Final Feasibility Study Report

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Ellenville Scrap Iron and Metal Site
Town of Warwarsing, Village of Ellenville
Ulster County, New York

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FEASIBILITY STUDY REPORT
ELLENVILLE IRON AND SCRAP METAL - RI/FS
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

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1.0 INTRODUCTION

This Feasibility Study (FS) for the Ellenville Scrap Iron and Metal Site (Site) was prepared by Henningson, Durham & Richardson Architecture and Engineering, P.C. (HDR) in association with HDR Engineering, Inc. under United States Environmental Protection Agency Region 2 (EPA) Contract Number EP-W-09-009, EPA Work Assignment Number 008-RICO-02LX.

The purpose of this FS is to identify remedial alternatives based on Site-specific conditions and results of the Remedial Investigation (RI) that will ensure protection of human health and the environment. Alternatives were developed by assembling combinations of remedial technologies into Site-wide alternatives. The development and screening of each alternative includes the following six general steps:

- Develop Remedial Action Objectives (RAO);
- Develop General Response Actions (GRA);
- Identify volumes and/or areas where GRAs will be applied;
- Identify and screen technologies applicable to each GRA;
- Identify and evaluate technology process options to select representative process options for each technology; and
- Assemble combinations of selected process options into Site-wide remedial alternatives.

Due to the number of alternatives developed for the Site, a screening of the alternatives was performed to reduce the number of alternatives that were analyzed in detail.

Once the alternatives were assembled, a detailed evaluation of the alternatives was completed. The purpose of the evaluation is to identify the advantages and disadvantages of each alternative as well as key trade-offs among the alternatives. The detailed evaluation of alternatives consists of an individual analysis of each alternative against the evaluation criteria and a comparative analysis among the alternatives to assess the relative performance of each alternative with respect to the evaluation criteria. The analysis is designed to provide decision makers with sufficient information to adequately compare the alternatives, select an appropriate remedy for the Site, and demonstrate satisfaction of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedy selection in the Record of Decision (ROD).

2.0 SITE DESCRIPTION AND HISTORY

For the purposes of this report, the facility is defined as the area occupied by the Ellenville Scrap Iron Metal as it existed during active operations. The Site is defined as the facility limits minus property A/B Cape Road. Properties are defined as individual lots outside the site boundary.

2.1 Location and Description

The Ellenville Scrap Iron and Metal Facility is a 24-acre, former scrap iron and metal reclamation facility located at property A/B Cape Road (also known as Cape Avenue) in the Village of Ellenville, Town of Wawarsing, Ulster County, New York (Figure 2-1). Approximately 10 acres of the Site were used for the scrap metal operations. The facility is bordered to the north by Cape Road; to the south and west by Beer Kill; and to the east by residential homes, one of which (property A/B Cape Road) was formerly part of the Site. Property A/B Cape Road was formerly used for the storage of heavy equipment and automobile batteries. The remainder of the facility consisted of an office building, truck scale, hydraulic bailing machine used for metal cans and other small parts, scrap metal piles, a landfill embankment composed of construction and demolition (C&D) debris, and automobile battery and brush piles. Deteriorated drums were scattered throughout the Site, the majority of which were on the lower portion adjacent to Beer Kill. The landfill embankment, approximately 40 feet in height, is a crescent shaped orientated along a northwesterly to southeasterly axis bisecting and dividing the Site into upper and lower portions or plateaus. A Site map with topographic elevation contours is included as Figure 2-2.

2.2 Background and Physical Setting

The facility, in operation since 1950, was used for recycling automobile batteries. The facility was purchased in late 1997 and subsequently used as a landfill and tire dump. A New York State Department of Environmental Conservation (NYSDEC) permit was never obtained to operate a solid waste management facility or to store tires at the Site. From 1987 to 1998, NYSDEC inspected the Ellenville facility on numerous occasions and directed the owners to remediate conditions at the Site. In March 1987, Ellenville Scrap proposed a Settlement of Claim with NYSDEC, which was accepted on January 15, 1988. As part of the Settlement of Claim, Ellenville Scrap agreed to close and cover the area where construction and demolition debris had been disposed. Subsequent Consent Orders entered into by Ellenville Scrap and C. Bruno Demolition with NYSDEC called for an evaluation of Site conditions and the removal of all C&D debris at the facility that did not meet exemption criteria of state environmental law. All C&D debris has since been removed from the Site by EPA.

Three main areas of contamination have been identified. Contaminated soils were found in (1) the facility disposal area, (2) the landfill embankment, and (3) the car battery casing area. Leachate has been observed to be discharging from the landfill embankment, ponding at its base and flowing out into the Site area.

The EPA NPL Site narratives states that there had been an observed release of bis(2-ethyhexyl)phthalate to a surface water/sediment sampling location in Beer Kill (EPA, September 5, 2005). However, the observed release appears to be a detection of that compound in one sediment sample. Beer Kill is a Class B and Class C fishery and is designated for trout spawning (NYSDEC Part 855.4). Seven residential properties are also located in a neighborhood adjacent to the Site. There was documented contamination above regulatory levels for lead and polychlorinated biphenyls (PCBs) at a residence that is located on what was formerly part of the facility that was used for the storage of heavy equipment and automobile batteries. This location has been remediated.

2.3 Geology and Hydrogeology

The Site is located on the eastern edge of the Appalachian Plateau and is approximately one mile west of the Valley and Ridge physiographic province. The Site overlies the Hamilton shale and sandstones of the Devonian Period, which are underlain by the Onondaga, Helderberg and Rondout limestone, outcropping in the valley just to the east. The high ridge, a mile to the east, is comprised of the highly resistant Shawangunk Conglomerate sandstone (Fisher et al, 1970). These sedimentary formations dip steeply to the northwest at the Shawangunk Ridge and become flat-lying to the west.

Overlying the bedrock are Pleistocene glacial deposits consisting of ground moraine and the stratified drift. Post glacial alluvium deposits are present on the flat terrain adjacent to Beer Kill, which represents the southern boundary of the Site. The stratified drift deposits of sand and gravel comprise the overburden aquifer.

The bedrock formation produces groundwater primarily through fractures or its secondary permeability. Wells completed in sedimentary bedrock formations in this area have reported yields typically 0.15 gallons per minute per foot (gpm/ft) or greater of exposed aquifer (Frimpter, 1972). These data suggest transmissivity (T) values of 10E+1 to 10E+2 feet squared per day (ft^2/day) or hydraulic conductivity (K) values of 10E-1 to 10E+0 feet per day (ft/day).

The overlying stratified drift deposits of sand and gravel comprise the aquifer that sustains Sandburg Creek in Ellenville at 10 million gallons per day (mgd) most of the time, representing about 1.7 mgd per mile of aquifer (Frimpter, 1972). Wells in Ellenville, completed in this aquifer, include a 39-foot public supply well drilled in 1961 that tested at 1,000 gallons per minute (gpm) and two wells drilled for Channel Master in the 1950s, one at 87 feet yielding 325 gpm and the other at 51 feet yielding 125 gpm (Frimpter, 1972). The K values are the order of 10E+2 ft/day or cm/sec. The depth to water at the Site is approximately 10 feet below ground surface (bgs).

3.0 SUMMARY OF REMEDIAL INVESTIGATIONS

Following is a chronological summary of the environmental investigations, removal actions, and major inspections at the Site. Analytical results and findings for the previous environmental investigations sampling events described below are discussed in Section 3.1.

- **Settlement of Claim –** Proposed by Ellenville Scrap Iron and Metal in March 1987 and accepted by NYSDEC in January 1988. Ellenville Scrap Iron and Metal acknowledged that it was operating a solid waste management facility without a NYSDEC permit and that it improperly disposed of industrial waste. Ellenville Scrap Iron and Metal paid a fine and agreed to close and cover the area where C&D debris had been disposed (New York State Supreme Court 1998a).

- **Spill Investigation** – October 24, 1990. A review of a NYSDEC Spill Report Form (NYSDEC 1990) indicates that NYSDEC personnel inspected the Site on October 24, 1990, and determined that drum crushing operations had resulted in a spill of unknown lubrication oils and solvents to groundwater. The spill was assigned number 9009037. "Heavy amounts of oil" were observed by the NYSDEC inspectors around and underneath two active crushers at the Site. Oil-soaked turnings were stored on-Site until they were dry enough to be picked up by magnet. Oil draining from the turnings piles was mixing with runoff water and the oil-water mixture was infiltrating into the ground in a wet area of the Site. In addition, the inspectors observed a pipe discharging oil and water into a small catch basin; the oil and water from the basin overflowed onto the ground and into the same wet area impacted by the turnings pile oil runoff. The source of the pipe was unknown but suspected to be one or both of the crushers. The inspector filing the spill report recommended sampling to determine if the observed runoff was hazardous.

- **Spill Investigation** – July 2, 1991. A review of a NYSDEC Spill Report Form (NYSDEC 1991) indicates that NYSDEC personnel inspected the Ellenville Scrap Iron and Metal Site on July 2, 1991 in response to a citizen report. NYSDEC determined that waste oil was being discharged into a nearby stream and a sheen was observed. The spill was assigned number 9103592 and was attributed to housekeeping. No additional details were available from the NYSDEC Spill Report.

- **Sampling Event –** January 13, 1992. NYSDEC representatives collected samples of oil present in the foundation of the building housing the hydraulic baler, discharge of an outfall pipe leading from the baler building to an embankment to the south, and soil adjacent to a storage tank that was designed to capture oils conveyed from the baler building by way of the discharge pipe (LAN Associates, Inc. 1996). Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds SVOCs and PCBs. As a result of this sampling event, NYSDEC issued violations of the Environmental Conservation Law to Ellenville Scrap Iron and Metal and Albert Koplik for discharge of hazardous materials from the pipe leading from the baler building to the storage tank. The violations were alleged to have occurred from December 1991 through

November 1992. In addition, a violation was issued for alleged mishandling of drums containing metal trimmings and other metal objects coated with petroleum product, which were allegedly drained, spilled, dumped or placed into the ground at the Site between June and November of 1992.

- As a result of the NYSDEC investigation, the Site was listed on the New York Registry of Inactive Hazardous Waste Disposal Sites under number 356022.

- **Plea Agreement** – Pursuant to a proposed criminal plea agreement between Ellenville Scrap Iron and Metal and NYSDEC that was outlined in a May 1994 letter from the New York State Department of Law to Ellenville Scrap Iron and Metal, Ellenville Scrap Iron and Metal was to enter into a Consent Order with NYSDEC to conduct a Preliminary Site Assessment (PSA) and to perform an Interim Remedial Measure (IRM) in the area surrounding a baler machine (NYSDEC 1995).

- **Order on Consent** – On January 18, 1995, Ellenville Scrap Iron and Metal and Albert Koplik entered into a Consent Order with NYSDEC in which they agreed to prepare and implement a PSA which would enable NYSDEC to evaluate Site conditions and the need for remediation of hazardous wastes and hazardous substances at the facility, and to perform an IRM in a portion of the facility surrounding a baler machine. In the Consent Order, Ellenville Scrap Iron and Metal and Mr. Koplik acknowledged that the Site had routinely handled waste, including wet cell batteries, old barrels, metal trimmings covered with oil residue, automotive parts, oil burner components, and electronic circuit board components (NYSDEC 1995).

- **Preliminary Site Assessment** – 1995/1996. According to a work plan dated February 16, 1996 (LAN Associates, Inc. 1996), LAN Associates, on behalf of Ellenville Scrap Iron and Metal, intended to perform a PSA under a Consent Order with NYSDEC. The purpose of the PSA was to investigate the presence of PCBs resulting from discharges associated with the baling machine and the presence of groundwater contamination resulting from alleged mishandling of drums containing metal trimmings and objects coated with petroleum products. According to the work plan, stormwater runoff from the property entering the below-grade foundation at the baler building was conveyed through a pipe to an embankment to the south of the baler facility. A storage tank had been placed below the outfall of the pipe to collect oils that may have been spilled within the baler foundation. A copy of the proposed PSA sampling location map obtained by HDR during review of NYSDEC files indicates that the baler building was located on the upper plateau of the Site, approximately 175 feet northwest of the Site entrance. The sampling location map also shows a storm drain and storage tank to the southwest of the baler building. According to the PSA work plan, the outfall pipe had been plugged by the time the work plan was written.

  - The PSA work plan proposed soil sampling for PCB analyses at the baler building and the storage tank, and the installation and sampling of one monitoring well. Analytical results for the work conducted during the PSA were missing from the files that were reviewed during the RI. According to a summary of NYSDEC

Hazardous Waste Remediation file (NYSDEC 1998a), LAN Associates completed the field work for the PSA and obtained the analytical results; however, because of non-payment by their client, LAN Associates did not submit the PSA report to NYSDEC.

- It should be noted that none of the available reports for the previous investigations and removal activities at the Ellenville Scrap Iron and Metals Site indicate that the discharge pipe leading from the baler building and the oil storage tank associated with the baler building were properly emptied, cleaned and removed.

- **Site Inspection** – October 20, 1995. NYSDEC personnel inspecting the Site observed C&D debris, waste tires, metal debris, abandoned automobiles, and several pieces of machinery (a barrel/drum crusher, an aluminum smelter/sweating furnace and a shearing unit). One groundwater monitoring well installed by LAN Associates was also observed (Weston 2001).

- **Site Inspection** – April 4, 1997. NYSDEC personnel inspecting the Site observed ponding leachate at the base of the landfill embankment and noticed sulfurous odors along the embankment. During the inspection, the Site owner stated that 30 to 40 60-cubic yard capacity trucks had dumped materials at the embankment. The monitoring well observed in October 1995 was no longer present (Weston 2001).

- **Order on Consent** – In May of 1997, John Bruno, on behalf of C. Bruno Demolition, entered into a Consent Order with NYSDEC in which he agreed to remove by September 1, 1997 all C&D debris at the facility that did not meet NYSDEC Site exemption criteria. Mr. Bruno also agreed to pay a fine, which was partly suspended provided the C&D debris was removed in compliance with the Consent Order. As part of the Consent Order, C. Bruno Demolition acknowledged that it had constructed and operated a solid waste management facility without the required NYSDEC permit. By July 1998, the bulk of the C&D debris at the facility had not been removed and C. Bruno Demolition had not paid the full amount of the fine (New York State Supreme Court 1998a).

- **Spill Investigation** – June 14, 1997. According to a NYSDEC Spill Report (NYSDEC 1997), NYSDEC personnel inspected the Ellenville Scrap Iron and Metal Site on June 14, 1997 in response to a citizen report. NYSDEC noted an odor at the Site, but could not determine the cause of the odor. The spill was assigned number 9703274. The form indicates that a Consent Order was in place to address the odors and that three aboveground storage tanks (ASTs) on-Site were supposed to be registered by the owner. Information regarding the material spilled, if any, the location of the spill, volume spilled and other information was not indicated on this Spill Report.

- **Notice of Payment of Suspended Penalty** – On February 25, 1998, NYSDEC notified John Bruno and C. Bruno Demolition that they had not complied with the May 1997 Consent Order and therefore had to pay the full amount of the fine (NYSDEC 1998b).

- **Spill Investigation** – March 16, 1998. According to a NYSDEC Initial Spill Report (NYSDEC 1998c), seven gallons of hydraulic oil spilled after a line at the hydraulic metal shear broke. The spill was assigned number 9713913. The hydraulic oil spilled onto the ground and reached a drainage ditch. The water in the ditch had an oily sheen. Cleanup of the spill was supposed to be conducted by the spiller (C. Bruno Demolition). A final version of this spill report and information on the cleanup or follow-up by NYSDEC were not available.

- **Sampling Event** – May 15, 1998. Two surface soil samples were collected on adjoining residential properties by an unidentified engineering firm on behalf of Congressman Maurice Hinchey, the village of Ellenville and Town of Wawarsing.

- **Site Inspections** – Several dates in 1998. NYSDEC personnel observed additional waste had been deposited, including railroad ties, wood pallets, paint cans, car seats, used carpets, and oil filters. Black, odiferous leachate was observed collecting at the bottom of the embankment and running downgradient towards a swale, a pile of C&D debris, and a pile of used tires (Weston 2001).

- **Sampling Event** - June 18, 1998. Soil sampling was conducted at three on-Site locations and at five residential lots by NYSDEC. Based on the material available for review, the samples were analyzed for PCBs and metals. The five residential properties were property D River Street, property G River Street, property H River Street, property A/B Cape Road and property C Cape Road. Three samples were collected from the property D with lead concentrations reported at 380 milligrams per kilogram (mg/kg), 430 mg/kg, and 640 mg/kg (New York State Department of Health [NYSDOH] 1998a). PCBs were detected on-Site and in two samples collected at property A/B Cape Road only with the highest detected concentration (30 mg/kg) reported at property A/B Cape Road. Based on notes in the NYSDEC files, the lead concentrations at property G and H were up to 167 mg/kg and 105 mg/kg, respectively.

- **Motion for a Preliminary Injunction** – On July 31, 1998, the attorney general of New York, on behalf of NYSDEC, submitted a motion for a preliminary injunction against C. Bruno Demolition, John Bruno, Ellenville Scrap Iron and Metal, and Albert Koplik. The injunction requested that the defendants be ordered to stop receiving solid waste and scrap metals at the Site, stop operating a solid waste management facility, to remove and dispose of all waste tires at a NYSDEC-approved facility within 30 days of the Order, to submit to NYSDEC within 14 days a leachate containment plan, to implement the leachate containment plan immediately after NYSDEC approval, to submit to NYSDEC within 30 days a closure and remediation plan, and to implement the closure and remediation plan after NYSDEC approval (New York State Supreme Court 1998a).

- **Temporary Restraining Order** – On August 28, 1998, the New York State Supreme Court issued a temporary restraining order against C. Bruno Demolition, John Bruno, Ellenville Scrap Iron and Metal, and Albert Koplik as requested by NYSDEC on July 31, 1998 (New York State Supreme Court 1998a).

- **Sampling Event** – September 3, 1998. Ulster County Public Health Department (UCDH) and the NYSDOH collected groundwater samples of three nearby domestic wells to assess potential groundwater contamination resulting from Site activities. The samples were analyzed for VOCs and SVOCs, ketones, heavy metals including lead, pesticides, and PCBs. The three wells were on the south side of Beer Kill: property J Greenfield Road, property K Greenfield Road, and property L Greenfield Road. No VOCs were detected in the potable well samples located at property J and K Greenfield Road. For the potable well sample collected at property L Greenfield Road, acetone (10 milligrams per liter or mg/l) and chloroform (3 mg/l) were detected, but at concentrations below the New York State drinking water standards. NYSDOH concluded chloroform is commonly formed in wells from disinfection and acetone is a common laboratory solvent. Four individual SVOCs (i.e., diethylphthalate, di-n-butylphthalate, butylbenzylphthalate, and bis(2-ethylhexyl) phthalate) were detected in the samples from the three residential wells. The detected SVOC concentrations were below the respective New York State drinking water standards and apparently flagged with the data qualifiers "BJ", indicating the chemicals were detected at a concentration below the analytical quantization limit or it is an estimated concentration. The data qualifier also indicates the compound was detected in the laboratory control blank. NYSDOH sent letters to each of the three property owners to notify them of the results (NYSDOH 1998b).

- **Sampling Event** – October 1, 1998. Sampling of on-Site groundwater monitoring wells and on-Site and off-Site (residential) soil was performed by NYSDEC to assess potential groundwater and soil contamination resulting from Site activities (NYSDEC 1999b).

- **Sampling Event** – February 23 and 24 1999. Collection of surface soil and leachate samples by EPA's Response, Engineering, and Analytical Contract (REAC) contractor was conducted to evaluate contamination resulting from waste disposal practices.

- **Examination Before Trial** – On April 9, 1999, John C. Bruno gave deposition to the Supreme Court of New York State as part of the examination before the trial of C. Bruno Demolition, John Bruno, Ellenville Scrap Iron and Metal, and Albert Koplik. Mr. Bruno testified as to Site history, Site operations and the circumstances under which he obtained ownership of the Site (New York State Supreme Court 1999).

- **Site Reconnaissance** – March 30 to 31, 2000. EPA Region 2 and their Superfund Technical Assessment and Response Team (START) contractor, NYSDEC and NYSDOH observed conditions similar to those previously reported by NYSDEC.

- **Sampling Event** – June 5 and 6, 2000. During an Integrated Assessment (IA) of the Site, EPA's Region 2 START contractor collected surface soil, sediment, and leachate samples to evaluate contamination resulting from Site activities. The Final IA Report (Weston 2001) was completed in January 2001.

- **Proposal for NPL** – September 13, 2001. The Site was proposed for placement on the EPA's National Priorities List (NPL).

- **Placement on NPL** – October 7, 2002. The Site was placed on the NPL.

- **Sampling Event** – In June 2004, EPA Region 2 conducted a removal assessment at the Site. Sampling included soil sampling at four nearby residential properties for metals; on-Site soil sampling for metals, pesticides and PCBs; and sampling of drums, an AST and smaller containers on-Site.

- **Sampling Event** – October 2004. EPA Region 2 and a contractor conducted delineation for lead contamination in soil at an adjoining property (property A/B Cape Road). Approximately 50 soil samples were analyzed on-Site for lead using an X-Ray Fluorescence (XRF) analyzer; 10 of the samples were submitted to a laboratory for confirmation analysis of total lead, and three samples were extracted by the Toxic Characteristic Leaching Procedure (TCLP) and analyzed for lead.

- **Removal Action** – November/December 2004. EPA Region 2 excavated lead-contaminated soil from a portion of an adjoining residential property (property A/B Cape Road). Soil was excavated to a depth of 12 inches and disposed off-Site. The excavated area was backfilled with certified clean fill. Ten (10) post-excavation samples were collected and analyzed for lead. The EPA also demolished buildings at the Site, and performed waste characterization and disposal for waste oils from ASTs and hazardous materials from approximately 20 drums on-Site.

