SITE AS GENERAL FILL/GRADING MATERIAL FOR CAP PLACEMENT.

BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK

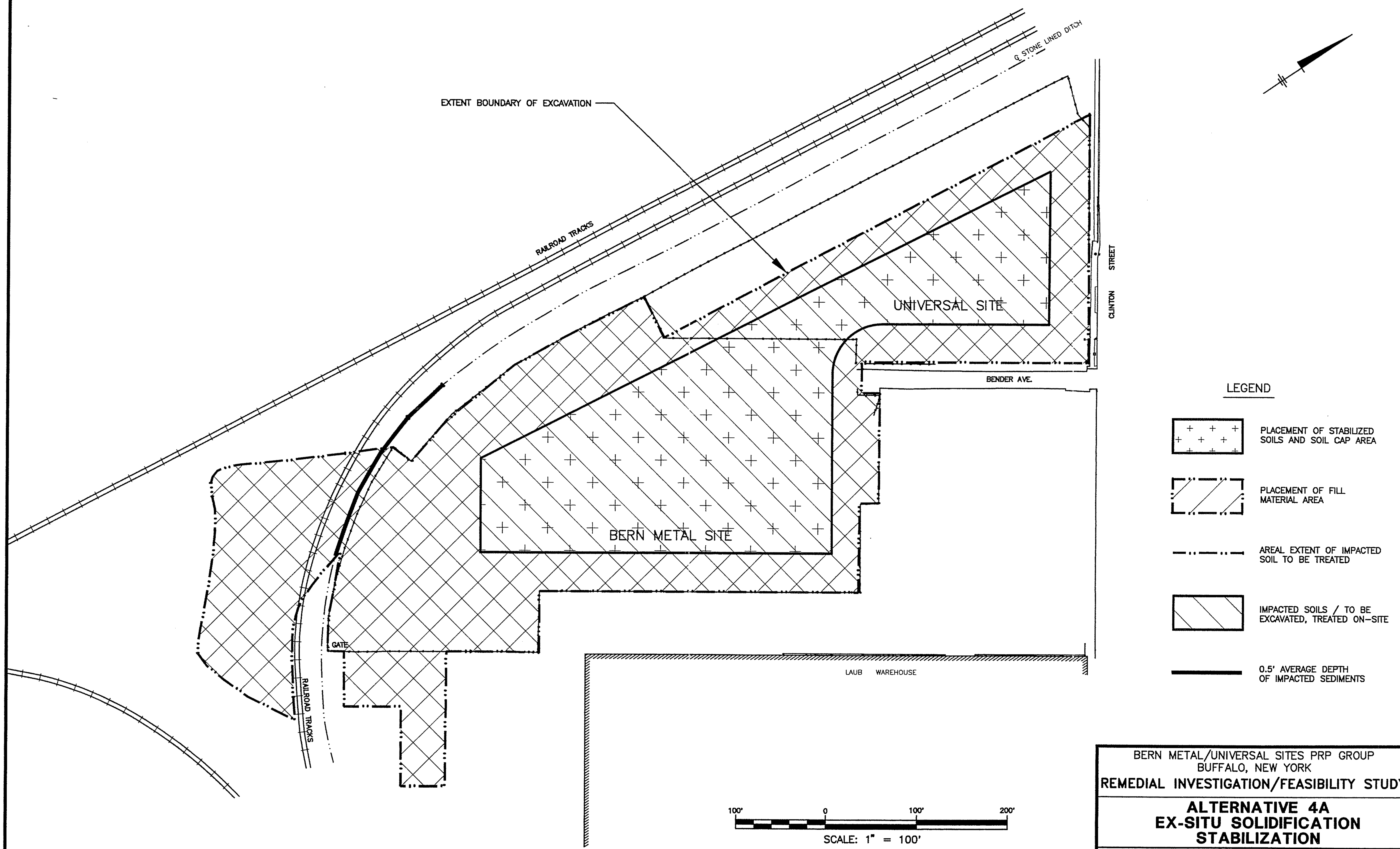
**REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