- **Remedial Action/Site Clean-up** - May to October 2005. EPA Region 2 performed clean-up activities at the Site by removing lead-acid battery casings from the surface of the slope behind the adjoining residential property (property A/B Cape Road) that was once part of the Site, and excavating and disposing of oil- and lead-contaminated soil from beneath the hydraulic compactor and shear unit. During the excavation at the former compactor building, an approximately 12- to 18- inch diameter pipe was excavated to the south of the former building. The pipe was plugged and observed to contain PCB-contaminated oil. A similar discharge pipe was described in the PSA work plan for the baler building (LAN Associates, Inc. 1996). However, based on the location information in the PSA, the two pipes are not identical. The EPA clean-up report indicated that oil-contaminated soil remained at the compactor building excavation and that oil had entered bedrock at this location. The report also recommended further investigation and excavation of oil-contaminated soil at the former compactor location. Two drums containing PCB oil from the pipe at the former compactor building were shipped for off-Site disposal, along with approximately 30 cubic yards of transit asbestos panels and the brush pile, pallet pile, railroad tie pile, debris piles, hydraulic shear, compactor, and tires. In addition, EPA conducted a radiation survey to investigate alleged dumping of radioactive waste.

3.1 Nature and Extent of Contamination

The results of the RI as well as previous investigations identified several source areas, impacted media and compounds that are of concern for the Site as well as for off-Site areas. The nature and extent of contamination by area and media of concern are summarized in this section.

3.1.1 Landfill Area

Based on the analytical results and observations during Site visits associated with the RI, the entire landfill area appears to be an ongoing source of contamination. The horizontal extent of the landfill appears to be from the toe of the slope adjacent to Cape Road to the bottom of the change in slope (i.e., toe of landfill) from the upper plateau to the lower plateau of the Site. Information from the test pit logs indicates that the fill material within this area may exceed 12 feet in thickness. Test pit TP-03 was advanced to 12 feet bgs and observations noted the fill material was present at that depth. The material was described as black and gray stained with a petroleum odor throughout. Miscellaneous debris, including metal, wood, ash, glass and plastic, was reportedly observed. A slight hydrogen sulfide (H_2S) odor was also noted.

Soil samples collected from the landfill area were reported to contain VOCs, SVOCs, pesticides, PCBs, and metals at concentrations that exceed the Unrestricted Use Soil Cleanup Objectives (SCOs). In general, the results of the soil samples collected from the landfill area were reported to have the highest concentrations of the soil samples collected for this Site. The extent of surface and subsurface soil contamination at the landfill was not delineated during the RI in the area to the north and west of the former compactor unit.

3.1.2 Former Baler Area

The former baler area is located on the upper plateau of the Site, approximately 175 feet northwest of the Site entrance. The baler building is indicated on the proposed PSA sampling location map obtained by HDR during review of NYSDEC files and is discernible on aerial photographs of the Site as a square structure with a brown roof. The hydraulic baler does not appear to be identical with the hydraulic shear, which was located slightly further to the north and was removed by EPA during the 2005 Site cleanup activities. The PSA sampling location map also shows a storm drain and storage tank to the southwest of the baler building.

The former baler area was initially identified as a location with spills and impacted soil in January 1992. At this time, NYSDEC representatives collected samples of: oil present in the foundation of the building that housed the hydraulic baler, discharge from an outfall pipe, and soil adjacent to a storage tank that was designed to capture oils conveyed from the baler building by way of the discharge pipe. The outfall pipe led from the baler building to an embankment to the south. Analytical results for these samples are presented in a NYSDEC Potential Site Notice Memorandum (NYSDEC 1993). The NYSDEC document indicates that a soil sample contained 31.5 mg/kg of PCBs, and an oil sample contained 11.9 mg/kg of PCBs.

The January 1995 Consent Order required that Ellenville Scrap Iron and Metal perform an IRM in a portion of the facility surrounding a baler machine. However, none of the available information indicates that Ellenville Scrap Iron and Metal completed any remedial measures in this area. One specific concern for the area of the former baler building is that the discharge pipe described by NYSDEC was buried and not emptied of waste, as was apparently the case at the former compactor building where a plugged pipe filled with PCB-contaminated oil was unearthed during excavation activities in 2005. Soil samples collected in the vicinity and downgradient of the former baler building indicated concentrations of PAHs, PCBs and lead above Unrestricted Use SCOs (samples SS-006, SS-007 and SS-008). Total PCBs as well as cadmium, chromium, copper, lead and zinc were reported at concentrations exceeding the Residential Use SCOs at this area. In addition, the highest tetrachloroethene concentration in a soil sample was detected at a location near this area.

3.1.3 Former Compactor Area

As presented in the conclusions section of the Site Cleanup and Radiation Survey Report (Weston 2006), further investigation, delineation and excavation was recommended for the former compactor excavation area at the north end of the upper plateau of the Site. The recommendation was based on observations of free product that had entered bedrock at this location as well as air monitoring and laboratory analytical results. Several samples were collected near this area during the RI, including one surface soil sample, five subsurface soil samples from direct-push borings, groundwater from Hydropunch® borings, and soil gas samples.

The surface sample collected at the former compactor area during the RI (direct push or DP-26, 1 foot bgs) had a total PCB concentration of 12.5 mg/kg, as well as several PAHs, pesticides and metals above the Unrestricted Use SCOs. No other surface soil samples were collected in the area. Therefore, the horizontal extent of surface contamination at the former compactor area is not known.

Information from the boring logs for the direct-push borings at the former compactor location show a black ash was encountered. An odor was noted at approximately 5 feet bgs in DP-025, which was advanced to the southeast of the former compactor area excavation. Results of the subsurface sample collected from 4 to 6 feet bgs at the DP-025 boring show benzene, ethylbenzene, toluene and xylenes were detected in concentrations exceeding the Unrestricted Use SCOs. SVOCs detected in this sample included PAHs at concentrations exceeding the Unrestricted Use SCOs. In general, the PAH concentrations were on the same order of magnitude as the Unrestricted Use SCOs. Concentrations of five pesticides were reported as above the Unrestricted Use SCOs with the concentrations of three compounds being an order of magnitude above the objectives. Considering the samples were collected several feet below the ground surface, the pesticide concentrations are not likely attributable to a land application unless material has been added to this area over time. Several metals, including lead, exceeded the Unrestricted Use SCOs at boring DP-025.

Concentrations for three individual PCB Aroclors for sample DP-025 were reported to exceed the Unrestricted Use SCOs, with a total PCB concentration of 20 mg/kg reported for this sample. Three of the four other direct-push boring samples collected from locations around the former compactor excavation also exceeded the Unrestricted Use SCO for PCBs, ranging from 0.312 mg/kg to 4.95 mg/kg. Lead, at a concentration of 3,030 mg/kg, as well as several other metals exceeded the Unrestricted Use SCOs in boring sample DP-30, which was collected between the former compactor excavation and Cape Road to the east.

At DP-025, concentrations of several PAHs, total PCBs, cadmium, copper, nickel and lead exceed the Residential Use SCOs. The total PCB concentration detected in the DP-029 sample as well as arsenic, cadmium, and lead concentrations exceeded the Residential Use SCOs. Arsenic and manganese concentrations exceed the Residential Use SCOs in the DP-030 sample.

3.1.4 Leachate Area

Samples of leachate were collected from two locations near the bottom of the landfill embankment during the RI. Analyses of the leachate samples shown contained two VOCs, several SVOCs consisting of polycyclic aromatic hydrocarbons (PAHs), one pesticide and several metals. Neither the VOCs nor the pesticide exceeded the respective NYSDEC Groundwater Effluent Limitations for NYSDEC Class GA Groundwater values, and benzo(a)pyrene at 0.52 micrograms per liter (ug/l) was the only SVOC that exceeded its Groundwater Effluent Limitation value (non-detect). Iron, lead and manganese exceeded the Groundwater Effluent Limitation values in sample LH-01, and manganese only in LH-02.

Analytical results for leachate samples collected in 1999 and 2000 indicated the presence of a large number of VOCs, SVOCs, pesticides and PCBs, and higher contaminant concentrations than detected during the RI. The apparent reduction in contamination in the leachate may reflect that operations at the Site ceased several years ago. Also, the leachate reduction may have been influenced by the EPA cleanup activities when petroleum products and contaminated soil with free petroleum products were removed from the upgradient former shear unit area in 2005. Observations at the test pits that were installed topographically upgradient of the leachate area indicated widespread staining by what appeared to be petroleum products, and analytical results indicated VOCs, SVOCs (mostly PAHs), pesticides and metals at concentrations above the Unrestricted Use SCOs. The upgradient landfill areas can be anticipated to continue to serve as source areas from which contamination will continue to leach to the base of the landfill. The leachate has been observed to overflow the pond area at the base of the landfill embankment and follow a drainage channel and terrain to the south and southeast.

3.1.5 Lead in Site Soil

Lead is the most pervasive metal present at the Site with concentrations in the soil above the Unrestricted Use SCO. While other metals also, and in some cases frequently, exceed Unrestricted Use SCO, the largest number of exceedances and the largest magnitude of exceedances were generally observed for lead. The major source of lead in soil at the Site is the historic reclamation of lead from automotive batteries that was conducted at the Site over several decades and the on-Site disposal of associated reclamation wastes.

Surface soil samples were collected in 2000 as part of the Roy F. Weston Inc. (Weston) investigation, in 2004 as part of an EPA investigation, and in 2007 as part of the TetraTech (TtEC) RI. Lead concentrations in exceedance of the Unrestricted Use SCO of 63 mg/kg were reported for all three investigations (as summarized below) for a large portion of the Site.

In June 2000, Weston collected 22 surface soil samples on-Site. Analytical results indicated lead concentrations were above the Unrestricted Use SCO in 19 of the 22 samples. The two samples with the highest lead concentrations (SS-09 at 18,200 mg/kg and SS-16 at 14,600 mg/kg) were collected from the lower plateau of the Site in an area without vegetation and at a battery pile. Locations of the surface soils were shown in Weston's report on a figure without a scale. Therefore, the exact sampling locations could not be reconstructed.

In June 2004, EPA collected 10 surface soil samples from the battery pile area at the Site. The battery pile area reportedly extended from the facility itself onto the adjacent Cape Road property A/B; which was once part of the Site. Lead concentrations for these samples ranged from 31 mg/kg to 1,600 mg/kg.

During the RI, lead concentrations above the Unrestricted Use SCO were detected in 37 of the 44 surface soil samples (approximately 84%) for which valid results were available. The analytical results for copper, lead and mercury for 14 surface soil samples collected during the RI on the lower plateau of the Site (samples SS-19 through SS-21 at the leachate/former large debris pile area, and samples SS-30 through SS-40 at the former creosote tie pile area) were rejected during the RI data validation process. Some of the samples collected in June 2000 by Weston cover these areas. These sample results can be used for a general evaluation of the concentrations of the three metals. At the time of the June 2000 sampling event, the debris and creosote tie piles were still in place at the Site. Therefore, the June 2000 samples only represent soil near these piles and not the area formerly covered by these piles. At the five locations sampled around the creosote tie pile area in June 2000 (Weston sample numbers SS03, SS04/SS05 Duplicate, SS06, SS07, and SS12), lead concentrations ranged from 94.8 mg/kg to 599 mg/kg (all exceeding the Unrestricted Use SCO of 63 mg/kg). In these samples, copper concentrations ranged from 42.9 mg/kg to 7,460 mg/kg (four of five locations above the Unrestricted Use SCO of 50 mg/kg), and mercury concentrations were between 0.064 mg/kg and 1.1 mg/kg (four of five locations above the Unrestricted Use SCO of 0.18 mg/kg). Results for the June 2000 sampling near the leachate/former large debris pile area (Weston sample numbers SS01 and SS02) indicated the presence of lead (469 mg/kg and 2,360 mg/kg), copper (265 mg/kg and 471 mg/kg) and mercury (0.71 mg/kg and 1.1 mg/kg) above Unrestricted Use SCO. In summary, the June 2000 sampling results indicate that lead, copper and mercury concentrations in surface soil at the creosote tie pile area and the leachate/former large debris pile area have historically exceeded Unrestricted Use SCOs.

Lead above the Unrestricted Use SCO was also reported for 13 of 40 (32.5%) of the subsurface soil samples. The lead concentrations in surface and subsurface soil exceeded the Unrestricted Use SCO by up to two orders of magnitude (maximum concentrations of 3,280 mg/kg and 3,840 mg/kg, respectively).

In comparison with the Residential Use SCOs, 18 samples collected during the Weston Investigation in 2000 were reported to have lead concentrations exceeding 400 mg/kg. For the RI, 21 on-Site surface soil samples and 10 on-Site subsurface soil samples were reported to have lead concentrations exceeding the Residential Use SCOs.

3.1.6 PCBs in Site Soil

During the RI, the concentrations of total PCBs exceeded the Unrestricted Use SCO (0.1 mg/kg) in 28 of the 58 surface soil samples collected on-Site. The sampling locations with exceedances were on the landfill, in the area of the former large debris pile at the base of the landfill, and the southeast portion of the lower plateau of the Site. The highest PCB concentration in surface soil (43 mg/kg) exceeded the Unrestricted Use SCO by two orders of magnitude. Total PCB concentrations in 12 surface soil samples exceeded the Unrestricted Use SCO by a factor of 10 or greater (seven locations on the upper plateau and five on the lower plateau of the Site).

In subsurface soil, the concentrations of total PCBs exceeded the Unrestricted Use SCO in 12 of 39 samples. The highest total PCBs concentrations in subsurface soil on-Site were detected in the samples from TP-08 (55 mg/kg) and DP-25 (20 mg/kg), both of which were collected between 4 to 6 feet bgs at locations on the upper plateau of the Site. Overall, 10 of the 12 subsurface samples that exceeded the Unrestricted Use SCO for total PCBs were collected from the upper plateau of the Site, including the landfill and the former compactor excavation area. The two exceedances of the Unrestricted Use SCO for total PCBs on the lower plateau of the Site were concentrations of 0.18 mg/kg and 0.3 mg/kg.

In comparison to the Residential Use SCOs, there were 17 surface soil samples with concentration exceedances. In addition, five subsurface soil samples have concentrations that exceed the Residential Use SCOs. In general, the bulk of the Residential Use SCO exceedances (12 samples) for total PCBs were within the landfill area. Two exceedances were near the base of the road from the upper portion of the Site to the lower portion, and three Residential Use SCO exceedances were in a topographic low area near the east Site boundary. One off-Site surface sample at property A/B Cape Road had an exceedance of the Residential Use SCOs for total PCBs.

3.1.7 Property A/B Cape Road Lead-Contaminated Soil

Four surface soil samples (0-2 feet bgs) collected at property A/B Cape Road property during the RI had lead concentrations between 202 mg/kg and 8,970 mg/kg. The horizontal and vertical extent of lead contamination above the NYSDEC Unrestricted Use and Residential Use SCOs at the property A/B Cape Road property has not been fully delineated. The analytical results also indicate that the total PCB concentration at the property exceeded the NYSDEC Unrestricted Use SCO (two samples) and the Residential Use SCO (one sample), although the concentration is on the same order of magnitude as the SCOs.

In June 2000, Weston collected three surface soil samples in the residential area of the property A/B Cape Road property. The samples were collected to the north and west of the residence and had the following lead concentrations: SS-22, 230,000 mg/kg; SS-23, 2,000 mg/kg; and SS-24, 1,210 mg/kg. In June 2004, EPA collected 20 surface soil samples from the area north and west of the Property A/B Cape Road residence. Lead concentrations in these samples ranged from 380 mg/kg to 28,000 mg/kg. Following additional delineation sampling in October 2004, EPA excavated the area to a depth of 1 foot, collected post-excavation samples and backfilled the excavation with certified clean fill. Post-excavation soil sampling at the property conducted during the November 2004 excavation indicated that at 12-18 inches bgs, soil with lead concentrations ranging from 1,300 mg/kg to 45,000 mg/kg remained in place at the completion of the removal action.

Documentation for the previous sampling events at the property A/B Cape Road property indicate that only limited sampling of deeper surface soil (1-2 feet bgs) has been conducted. It appears that sampling of subsurface soil (> 2 feet bgs) has not been conducted at the property.

3.1.8 Lead in Soil at other Residential Properties

In addition to the property A/B Cape Road area, lead contamination above the Unrestricted Use SCO of 63 mg/kg (five lots) and the Residential Use SCO of 400 mg/kg (three residential properties on River Street) was detected at other residential properties to the southeast of the Site during the RI. Three samples collected at properties on River Street, RSS-13 (1,010 mg/kg), RSS-14 (528 mg/kg) and RSS-18 (5,280 mg/kg) were reported to have lead concentrations that were two orders of magnitude above the Unrestricted Use SCOs and up to one order of magnitude above the Residential Use SCOs.

In the absence of any other known source, elevated lead concentrations detected in the residential soil samples along River Street is likely the result of surface runoff or windborne transport from the property A Cape Road residential area and the Site. Although surface soil was removed from one area of the property A/B Cape Road residence in 2004, lead impacted soil likely remains along the steep slope behind the residence where the battery carcasses were disposed. Precipitation events followed by surface runoff likely caused migration of the lead-impacted soil to lower lying areas to the south and east for the former battery wall.

Previous investigations also detected lead above the Unrestricted Use SCO of 63 mg/kg and the Residential Use SCO at residences on Cape Road and on River Street. The horizontal and vertical extent of the soil with concentrations above the Unrestricted Use and Residential Use SCOs has not been delineated.

3.1.9 Soil Gas

The soil gas investigation indicated the presence of six compounds (benzene, chloroform, chloromethane, ethylbenzene, tetrachloroethene and trichloroethene) above the respective EPA's Target Shallow Gas Concentration 10^{-6} values presented in the EPA document *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* at one or more locations. Chloromethane exceeded its Target Shallow Gas Concentration by an order of magnitude in one sample and the only two other detections of chloromethane were one to two orders of magnitude lower. Tetrachloroethene was detected in each of the 13 verification samples at concentrations above the Target Shallow Gas Concentration value of 8.1 micrograms per cubic meter (ug/m^3) and had a maximum concentration of 2,441.7 ug/m^3 in a sample collected from the landfill on Site. Trichloroethene exceeded the Target Shallow Gas Concentration of 0.22 ug/m^3 at four locations (maximum concentration: 96.7 ug/m^3). The benzene, ethylbenzene, and chloroform concentrations that exceeded the Target Shallow Soil Gas concentrations were on the same order of magnitude as the Target concentrations.

The highest concentrations for 22 of the 30 detected compounds were encountered in the four soil gas samples collected from the upper plateau of the Site, including the highest concentrations for tetrachloroethene, trichloroethene and the benzene, toluene, ethylbenzene and xylene (BTEX) compounds. The elevated concentrations of VOCs in soil gas at the Site generally reflect the presence of primary VOC sources in the landfill as indicated by the occurrence of most of the highest compound concentrations in this area. Based on the lack of VOC impacted soil near the eastern Site boundary, it appears that impacted groundwater emanating from the landfill and migrating to the east may be the source of the soil gas concentrations detected in that area.

Concentrations of tetrachloroethene in two soil gas samples (122.1 ug/m^3 at SG-096 and 128.9 ug/m^3 at SG-098) collected in the southernmost portion of the Site, on the lower plateau of the property A/B Cape Road residential lot, exceeded the Target Shallow Gas Concentration (81 ug/m^3). These two soil gas sampling locations are upgradient of the residential area along River Street to the south and southeast. Location SG-096 is approximately 65 feet upgradient of the nearest residence on River Street and location SG-098 is approximately 165 feet and side gradient from the nearest residence on River Street. The residence at property A/B Cape Road is approximately 80 feet from the nearest soil gas sample location (SG-025), and is topographically above the three sampling locations on the lower plateau.

The results for the verification soil gas samples indicate the potential for inhalation of VOCs in indoor air from subsurface vapor intrusion over a large portion of the Site. However, there are no existing buildings on-Site. Based on the PCE concentration in the soil gas sample collected at SG-095 near the east Site boundary, vapor intrusion potential may extend in the downgradient residential area off-Site in the direction of groundwater flow. The horizontal extent of soil gas concentrations above the Target Shallow Gas Concentrations was not delineated during the RI.

3.1.10 Chlorinated Solvents in Groundwater

In 1998, the monitoring wells installed as part of the NYSDEC investigation were sampled. Results of the groundwater sampling event showed tetrachloroethene in two of the monitoring wells. The concentrations reported for MW-2 and MW-3 were 8 ug/l and 22 ug/l, respectively, compared to the Class GA Groundwater Standard of 5 ug/l. A well installed further east, MW-1, also had a detected tetrachloroethene concentration (1 ug/l), albeit below the Class GA Groundwater Standard.

As part of the RI, several groundwater samples were collected in Hydropunch® borings near these areas. Although none of the results of the samples collected from these borings were above the Class GA Groundwater standards, the detected concentrations show that tetrachloroethene has impacted groundwater to the east, toward the residences along River Street. As discussed above, chlorinated solvents were detected in soil gas samples.

Tetrachloroethene was also reported in all 13 soil gas verification samples collected during the RI, exceeding its Target Shallow Gas Concentration 10^{-6} value by up to three orders of magnitude. The highest concentration was reported for sample SG-124, which was collected on the upper plateau of the Site near the former shear unit and a former drum storage area identified on maps for the June 2000 EPA investigation. Near the east Site boundary, concentrations for four compounds (tetrachloroethene, along with other compounds) exceeded the Target Shallow Gas Concentrations in three samples that were collected in this area (Block 1, Lot 2), which is the same property as property A/B Cape Road, although on the Site portion of the property. No corresponding source of the tetrachloroethene concentrations were identified in the surface and subsurface soil sample investigation. Therefore, the source of the tetrachloroethene concentrations in soil gas is likely off gassing of groundwater. Additional monitoring wells will be installed in the area in question as part of the pre-design investigation to assess groundwater conditions.

4.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) have been developed for the Site for the protection of public health and the environment based on findings of the RI. The RAOs are organized by media of concern and specify contaminant type, exposure pathways and preliminary remediation goals based on chemical specific Applicable or Relevant and Appropriate Requirements (ARARs). The ARAR preliminary remediation goals identify Standards, Criteria, and Guidance (SCGs) that will be utilized to establish soil and groundwater cleanup objectives that eliminate or mitigate the significant threat to the public health and environment. The Site-specific RAOs are presented below:

Groundwater

1. Prevent ingestion of water with contaminant concentrations greater than NYSDEC Technical & Operational Guidance Series (TOGS) groundwater (Class GA) water quality standards.

2. Prevent off-Site migration of groundwater with contaminant concentrations greater than the NYSDEC TOGS groundwater (Class GA) water quality standards.

3. Prevent discharge of groundwater with contaminant concentrations greater than the NYSDEC TOGS groundwater (Class GA) water quality standards to adjacent surface water (Beer Kill).

4. To the extent practicable, restore groundwater contaminant concentrations to less than the NYSDEC TOGS groundwater (Class GA) water quality standards.

5. Prevent exposure to or inhalation of volatilized contaminants from groundwater with concentrations greater than the NYSDEC TOGS groundwater (Class GA) water quality standards.

Soil

1. Prevent ingestion/direct contact of soil with contaminant concentrations greater than NYSDEC Part 375 Residential Use SCOs.

2. Prevent inhalation of soil dust with contaminant concentrations greater than NYSDEC Part 375 Residential Use SCOs.

3. Prevent off-Site migration of soil with contaminant concentrations greater than NYSDEC Part 375 Residential Use SCOs.

4. Prevent or minimize impacts to groundwater and/or surface water resulting from soil contamination with concentrations greater than NYSDEC Part 375 Protection of Groundwater SCOs.

5. Prevent off-Site migration of soil with contaminant concentrations greater than NYSDEC Part 375 Protection of Ecological Resources Soil Cleanup Objectives.

Solid Wastes

1. Prevent ingestion/direct contact with solid wastes with contaminant concentrations greater than NYSDEC Part 375 Residential Use SCOs.

2. Prevent off-Site migration of solid wastes with contaminant concentrations greater than NYSDEC Part 375 Residential Use SCOs.

3. Prevent or minimize impacts to groundwater and/or surface water resulting from solid wastes with concentrations greater than NYSDEC Part 375 Protection of Groundwater SCOs.

4. Prevent ingestion of leachate with contaminant concentrations greater than the NYSDEC TOGS groundwater (Class GA) water quality standards.

5. Prevent off-Site migration of leachate with contaminant concentrations greater than the NYSDEC TOGS groundwater (Class GA) water quality standards.

6. Prevent exposure to or inhalation of volatilized contaminants from the solid wastes.

7. Prevent migration of landfill gas generated by the decomposition of solid wastes.

Surface Water

None.

Sediment

None.

Air

None additional to the inhalation RAOs listed above.

5.0 GENERAL RESPONSE ACTIONS

General Response Actions (GRAs) are broad types of activities that will potentially satisfy the remedial action objectives. VOCs, SVOCs, metals, PCBs and pesticides have been detected in the soil and groundwater at the Site at concentrations greater than the applicable SCGs. GRAs were identified for the Site taking in to account the physical Site-specific conditions, contaminant chemical characteristics and the RAOs. GRAs for each media of concern at the Site are presented below.

5.1 Soil General Response Actions

The GRAs for impacted on-Site soils include no action, institutional controls, containment, treatment, and removal.

No Action – The no action option is included as a basis for comparison with the active soil remediation technologies. If no action is taken, the contaminants will remain in place and the RAOs will not be met.

Institutional Controls – Restricting the Site use through institutional controls (deed restrictions, environmental easements) would reduce the volume of soil requiring active remediation. Based on the Village of Ellenville and Town of Wawarsing respective zoning maps, the Site is currently zoned for residential/industrial use and has been used for residential/industrial use in the past, the majority of the site is located in the Town of Wawarsing and that section is zoned as rural. NYSDEC Part 375 Restricted Use SCOs include residential, restricted residential, commercial, industrial, protection of ecological resources and protection of groundwater. However, because contaminants were detected in soil at concentrations greater than the Restricted Use SCOs, additional response action(s) will need to be employed in conjunction with institutional controls to meet the RAOs.

Containment – Containment options are often performed to prevent, or significantly reduce, the migration of contaminants in soils. Containment is necessary whenever contaminated materials are to be buried or left in place at a site. In general, containment is performed when extensive subsurface contamination at a site precludes excavation and removal of wastes because of potential hazards, unrealistic cost, or lack of adequate treatment technologies. Containment solutions offer quick installation times and are typically a low to moderate cost treatment group. Containment generally does not require excavation of soils, although limited regrading may be required. Containment treatments require periodic inspections and maintenance and often require additional long term groundwater monitoring. Even with these long-term requirements, containment solutions usually are considerably more economical than excavation and removal of the wastes.

Treatment – Treatment of contaminants can be achieved either in situ or ex-situ and includes several type of technologies that encompass biological, thermal, and physical/chemical treatment approaches.

- Biological – Bioremediation consists of stimulation of microorganisms to promote degradation of contaminants. Biological treatment is generally effective for organic contaminants (VOCs and SVOCs); however, biological treatment may not be effective for addressing metal contaminants in soil.

- Thermal – Thermal treatment processes are viable strategies to mobilize and remove or destroy contaminants in soils.

- Physical/Chemical – Physical/Chemical treatment process can be used to destroy, separate or immobilize contaminants in soil.

Removal – Excavation and off-Site disposal will permanently remove contaminants from the Site. Soil excavation may be accomplished using conventional earthmoving equipment. Disposal options for excavated soils include transportation to an off-Site landfill or treatment facility.

5.2 Groundwater General Response Actions

The GRAs for impacted groundwater include no action, institutional controls, containment, treatment, and discharge.

No Action – The no action option is included as a basis for comparison with the active groundwater remediation technologies. If no action is taken, the contaminants will remain in place and the RAOs will not be met.

Institutional Controls – Restricting the Site use through institutional controls (deed restrictions, environmental easements) would reduce the volume or eliminate the need for active remediation of groundwater. Long term monitoring would be required in conjunction with implementation of institutional controls.

Containment – Containment options are often performed to prevent, or significantly reduce, the migration of contaminants in groundwater. Containment solutions often require additional long term groundwater monitoring.

Treatment – Treatment of contaminants can be achieved either in situ or ex situ and includes several type of technologies that encompass biological, thermal, and physical/chemical treatment approaches.

- Biological – Bioremediation consists of stimulation of microorganisms to promote degradation of contaminants. Biological treatment is generally effective for organic contaminants (VOCs and SVOCs); however, biological treatment may not be effective for addressing metal contaminants in groundwater.

- Thermal – Thermal treatment processes are viable strategies to mobilize and remove or destroy contaminants in groundwater.

- Physical/Chemical – Physical/Chemical treatment process can be used to destroy, separate or immobilize contaminants in groundwater.

Discharge – Disposal options for extracted groundwater include discharge to a publicly owned treatment works (POTW) or surface water after treatment.

5.3 Solid Waste General Response Actions

The GRAs for solid waste include no action, institutional controls, containment, treatment, and removal.

No Action – The no action option is included as a basis for comparison with the active remediation technologies. If no action is taken, the contaminants will remain in place and the RAOs will not be met.

Institutional Controls – Restricting the Site use through institutional controls (deed restrictions, environmental easements) would be required if solid wastes were to remain at the Site. Long term monitoring would be required in conjunction with implementation of institutional controls.

Containment – Containment options are often performed to prevent, or significantly reduce, the migration of contaminants. Containment solutions often require additional long term monitoring requirements.

Treatment – Treatment of contaminants can be achieved either in situ or ex situ and includes several type of technologies that encompass biological, thermal, and physical/chemical treatment approaches.

- Biological – Bioremediation consists of stimulation of microorganisms to promote degradation of contaminants. Biological treatment will have limited effectiveness given the type of solid wastes (scrap metal) observed at the Site.

- Thermal – Thermal treatment processes are viable strategies to stabilize or destroy solid waste.

- Physical/Chemical – Physical/Chemical treatment processes can be used to destroy, separate or immobilize solid waste.

Removal – Collection and off-Site disposal of excavated solid waste will permanently remove contaminants from the Site. Disposal options for excavated solid waste include transportation to an off-Site landfill or treatment facility.

6.0 IDENTIFY VOLUMES OR AREAS OF MEDIA

The RI identified varying types, concentrations and combinations of contaminants across the Site. For the purposes of conducting a feasibility analysis, the Site has been divided into six (6) Areas of Concern (AOCs) in order to facilitate development and evaluation of remedial alternatives based on the nature and extent of contamination. The six AOCs are defined as follows:

AOC 1 - Landfill Area – Upgradient area of the Site adjacent to Cape Avenue where a majority of Site operations were conducted. Solid waste (scrap metal, wood, concrete, glass, plastic, and C&D debris) were deposited in this area, accumulating of greater than 12 feet thick. VOCs, SVOCs, metals, PCBs and pesticides were detected in the soil within the area at concentrations greater than the Residential Use SCOs.

AOC 2 - Debris Pile Area – This AOC is adjacent to the southern boundary on the landfill area, on the lower plateau area of the Site. The area was used for debris piles (scrap metal, pallets, rail road ties, tires, transite, batteries). The debris piles were removed in 2005 by NYSDEC. The area is a characterized by debris mixed into the surface soils and a leachate seep from the landfill area. SVOCs, metals, PCBs and pesticides were detected in the soil within the area at concentrations greater than the Residential Use SCOs.

AOC 3 - Dumpster Staging Area – This AOC is located adjacent to and south of the landfill area. The area was used for the storage of solid waste dumpsters. SVOCs, metals, and PCBs were detected in the soils within the area at concentrations greater than the Residential Use SCOs. This area was separated from the debris pile area because of differences in the amount of the surficial debris observed in the area.

AOC 4 - Scattered Debris Area – This AOC is located along the southern boundary of the Site and extends along the Beer Kill and to the north of the landfill area. The area is vegetated with older growth trees, scattered debris and isolated debris piles (drums, scrap metal, ties). The drums and some of the debris were removed by EPA in 2005. Metals were detected in the soils at one location within the area at concentrations greater than the Residential Use SCOs.

AOC 5 - Battery Disposal Area – This AOC is located adjacent to and east of the landfill area (property A/B Cape Road). Battery casings were disposed of on the hillside behind the residence (property A/B Cape Road). Hand removal of a portion of the battery casings from the surface of the hillside was completed by EPA in 2005. Metals and PCBs were detected in the soils within the area at concentrations greater than the Residential Use SCOs.

AOC 6 - Off-Site Residential Area – This AOC is located off-Site to the east of the Site. Several residential structures are located on the three residential properties. SVOCs and metals were detected in the soils within the area at concentrations greater than the Residential Use SCOs.

The six AOCs are shown on Figure 6-1. A summary of the AOCs identified and estimated dimensions and quantities is included on Table 6-1.

6.1 AOC 1 - Landfill Area

The landfill area is located in the upper plateau area of the Site and is the area where a majority of the Site operations were conducted. Specific operation areas located within the landfill area include a shear/baler area and a compactor area. Solid waste was deposited in a wide spread area within the AOC. A leachate seep is located at the toe of slope of the solid waste. Each of these sub AOCs (AOC 1A – Solid Waste, AOC 1B - Shear/Baler Area, AOC 1C - Compactor Area, AOC 1D - Leachate Seep) are shown on Figure 6-1 and are discussed below in greater detail. The remainder of the landfill area specifically at the site entrance is discussed in the following paragraph.

The Site entrance, including truck scales, is located within the landfill area. Metals (cadmium, chromium, copper, lead and mercury) have been detected in the soils in the landfill area near the Site entrance at concentrations greater than the Residential Use SCOs. PAHs have also been detected at concentrations greater than the Residential Use SCOs. The areal extent of the PAHs and metal contamination has not been delineated although there is some delineation to the north along Cape Avenue. PAH and metal contamination has not been delineated for depth. Based on available test pit and direct push boring sample analytical results, PAHs and metal soil contamination extends to a depth of greater than 4 feet bgs. A summary of the sample soil analytical results for the Landfill AOC is shown on Figure 6-2. For the purpose of this FS, the contamination is assumed to extend to the horizontal limit of AOC 1, shown on Figure 6-2. The soil contamination at the Site entrance is estimated to extend to an average depth of 4.6 feet bgs. Based on the assumed extent of soil contamination, an area of 32,600 square feet and a volume of 4,800 cubic yards of soil have been impacted.

6.1.1 AOC 1A – Solid Waste

Ten (10) test pits were excavated within the landfill area to delineate the extent of solid waste. Solid waste (scrap metal, wood, concrete, glass, plastic, and construction and demolition debris) were deposited in this area to a depth of greater than 12 feet thick in some areas. The areal extent and inferred depth of the solid waste deposited at the Site is shown on Figure 6-2. Based on the extrapolated limit of solid waste, approximately 31,466 cubic yards of solid waste were deposited at the Site. With the exception of samples collected from DP-23 and DP-24, metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, manganese, nickel and zinc) were detected at concentrations greater than the Residential Use SCOs. PAHs were also detected at a majority of the soil sample locations at concentrations greater than the Residential Use SCOs. Pesticides were detected at three locations (SS-12W, TP-02 and TP-03) at concentrations greater than the Residential Use SCOs. PCBs were detected in the central portion of the solid waste area at concentrations greater than the Residential Use SCOs. At one location (TP-08), PCBs were detected at a concentration (55 mg/kg) greater than the Toxic Substance Control Act (TSCA) standards of 50 mg/kg.

The areal extent of metal, PAH, PCB and pesticide contaminated soil has not been delineated. For the purposes of this FS, it is assumed that the soil contamination extends to the limits of the solid waste AOC. Soil impacts have been delineated vertically at two locations, DP-23 and DP-24, to a depth of 6 and 15 feet bgs, respectively. For the purposes of this FS, it is assumed that the soil contamination extends to the inferred depth as shown on Figure 6-2 or an average depth of approximately 8 feet bgs. Based on the assumed extent of solid waste, an area of 207,800 square feet and a volume of 61,600 cubic yards of solid waste have been deposited at the Site.

6.1.2 AOC 1B – Shear/Baler Area

The shear/baler area is located in the northeast portion of the landfill area adjacent to the Site entrance. The area was used to process solid waste as part of the Site operations. ASTs used for fuel and waste oil were also located in this area. Metals (arsenic, cadmium, chromium, copper, lead and mercury) were detected in the soils at concentrations greater than the Residential Use SCOs. PAHs and PCBs were also detected at concentrations greater than the Residential Use SCOs. A summary of the soil sample analytical results is shown on Figure 6-2.

The areal extent of metal, PAH, and PCB contaminated soil has not been delineated. For the purposes of this FS, it is assumed that the soil contamination extends to the limits of the shear/baler area AOC. Soil impacts have not been delineated vertically and, based on the test pit data (TP-10), soil contamination extends to a depth greater than 3 feet bgs. For the purposes of this FS, it is assumed that the soil contamination extends to an average depth of 8 feet bgs. Based on the assumed extent of soil contamination, an area of approximately 15,300 square feet and a volume of approximately 4,500 cubic yards of soil have been impacted to a level greater than the Residential Use SCOs.

6.1.3 AOC 1C – Compactor Area

A compactor was located in the northwest portion of the landfill area. The compactor was removed and soils beneath the compactor area were excavated. Metals (arsenic, cadmium, chromium, copper, lead, and mercury) have been detected in the remaining soil at concentrations greater than the Residential Use SCOs. PCBs were detected at three locations at concentrations greater than the Residential Use SCOs. PAHs were detected at one location at concentrations greater than the Residential Use SCOs. A summary of the soil sample analytical results is shown on Figure 6-2.

The areal extent of metal, PCB and PAH impacted soil has not been delineated. Soil contamination at depth appears to be delineated to the north. For the purpose of this FS, it is assumed that the soil contamination extends to the limits of the compactor area AOC footprint. Elevated PAHs and PCBs concentrations extend to a depth greater than 6 feet bgs and appear to be delineated at a depth of approximately 7 feet bgs. Metal contaminated or impacted soil contamination has not been delineated for depth but extends to a depth greater than 9 feet bgs. For the purpose of this FS, it is assumed that soil contamination extends to an average depth of 8 feet bgs. Based on the assumed extent of soil contamination, an area of approximately 5,900 square feet and a volume of approximately 1,700 cubic yards of soil media have been impacted to a level greater than the Residential Use SCOs.

6.1.4 AOC 1D – Leachate Seep

A leachate seep is located at the toe of the southern landfill slope at the approximate east-west midpoint of the solid waste area. The leachate pond is an approximately 3-inch deep depression at the base of the landfill slope. Under wet conditions, the leachate pond appears to extend away from the landfill slope towards the south-southwest. Two saturated soil samples (SWSD-03 and SWSD-04) and two surface soil samples (SS-03W and SS-01W/LO1) have been collected from the area during the RI. Metals (barium, cadmium, chromium, lead, and mercury) have been detected in soil at concentrations greater than the Residential Use SCOs. PAHs were also detected at concentrations greater than the Residential Use SCOs. A summary of the surface soil sample analytical results for this AOC is shown on Figure 6-2.

The horizontal and vertical limits of the soil contamination have not been delineated. For the purposes of this FS, soil impacts are assumed to extend to the limits of the leachate seep area and to a depth of 3 feet bgs. Soil impacted as a result of the leachate seeping from the landfill is addressed as part of AOC 2 – Debris Pile Area. Based on the assumed extent of soil contamination, an area of approximately 7,300 square feet and a volume of approximately 800 cubic yards of soil media have been impacted to a level greater than the Residential Use SCOs. Soil impacted as a result of the leachate seeping from the landfill is addressed as part of AOC 2 - Debris Pile Area.

6.2 AOC 2 - Debris Pile Area

The debris pile area is located on the lower plateau portion of the Site south and adjacent to the landfill area. The area has been cleared of trees and large vegetation and several large debris piles were located in this area. The debris piles included a general debris (wood, plastic, metal, concrete, and glass) pile, brush pile, transite pile, tire pile, wood pallet pile, and creosote coated railroad tie pile. Miscellaneous debris including drums, piping, steel tanks, and straps were also identified within the area. The debris piles were removed in 2005 as part of the EPA remedial activities. Remnants of the debris staged in the area (wood, plastic, metal, glass, hoses and concrete) are present in the surface soils within the area. Areas of soil staining and stressed vegetation are also present within the area.

Soil sampling within the area indicated the presence of metals (barium, cadmium, chromium, copper, lead, mercury, nickel and zinc), PAHs, and PCBs at concentrations greater than the Residential Use SCOs in the surface soils within the area. PCBs appear to be localized near the access road and former large debris pile area. PAH and metal impacted surface soils have not been delineated horizontally. For the purposes of this FS, it is assumed the surface soil impacts extend to the limits of the AOC area. Based on the subsurface soil sampling results, soil impacts have been delineated to depths ranging between 5 to 9 feet bgs across the area. A summary of the soil sample analytical results for this AOC is shown on Figure 6-3. For the purpose of this FS, it is assumed that soil contamination extends to an average depth of 3 feet bgs in the debris pile AOC. Based on the assumed extent of soil contamination, an area of approximately 179,800 square feet and a volume of approximately 20,000 cubic yards of soil have been impacted to a level greater than the Residential Use SCOs.

6.3 AOC 3 - Dumpster Staging Area

The dumpster staging area is located to the south of the landfill area. The majority of the area has been cleared of trees and was used to store solid waste dumpsters as part of the Site operations. Although there are some scattered debris and isolated debris piles, there is significantly less debris in the surface soils compared to the debris pile area.

Metals (arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc), PAHs and PCBs have been detected in the soil at concentrations greater than the Residential Use SCOs. Soil impacts have not been delineated horizontally and for the purposes of this FS are assumed to extend to the limits of the AOC. A summary of the soil sample analytical results for this AOC is shown on Figure 6-4. Based on subsurface soil sample results (DP-002), soil contamination extends to a depth greater than 5 feet bgs in some areas and less than 2 feet bgs (DP-001) and 6 feet bgs (DP-003) in other areas of the AOC. For the purpose of this FS, it is assumed that soil contamination extends to an average depth of 3 feet bgs in the dumpster staging AOC. Based on the assumed extent of soil contamination, an area of approximately 60,200 square feet and a volume of approximately 6,700 cubic yards of soil media have been impacted to a level greater than the Residential Use SCOs.

6.4 AOC 4 - Scattered Debris Area

The scattered debris area is located to the east of the dumpster staging and debris pile areas and extends along Beer Kill to the north of the landfill area. Trees and vegetation are well established throughout the area. Isolated debris and debris piles including hoses, drums, paint cans, truck frames, tires, and piping were scattered throughout the area. The drums and drum remnants were removed in 2005 by the EPA. This area does not appear to have been used as part of the recent Site operations, although the scattered debris suggests that the area was used historically.

Metals (cadmium, copper and lead) and PAHs have been detected in soils within the scattered debris AOC at concentration greater than the Residential Use SCOs. The two samples with metal exceedances (SS-052 and SS-16W) and one sample with PAH SCO exceedances (SS-16W) are in two isolated areas near the southern corner of the Site. The soil contamination appears to be the result of the isolated dumping of paint cans at one location and batteries at the other. The soil contamination has not been delineated horizontally or vertically. Based on the pattern of debris, the contamination appears to be localized in nature and most likely does not extend far from the debris location. A summary of the soil sample analytical results for this AOC is shown on Figure 6-5. For the purposes of this FS, it is assumed that each sample location is represented by a 50-foot by 50-foot impacted area that extends to a depth of 3 feet bgs. Based on the assumed extent of soil contamination, an area of approximately 5,000 square feet and a volume of approximately 600 cubic yards of soil media have been impacted to a level greater than the Residential Use SCOs.

6.5 AOC 5 - Battery Disposal Area

The battery disposal area consists of an embankment behind the residence at property A/B Cape Road where battery carcasses were disposed after the metal was reclaimed from the battery. Hand removal of a portion of the battery casings was completed by EPA in 2005. Metals (cadmium, copper and lead) were detected in the soil at concentrations greater than the Residential Use SCOs. The areal extent of the soil impacts has not been delineated with the exception of the eastern corner and along the southeast boundary of the area. For the purposes of this FS, it is assumed the soil metal impacts extend to the limits of the battery disposal AOC. Soil impacts have been delineated vertically at one location (DP-021) at the toe of the embankment at a depth of 1 foot to 3 feet bgs. A summary of the soil sample analytical results for this AOC is shown on Figure 6-4. For the purposes of this FS, it is assumed that the soil contamination extends to an average depth of 2 feet across the battery disposal area embankment. Based on the assumed extent of soil contamination, an area of approximately 10,300 square feet and a volume of approximately 800 cubic yards of soil have been impacted to a level greater than the Residential Use SCOs.