**ALTERNATIVE 3**
**CAPPING**

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **5-2**

L OFF: BLDG,CAP2,EXC*,
FBKL070,GSM,LIMITS,LN_FENCE,PL,REF
DATE: 9/21/95 54–ATJ 2/2/96
C:P:DWG/1995/77801001/77801G05.DWG

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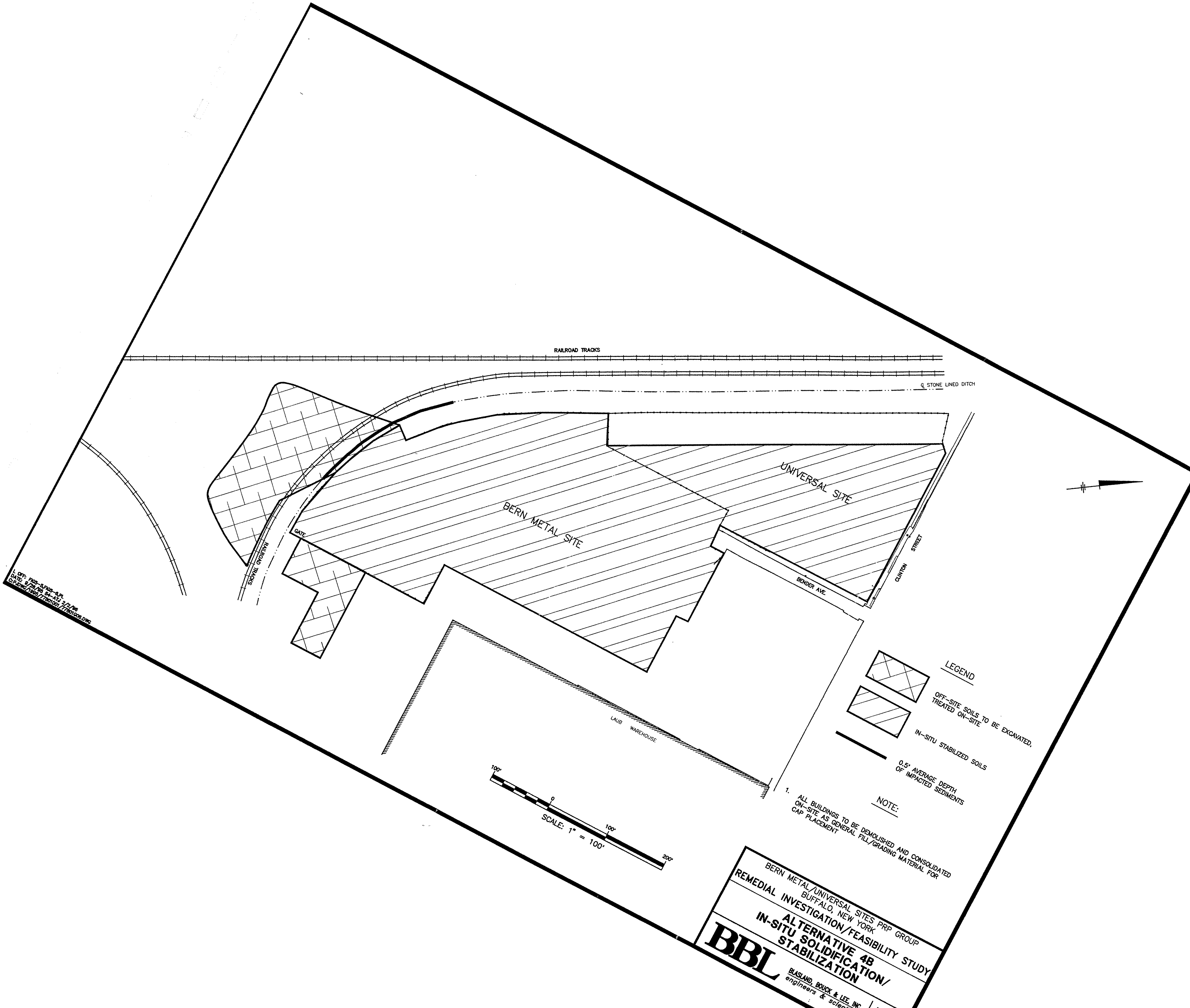
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

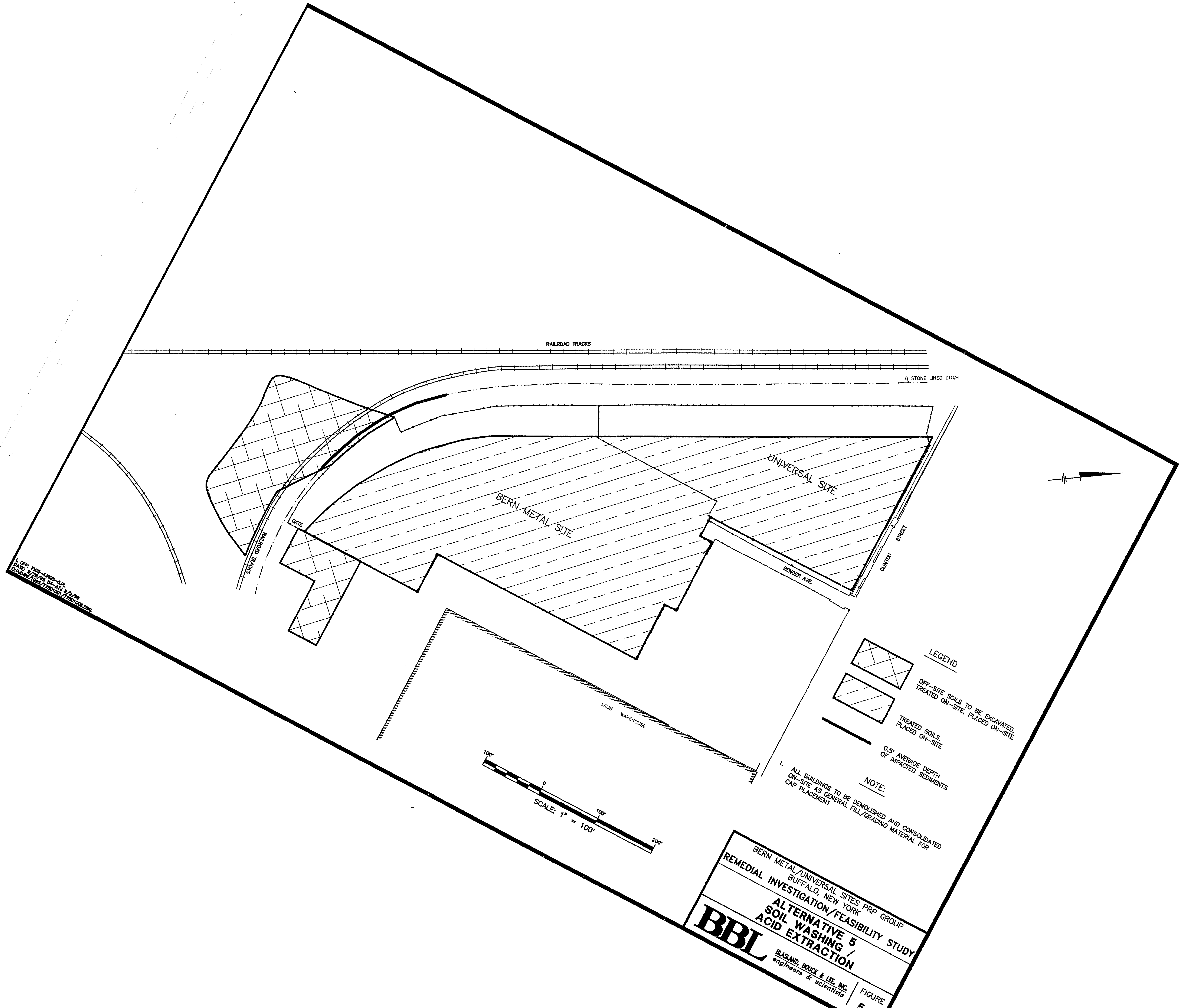
**ALTERNATIVE 4A**
**EX-SITU SOLIDIFICATION STABILIZATION**

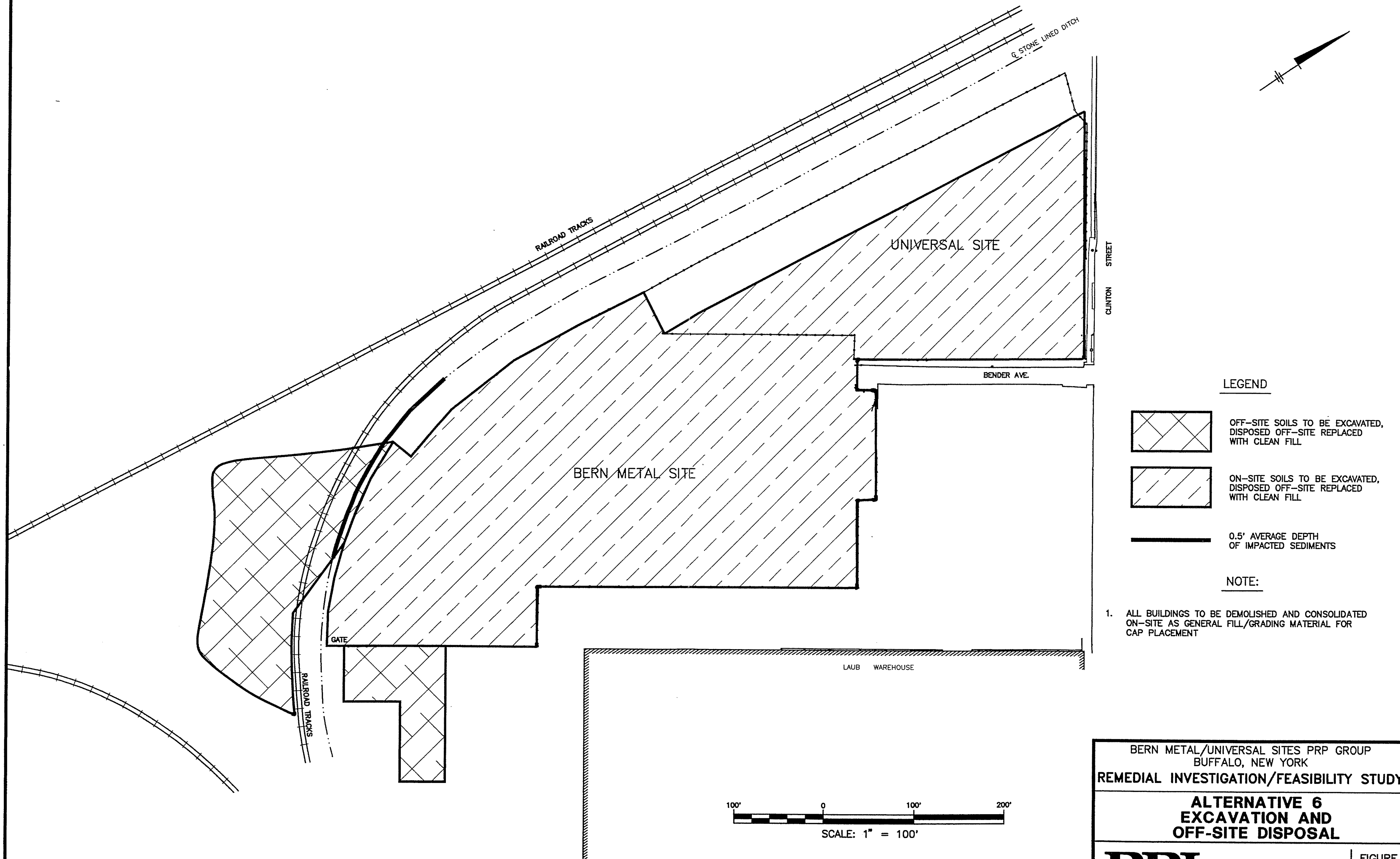
**BBL** BLASLAND, BOUCK & LEE, INC.
*engineers & scientists*

FIGURE **5-3**

L OFF: BLDG,CAP*,FBKL070,GSM,LIMITS,PL,REF
DATE: 9/21/95 54-ATJ 2/2/96
C:PJDWG/1995/77801001/77801G05.DWG


RAILROAD TRACKS
℄ STONE LINED DITCH
UNIVERSAL SITE
BERN METAL SITE
GATE
RAILROAD TRACKS
CLINTON STREET
BENDER AVE.
LAUB WAREHOUSE
LEGEND
OFF-SITE SOILS TO BE EXCAVATED, TREATED ON-SITE
IN-SITU STABILIZED SOILS
0.5' AVERAGE DEPTH OF IMPACTED SEDIMENTS
NOTE:
1. ALL BUILDINGS TO BE DEMOLISHED AND CONSOLIDATED ON-SITE AS GENERAL FILL/GRADING MATERIAL FOR CAP PLACEMENT
100' 0 100' 200'
SCALE: 1" = 100'
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
ALTERNATIVE 4B
IN-SITU SOLIDIFICATION/ STABILIZATION
BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists
FIGURE
5-4


RAILROAD TRACKS
℄ STONE LINED DITCH
RAILROAD TRACKS
GATE
BERN METAL SITE
UNIVERSAL SITE
BENDER AVE.
CLINTON STREET
LAUB WAREHOUSE
LEGEND
OFF-SITE SOILS TO BE EXCAVATED, TREATED ON-SITE, PLACED ON-SITE
TREATED SOILS, PLACED ON-SITE
0.5' AVERAGE DEPTH OF IMPACTED SEDIMENTS
NOTE:
1. ALL BUILDINGS TO BE DEMOLISHED AND CONSOLIDATED ON-SITE AS GENERAL FILL/GRADING MATERIAL FOR CAP PLACEMENT
100'
0
100'
200'
SCALE: 1" = 100'
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
ALTERNATIVE 5
SOIL WASHING / ACID EXTRACTION
BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists
FIGURE
5-5