6.6 AOC 6 - Off-Site Residential Area

The off-Site residential area consists of the residential houses and properties to the southeast of the Site, including property A/B Cape Road. Metals (arsenic, barium, cadmium, copper, lead, mercury and zinc) have been detected at concentrations greater than the Residential Use SCOs in the off-Site soil. At one location (RSS-18), benzo(b)flouranthene was detected at a concentration greater than the Residential Use SCOs. An impacted soil removal was completed on property A/B Cape Road by NYSDEC in 2005, however, soil impacts on the property remain.

Metal soil impacts on property A/B Cape Road have been horizontally delineated to the southeast. However, metal impacted soil has not been delineated in the remaining horizontal directions. In addition, metal soil impacts on property A/B Cape Road have not been vertically delineated. An impacted soil removal was completed on property A/B Cape Road by EPA in 2005.

A summary of the soil sample analytical results for this AOC is shown on Figure 6-6. The areal extents of the soil impacts located on the River Street properties are delineated as shown on Figure 6-6. However, the area defined by the clean samples includes several residential structures and likely is not representative of the limits of soil contaminants. A pre-design investigation is recommended to delineate the soil impacts in the off-Site residential properties. There are 11 soil sample locations where contaminants were detected at concentrations greater than the Residential Use SCOs. For the purposes of this FS, it is assumed that soil impacts extend to an area of 10 feet by 10 feet and to a depth of 3 feet bgs. Based on the assumed extent of soil contamination, an area of approximately 1,100 square feet and a volume of approximately 100 cubic yards of soil have been impacted to a level greater than the Residential Use SCOs.

6.7 AOC 7 – Site Wide Groundwater

Groundwater has been addressed as a Site wide AOC independent of the soil AOCs described above. Metals and VOCs have been detected in the groundwater at concentrations greater than the NYSDEC Class GA groundwater quality standards. A summary of the groundwater sample analytical results is shown on Figure 6-7.

7.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Specific technologies for each of the GRAs listed above are identified and assessed in this section. The technologies are grouped by medium (soil and groundwater) and screened to identify those that appear to be: most appropriate to the Site-specific conditions and Site contamination, technically implementable, and capable of achieving the Site's RAOs.

Site specific conditions, including contamination type, concentration, location (areal extent and depth), and estimated quantity were considered during the initial screening process. The initial screening was also based on the effectiveness for treating the contaminants present at the Site, implementability given Site-specific conditions, and cost.

Remedial technologies that were deemed to be not technically appropriate or cost prohibitive were dropped from further consideration. Tables 7-1 and 7-2 summarize the technology identification and screening process for soil and groundwater, respectively. The tables are grouped by the general response action (i.e., in situ treatment, ex situ treatment, containment). Technologies that may be appropriate for addressing the contaminants at the Site and that were thus retained for further evaluation are identified on the last columns of Tables 7-1 and 7-2. Technologies that were screened out and not retained for further analysis are designated as "no" in the last columns of Tables 7-1 and 7-2.

The most promising technologies were combined into remedial alternatives, which are described in the development of alternatives section of this report.

7.1 Identification and Screening of Technology for Soil

As discussed in Section 5.0, VOCs, SVOCs (specifically PAHs), metals, pesticides and PCBs have been detected in soil at the Site at concentrations greater than Residential Use SCOs. The GRAs for impacted on-Site soils include no action, institutional controls, containment, treatment, and removal. Remedial technologies are grouped by GRA and discussed in detail in the following sections. A summary of the soil screening process is provided in Table 7-1.

7.1.1 Containment

The in-place containment of contaminated soils may be accomplished through capping or surface sealing. These containment technologies would mitigate stormwater infiltration to contaminated areas, thereby reducing a mechanism for contaminant migration from soil to groundwater or surface water. These technologies are effective at minimizing human exposures to impacted soils and other media.

7.1.1.1 Capping

Capping is one of the most common forms of remediation because it is generally less expensive and more easily implemented than other technologies, and it effectively manages human and ecological risks associated with a contaminated Site. Land caps can be used to:

- Minimize direct contact with contaminated soils;
- Minimize vertical infiltration of water into subsurface wastes/contaminated zones that may result in migration of soil contaminants;
- Control vapor emissions from underlying contamination; and
- Create a land surface that can support vegetation and/or be implemented into existing or future Site uses.

Capping does not lessen toxicity, mobility, or volume of contaminated soil, but does mitigate migration. Capping systems are most effective where most of the underlying contaminated soil is above the water table. The technology requires long-term inspection and maintenance. Excavation and regrading is often required for slope stability and to facilitate stormwater runoff.

The design of capping systems is Site-specific and depends on the intended functions of the system/contemplated Site uses. Caps can be designed to be permeable (i.e., water from rain/snow melt is allowed to percolate through the cap and into the soil column) or impermeable (i.e., surface water runoff occurs, diverting water away and minimizing [or eliminating] the passage of waters through contaminated soil). Given the nature of the Site contamination as a potential groundwater contamination source, permeable caps may require additional enhancements to minimize water infiltration and/or long term groundwater monitoring.

Impermeable capping systems can range from a one-layer system of vegetated soil to a complex multi-layer system of soils and geosynthetics. Typically, the most effective single-layer caps are composed of concrete or bituminous asphalt. These materials are constructed to form a surface barrier between soil contamination and the above-grade environment. An asphalt or concrete cap can be incorporated into a commercially developed or improved Site to provide additional beneficial use such as a parking lot. Because the Site is undeveloped and older growth vegetation is established, an asphalt or concrete cap has not been retained for further evaluation. However, a permeable soil and multilayer impermeable cap have been retained for further analysis.

7.1.1.2 Cap Enhancements

The purpose of land cover enhancement is to reduce or eliminate contaminant migration (e.g., percolation). Water harvesting and vegetative cover are two means of cover enhancements. Water harvesting uses runoff enhancement systems to manage a Site's water balance (often at large solid waste landfill facilities, but not typically at contaminated properties such as the subject Site). Vegetative cover reduces soil moisture via plant uptake and evapotranspiration. Cap enhancement technology is readily implementable and may be a practicable way to manage potential leaching of soil contaminants. Therefore, this technology has been retained for further analysis.

7.1.2 In Situ Biological Treatment

Implementation of in situ treatment does not require the excavation of contaminated media. In situ technologies can minimize potential worker exposure to contaminants. In situ technologies generally require a longer period of time to meet remedial objectives and can result in high operation and maintenance requirements compared to ex situ technologies.

7.1.2.1 Bioventing

Bioventing stimulates the natural in situ biodegradation of aerobically degradable compounds in soil by providing oxygen to existing soil microorganisms. Oxygen is delivered to contaminated unsaturated soils by forced air movement (either extraction or injection of air, or a combination of both). Bioventing uses relatively low air flow rates to provide only enough oxygen to sustain microbial activity.

Bioventing is not effective in treating inorganics and many chlorinated organics. Based on Site conditions and subsurface contamination, bioventing has been screened out and will not be evaluated further.

7.1.2.2 Enhanced Bioremediation

Enhanced bioremediation is a process in which indigenous or inoculated microorganisms degrade (metabolize) organic contaminants found in soil and/or groundwater, converting the contaminants to innocuous end products. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials. Enhanced bioremediation of soil typically involves the percolation or injection of groundwater or uncontaminated water mixed with nutrients and/or saturated with dissolved oxygen. An infiltration gallery or spray irrigation is typically used for shallow contaminated soils, and injection wells are used for deeper contaminated soils. A surface treatment system, such as air stripping or carbon adsorption, may be required to treat extracted water prior to re-injection or disposal.

Bioremediation is most effective for remediating low-level residual organic contamination in conjunction with source removal and is generally lower in cost than other treatment technologies. However, bioremediation cannot degrade inorganic contaminants.

Distribution of water-based reagents may be effective in heterogeneous subsurface environments. However, the presence of preferential flow paths (as caused by fill material and buried debris) may severely decrease contact between injected fluids and contaminants throughout the treatment zones. Circulation of water-based reagents through the soil may increase contaminant mobility impacting the underlying groundwater. Based on subsurface conditions (presence of fill), Enhanced Bioremediation has been screened out and will not be evaluated further.

7.1.2.3 Phytoremediation

Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. This technology is limited to shallow soils and is potentially implementable given the current Site use. Phytoremediation has been retained for further evaluation.

7.1.3 In Situ Physical/Chemical Treatment

7.1.3.1 Chemical Oxidation

In situ chemical oxidation (ISCO) is a process where powerful oxidizing chemicals are injected into the subsurface to chemically convert contaminants to less toxic compounds. In addition, contaminants may become more stable, less mobile, and/or inert. Chemical oxidant delivery systems may include vertical or horizontal injection wells and sparge points, with forced advection to rapidly move the oxidant into the subsurface. Oxidizing agents that are commonly used to address contaminants include ozone, hydrogen peroxide, potassium permanganate, hypochlorites, chlorine, and chlorine dioxide.

ISCO is a viable remediation technology for mass reduction of organic contaminants in source areas. Chemical oxidation can have a relatively rapid treatment time, and can be implemented with readily available equipment. Limitations associated with chemical oxidation include: limited effectiveness in treating SVOCs and inorganics; requirements to handle and administer large quantities of hazardous oxidizing chemicals; and, naturally occurring organic material in the formation can consume large quantities of oxidant. Based on the type of soil contamination (inorganics) chemical oxidation has been screened out and will not be evaluated further.

7.1.3.2 Electrokinetic Separation

The electrokinetic separation process consists of the application of a low-intensity direct current through the soil via ceramic electrodes installed in and around soil contamination areas. The induced current mobilizes charged contaminants toward the polarized electrodes to concentrate the contaminants for subsequent removal and ex situ treatment/disposal.

The electrokinetic separation process is generally used to remove metals from low permeability soils (i.e., clay). Electrokinetics is most effective in clays because of the negative surface charge of clay particles. Due to the Site geology (i.e., presence of sands and gravel in much of the overburden soils), this technology has been screened out and will not be evaluated further.

7.1.3.3 Fracturing

Fracturing is an enhancement technology designed to increase the efficiency of other in situ technologies in certain types of subsurface conditions (i.e., very low permeability soils/rock). Cracks are created in the media of interest by fracturing (pneumatically or mechanically) to create new passageways or channels. Fracturing can thus increase the effectiveness of many in situ processes and enhance extraction efficiencies. Fracturing is not highly amenable to the Site, based on the geology (presence of higher permeability material). This technology has been screened out and will not be retained for further evaluation.

7.1.3.4 Soil Flushing

Soil flushing is a process where contaminants are extracted from the soil by passing uncontaminated water (or water containing an additive to enhance contaminant solubility) through in-place soils. Contaminants are leached into the water, which is then extracted and treated.

In general, heterogeneous soils, as are present on-Site, are difficult to treat via soil flushing. In addition, there is a potential for contaminant migration if contaminants are flushed beyond the capture zone. Further, ex situ treatment costs for recovered fluids can add significantly to remedial costs associated with this process. Due to the concerns raised above, this technology has not been retained for further analysis.

7.1.3.5 Soil Vapor Extraction

Soil vapor extraction (SVE) is an in situ unsaturated (vadose) zone soil remediation technology where a vacuum is applied to the subsurface soil to induce air flow through the soil medium and remove volatile (and some semi-volatile) contaminants. Contaminants captured in the extracted soil vapor are typically treated above grade, via activated carbon or other process. The effectiveness of an SVE system may be enhanced by applying surficial capping over the active remediation areas to prevent short-circuiting from drawing in ambient air to the subsurface. SVE is an effective remediation technology for the removal of VOCs and some SVOCs but is ineffective in removing inorganic contaminants. Given the limited VOC contaminants and wide spread metal contaminants; SVE has been screened out and will not be retained for further evaluation.

7.1.3.6 Solidification/Stabilization (in situ)

Solidification/stabilization (S/S) reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).

Auger/caisson and reagent/injector systems are techniques where S/S agents can be added to soils to trap or immobilize contaminants. These systems have limited effectiveness for SVOCs and limited or no effectiveness for VOCs.

In situ vitrification (ISV) is another in situ S/S process that uses an electric current to heat soil or other earthen materials to extremely high temperatures. Inorganic pollutants are immobilized within the resulting vitrified/crystalline mass. The vitrification product is a chemically stable, leach-resistant, glass and crystalline material similar to obsidian or basalt rock. The ISV process destroys and/or removes organic materials. Vapors and combustion products need to be captured and treated to remove particulates and other pollutants from the off gases. In addition to the high energy consumption, ISV may result in a decrease in soil volume and the solidified material may hinder future Site use.

Based on the discussions above, S/S has not been retained for further evaluation.

7.1.4 In Situ Thermal Treatment

7.1.4.1 Thermal Treatment

Steam/hot air injection or heating via electrical resistance, fiber optics, radio frequency, or other means can be utilized to increase the volatilization rate of VOCs and SVOCs and facilitate extraction. The process is otherwise similar to conventional SVE but requires heat resistant extraction wells.

Thermal treatment heats soil to enhance SVE in the followings ways: VOC and SVOC volatility are increased by heating; the soil permeability is increased by drying; water vapor converted to steam can facilitate stripping of volatile contaminants in the overburden; and heating may cause a decrease in contaminant viscosity which improves contaminant mobility.

Hot air or steam can be injected below the contaminated zone to heat the impacted soils and release contaminants from the soil matrix, where they are collected and transferred to the surface through SVE. Extracted vapor can then be treated by a variety of existing technologies (i.e., granular activated carbon).

Thermal treatment is not effective in treating inorganics. Subsurface fill materials and solid waste debris may inhibit the implementation of this technology. Due to the limitations of thermal treatment, this technology has been screened out and will not be retained for further evaluation.

7.1.5 Ex Situ Biological Treatment

The following ex situ treatment technologies assume the excavation of impacted soils at the Site.

7.1.5.1 Biopiles

Biopiles include the controlled staging of excavated soils and mixing with soil amendments to enhance contaminant reduction. The biopiles are typically placed on a designated treatment area that includes a leachate collection system and a form of aeration to address VOCs and SVOCs. The treatment area will generally be covered or contained with an impermeable liner to minimize the risk of contaminants leaching into uncontaminated soil.

Biopiles have limited effectiveness in treating inorganics. Implementation of the biopile technology requires a portion of the Site to be dedicated (moderate to long-term time frame) to the treatment and monitoring of excavated soils. Given the wide spread inorganic contamination at the Site, biopiles do not appear to be compatible for the Site. Therefore, biopile technology has been screened out and has not been retained for further evaluation.

7.1.5.2 Composting

For the composting technology, contaminated soil is excavated and mixed with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes. Composting is a controlled biological process by which organic contaminants (e.g., VOCs, PAHs) are converted by microorganisms (under aerobic and anaerobic conditions) to innocuous, stabilized byproducts.

Factors that limit the applicability and effectiveness of composting include: off-gas control may be required for VOC and SVOC contamination; inorganics will not be degraded; a volumetric increase in material results because of the addition of amendment material; end products must be handled (spread around the area or disposed of); and substantial dedicated space may be required. Based on these limitations, composting has been screened out and will not be retained for further evaluation.

7.1.5.3 Landfarming

With this technology, contaminated soil is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste. Landfarming is a full-scale bioremediation technology, which usually incorporates liners/drainage systems and other methods to control leaching of contaminants from the excavated soils.

Soil conditions in the beds are typically controlled and monitored to optimize the rate of contaminant degradation. Conditions requiring monitoring and control include:

- Moisture content (usually by irrigation or spraying).
- Aeration rate (by routinely tilling the soil within a predetermined frequency; the soil is mixed and aerated).
- pH (buffered to keep near neutral, by adding crushed limestone or agricultural lime).
- Other amendments (e.g., soil bulking agents, nutrients, etc.).

Contaminated media is usually treated in lifts that are up to 18 inches thick. When the desired level of treatment is achieved, the lift is removed and a new lift is constructed. It may be desirable to only remove the top of the remediated lift, and then construct the new lift by adding more contaminated media to the remaining material and mixing. This serves to inoculate the freshly added material with an actively degrading microbial culture, and can reduce treatment times.

Factors that may limit the applicability and effectiveness of the process include:

- A large amount of dedicated space is required.
- Conditions affecting biological degradation of contaminants (e.g., temperature, rainfall) are largely uncontrolled, which increases the length of time to complete remediation.
- Inorganic contaminants will not be biodegraded.
- Volatile contaminants, such as solvents and product-saturated soils may require pre-treatment before landfarming.
- Dust control is an important consideration, especially during tilling and other material handling operations.
- Runoff collection facilities must be constructed and monitored.
- Topography, erosion, climate, soil stratigraphy, and permeability of the soil at the Site must be evaluated to determine the optimum design of facility.
- Waste constituents may be subject to "land-ban" regulation and thus may not be applied to soil for treatment by landfarming (e.g., some petroleum-saturated soils).

Based on these limitations, landfarming has been screened out and has not been retained for further evaluation.

7.1.5.4 Slurry Phase Biological Treatment

An aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The excavated soil is first processed to physically separate debris, stones, and rubble. The soil is then mixed with water to form a slurry. The solids are maintained in suspension in a reactor vessel and mixed with nutrients and oxygen. When biodegradation is complete, the soil slurry is dewatered.

Slurry phase biological treatment is not effective for treatment of metals and VOCs, requires screening soils prior to treatment, and is potentially cost-intensive due to dewatering of fines after treatment. For these reasons, slurry phase biological treatment will not be retained for further evaluation.

7.1.6 Ex Situ Physical/Chemical Treatment

The following ex situ treatment technologies assume the excavation of impacted soils at the Site.

7.1.6.1 Chemical Extraction

For the chemical extraction technology, contaminated soils are mixed in an extractor vessel, thereby dissolving the contaminants. The extracted solution is then placed in a separator unit, where the contaminants and extractant are separated for treatment and/or potential reuse as fill material. Chemical extraction does not destroy wastes but is a means of separating hazardous contaminants from soils, thereby reducing the volume of the hazardous waste that must be managed.

Limitations of the technology include: traces of solvents may remain in the treated solids; the technology may not be effective on higher molecular weight organic and/or very hydrophilic substances; after acid extraction, any residual acid in the treated soil may require neutralization; and achieving stringent SCOs may prove uneconomical. Preliminary separation processes may also be required before chemical extraction to grade the soil into coarse and fine fractions. Based on these limitations, chemical extraction has been screened out and will not be evaluated further.

7.1.6.2 Chemical Reduction/Oxidation

Reduction/oxidation chemically converts soil contaminants to less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide.

This technology has limited effectiveness in treating inorganic contaminants. In addition, the technology requires handling and administering of large quantities of hazardous oxidizing chemicals. Therefore, this technology has not been retained for further analysis.

7.1.6.3 Dehalogenation

In this technology, halogen contaminated soil (i.e., chlorinated VOCs) is excavated, screened, and processed with a crusher and pug mill, and mixed with reagents. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants. The target contaminant groups for dehalogenation treatment are halogenated VOCs/SVOCs and pesticides. Due to the nature and extent of the Site specific contaminants, this technology has not been retained for further evaluation.

7.1.6.4 Separation

The separation processes are used for removing/reducing contaminants in soils. Separation techniques concentrate contaminated solids through physical and chemical means. Ex situ separation can be performed by many processes including gravity separation, sieving/physical separation, and magnetic separation. Physical separation often precedes chemical extraction treatment based on the assumption that most of the contamination is bound to finer soil particles (thus, separation will not readily address the fine fraction of impacted soil on its own). This technology has been screened out and has not been retained for further evaluation.

7.1.6.5 Soil Washing

Soil washing is a water-based process for scrubbing soils ex situ to remove contaminants. Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and inorganics. The process removes contaminants from soils in one of the following two ways:

- By dissolving or suspending them in the wash solution (which can be sustained by chemical manipulation of pH for a period of time); or

- By concentrating them into a smaller volume of soil through particle size separation, gravity separation, and attrition scrubbing (similar to those techniques used in sand and gravel operations).

Complex waste mixtures (e.g., metals with organics) can make formulating the washing fluid difficult. Sequential washing, and applying various wash formulations and/or different soil-to-wash fluid ratios may be required for heterogeneous contaminant compositions (as exist at the Site). Additional treatment may be required to address the waste wash waters. This technology has been retained for further evaluation.

7.1.6.6 Solidification/Stabilization (ex situ)

With ex situ soil solidification/stabilization, soil contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization). Ex situ S/S typically requires disposal of the resultant materials.

Nine distinct innovative processes or groups of processes have been identified for this ex-situ technology: (1) bituminization, (2) emulsified asphalt, (3) modified sulfur cement, (4) extrusion,

(5) pozzolan/Portland cement, (6) radioactive waste solidification, (7) sludge stabilization, (8) soluble phosphates, and (9) vitrification/molten glass.

Factors that may limit the applicability and effectiveness of the process include: soil geology and contaminant conditions may affect the long-term immobilization of contaminants; processes may result in a significant increase in volume (up to double the original volume); and organics are generally not immobilized. As with in-situ S/S, this technology has not been retained for further evaluation.

7.1.7 Ex Situ Thermal Treatment

The following ex situ treatment technologies assume the excavation of impacted soils at the Site.

7.1.7.1 Hot Gas Decontamination

This process involves staging the impacted soil in a dedicated vessel and raising the temperature of the contaminated material for a specified period of time. The gas effluent from the material is treated in an afterburner system to destroy all volatilized contaminants. This is not a proven/highly demonstrated technology for VOCs, SVOCs, or metals. Therefore, this technology has not been retained for further evaluation.

7.1.7.2 Incineration

For this technology, excavated soil is transported off-Site for incineration. High temperatures, 870°C - 1,200°C (1,600°F - 2,200°F), are used to combust (in the presence of oxygen) organic constituents in the affected media. Often, auxiliary fuels are employed to initiate and sustain combustion. Off gases and combustion residuals generally require treatment.

Incineration is generally used for hazardous wastes. Therefore, this technology has not been retained for further evaluation.

7.1.7.3 Pyrolysis

With pyrolysis, chemical decomposition is induced in organic materials by heat in the absence of oxygen. Organic materials are transformed into gaseous components and a solid residue ("coke") containing fixed carbon and ash. Pyrolysis of organic materials produces combustible gases, including carbon monoxide, hydrogen, methane, and other hydrocarbons. The pyrolysis gases typically will require further treatment. Particulate removal equipment such as fabric filters or wet scrubbers are also required.

Pyrolysis is generally not effective for treating inorganics. Therefore, pyrolysis has not been retained for further evaluation.