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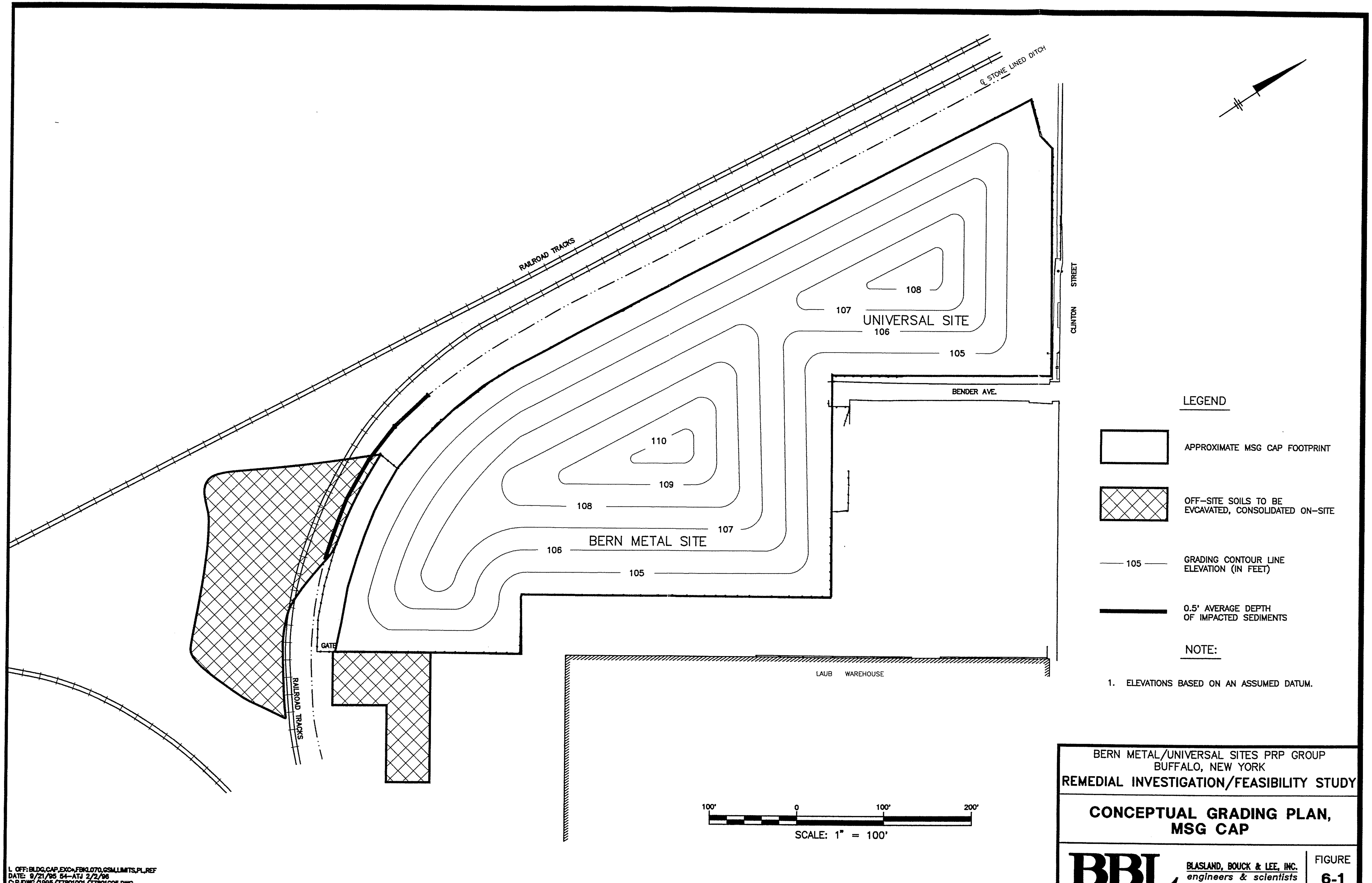
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

**ALTERNATIVE 6**
**EXCAVATION AND**
**OFF-SITE DISPOSAL**

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-6

L OFF: FIG5-4,FIG5-5,PL
DATE: 9/26/95 54-ATJ 2/2/96
C:PJDWG/1995/77801001/77801G06.DWG

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BUFFALO, NEW YORK

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

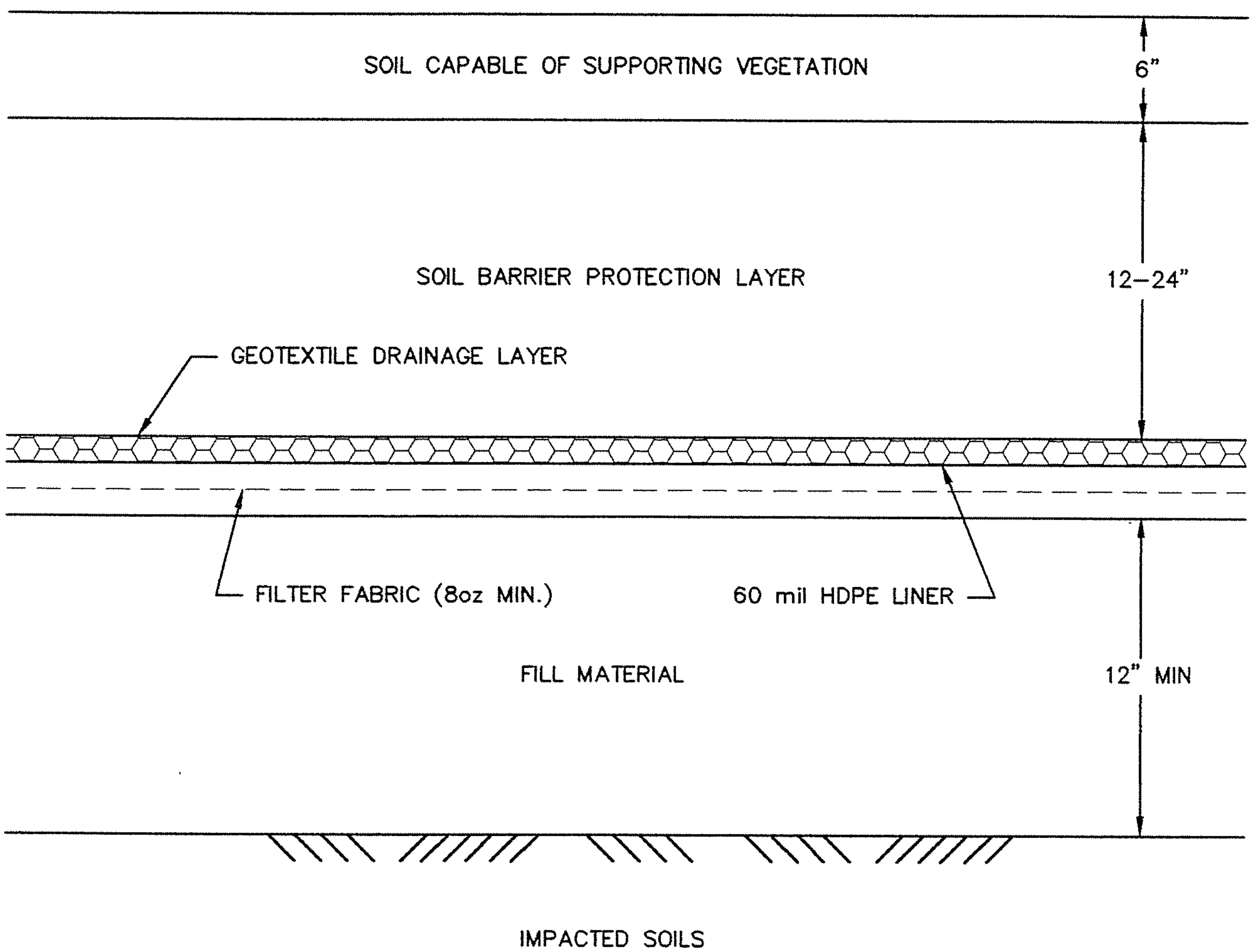
**CONCEPTUAL GRADING PLAN, MSG CAP**

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 6-1

# BERN METAL / UNIVERSAL SITES

## PROPOSED MSG CAP DESIGN

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*ENGINEERS & SCIENTISTS*

BERN METAL/UNIVERSAL PRP GROUP
BUFFALO, NEW YORK

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

**MSG CAP DETAILS**

FIGURE **6-2**

DATE: 9/25/95 13-ATJ 10/4/95
C:PJDWG/1995/77801001/77801G04.DWG