7.1.7.4 Thermal Desorption

Thermal desorption is a physical separation process where excavated soils are heated to volatilize water/moisture and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to an off-gas treatment system. All thermal desorption systems require treatment of the off-gas to remove particulates and vapor phase contaminants. Particulates are removed by conventional equipment, such as wet scrubbers or fabric filters. Contaminants are removed through condensation followed by carbon adsorption, or they are destroyed in a secondary combustion chamber or a catalytic oxidizer.

Thermal desorption is not effective in removing inorganic contaminants. Due to the relative complexity of this treatment technology, thermal desorption has not been retained for further evaluation.

7.1.8 Removal

7.1.8.1 Excavation

Implementation of the ex situ technologies requires excavation of the contaminated soil prior to treatment. Soil excavation may be accomplished using conventional earthmoving equipment. Limitations that may affect the applicability and effectiveness of excavation at a site include: potential generation of fugitive emissions requiring monitoring and suppression; exposure of subsurface contaminants to workers; and depth and composition of the soil requiring excavation. Excavation can be implemented in a relatively short time frame and has no long-term monitoring and maintenance considerations. Excavation has been retained for further evaluation.

7.1.8.2 Off-Site Disposal

For off-Site disposal, contaminated material is removed and transported to permitted off-Site treatment and/or disposal facilities. The applicability and cost-effectiveness of off-Site disposal may be limited by the distance from the subject Site to the nearest disposal facility. Also, transportation of impacted soil via truck through populated areas may affect community acceptability. However, reliability in the technology is high. Off-Site disposal has been retained as a feasible alternative.

7.2 Identification and Screening of Technology for Groundwater

VOCs and metals have been detected in groundwater at the Site at concentrations greater than NYSDEC Class GA Groundwater Quality Criteria. The GRAs for impacted on-Site groundwater include no action, institutional controls, containment, treatment, and removal. Remedial technologies are grouped by GRA and discussed in detail in the following sections. A summary of the soil screening process is provided in Table 7-2.

7.2.1 Containment

7.2.1.1 Physical Barriers

Subsurface physical barriers generally consist of vertically excavated trenches filled with slurry. Physical barriers (or slurry walls) are used to slow groundwater flow and minimize migration of contaminated groundwater and/or provide a hydraulic barrier to enhance groundwater pumping systems. Slurry walls often are used where the waste mass is too large for treatment and where soluble and mobile constituents pose an imminent threat to a sensitive receptor.

Site specific hydrogeology and foot print of the source area would likely require an extensive barrier system limiting the practicability of implementing this technology at the Site. Thus, physical barrier technology has been eliminated from further evaluation.

7.2.1.2 Deep Well Injection

Deep well injection is a liquid waste disposal technology that uses injection wells to place treated or untreated liquid waste into geologic formations that have no potential to allow migration of contaminants. Given the Site geology and proximity to the Beer Kill, this technology was deemed not practicable for the Site, and has been screened out from further evaluation.

7.2.2 In Situ Biological Treatment

7.2.2.1 Enhanced Bioremediation

Enhanced bioremediation is a process that attempts to accelerate the natural biodegradation process by introducing nutrients, electron acceptors, and/or competent contaminant-degrading microorganisms to the subsurface.

The rate of bioremediation can be enhanced by increasing the concentration of oxygen (aerobic condition) or adding a carbon substrate (anaerobic condition) to the groundwater. Oxygen enhancement can be achieved by either sparging air below the water table or circulating chemically bound oxygen (i.e., hydrogen peroxide, ORC [oxygen releasing compound]) throughout the contaminated groundwater zone. Oxygen enhancement with air sparging is typically used in conjunction with SVE or bioventing to enhance removal of the volatile component of the subsurface contamination. Under anaerobic conditions, a carbon source (nitrate) is circulated throughout the groundwater contamination zone to enhance bioremediation.

Factors that may limit the applicability and effectiveness of these processes at the Site include: time to remediate plume may take years; heterogeneous or low permeability subsurface environments can present difficulties in delivering reagent throughout entire contamination zone; air injection may result in vapor generation that can accumulate in buildings; limited degradation of metals/inorganics; limited degradation of chlorinated VOCs; and, a vapor collection and treatment system is likely to be required. Based on the rationale above, enhanced bioremediation has not been retained for further analysis.

7.2.2.2 Long Term Monitoring

Long Term Monitoring (LTM) is a process where natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are allowed to reduce contaminant concentrations to acceptable levels. Regulatory approval of this option usually requires modeling and evaluation of contaminant degradation rates and pathways, and predicting contaminant concentration at potential down gradient receptor points. The primary objective of Site modeling is to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations below regulatory standards or risk-based levels before potential exposure pathways are completed. In addition, long term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting cleanup objectives.

If free product exists, it may have to be removed prior to implementing LTM. Under LTM, longer time frames are required to achieve remediation objectives, compared to active remediation. LTM has been retained for further evaluation for the Site.

7.2.2.3 Phytoremediation

Phytoremediation is a set of processes that uses plants to remove, transfer, stabilize and destroy organic/inorganic contamination in groundwater. Phytoremediation processes are limited to shallow groundwater and may not implementable given the depth to groundwater at the Site.

Therefore, phytoremediation technology for groundwater remediation will not be not considered further.

7.2.3 In Situ Physical/Chemical Treatment

7.2.3.1 Air Sparging

Air sparging is an in situ technology in which air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating a subsurface "air stripper" that removes contaminants by volatilization. The injected air helps to flush (bubble, or sparge) the contaminants upward into the unsaturated zone where a vapor extraction system is usually implemented (in conjunction with air sparging) to remove the generated vapor phase contamination. Low permeability aquifers may limit the effectiveness of air sparging. Inorganics are not effectively remediated via air sparging. Based on Site-specific geology/hydrogeology, as well as its limited effectiveness with addressing inorganics, air sparging has not been retained for further evaluation.

7.2.3.2 Bioslurping

Bioslurping combines the two remedial approaches of bioventing and vacuum-enhanced free-product recovery. Bioventing stimulates the aerobic bioremediation of hydrocarbon-contaminated groundwater. Vacuum-enhanced free-product recovery extracts light non-aqueous phase liquids (LNAPLs) from the capillary fringe and the water table without extracting large quantities of ground water.

Conditions that may limit the applicability and effectiveness of this technology include: bioslurping is less effective in tight (low-permeability) soils; aerobic biodegradation of chlorinated compounds may not be effective; and, collected vapor and/or groundwater generally requires treatment. Separate phase product was not observed in groundwater at the Site, therefore bioslurping has not been retained for further evaluation.

7.2.3.3 Chemical Oxidation

ISCO chemically converts contaminants to less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, potassium permanganate, hypochlorites, chlorine, and chlorine dioxide. Newer reagents (i.e., alkaline activated persulfate [AAP]) may also be considered. Matching the oxidant and in situ delivery system to the contaminants of concern and the Site conditions is the key to successful implementation and achieving performance goals.

ISCO is a viable remediation technology for mass reduction of organic contaminants in groundwater. Chemical oxidation can have a relatively rapid treatment time, and can be implemented with readily available equipment. Limitations associated with chemical oxidation include: limited effectiveness in treating SVOCs and inorganics; requirements for handling and administering large quantities of hazardous oxidizing chemicals; and naturally occurring organic material in the formation can consume large quantities of oxidant. Chemical oxidation has not been retained for further analysis due to the technology's limited effectiveness in treating inorganic contaminants.

7.2.3.4 Directional Wells

Drilling techniques can be modified to position wells horizontally, or at an angle, to reach contaminants not accessible by direct vertical drilling. Directional drilling may be used to enhance other in-situ or in-well technologies such as groundwater pumping, bioventing, SVE, soil flushing, and in-well air stripping. Based on Site conditions, directional wells do not appear to be an applicable technology. Therefore, this technology will not be retained for further evaluation.

7.2.3.5 Dual Phase Extraction

Dual-phase extraction (DPE), also known as multi-phase extraction or vacuum-enhanced extraction is a technology that utilizes a high vacuum system to remove various combinations of contaminated groundwater, separate-phase product (NAPL), and soil vapor from the subsurface. Extracted liquids and vapor are treated and collected for disposal or discharge (where permissible under applicable state regulations).

DPE systems are utilized in low permeability or heterogeneous formations. The vacuum extraction well includes a screened section in the zone crossing contaminated soils and groundwater, removing contaminants from above and below the water table. The system lowers the water table around the well, exposing more of the impacted formation. Contaminants in the newly exposed vadose zone are then more amenable to vapor extraction. Once above ground, the extracted vapors or liquid-phase organics and ground water are separated and treated. DPE has not been retained for further analysis because separate phase product (NAPL) was not observed in groundwater at the Site.

7.2.3.6 Thermal Treatment

In this technology, steam is forced into an aquifer through injection wells to vaporize volatile and semi-volatile contaminants. Vaporized components rise to the unsaturated zone where they are removed (i.e., by vacuum extraction) and the off-gases are treated. Soil type, contaminant characteristics and concentrations, geology, and hydrogeology significantly impact process effectiveness. Based on the Site geology, thermal treatment has not been retained for further evaluation.

7.2.3.7 Hydrofracturing Enhancements

This technology includes the injection of pressurized water through wells to form cracks in low permeability and over-consolidated soils. The cracks are filled with porous media that serve as substrates for bioremediation or to improve groundwater pumping/extraction efficiencies. Fracturing can also promote more uniform delivery of treatment fluids to the subsurface. However, with this technology the potential exists to create numerous pathways leading to the unwanted migration of contaminants (e.g., Dense Non Aqueous Phase Liquid (DNAPLs)).

Hydrofracturing could be used to enhance other remedial technologies at the Site. Typical technologies linked with hydrofracturing include soil vapor extraction, in situ bioremediation, and pump-and-treat systems. Based on the available geological data, there is no indication that hydrofracturing would be required to improve the effectiveness of another remedial technology. Therefore, hydrofracturing has been screened out and will not be evaluated further.

7.2.3.8 In-Well Air Stripping

With in-well air stripping technology, air is injected into a vertical well that has been screened at two depths. The lower screen is set in the groundwater saturated zone, and the upper screen is set in the unsaturated zone. Pressurized air is injected into the well below the water table, aerating the water. The aerated water rises in the well and flows out of the system at the upper screen, inducing localized movement of groundwater into (and up) the well as contaminated groundwater is drawn into the system at the lower screen. VOCs vaporize within the well at the top of the water table, where the air bubbles out of the water. The contaminated vapors accumulating in the wells are collected via vapor extraction contained within the well. Vapor phase treatment typically occurs above grade. The partially treated groundwater is never brought to the surface; it is forced into the unsaturated zone, and the process is repeated as water follows a hydraulic circulation pattern or cell that allows continuous cycling of groundwater. As groundwater circulates through the treatment system in situ, and vapor is extracted, contaminant concentrations are gradually reduced.

For effective in-well treatment, the contaminants must be adequately soluble and mobile so they can be transported by the circulating ground water. In general, in-well air strippers are more effective at Sites containing high concentrations of dissolved contaminants with high Henry's Law constants. In-well treatment should not be applied to areas containing NAPLs to prevent the possibility of smearing the contaminants. In-well air stripping is not effective for the removal of metals or in aquifers with low permeability. Based on the constraints listed above, in-well air stripping has not been retained for further evaluation.

7.2.3.9 Passive/Reactive Treatment Walls

Treatment walls (or, treatment barriers) allow the passage of impacted groundwater while causing the degradation or removal of contaminants. A permeable reactive wall is installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. The contaminants will either be degraded or retained in a concentrated form by the barrier material. The wall could provide permanent containment for relatively benign residues or provide a decreased volume of the more toxic contaminants for subsequent treatment.

Passive/reactive treatment walls do not appear to be an efficient/effective technology for addressing groundwater contaminants given the physical characteristics of the Site and concentrations and configuration of the groundwater plume. Therefore, passive/reactive treatment walls have been screened out and will not be evaluated further.

7.2.4 Ex Situ Biological Treatment

The following ex-situ treatment technologies assume the pumping of impacted groundwater at the Site.

7.2.4.1 Bioreactors

Contaminants in extracted groundwater are put into contact with microorganisms in attached or suspended growth biological reactors. Contaminated groundwater is circulated in suspended media, such as activated sludge, within an aeration basin. In attached systems, such as rotating biological contractors and trickling filters, microorganisms are established on an inert support matrix.

The dilute nature of the contamination (including metals, SVOCs) in on-Site groundwater will not likely support an adequate microbial population density; therefore, bioreactors have been screened out and will not be evaluated further.

7.2.4.2 Constructed Wetlands

The constructed wetlands-based treatment technology uses natural geochemical and biological processes inherent in an artificial wetland ecosystem to accumulate and fixate/remove metals and other contaminants from influent waters. The wetland technology can utilize filtration or the degradation process. Typically, large areas need to be dedicated to establish adequate treatment wetlands. The wetland components also need to be monitored and maintained. Constructed wetlands technology has been retained for further evaluation.

7.2.5 Ex Situ Physical/Chemical Treatment

The following ex situ treatment technologies assume the pumping of impacted groundwater at the Site.

7.2.5.1 Adsorption

The adsorption process consists of passing contaminated groundwater through a sorbent media. Contaminants are adsorbed onto the media, reducing their concentration in the bulk liquid phase. Adsorption mechanisms are generally categorized as either physical adsorption, chemisorption, or electrostatic adsorption. The most common adsorbent is granular activated carbon (GAC).

Liquid phase GAC adsorption is a process where groundwater is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb. When the concentration of contaminants in the effluent from the bed exceeds a certain level, the carbon can be regenerated in place; removed and regenerated at an off-Site facility; or removed and disposed. Vapor-phase GAC adsorption is a similar process used for removing VOCs from vapor/air streams resulting from treatment such as SVE.

Adsorption is a viable technology for VOC and SVOC treatment of extracted groundwater/vapors. Adsorption is generally less effective for the removal of inorganic contaminants; therefore adsorption via GAC has been screened out and will not be evaluated further.

7.2.5.2 Advanced Oxidation Processes

Advanced oxidation processes including ultraviolet (UV) radiation, ozone, and/or hydrogen peroxide are used to destroy organic contaminants as impacted water is pumped into a treatment vessel. If ozone is used as the oxidizer, an ozone destruction unit(s) may be required to treat off-gases from the treatment tank and where ozone gas may accumulate or escape. Advance oxidation technology is associated with high energy requirements. Therefore, advanced oxidation process technology has been screened out and will not be retained for further analysis.

7.2.5.3 Air Stripping

Air stripping involves the mass transfer of volatile contaminants from water to air. Volatile organics are separated from extracted groundwater by exposing the contaminated water to a flow of air. Air stripping configurations include packed towers, diffused aeration, tray aeration, and spray aeration.

Limitations to the applicability and effectiveness of the air stripping include: potential for inorganic or biological fouling, requiring pretreatment; ineffectiveness for the removal of metals and some SVOCs; relatively high energy demands; and off gases generally require collection and treatment. Due to the reasons listed above, air stripping has been screened out and will not be evaluated further.

7.2.5.4 Groundwater Pumping/Pump and Treat

Groundwater pumping consists of pumping groundwater from an aquifer to remove dissolved phase contaminants and/or achieve hydraulic containment of contaminated groundwater to prevent migration. Processes typically evaluated or used in Pump and Treat systems include:

- Ion Exchange
- Precipitation/Coagulation/Flocculation
- Adsorption
- Separation
- Sprinkler Irrigation

Generally, treatment and monitoring of extracted groundwater is required. A multiple treatment train may be required for groundwater with multiple types of contaminants. A groundwater monitoring program is a component of any groundwater extraction system to verify its effectiveness.

Potentially long time periods are required for groundwater pumping to achieve remediation goals. Groundwater pumping may not be effective (or predictable) in aquifers with low hydraulic conductivities or in bedrock regimes. Operation and maintenance considerations associated with treatment systems may be more extensive than other treatment technologies. Groundwater pumping has been retained for further analysis.

7.2.6 Discharge

7.2.6.1 On-Site Discharge to Surface Water (Beer Kill)

On-site groundwater discharge to Surface Water consists of discharging treated groundwater to the Beer Kill. On-site discharge to the beer kill has been retained for further evaluation.

7.2.6.2 On-Site Discharge to Infiltration Gallery

On-site discharge to an infiltration basin consists of discharging treated effluent to the subsurface via 15 foot diameter wet wells. This is an effective and readily implementable discharge method. On-site discharge to infiltration has been retained for further evaluation.

7.2.6.3 Off-Site Discharge to POTW

Off-site discharge to a POTW consists of discharging treated effluent directly to a sanitary sewer line or transporting the water to and off-site POTW via tanker trucks. This is an effective and readily implementable discharge method. Off-site discharge to the POTW has been retained for further evaluation.

7.3 Identification and Screening of Technology for Solid Waste

Solid waste has been detected at the Site. The GRAs for impacted on-Site soils include no action, institutional controls, containment, treatment and removal. Remedial technologies are grouped by GRA and discussed in detail in the following sections. A summary of the solid waste screening process is provided in Table 7-3.

7.3.1 Containment

The in-place containment of solid waste may be accomplished through capping or surface sealing. These containment technologies would mitigate storm water infiltration to contaminated areas, thereby reducing a mechanism for contaminant migration from solid waste to groundwater or surface water. These technologies are effective at minimizing human exposures to impacted soils and other media.

7.3.1.1 Capping

Capping is one of the most common forms of remediation because it is generally less expensive and more easily implemented than other technologies, and it effectively manages human and ecological risks associated with a contaminated Site.

Capping does not lessen toxicity, mobility, or volume of contaminated soil, but does mitigate migration. Capping systems are most effective where most of the underlying contaminated soil is above the water table. The technology requires long-term inspection and maintenance. Excavation and regrading is often required for slope stability and to facilitate storm water runoff.

The design of capping systems is Site-specific and depends on the intended functions of the system/contemplated Site uses. Caps can be designed to be permeable (i.e., water from rain/snow melt is allowed to percolate through the cap and into the soil column) or impermeable (i.e., surface water runoff occurs, diverting water away and minimizing [or eliminating] the passage of waters through contaminated soil). Given the nature of the Site contamination as a potential groundwater contamination source, permeable caps may require additional enhancements to minimize water infiltration and/or long term groundwater monitoring.

Impermeable capping systems can range from a one-layer system of vegetated soil to a complex multi-layer system of soils and geosynthetics. Typically, the most effective single-layer caps are composed of concrete or bituminous asphalt. These materials are constructed to form a surface barrier between soil contamination and the above-grade environment. An asphalt or concrete cap can be incorporated into a commercially developed or improved Site to provide additional beneficial use such as a parking lot. Because the Site is undeveloped and older growth vegetation is established, an asphalt or concrete cap has not been retained for further evaluation.

A permeable soil and multilayer impermeable cap have been retained for further analysis.

7.3.1.2 Cap Enhancements

The purpose of land cover enhancement is to reduce or eliminate contaminant migration (e.g., percolation). Water harvesting and vegetative cover are two means of cover enhancements. Water harvesting uses runoff enhancement systems to manage a Site’s water balance (often at large solid waste landfill facilities, but not typically at contaminated properties such as the subject Site). Vegetative cover reduces soil moisture via plant uptake and evapotranspiration. Cap enhancement technology is readily implementable and may be a practicable way to manage potential leaching of soil contaminants. Therefore, this technology has been retained for further analysis.

7.3.2 Treatment

7.3.2.1 Incineration

For this technology, excavated solid waste is transported off-Site for incineration. High temperatures, 870°C - 1,200°C (1,600°F - 2,200°F), are used to combust (in the presence of oxygen) organic constituents in the affected media. Often, auxiliary fuels are employed to initiate and sustain combustion. Off gases and combustion residuals generally require treatment. Incineration is generally used for hazardous wastes. Therefore, this technology will not be evaluated further.

7.3.2.2 Separation

Separation techniques concentrate solid waste through physical means to reduce the volume of material requiring treatment/disposal. Ex situ separation can be performed by many processes including gravity separation, sieving/physical separation, and magnetic separation. Physical separation of solid waste from soil often precedes implementation of soil remedial action. This technology has been retained for further evaluation.

7.3.3 Removal

7.3.3.1 Excavation

Excavation of solid waste may be accomplished using conventional earthmoving equipment. Limitations that may affect the applicability and effectiveness of excavation at a Site include: potential generation of fugitive emissions requiring monitoring and suppression; exposure of subsurface contaminants to workers; and depth and composition of the solid waste requiring excavation. Excavation can be implemented in a relatively short time frame (i.e. less than one year) and has no long-term monitoring and maintenance considerations. Excavation has been retained for further evaluation.

7.3.3.2 Off-Site Disposal

For off-Site disposal, solid waste is removed and transported to permitted off-Site treatment and/or disposal facilities. The applicability and cost-effectiveness of off-Site disposal may be limited by the distance from the subject Site to the nearest disposal facility. Also, transportation of solid waste via truck through populated areas may affect community acceptability. However, reliability in the technology is high. Off-Site disposal has been retained as a feasible alternative.

7.4 Evaluation of Technologies and Selection of Representative Process Options

7.4.1 Retained Soil Process Options

Twenty eight (28) soil remedial technologies were screened for potential applicability, effectiveness, and implementation at the Site. Technologies that successfully passed the screening process are:

- Phytoremediation
- Soil Washing
- Capping
- Excavation/Off-Site Disposal.

These technologies are incorporated in the remedial alternatives and further evaluated based on their applicability to Site conditions and effectiveness in meeting the RAOs.

7.4.2 Retained Groundwater Process Options

Twenty (20) groundwater remedial technologies were screened for potential applicability, effectiveness, and implementation at the Site. Technologies that successfully passed the technology screening process are as follows:

- Long Term Monitoring
- Constructed Wetlands
- Pump and Treat

These technologies are incorporated in the remedial alternatives and further evaluated based on their applicability to Site conditions and effectiveness in meting the RAOs.

7.4.3 Retained Solid Waste Process Options

Seven solid waste remedial technologies were screened for potential applicability, effectiveness, and implementation at the Site. Technologies that successfully passed the technology screening process are as follows:

- Separation
- Capping
- Excavation/Off-Site Disposal

These technologies are incorporated in the remedial alternatives and further evaluated based on their applicability to Site conditions and effectiveness in meting the RAOs.

8.0 EVALUATE PROCESS OPTIONS

An evaluation of the retained process options was completed relative to the AOCs identified in Section 6.0. Process options were evaluated based on effectiveness, implementability and cost. Process options that cannot be effectively implemented within the AOC due to current use restrictions and/or topography were eliminated from further consideration.

8.1 Soil Process Options

Retained soil process options include impermeable and permeable caps, phytoremediation (constructed vegetation), soil washing and off-Site disposal. The no action option and institutional options were also included for evaluation. The evaluation was applied to process options based on the characteristics of the AOC and not the Site as a whole. A summary of the soil process option evaluation is summarized in Table 8-1 and discussed in greater detail below.

8.1.1 AOC 1 – Landfill Area

The Landfill Area is characterized by the presence of solid waste and VOC, SVOC, metal, PCB and pesticide contamination. The landfill is generally flat on the top with a steep side slope (greater than 2 to 1, Horizontal:Vertical) along the western edge.

<u>No Action</u> – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

<u>Deed Restrictions</u> – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Long term monitoring, including Site inspections, is generally required. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

<u>Impermeable Cap</u> – Effective for preventing direct contact with soil contaminants, leaching of contaminants from storm water infiltration and landfill gas migration. Grading of the landfill side slope to a 3 on 1 slope would be required to meet 6 New York Code of Rules and Regulations (NYCRR) Part 360 regulation landfill closure regulations. This process option is retained for further analysis.

Permeable Cap – Effective at preventing direct contact to soil contaminants. Not effective for preventing the migration of contaminants leaching into groundwater or as a barrier to landfill gas migration. In addition, the permeable barrier does not meet the requirements of the 6 NYCRR Part 360 regulations and will likely not be acceptable to the NYSDEC. This process option has been screened out from further consideration.

Constructed Vegetation – Constructed vegetation would be difficult to install and maintain on the landfill side slopes and would not meet the 6 NYCRR Part 360 regulation landfill closure regulations. Phytoremediation may not be effective in removal of PCBs and some of the heavy metals and would be limited to only the shallow surface soil. Phytoremeditation requires contact with plant roots and is limited to surface soils to a depth only as deep as the roots can reach. Contaminants in this area extend deeper than the anticipated root depth. Phytoremediation is generally not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs). PCBs are hydrophobic and do not readily dissolve into water. Plant uptake of PCBs is limited due to the hydrophobic nature of the contaminant. Recent research indicates that under the correct conditions and with specific plant species, phyotoremediation of PCBs may be possible. However, phytoremediation of PCBs is not a well established technology and is generally deemed to be ineffective. Therefore, this process option has been screened out from further evaluation.

Excavation/Soil Wash/Disposal – This process option consists of excavation of the solid waste/soil mixture, separation of debris from the soil, soil washing to remove the contaminated portion of the soil (silt and clay fine particles) and off-Site disposal of the impacted soils. Upon satisfactory confirmatory sampling, the portion of the uncontaminated soil can be returned to the excavation as backfill. The option will be effective in removing unknown drums and/or hazardous waste. Soil washing effectiveness is dependent upon the Site specific soil characteristics. Generally, metal contamination is sorbed onto the fines of the soil matrix (silt and clay). Separation of the larger soil particles (sand, gravel, cobles) from the soil matrix would results in a significant reduction in the volume of impacted material. Given the regional geology (river sediments), it is likely the soil is comprised of a relatively large component of larger soil particles increasing the likely effectiveness of the soil washing technology in reducing the overall mass of impacted soil. This process option is retained for further analysis.

Excavation/Off-Site Disposal – Soil contamination is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost.

8.1.2 AOC 2 – Debris Pile Area

VOC, SVOC, metals and PCBs have been detected in the Debris Pile Area at concentrations greater than the Residential Use SCOs. Solid waste debris (metal, wood, plastic, concrete, glass and rubber) is present in the surface soils across the area.

No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Long term monitoring, including Site inspections, is generally required. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Impermeable Cap – Effective for preventing direct contact with soil contaminants and leaching of contaminants from stormwater infiltration. This process option is readily implementable and is retained for further analysis.

Permeable Cap – Effective at preventing direct contact to soil contaminants. Not effective for preventing the migration of contaminants leaching into groundwater. Therefore, this process option has been screened out from further evaluation.

Constructed Vegetation – Phytoremediation may not be effective in removal of PCBs and some of the heavy metals and would be limited to only the shallow surface soil. Phytoremeditation requires contact with plant roots and is limited to surface soils to a depth only as deep as the roots can reach. Contaminants in this area extend deeper than the anticipated root depth. Phytoremediation is generally not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs). PCBs are hydrophobic and do not readily dissolve into water. Plant uptake of PCBs is limited due to the hydrophobic nature of the contaminant. Recent research indicates that under the correct conditions and with specific plant species, phyotoremediation of PCBs may be possible. However, phytoremediation of PCBs is not a well established technology and is generally deemed to be ineffective. Therefore, this process option has been screened out from further evaluation.

Excavation/Soil Wash/Disposal – This process option consists of excavation of soil, separation of debris, soil washing to remove the contaminated portion of the soil (silt and clay fine particles) and off-Site disposal of the impacted soils. Upon satisfactory confirmatory sampling, the portion of the uncontaminated soil can be returned to the excavation as backfill. Soil washing effectiveness is dependent upon the Site specific soil characteristics. Generally, metal contamination is sorbed onto the fines of the soil matrix (silt and clay). Separation of the larger soil particles (sand, gravel, cobles) from the soil matrix would results in a significant reduction in the volume of impacted material. Given the regional geology (river sediments), it is likely the soil is comprised of a relatively large component of larger soil particles increasing the likely effectiveness of the soil washing technology in reducing the overall mass of impacted soil. This process option has been retained for further analysis.

Excavation/Off-Site Disposal – Soil contamination is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost. This process option has been retained for further analysis.

Excavation/On-Site Consolidation – Impacted soils are excavated and relocated to one location at the Site. Under this process, it is assumed that the landfill area would be used to consolidate soils. This readily implementable option has a relatively low cost and is retained for further analysis.

8.1.3 AOC 3 – Dumpster Staging Area

SVOC, metals and PCBs have been detected in the Dumpster Staging Area at concentrations greater than the Residential Use SCOs.

No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to the Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Long term monitoring, including Site inspections, is generally required. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Impermeable Cap – Effective for preventing direct contact with soil contaminants and leaching of contaminants from storm water infiltration. This process option is readily implementable and is retained for further analysis.

Permeable Cap – Effective at preventing direct contact to soil contaminants. Not effective for preventing the migration of contaminants leaching into groundwater. Therefore, this process option has been screened out from further evaluation.

Constructed Vegetation – Phytoremediation may not be effective in removal of PCBs and some of the heavy metals and would be limited to only the shallow surface soil. Phytoremeditation requires contact with plant roots and is limited to surface soils to a depth only as deep as the roots can reach. Contaminants in this area extend deeper than the anticipated root depth. Phytoremediation is generally not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs). PCBs are hydrophobic and do not readily dissolve into water. Plant uptake of PCBs is limited due to the hydrophobic nature of the contaminant. Recent research indicates that under the correct conditions and with specific plant species, phyotoremediation of PCBs may be possible. However, phytoremediation of PCBs is not a well established technology and is generally deemed to be ineffective. Therefore, this process option has been screened out from further evaluation.

Excavation/Soil Wash/Disposal – This process option consists of excavation of soil, soil washing to remove the contaminated portion of the soil (silt and clay fine particles) and off-Site disposal of the impacted soils. Upon satisfactory confirmatory sampling, the portion of the uncontaminated soil can be returned to the excavation as backfill. Soil washing effectiveness is dependent upon the Site specific soil characteristics. Generally, metal contamination is sorbed onto the fines of the soil matrix (silt and clay). Separation of the larger soil particles (sand, gravel, cobles) from the soil matrix would results in a significant reduction in the volume of impacted material. Given the regional geology (river sediments), it is likely the soil is comprised of a relatively large component of larger soil particles increasing the likely effectiveness of the soil washing technology in reducing the overall mass of impacted soil. This process option has been retained for further analysis.

Excavation/Off-Site Disposal – Soil contamination is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost. This process option has been retained for further analysis.

Excavation/On-Site Consolidation – Impacted soils are excavated and relocated to one location at the Site. Under this process, it is assumed that the landfill area would be used to consolidate soils. This readily implementable option has a relatively low cost and is retained for further analysis.

8.1.4 AOC 4 – Scattered Debris Area

SVOC and metals have been detected in the Scattered Debris Area at concentrations greater than the Residential Use SCOs. Impacted soils appear to be limited to small discrete areas where localized dumping occurred.
No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to the Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Long term monitoring, including Site inspections, is generally required. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Impermeable Cap – Effective for preventing direct contact with soil contaminants and leaching of contaminants from storm water infiltration. Constructing and maintaining an impermeable cap is not as cost effective for small discrete areas relative to other remedial technologies (i.e., removal). Because there are other remedial technologies that are more effective than containment (i.e., removal) for approximately the same cost, this process option was not retained for further analysis.

Permeable Cap – Effective at preventing direct contact to soil contaminants. Not effective for preventing the migration of contaminants leaching into groundwater. Constructing and maintaining an impermeable cap is not as cost effective for small discrete areas relative to other remedial technologies (i.e., removal). Because there are other remedial technologies that are more effective than containment (i.e., removal) for approximately the same cost, this process option was not retained for further analysis.

Constructed Vegetation – Phytoremediation may not be effective in removal of PCBs and some of the heavy metals and would be limited to only the shallow surface soil. Phytoremeditation requires contact with plant roots and is limited to surface soils to a depth only as deep as the roots can reach. Contaminants in this area extend deeper than the anticipated root depth. Phytoremediation is generally not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs). PCBs are hydrophobic and do not readily dissolve into water. Plant uptake of PCBs is limited due to the hydrophobic nature of the contaminant. Recent research indicates that under the correct conditions and with specific plant species, phyotoremediation of PCBs may be possible. However, phytoremediation of PCBs is not a well established technology and is generally deemed to be ineffective. Therefore, this process option has been screened out from further evaluation.

Excavation/Soil Wash/Disposal – This process option consists of excavation of soil, soil washing to remove the contaminated portion of the soil (silt and clay fine particles) and off-Site disposal of the impacted soils. Upon satisfactory confirmatory sampling, the portion of the uncontaminated soil can be returned to the excavation as backfill. Soil washing effectiveness is dependent upon the Site specific soil characteristics. Generally, metal contamination is sorbed onto the fines of the soil matrix (silt and clay). Separation of the larger soil particles (sand, gravel, cobles) from the soil matrix would results in a significant reduction in the volume of impacted material. Given the regional geology (river sediments), it is likely the soil is comprised of a relatively large component of larger soil particles increasing the likely effectiveness of the soil washing technology in reducing the overall mass of impacted soil. This process option has been retained for further analysis.

Excavation/Off-Site Disposal – Soil contamination is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost. This process option has been retained for further analysis.

Excavation/On-Site Consolidation – Impacted soils are excavated and relocated to one location at the Site. Under this process, it is assumed that the landfill area would be used to consolidate soils. This readily implementable option has a relatively low cost and is retained for further analysis.

8.1.5 AOC 5 – Battery Disposal Area

Metals and PCBs have been detected in the Battery Disposal Area at concentrations greater than the Residential Use SCOs.

No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to the Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Any restrictions must be consistent with the current Site use. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Impermeable Cap – Effective for preventing direct contact with soil contaminants and leaching of contaminants from storm water infiltration. This process option may be difficult to implement given the topography and restrictions based on the site configuration. Therefore, this process option has not been retained for further analysis.

Permeable Cap – Effective at preventing direct contact to soil contaminants. Not effective for preventing the migration of contaminants leaching into groundwater. A permeable cap would not limit rainfall infiltration which may potentially leach contaminants from impacted soil within the AOC and result in migration of contaminants to the groundwater. The concentrations of several COCs have been detected in the soils of AOC 4 at concentrations greater then the NYSDEC Part 375 protection of groundwater SCO. Leaching of soil contaminants into the groundwater may already be occurring given that concentrations of several COCs have been detected in the groundwater monitoring wells at the Site. A permeable cap does not address the RAO of protection of the groundwater quality from impacted soils acting as a continuing source of groundwater contamination.

The battery disposal area is bounded to the east and south by off-site residential properties. The steep relief and the configuration of the disposal area relative to the surrounding properties create additional complexities in implementing the cap technology. This process option may be difficult to implement given the topography. Therefore, a permeable cap was eliminated from further consideration.

Constructed Vegetation – Phytoremediation may not be effective in removal of PCBs and some of the heavy metals and would be limited to only the shallow surface soil. Phytoremeditation requires contact with plant roots and is limited to surface soils to a depth only as deep as the roots can reach. Contaminants in this area extend deeper than the anticipated root depth. Phytoremediation is generally not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs). PCBs are hydrophobic and do not readily dissolve into water. Plant uptake of PCBs is limited due to the hydrophobic nature of the contaminant. Recent research indicates that under the correct conditions and with specific plant species, phyotoremediation of PCBs may be possible. However, phytoremediation of PCBs is not a well established technology and is generally deemed to be ineffective. Therefore, this process option has been screened out from further evaluation.

Excavation/Soil Wash/Disposal – This process option consists of excavation of soil, soil washing to remove the contaminated portion of the soil (silt and clay fine particles) and off-Site disposal of the impacted soils. Upon satisfactory confirmatory sampling, the portion of the uncontaminated soil can be returned to the excavation as backfill. Soil washing effectiveness is dependent upon the Site specific soil characteristics. Generally, metal contamination is sorbed onto the fines of the soil matrix (silt and clay). Separation of the larger soil particles (sand, gravel, cobles) from the soil matrix would results in a significant reduction in the volume of impacted material. Given the regional geology (river sediments), it is likely the soil is comprised of a relatively large component of larger soil particles increasing the likely effectiveness of the soil washing technology in reducing the overall mass of impacted soil. This process option has been retained for further analysis.

Excavation/Off-Site Disposal – Soil contamination is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost. This process option has been retained for further analysis.

Excavation/On-Site Consolidation – Impacted soils are excavated and relocated to one location at the Site. The area impacted by soils excavation would be properly backfilled and the slope would be stabilized to ensure that existing house and slope would not be at risk for failure. Under this process, it is assumed that the landfill area would be used to consolidate soils. This readily implementable option has a relatively low cost and is retained for further analysis.

8.1.6 AOC 6 – Off-Site Residential Area

SVOC, metals and PCBs have been detected in the Off-Site Residential Area at concentrations greater than the Residential Use SCOs.

No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to the Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Any restrictions must be consistent with the current Site use. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Impermeable Cap – Effective for preventing direct contact with soil contaminants and leaching of contaminants from storm water infiltration. This process option cannot be implemented given the current Site use. Therefore, this process option has not been retained for further analysis.

Permeable Cap – Effective at preventing direct contact to soil contaminants. Not effective for preventing the migration of contaminants leaching into groundwater. This process option cannot be implemented given the current Site use. Therefore, this process option has not been retained for further analysis.

Constructed Vegetation – Phytoremediation may not be effective in removal of PCBs and some of the heavy metals and would be limited to only the shallow surface soil. This process option cannot be implemented given the current Site use. Phytoremeditation requires contact with plant roots and is limited to surface soils to a depth only as deep as the roots can reach. Contaminants in this area extend deeper than the anticipated root depth. Phytoremediation is generally not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs). PCBs are hydrophobic and do not readily dissolve into water. Plant uptake of PCBs is limited due to the hydrophobic nature of the contaminant. Recent research indicates that under the correct conditions and with specific plant species, phyotoremediation of PCBs may be possible. However, phytoremediation of PCBs is not a well established technology and is generally deemed to be ineffective. Therefore, this process option has not been retained for further analysis.

Excavation/Soil Wash/Disposal – This process option consists of excavation of soil, soil washing to remove the contaminated portion of the soil (silt and clay fine particles) and off-Site disposal of the impacted soils. This process option cannot be implemented given the current Site use. Therefore, this process option has not been retained for further analysis.

Excavation/Off-Site Disposal – Soil contamination is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost. This process option has been retained for further analysis.

Excavation/On-Site Consolidation – Impacted soils are excavated and relocated to one location at the Site. Under this process, it is assumed that the landfill area would be used to consolidate soils. This readily implementable option has a relatively low cost and is retained for further analysis.

8.2 Groundwater Process Options

Retained groundwater process options include slurry wall, reactive barrier wall, long term monitoring, constructed wetlands, pump and treat and off-Site disposal. The no action and institutional control options (deed restriction) were also included for evaluation. The evaluation was applied to process options based on Site specific and chemical contaminant characteristics. A summary of the groundwater process option evaluation is summarized in Table 8-2 and discussed in greater detail below.

No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at restricting use and exposure to the Site contaminants. Future water use under the landfill must be restricted via legal restrictions that require continued implementation to remain effective. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Slurry Wall – Effective for reducing off-Site migration of groundwater contaminants. Given the radial flow of the lower plateau area of the Site, a slurry wall would need to be installed along a relatively long expanse of the down gradient property boundary to be effective. In addition, a collection and/or treatment system would be required to manage groundwater mounding behind the slurry wall. Therefore, this process option has not been retained for further analysis.

Long Term Monitoring – This process option is effective for groundwater plumes with relatively low levels of contamination or for steady state plumes (i.e., not expanding). The groundwater contamination consists of relatively low contaminant levels and is relatively stable. Therefore, this process option has been retained for further analysis.

Reactive Barrier Wall – The radial nature of the groundwater flow at the Site is not favorable for the implementation of this process option. A relatively long barrier wall would be required to intercept the contaminant plume. Therefore, this process option has not been retained for further analysis.

Constructed Wetlands – This process option consists of directing groundwater through a constructed wetland for the uptake of heavy metal by plant vegetation (phytoaccumulation). This process option may not be effective for the complex mixture of Site contaminants and has not been retained for further analysis.

Pump and Treat – Pump and treat systems are effective at mass removal and establishing hydraulic control of the aquifer to minimize off-Site migration of contaminants. Extracted groundwater is treated via GAC for organic removal and ion exchange for metal removal. This is a well established technology that is readily implementable and has a relatively high capital on operational cost. This process option has been retained for further analysis.

On-Site Discharge to Surface Water – Extracted groundwater is treated and discharged to a nearby surface water. The effluent standards for discharging to surface water are more stringent compared to discharging to groundwater. Additional treatment trains to ‘polish’ the effluent prior to discharge may be required, increasing the cost of this option. This option has not been retained for further analysis.

On-Site Discharge to Groundwater – Extracted groundwater is treated and discharged to groundwater via an infiltration basin or gallery. This readily implementable option has a relatively low cost and has been retained for further analysis.

Off-Site Disposal – Extracted groundwater is transported to an off-Site disposal facility (POTW) for treatment. This readily implementable option has a relatively high cost due to the transportation and disposal costs. This option has not been retained for further analysis.

8.3 Solid Waste Process Options

Retained groundwater process options include multilayer impermeable cap, vegetative soil cap, separation, excavation/off-Site disposal, and excavation/on-Site consolidation. The no action and institutional options (deed restrictions) were also included for evaluation. The evaluation was applied to process options based on Site specific and chemical contaminant characteristics. A summary of the groundwater process option evaluation is summarized in Table 8-3 and discussed in greater detail below.

No Action – The no action option will not meet the RAOs for the Site and will not be acceptable to the local community or the state. There is no cost associated with this option. The no action option has been retained to provide a basis for comparison with other active remedial process options.

Deed Restrictions – Deed restrictions will not reduce the mass of contamination at the Site but are effective at reducing access and exposure to the Site contaminants. Future land use must be restricted via legal restrictions that require continued implementation to remain effective. Any restrictions must be consistent with the current Site use. Deed restrictions can be used in conjunction with other remedial process options and have been retained for further consideration.

Impermeable Cap – Effective for preventing direct contact with solid waste and leaching of contaminants from storm water infiltration. This process option can also be used to manage landfill gas. This process option has been retained for further analysis.

Vegetative Soil Cap – Effective at preventing direct contact to solid waste. Not effective for preventing the migration of contaminants leaching into groundwater. This process option does not meet the state regulation for solid waste. Therefore, this process option has not been retained for further analysis.

Separation – The process option consists of excavation of the solid waste and separating the solid waste from the surrounding soil. Segregated debris can be transported off-Site for disposal. The option reduces the total volume of material requiring disposal. Physical separation of solid waste from soil often precedes implementation of soil remedial action. This technology has been retained for further evaluation.

Excavation/Off-Site Disposal – Solid waste is permanently removed from the Site under this process option. This effective readily implementable option has a relatively high disposal and overall cost. This process option has been retained for further analysis.

Excavation/On-Site Consolidation – Solid wastes are excavated and relocated to one location at the Site. Under this process, it is assumed that the landfill area would be used to consolidate soils. This readily implementable option has a relatively low cost and is retained for further analysis.

9.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Preliminary remedial alternatives for the Site have been developed by combining the remedial technologies/process options that have successfully passed the screening stage into a range of alternatives. The range of alternatives for each AOC that meet the RAOs based on the process option screening results are summarized in Table 9-1. The soil and solid waste were combined because of the significant interaction between the media process options. The estimated depths and volumes are listed in Table 6-1 for each AOC. The range of alternatives has been assembled into media specific Site wide alternatives that are discussed in detail below.

9.1 Soil and Solid Waste Alternative Development

Remedial alternatives were developed, based on the retained remedial technologies and Site-specific conditions. The soil remedial technologies retained for further analysis include capping, soil washing, excavation/on-Site consolidation, and excavation/off-Site disposal.

Remedial alternatives development included: identifying the size and configuration of selected process options; estimated time frame for implementation; operation and maintenance requirement for remedial alternatives; estimated flow rate or treatment rate; spatial requirements; disposal requirements including distances for disposal; permitting requirements; technical or administrative limitations; and, other factors that may affect the overall performance of the alternative.

The preliminary soil alternatives are summarized on Table 9-2 and described in the following sections.

9.1.1 Alternative 1 – No Action

The "no action" option is included as a basis for comparison with active soil remediation technologies. If no remedial action is taken, contaminants already present in the soil will remain in place or continue to impact the underlying groundwater. Organic contaminants (PAHs) may degrade over time due to natural attenuation processes. Metal and PCB contaminants will remain in the Site soils for long periods of time with little or no decrease in concentration. There are no capital, operations/maintenance, or monitoring costs associated with this alternative. There are no permitting or institutional legal restrictions needed for this alternative. This alternative will not meet any of the RAOs for the Site and is unlikely to be accepted by the state and/or local community.

9.1.2 Alternative 2A – Capping/On-Site Consolidation

The number 2 alternatives represent the containment GRA and consist of an impermeable cap over a portion of the Site. The impermeable cap will consist of a 60 mil high-density polyethylene (HDPE) liner underlain by a gas collection layer, if needed, and overlain by a 2-foot thick soil protective layer. The proposed cap will meet the substantive requirements of 6 NYCRR Part 360 regulations landfill cap.

Alternative 2A consists of installing an impermeable cap in AOCs 1, 2 and 3. Soil in AOCs 4, 5, and 6 with concentrations greater than the Residential Use SCOs will be excavated and relocated to AOC 1 prior to capping (on-Site consolidation) (Figure 9-1). Institutional controls will be required as part of this alternative.

The excavation and on-Site consolidation can be implemented in a relatively short time frame and there are no long term monitoring requirements. Delineation of the soil impacts in either a pre-design or post excavation sampling program would be required as part of the remedial action. Impacted soil would be excavated and transported to the landfill AOC where the soil will be incorporated into the regrading prior to installation of the cap. The excavation will be backfilled with clean fill imported from an off-Site source.

Construction of the cap can also be completed in a relatively short time frame. However, there will be long-term monitoring and maintenance costs associated with the cap. A storm water management system will be incorporated into the cap design to divert storm water flow around and away from the solid waste. It is anticipated that passive vents will be installed into the gas collection layer of the cap. Solid waste at the Site appears to be located above the water table and is not in direct contact with the groundwater. Leachate generation from solid waste in direct contact with groundwater does not appear to be occurring at the Site. The primary mechanism of leachate generation appears to be the infiltration of storm water through the solid waste to the groundwater or seeping from the toe of slope. Installation of an impermeable cap will eliminate of significantly reduce storm water infiltration. Leachate production is expected to diminish considerably or cease permanently once the impermeable cap is installed on top of the waste. Therefore, a leachate collection system has not been assumed as part of the remedial design.

A pre-design investigation consisting of test trenching and exploratory test pits around the perimeter of the solid waste area has been included as part of this alternative. The test pit/trench investigation will establish the limit of the solid waste. Any solid waste located outside the proposed cap will be excavated and relocated within the footprint of the cap.

Any soil or waste that is characterized as hazardous will be transported off-Site for proper disposal and will not be placed beneath the cap.

A groundwater monitoring program will be developed and implemented in conjunction with the cap in order to verify the effectiveness of the cap in protecting groundwater quality at the Site.

9.1.3 Alternative 2B – Capping/Off-Site Disposal

Alternative 2B consists of installing an impermeable cap in AOCs 1, 2 and 3. Soil in AOCs 4, 5, and 6 with concentrations greater than the Residential Use SCOs will be excavated and disposed off-Site. This alternative is identical to alternative 2A, with the exception that impacted soils in AOCs 4, 5, and 6 will be excavated and transported off-Site for disposal (Figure 9-2).

The excavation and off-Site disposal can be implemented in a relatively short time frame and there are no long term monitoring requirements. Delineation of the soil impacts in either a pre-design or post excavation sampling program would be required as part of the remedial action. Impacted soil would be excavated and transported off-site for disposal. It is assumed that impacted soil will be disposed in a subtitle D landfill. Soil that does not have an odor, is relatively free of debris, and does not overly saturated can be used as landfill daily cover. Landfills accept a limited amount of soil at reduced tipping fees for use as daily cover of accepted waste. Brownfield properties that are accepting impacted soil may also be used as a potential disposal site. Soil will need to meet the requirements of the Brownfield property and have sufficient capacity to accept soil. Overall soil disposal costs can be reduced if these alternate disposal options are available at the time of construction.

A groundwater monitoring program will be developed and implemented in conjunction with the cap in order to verify the effectiveness of the cap in protecting groundwater quality at the Site.

9.1.4 Alternative 2C – Capping/On-Site Consolidation

Alternative 2C consists of capping AOC 1 and excavating and consolidating impacted soil with concentrations greater than the Residential Use SCOs from all other AOCs (2, 3, 4, 5, and 6). This alternative is similar to alternative 2A except that the cap is limited to AOC 1 and impacted soil will be relocated from AOCs 3 and 4 (Figure 9-3).

A groundwater monitoring program will be developed and implemented in conjunction with the cap in order to verify the effectiveness of the cap in protecting groundwater quality at the Site.

9.1.5 Alternative 2D – Capping/Off-Site Disposal

Alternative 2D consists of capping AOC 1 and excavation and off-Site disposal of impacted soil with concentrations greater than the Residential Use SCOs from all other AOCs (2, 3, 4, 5, and 6). This alternative is similar to alternative 2C except that the off-Site disposal process option is used instead of on-Site consolidation (Figure 9-4).

9.1.6 Alternative 3A – Soil Washing/Off-Site Disposal

The number 3 alternatives include the treatment GRA of soil washing. Soil washing reduces the overall volume of impacted soil however, a portion of the soil will still require off-Site disposal. Alternative 3A consists of soil washing for AOCs 1 through 5 and off-Site disposal for AOC 6. Conducting soil wash operations in the off-Site residential area was determined to be impracticable and off-Site disposal is the remedial action to address impacted soils in that area.

Because soil washing is a water-based process, a water source and treatment system for wash water will be required. Due to the complex nature of the soil contaminants (PCBs, metals, SVOCs), a chemical precipitation or ion exchange will be needed for the metal removal. Sediment removal via frac tanks or clarifier and GAC for organic removal will also be needed. Treated effluent can be discharged to an infiltration basin. A State Pollutant Discharge Elimination System (SPDES) permit will be required for the treatment system discharge. An effluent sampling program will be conducted to ensure compliance with the effluent discharge standards. Disposal of the precipitated sludge and spent GAC will be required.

Excavation and separation of the solid waste will be required prior to implementation of the soil washing process option. Excavated solid waste soil mixture will be passed through a mechanical bar screen or other mechanical equipment to separate solid waste from the soil. Solid waste and segregated debris will be transported off-Site for disposal (Figure 9-5).

This alternative can be implemented in a relatively short time frame, although soil washing takes longer than off-Site disposal due to the need to double handle the soil. There are no long term operations, maintenance or monitoring costs associated with this alternative.

9.1.7 Alternative 3B – Capping/Soil Washing/Off-Site Disposal

Alternative 3B consists of capping AOC 1, soil washing of impacted soil in AOCs 2 through 5, and off-Site disposal of impacted soil from AOC 6. This alternative is similar to alternative 3A except that AOC 1 will be capped rather than implementing soil washing (Figure 9-6).

9.1.8 Alternative 4 – Off-Site Disposal

Alternative 4 consists of excavation and off-Site disposal of soils with contaminants greater than Residential Use SCOs. This alternative will meet all of the RAOs and return the Site to pre-release conditions remove soil that poses health risks at the Site (Figure 9-7). This alternative can be implemented in a relatively short time frame. However, this alternative has relatively high cost due to the significant disposal costs that will be incurred. There are no long term monitoring, maintenance or operations costs associated with this alternative.

9.2 Groundwater Alternative Development

9.2.1 Alternative G1 – No Action

The "no action" option is included as a basis for comparison with other groundwater remedial alternatives. If no remedial action is taken, contaminants already present in the groundwater will remain in place and continue to migrate with groundwater flow. There are no capital, operations/maintenance, or monitoring costs associated with this alternative. There are no permitting or institutional legal restrictions needed for this alternative. This alternative will not meet any of the RAOs for the Site and it is unlikely to be accepted by the state and/or local community.

9.2.2 Alternative G2 – Long Term Monitoring

There is no active remedial action associated with Alternative G2. However, there is a long term monitoring component to this alternative. In addition to the seven existing EPA monitoring wells, it is assumed that three additional groundwater monitoring wells will be installed as part of this alternative. Sampling of the groundwater monitoring wells will be completed on a semi-annual basis. The monitoring plan will be developed during the remedial design period. For cost estimation purposes only, a 30-year period is assumed. Groundwater samples will be analyzed for VOCs, SVOCs, metals and PCBs.

9.2.3 Alternative G3 – Groundwater Pump and Treat

This active remedial option consists of pumping groundwater to remove contaminant mass from high concentration areas of the aquifer and establish hydraulic control of the aquifer to minimize off-Site migration of the groundwater plume. Due to the radial flow at the Site, it is assumed that three extraction wells pumping at approximately 10 gpm each would be required to control the aquifer at the Site. A 30-gpm treatment system capable of removing VOCs and metals would be required. VOCs can be removed via GAC units and the metal removal could be achieved via ion exchange.

Pump and treat systems have relatively long time frames of operation (30 years assumed). The treatment system will require a small enclosure (building) that is assumed to be located near the Site entrance to facilitate utility service. This alternative assumes that treated effluent will be discharged to an infiltration system. Therefore, a SPDES permit will be required for the treatment plant.

10.0 ALTERNATIVE SCREENING

10.1 Criteria for Alternative Screening Process

Identified alternatives are screened based on effectiveness, implementability and cost. The Remedial Alternatives identified in the sections above were screened in this section based upon the anticipated future land use, subsurface geologic and hydrogeologic conditions, contaminants present at the Site, and the following criteria:

Effectiveness – Each alternative was screened for its effectiveness relative to other alternatives and the capability of each remedial alternative to protect human health and the environment and achieve the RAOs at the Site.

Implementability – Each alternative was screened based on the feasibility of implementing the remedial technology given the existing Site conditions, including the subsurface geology/hydrology and the distribution of contaminants. The screening was used to measure both the technical and administrative feasibility of constructing, operating, and maintaining the remedial alternative, including the availability of the technologies involved in the remedial alternative. Remedial alternatives that are difficult to construct and operate, result in potential adverse health and/or environmental impacts, or have reduced effectiveness due to existing conditions were eliminated.

Cost – Remedial alternatives that are higher in relative cost compared with other alternatives without offering greater implementability and/or effectiveness were eliminated.

The goal of the screening process is to reduce the number of alternatives that will be included for subsequent detailed evaluation by identifying those that are most compatible with the conditions of the Site and meet the RAOs. Remedial alternatives that appeared most feasible and appropriate were retained for detailed evaluation in Section 11.0.

10.2 Soil Alternative Screening

The eight soil alternatives included no action, institutional controls, containment, treatment and removal response actions and were screened based on relative effectiveness, implementability and cost. A summary of the comparative analyses based on the screening criteria is presented in Table 10-1.

Effectiveness – The no action alternative does not meet any of the RAOs established for the Site. An impermeable cap (Alternatives 2A, 2B, 2C and 2D) is a well established simple technology. However, impacted soils will remain on-Site. Soil washing (Alternatives 3A and 3B) is a complex technology that may be less effective because of a mixture of contaminants (i.e., organic and inorganics) and soil characteristics. Off-Site disposal of the impacted soil is very effective and meets all of the Site RAOs.

Implementability – Cap technology is reliably implementable, although regrading the Site will be required to improve slope stability and promote stormwater runoff. Excavation for off-Site disposal, on-Site consolidation and soil washing can be readily implemented using conventional earth moving equipment. Soil washing requires additional separation equipment and equipment for the treatment of wash water.

Cost – The no action option requires the least short term and long term costs relative to the other Alternatives. The on-Site consolidation Alternatives (2A and 2C) have relatively less short term costs compared to the off-Site disposal Alternatives (2B and 2D) due to differences in the disposal cost. Alternative 2A has relatively greater short term cost compared to Alternative 2C due to the larger cap area required under Alternative 2A. Soil washing has a relatively high short term cost compared to the containment Alternatives (2A, 2B, 2C and 2D). Excavation and off-Site disposal Alternative 4 has the relative greatest short term cost. Conversely, the no action, off-Site disposal Alternative 4 and soil washing Alternative 3A, have the least cost relative to the alternatives that include a cap (2A, 2B, 2C, 2D and 3B). The alternatives that include a cap over only the landfill area (2C, 2D and 3B) have relatively lower long term costs compared to alternatives that include a cap over a larger area (2A and 2B).

Based on the screening analyses, Alternatives 2B and 2D have been screened out as they do not offer greater effectiveness and are higher in costs relative to the on-Site consolidation Alternatives (2A and 2C). Both the off-Site disposal and on-Site consolidation alternatives permanently remove soil with contaminant concentrations greater than the Residential Use SCOs. Due to the disposal costs, the off-Site disposal option is significantly greater in cost relative to the on-Site consolidation alternatives.

Based on the screening analyses, Alternatives 3A and 3B have been screened out due to potential difficulty in implementation relative to other alternatives without providing significant additional effectiveness. Soil washing may be less effective due to the complex mixture of wastes at the Site. Formulating the washing fluid may be difficult and a complex multiple treatment train system with sequential washing may be required to achieve the SCOs. Additional treatment is likely to be required to address the waste wash waters.

10.2.1 Retained Soil Alternatives

The no action Alternative 1 has been retained to provide a comparison to the active remedial options. Containment Alternatives 2A and 2C cap or excavate soil with concentrations greater than the Residential Use SCOs and have been retained for the detailed evaluation. Alternative 4 will remove soil that poses health risks from the Site and has been retained for further analyses.

10.3 Groundwater Alternative Screening

Three viable groundwater alternatives were developed for the Site: No Action (Alternative G1), Long Term Monitoring (Alternative G2), and Pump and Treat (Alternative G3). Due to the relatively small number of groundwater alternatives, a qualitative preliminary screening of the alternatives was not performed. All three groundwater alternatives were carried forward for detailed evaluation.

11.0 DETAILED EVALUATION OF ALTERNATIVES

This section presents the detailed evaluation of the remedial alternatives described in Section 10.0 The purpose of the evaluation is to identify the advantages and disadvantages of each alternative as well as key trade-offs among the alternatives. The detailed evaluation of alternatives consists of an individual analysis of each alternative against the evaluation criteria and a comparative analysis among the alternatives to asses the relative performance of each alternative with respect to the evaluation criteria. Additional alternative details are provided, if necessary, with respect to the volumes or areas to be addressed, technologies to be used, or any performance requirements associated with the technologies.

Typically the media specific alternatives are assembled into Site wide alternatives for the detailed evaluation. However, the groundwater alternatives can be implemented independently of the soil/solid waste remedy and have been evaluated separately to allow the decision makers additional flexibility in selecting a soil and groundwater remedy for the Site.

11.1 Evaluation Criteria

The evaluation was based on criteria established under *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA October 1988). The nine evaluation criteria have been developed to address Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements and to address the additional technical and policy considerations that have proven to be important for selecting among remedial alternatives. The evaluation criteria are as follows:

<u>Overall Protection of Human Health and the Environment:</u> This criterion is an evaluation of the alternative's ability to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, engineering controls or institutional controls. The alternative's ability to achieve each of the RAOs is evaluated.

<u>Compliance with ARARs</u>**:** This criterion evaluates how the alternative complies with the ARARs, or if a waiver is required and how it is justified.

<u>Long Term Effectiveness and Permanence:</u> Each alternative is evaluated for its long-term effectiveness after implementation. If wastes or treated residuals remain on-Site after the selected remedy has been implemented, the following items are evaluated:

- The magnitude of the remaining risks (i.e., will there be any significant threats, exposure pathways, or risks to the community and environment from the remaining wastes or treated residuals);

- The adequacy of the engineering and institutional controls intended to limit the risk;
- The reliability of these controls, and
- The ability of the remedy to continue to meet RAOs in the future.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment: The alternative's ability to reduce the toxicity, mobility or volume of Site contamination is evaluated. Preference should be given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.

Short Term Impacts and Effectiveness: The potential short-term adverse impacts and risks of the remedy upon the community, the workers, and the environment during the construction and/or implementation are evaluated. A discussion of how the identified potential adverse impacts to the community or workers at the Site will be controlled, and the effectiveness of the controls, should be presented. A discussion of engineering controls that will be used to mitigate short term impacts (i.e., dust control measures) is provided. The length of time needed to achieve the remedial objectives is also estimated.

Implementability: The technical and administrative feasibility of implementing each alternative is evaluated for this criterion. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.

Relative Cost: This criterion evaluates the estimated capital, operations, maintenance, and monitoring costs for each alternative. Relative costs are estimated and presented on a present worth basis.

State Acceptance: The public's comments, concerns and overall perception of the remedy are evaluated in a format that responds to all questions that are raised (i.e., responsiveness summary).

Community Acceptance: The public's comments, concerns and overall perception of the remedy are evaluated in a format that responds to all questions that are raised (i.e., responsiveness summary).

The eighth and ninth criteria, State and Community acceptance, will be evaluated following comment on the RI/FS report and the proposed plan and will be addressed once a final decision has been made and the Record of Decision (ROD) is being prepared.

11.2 Individual Analysis of Alternatives

The individual analysis of the remedial alternatives with respect to the first seven criteria is presented below and summarized in Table 11-1.

11.2.1 Alternative 1 – No Action

The no action alternative provides a baseline for comparison with other active remedial alternatives. Because no remedial activities would be implemented with the no action alternative, long term human health and environmental risks for the Site essentially would be the same as those indentified in the baseline risk assessment.

Overall Protection of Human Health and the Environment – Alternative 1 provides no control of exposure to contaminated soil and no reduction in risk to human health posed by contaminated soil. The alternative allows for the potential for migration of contaminated soil and potential for impact to groundwater from contaminated soil.

Compliance with ARARs – Because no action is being taken, no ARARs (direct contact New York State Part 375 Residential Use SCOs and New York State Part 375 impact to groundwater SCOs) will be met.

Long Term Effectiveness and Permanence – No long term management or controls for exposure are included in this alternative. Long term potential risks would remain unchanged under this alternative.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Alternative 1 will provide no reduction in toxicity, mobility, or volume of the contaminated soil.

Short Term Impacts and Effectiveness – This alternative does not result in disruption of the Site and therefore no additional risks are posed to the community, workers, or the environment as no remedial actions will occur at the Site.

Implementability – There are no implementability concerns posed by this remedy as no remedial actions are being implemented.

Relative Cost – Because this is a no action alternative, the capital, operations and maintenance, and net present value costs are estimated to be $0. The estimated cost for Alternative 1 is summarized in Table 11-2.

11.3 Alternatives 2A and 2C: Common Components

Alternatives 2A and 2C have four components in common (use of institutional controls, regrading/consolidation of on-Site soils, multilayer impermeable cap, and erection of a perimeter fence). A description of these common components is provided below:

Pre-Design Investigation – During the pre-design investigation, for all soil excavations from the AOCs that are to be consolidated, the specific locations, including areal extent and depth, will be fully delineated. It is anticipated that pre-design investigation activities will be completed for the following AOCs:

AOC 1 – Landfill Area
AOC 2 – Debris Pile Area
AOC 3 – Dumpster Staging Area
AOC 4 – Scattered Debris Area
AOC 5 – Battery Disposal Area
AOC 6 – Off-Site Residential Area
AOC 7 – Site Wide Groundwater

Institutional Controls – A deed restriction will be placed on the Site that would prohibit excavation and construction of buildings on any part of the Site still containing solid waste or soil with contaminant concentrations greater than the Residential Use SCOs.

Regrading/Consolidation of On-Site Soils – Regrading of the existing landfill topography will be required to facilitate storm water runoff and increase slope stability. The regrading will have a minimum 5 percent slope and a maximum side slope of 33 percent (3 on 1). The revised grades will conform with 6 NYCRR Part 360 regulations landfill cap requirements. Impacted soil will be excavated and placed within the footprint in the cap and used as part of the regrading to meet the minimum/maximum grade requirements prior to placement of the cap.

Multilayer Impermeable Cap – A cap will be installed consisting of a gas venting layer, 60 mil HDPE geomembrane, and 2 feet of protective soil cover. The cap will satisfy the 6 NYCRR Part 360 regulation landfill closure cap requirements. The HDPE geomembrane will provide a permeability not to exceed 10^{-7} cm/sec. The 2-foot protection layer will consist of 18 inches of structural fill and 6 inches of topsoil. Four inch polyvinyl chloride (PVC) pipes will be installed through the cap to the gas collection layer to provide passive venting of any landfill gas that may be generated by the decomposition of solid waste. Topsoil will be hydroseeded to establish vegetation on the cap to minimize soil erosion. A gravel access road from the Site entrance will be extended down the slope of the landfill to provide access to the lower plateau area. Because the solid waste appears to be located above the groundwater table, it is anticipated that an impermeable cap will minimize or eliminate the leachate generation. Therefore, a leachate collection system has not been included in the cap design.

Fencing – A 6-foot high chain link fence would be installed around the perimeter of the capped area to restrict public access. Signage warning of the presence of impacted soils and potential exposure danger would be posted on the fence to further discourage unauthorized access to the Site.

11.4 Alternative 2A – Cap (AOCs 1 through 3) and On-Site Consolidation (AOCs 4 through 6)

Alternative 2A consists of capping AOCs 1 through 3 and excavation and on-Site consolidation of impacted soils from AOCs 4 through 6. A continuous 12 acre cap would be installed over the landfill debris pile and dumpster staging area consistent with the 6 NYCRR Part 360 regulations requirements described above. Approximately 3,200 linear feet of fence will be installed around the perimeter of the cap. A conceptual final grading plan and corresponding cross section are shown on Figures 11-1 and 11-3, respectively.

Prior to installation of the cap, soil from AOCs 4 through 6 with contaminant concentrations greater than the Residential Use SCOs will be excavated and placed within the proposed cap footprint. In addition to containment of the impacted soil, the soil will be used to meet the minimum slope requirements of the cap. A pre-design investigation will be performed as described above prior to the remedial design to better define the quantity of impacted soil to be relocated. A post excavation confirmatory sampling program would be completed in accordance with NYSDEC Data Evaluation Report (DER)-10 guidance to verify that the excavations have removed soils greater than the Residential Use SCOs. The post excavation sampling frequency is assumed to be one sample for every 30 linear feet of excavation side wall and one bottom sample for every 900 square feet of excavation area.

Overall Protection of Human Health and the Environment – The impermeable cap would prevent exposure to the contaminated soil, eliminate migration of contaminated soil due to wind blown dust or storm water erosion, and mitigate inhalation risks of potential landfill gas. In addition, the impermeable cap would minimize further release of contaminants to the groundwater by limiting future storm water infiltration through the cap.

Compliance with ARARs – Because a solid waste landfill would be capped, 6 NYCRR Part 360 regulation closure requirements have been determined to be relevant and appropriate to this alternative. This alternative would meet the state landfill closure requirements by construction of a soil/geomembrane cap that conforms to the Part 360 standards. Based on discussions with the lead and support agencies and as incorporated into the Site RAOs, New York State Part 375 Residential Use SCOs and New York State Part 375 impact to groundwater SCOs have been determined to be relevant and applicable to the Site. This alternative includes a post excavation confirmatory sampling program that will verify that the State SCOs are achieved. Additional standards, criteria , guidance, and permits to be considered for this alternative include a soil erosion and sedimentation control plan (SESCP), SPDES construction permit, community air monitoring program (CAMP), community participation plan (CPP), Site management plan (SMP) and federal Occupational Health and Safety Administration (OSHA) regulations.

Long Term Effectiveness and Permanence – In order for this alternative to remain effective over the long term, an inspection and maintenance program would be required. Any damage to the cap via erosion, slope failure or overgrown vegetation, would need to be repaired. Careful maintenance of a healthy vegetative layer over the cap would be required to minimize erosion. Failure to address damage to the cap integrity could result in potential for direct contact to contaminated soil, increased leachate production and subsequent groundwater contamination. Because the contaminated soil would remain on-Site, long term maintenance and groundwater monitoring would be required. In accordance with CERCLA, a review would need to be conducted at least every 5 years to verify that the remedy continues to provide adequate protection of human health and the environment.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – This alternative provides no reduction in toxicity, mobility or volume of contaminated soil through treatment. The estimated 80,000 cubic yards of contaminated soil and 23,000 cubic yards of solid waste would remain on-Site.

Short Term Impacts and Effectiveness – The on-Site consolidation of soil and the cap construction is estimated to be completed in approximately 9 months. There is an increased risk of exposure to contaminated soil during construction to workers, the community and the environment due to potential particulate emissions (dust) and soil erosion during construction. The increased risk would be managed through the use of dust control techniques (water spray) and implementation of soil erosion and sedimentation controls (silt fence, hay bales).

Implementability – No special techniques, materials, permits, or labor would be required to construct the cap. All excavation, regrading, backfill, and cap soil placement would be completed with conventional earth moving equipment. A contractor with sufficient experience in the installation and welding of HDPE liner panels would be required for the cap construction.

Relative Cost – The 30-year present value cost of this alternative is estimated to be $6,323,000. The capital cost is estimated to be $5,152,800 and the annual operations and monitoring cost is estimated to be $75,500. The capital cost is primarily for installing the caps and the operations and monitoring costs are primarily for monitoring and maintaining the caps. The estimated cost for Alternative 2A is summarized in Table 11-3.

11.5 Alternative 2C – Cap (AOC 1) and On-Site Consolidation (AOCs 2 through 6)

Alternative 2C consists of capping AOC 1 and excavation and on-Site consolidation of impacted soils from AOCs 2 through 6. A 7-acre cap would be installed over the landfill debris pile and dumpster staging area consistent with the 6 NYCRR Part 360 regulations requirements described above. Approximately 2,300 linear feet of fence will be installed around the perimeter of the cap. A conceptual final grading plan and corresponding cross section are shown on Figures 11-2 and 11-3, respectively.

Prior to installation of the cap, soil from AOCs 2 through 6 with contaminant concentrations greater than the Residential Use SCOs will be excavated and placed within the proposed cap footprint. In addition to containment of the impacted soil, the soil will be used to meet the minimum slope requirements of the cap. A pre-design investigation will be performed as described above prior to the remedial design to better define the quantity of impacted soil to be relocated. A post excavation confirmatory sampling program would be completed in accordance with NYSDEC DER-10 guidance to verify that the excavations have removed soils greater than the Residential Use SCOs. The post excavation sampling frequency is assumed to be one sample for every 30 linear feet of excavation side wall and one bottom sample for every 900 square feet of excavation area.

<u>Overall Protection of Human Health and the Environment</u> – The impermeable cap would prevent exposure to the contaminated soil, eliminate migration of contaminated soil due to wind blown dust or storm water erosion, and mitigate inhalation risks of potential landfill gas. In addition, the impermeable cap would minimize further release of contaminants to the groundwater by limiting future storm water infiltration through the cap.

<u>Compliance with ARARs</u> – Because a solid waste landfill would be capped, 6 NYCRR Part 360 regulation closure requirements have been determined to be relevant and appropriate to this alternative. This alternative would meet the state landfill closure requirements by construction of a soil/geomembrane cap that conforms to the Part 360 standards. Based on discussions with the lead and support agencies and as incorporated into the Site RAOs, New York State Part 375 Residential Use SCOs and New York State Part 375 impact to groundwater SCOs have been determined to be relevant and applicable to the Site. This alternative includes a post excavation confirmatory sampling program that will verify that the state SCOs are achieved. Additional standards, criteria , guidance, and permits to be considered for this alternative include a SESCP, SPDES construction permit, CAMP, CPP, SMP and OSHA regulations.

<u>Long Term Effectiveness and Permanence</u> – In order for this alternative to remain effective over the long term, an inspection and maintenance program would be required. Any damage to the cap via erosion, slope failure or overgrown vegetation, would need to be repaired. Careful maintenance of a healthy vegetative layer over the cap would be required to minimize erosion.

Failure to address damage to the cap integrity could result in potential for direct contact to contaminated soil, increased leachate production and subsequent groundwater contamination. Because the contaminated soil would remain on-Site, long term maintenance and groundwater monitoring would be required. In accordance with CERCLA, a review would need to be conducted at least every 5 years to verify that the remedy continues to provide adequate protection of human health and the environment.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – This alternative provides no reduction in toxicity, mobility or volume of contaminated soil through treatment. The estimated 30,000 cubic yards of contaminated soil and 1,000 cubic yards of solid waste would remain on-Site.

Short Term Impacts and Effectiveness – The on-Site consolidation of soil and the cap construction is estimated to be completed in approximately 9 months. There is an increased risk of exposure to contaminated soil during construction to workers, community and the environment due to potential particulate emissions (dust) and potential soil erosion during construction. The increased risk would be managed through the use of dust control techniques (water spray) and implementation of soil erosion and sedimentation controls (silt fence, hay bales).

Implementability – No special techniques, materials, permits, or labor would be required to construct the cap. All excavation, regrading, backfill, and cap soil placement would be completed with conventional earth moving equipment. A contractor with sufficient experience in the installation and welding of HDPE liner panels would be required for the cap construction.

Relative Cost – The 30-year present value cost of this alternative is estimated to be $5,711,000. The capital cost is estimated to be $4,695,938 and the annual operations and maintenance cost is estimated to be $65,700. The capital cost is primarily for installing the caps and the operations and monitoring costs are primarily for monitoring and maintaining the caps. The estimated cost for Alternative 2C is summarized in Table 11-4.

11.6 Alternative 4 – Off-Site Disposal

Alternative 4 consists of excavation of soil from all AOCs with contaminant concentrations greater than the Residential Use SCOs. Excavated soil will be transported off-Site to an appropriate disposal facility (landfill). Similarly, solid waste will be excavated and transported off-Site for disposal. It is estimated that approximately 40,000 cubic yards of solid waste and 60,000 cubic yards of contaminated soil would need to be excavated and disposed off-Site. It is assumed that the disposal facility will require waste characterization sampling (e.g. TCLP analysis) of the excavated material at the rate of one sample every 500 cubic yards. It is assumed that all of the soil and solid waste will be characterized as non-hazardous and will be disposed of in a Resource Conservation and Recovery Act (RCRA) Subtitle D solid waste disposal facility.

A pre-design investigation will be performed as described above prior to the remedial design to better define the quantity of impacted soil to be excavated and disposed. A post excavation confirmatory sampling program would be completed in accordance with NYSDEC DER-10 guidance to verify that the excavations have removed soils greater than the Residential Use SCOs. The post excavation sampling frequency is assumed to be one sample for every 30 linear feet of excavation side wall and one bottom sample for every 900 square feet of excavation area. There will be some uncertainties with the volume estimate as the sampling during excavation will determine when sufficient soil has been removed.

<u>Overall Protection of Human Health and the Environment</u> – This alternative is protective of human health and the environment as the Site will essentially be restored to pre-disposal conditions. Direct contact risks would be reduced by removing soil with concentration greater than the Residential Use SCOs. Potential for impacts to groundwater will be mitigated by removing soil with contaminant concentrations greater than the impact to groundwater SCOs.

<u>Compliance with ARARs</u> – Based on discussions with the lead and support agencies, and as incorporated into the Site RAOs, New York State Part 375 Residential Use SCOs and New York State Part 375 impact to groundwater SCOs have been determined to be relevant and applicable to the Site. This alternative includes a post excavation confirmatory sampling program that will verify that the State SCOs are achieved. Additional standards, criteria , guidance, and permits to be considered for this alternative include a SESCP, SPDES construction permit, CAMP, CPP, SMP and OSHA regulations.

<u>Long Term Effectiveness and Permanence</u> – This alternative provides long term effectiveness as soil contaminants are permanently removed from the Site. Long term monitoring would not be required for the area where soil is removed and a 5 year review would not be required.

<u>Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment</u> – This alternative will result in a reduction in toxicity, mobility or volume of contaminated soil present at the Site by removing the contaminant source. Although the impacted soil is not treated, the soil will be disposed in a permitted lined landfill limiting the mobility of the contaminants.

<u>Short Term Impacts and Effectiveness</u> – The on-Site consolidation of soil and the cap construction is estimated to be completed in approximately 6 months. There is an increased risk of exposure to contaminated soil during construction to workers, community and the environment due to particulate emissions (dust) and potential soil erosion during construction.

The increased risk would be managed through the use of dust control techniques (water spray) and implementation of soil erosion and sedimentation controls (silt fence, hay bales).

Implementability – No special techniques, materials, permits, or labor would be required to excavate and dispose of the soil. All excavation, backfill, and Site restoration would be completed with conventional earth moving equipment.

Relative Cost – The 30-year present value cost of this alternative is estimated to be $23,822,000. The capital cost is estimated to be $23,822,000 and the annual operations and maintenance cost is estimated to be $0. The capital cost is primarily the cost of disposing of the impacted soil and solid waste. The estimated cost for Alternative 2A is summarized in Table 11-5.

11.6.1 Alternative G1 – No Action

The groundwater no action alternative provides a baseline for comparison with other active remedial alternatives. Because no remedial activities would be implemented with the no action alternative, long term human health and environmental risks for the Site essentially would be the same as those indentified in the baseline risk assessment.

Overall Protection of Human Health and the Environment – Alternative 1 provides no control of exposure to contaminated groundwater and no reduction in risk to human health posed by contaminated groundwater. The alternative allows for the potential continued migration of contaminated groundwater and further degradation of the groundwater quality at the Site.

Compliance with ARARs – Because no action is being taken, no ARARs (NYSDEC TOGS groundwater Class GA water quality standards) will be met.

Long Term Effectiveness and Permanence – No long term management or controls for exposure are included in this alternative. Long term potential risks would remain unchanged under this alternative.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Alternative G1 will provide no reduction in toxicity, mobility, or volume of the contaminated groundwater.

Short Term Impacts and Effectiveness – There would be no additional risks posed to the community, workers or the environment as a result of this alternative being implemented.

Implementability – There are no implementability concerns posed by this remedy as no remedial actions are being implemented.

Relative Cost – Because there are no actions, the capital, operations and maintenance, and net present value costs are estimated to be $0. The estimated cost for Alternative G1 is summarized in Table 11-6.

11.6.2 Alternative G2 – Long Term Monitoring

This alternative consists of the natural attenuation and long term monitoring of the contaminated groundwater. To estimate the effect of natural attenuation on the contaminated groundwater, it was assumed that a soil remedy will be implemented that will significantly reduce or eliminate future contaminant contributions to the groundwater from soil and solid waste at the Site. Considering the site is not active and based on the existing data, it is assumed that the current groundwater plume does not extend beyond the Site boundary and the plume is in a steady state (i.e., not expanding or contracting). Based on the surrounding topography, it is assumed that the Beer Kill is a gaining stream and vertical gradient is upward (i.e., groundwater flows from bedrock to overburden). Therefore, it is assumed that there is little, if any, contamination of the bedrock aquifer. However, three bedrock wells would be installed as part of this alternative in the pre-design investigation to collect necessary data on the bedrock aquifer required for the remedial design. As discussed in the RI, a Non-Aqueous Phase Liquid (NAPL) was observed seeping into the bedrock during a removal action associated with the shear/baler area. Installation of a bedrock well in this area is also part of this alternative.

A long term monitoring program of the overburden aquifer would also be required for this alternative. In addition, to the existing seven monitoring wells installed by EPA, it is assumed that three additional overburden wells will be installed to monitor the Site (total of 10 overburden wells). To meet state landfill closure requirements for the capping soil alternatives (2A and 2C), one monitoring well is required every 500 feet around the perimeter of the landfill. No additional monitoring wells would be required for the off-Site disposal Alternative 4.

Institutional controls (deed restriction) will be placed on the Site to prohibit the on-Site groundwater from being used as a source of drinking water until contaminant levels in the aquifer reached acceptable levels.

Overall Protection of Human Health and the Environment – Although Alternative G2 is protective of human health and the environment by controlling exposure to contamination through institutional controls, the potential for groundwater migration remains. It appears based on available investigation data that the existing groundwater plume is relatively stable and any soil remedy that reduces future contaminant infiltration to the groundwater will likely result in the reduction in the size of the groundwater plume.

Compliance with ARARs – This alternative would control exposure to the contaminated groundwater through institutional controls until the ARARs (NYSDEC TOGS Class GA groundwater quality standards) are reached. It may take over 30 years of monitoring for the groundwater to reach chemical specific ARARs at the Site.

Long Term Effectiveness and Permanence – Because contaminated groundwater would remain on-Site with contaminant concentrations greater than health based risk levels for up to 30 years or longer, long term monitoring would be required under this alternative. Institutional controls will remain effective in preventing exposure as long as they are enforced. In accordance with CERCLA, a review would need to be conducted at least every 5 years to verify the remedy continues to provide adequate protection of human health and the environment.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Alternative G2 will provide no reduction in toxicity, mobility, or volume of the contaminated groundwater.

Short Term Impacts and Effectiveness – There would be no additional risks posed to the community, workers or the environment as a result of this alternative being implemented.

Implementability – There are no implementability concerns posed by this remedy as no active remedial actions are being taken.

Relative Cost – The 30-year present value cost of this alternative is estimated to be $770,000. The capital cost is estimated to be $63,625 and the annual operations and maintenance cost is estimated to be $51,000. The capital cost is primarily the cost of establishing the institutional controls and the operations and maintenance costs are primarily for long term monitoring of the groundwater. The estimated cost for Alternative G2 is summarized in Table 11-7.

11.6.3 Alternative G3 – Pump and Treat (Discharge to Groundwater)

This alternative consists of extraction of the groundwater via pumping and ex situ treatment of the extracted groundwater prior to on-Site discharge into an infiltration gallery. The three extraction well network will remove contaminant mass from the high concentration area and establish hydraulic control of the down gradient edge on the groundwater plume. Extracted groundwater will be treated via ion exchange for metals removal and GAC for VOC removal. It is estimated that a treatment plant capacity of 30 gpm will achieve the mass removal and hydraulic control objectives. This alternative includes a 72-hour pump test to be completed as part of the pre-design investigation to collect needed aquifer data to complete the remedial design of the pump and treat system.

Treated groundwater effluent will be discharged back to groundwater via an infiltration gallery. The infiltration gallery will consist of a subsurface leach field constructed of perforated piping embedded in gravel. A percolation test will be completed during the pre-design investigation to collect the needed data to design the infiltration gallery.

In evaluating this alternative, it was assumed that a soil remedy will be implemented that will significantly reduce or eliminate future contaminant contributions to the groundwater from soil and solid waste at the Site. In addition, it is assumed the current groundwater plume does not extend beyond the Site boundary and the plume is steady-state in nature (i.e., not expanding or contracting).

Based on the surrounding topography, it is assumed that the Beer Kill is a gaining stream and vertical gradient is upward (i.e., groundwater flows from bedrock to overburden). Therefore, it is assumed that there is little, if any, contamination of the bedrock aquifer.] However, three bedrock wells would be installed as part of this alternative in the pre-design investigation to collect necessary data on the bedrock aquifer required for the remedial design. As discussed in the RI, NAPL was observed seeping into the bedrock during a removal action associated with the shear/baler area. Installation of a bedrock well in the former shear/baler area is also part of this alternative.

A long-term monitoring program would be required for this alternative. In addition, to the existing seven monitoring wells installed by EPA, it is assumed that three additional wells will be installed to monitor the Site (total of 10 wells). To meet state landfill closure requirements for the capping soil alternatives (2A and 2C), one monitoring well is required every 500 feet around the perimeter of the landfill. No additional monitoring wells would be required for the off-Site disposal Alternative 4.

Institutional controls (deed restrictions) will be placed on the Site to prohibit use of on-Site groundwater as a source of drinking water until contaminant levels in the aquifer reached acceptable levels.

<u>Overall Protection of Human Health and the Environment</u> – This alternative is protective of human health and the environment. Groundwater extraction and on-Site treatment would reduce the risks to human health from ingestion of contaminated groundwater and reduce the potential for additional migration.

<u>Compliance with ARARs</u> – This alternative would meet the ARARs, NYSDEC TOGS Class GA groundwater quality standards, after an extended period of operation. The treatment system would be designed so that treated effluent would meet the SPDES requirements.

<u>Long Term Effectiveness and Permanence</u> – The long term effectiveness of the pump and treat system to achieve the clean up goal is somewhat uncertain. A long-term monitoring program

would be implemented to verify the long term effectiveness of the pump and treat system. In accordance with CERCLA, a review would need to be conducted at least every 5 years to verify that the remedy continues to provide adequate protection of human health and the environment.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment –Groundwater extraction irreversibly reduces the toxicity of the aquifer by removing contaminated groundwater from the aquifer. The ion exchange and carbon treatment process reduce the toxicity and mobility of the contaminants. Contaminants trapped on the carbon would be destroyed during regeneration of the carbon making this component irreversible.

Short Term Impacts and Effectiveness – Extraction of the groundwater to the surface for treatment increases the risks of exposure, ingestion and inhalation of contaminants by workers and the community. Safety techniques including alarmed monitoring equipment would be used to minimize risks from failures of treatment system components. A fence would be installed around treatment system to discourage trespassers and limit potential exposure. Once pumping commences, the contaminant plume would begin to recede from its current dimensions.

Implementability – This alternative involves the use of proven technologies. Both the ion exchange and GAC units are readily available equipment. Operation of the treatment system would require frequent sampling to assess the effectiveness of the system. The treatment components can be expanded to improve treatment effectiveness, if required.

Relative Cost – The 30-year present value cost of this alternative is estimated to be $5,896,000. The capital cost is estimated to be $629,000 and the annual operations and maintenance cost is estimated to be $416,900. The capital cost is primarily the cost of the constructed treatment facility and the operations and maintenance costs are primarily for operation of the treatment system. The estimated cost for Alternative G3 is summarized in Table 11-8.

11.7 Comparative Alternative Analysis

A comparative analysis was completed where the alternatives were evaluated in relation to each other for each of the evaluation criteria. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative.

11.7.1 Overall Protection of Human Health and the Environment

All of the alternatives, except the no action Alternatives (1 and G1), provide protection of human health and the environment. Risks from direct contact, inhalation, and migration of soil contaminants including impacts to groundwater are addressed by soil Alternatives 2A, 2C and 4. Exposure risks are slightly lower under Alternative 2C compared to Alternative 2A due to the smaller footprint and hence surface area, of the impacted soils that will remain at the Site. Alternative 4 exposure risks are less than Alternatives 2A and 2C because the contaminated soil would be permanently removed from the Site under Alternative 4.

Alternatives G2 and G3 reduce the risks of ingestion of impacted groundwater. Alternative G3 prevents the further migration of contaminated groundwater by extracting and treating the plume. Ingestion risks are slightly less under Alternative G3 compared to Alternative G2 as the size of the plume will begin to be reduced as pumping under Alternative G3 commences.

11.7.2 Compliance with ARARs

All alternatives meet their respective ARARs except the no action alternatives.

11.7.3 Long Term Effectiveness and Permanence

Alternative 4 provides the highest degree of long term effectiveness and permanence because the impacted soil is permanently removed from the Site. Alternative 4 would have no long term reliance on institutional controls. Alternatives 2A and 2C rely on a soil/HDPE liner cap to control infiltration, direct contact exposure and migration of impacted soil. The soil/HDPE liner cap is a reliable technology if properly maintained. Although capping is effective and reliable for reducing exposure risk, it is less reliable in the long term compared to removal (Alternative 4) due to the remaining potential for cap failure. Alternative 2C has slightly less risk compared to Alternative 2A due to the smaller cap footprint and resulting lower risk of cap failure.

Alternative G3 permanently removes contaminants from the groundwater aquifer and irreversibly treats VOCs and metal contaminants. Alternatives 2 and 3 have long term groundwater monitoring requirements.

11.7.4 Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment

Alternatives 2A, 2C and 4 do not use any treatment technologies to reduce the toxicity, mobility or volume of contaminants through treatment. Under Alternatives 2A and 2C, contaminated soil, although controlled by a cap, would remain on Site. Contaminated soil in Alternative 4 would be transported to a lined landfill for disposal.

Alternative G3 uses treatment technologies to reduce the hazards posed by contaminants in the groundwater at the Site. Regeneration of the carbon ultimately destroys the organic contaminants. Alterative G2 uses no treatment technologies and contaminated groundwater will remain, although contaminants will naturally attenuate.

11.7.5 Short Term Impacts and Effectiveness

Risks of some particulate emissions and potential migration due to erosion during soil handling and cap construction are anticipated during implementation. Dust control and soil erosion and sedimentation controls would reduce the risk. Alternative 4 poses the greatest risk as the largest volume of soil/solid waste will be disturbed and handled. Similarly, Alternative 2C poses a slightly larger risk compared to Alternative 2A because Alternative 2C involves relocating a greater quantity of impacted soil.

Alternative G2 has the greatest short term effectiveness as contaminated groundwater remains in situ and is not extracted to the surface. Alternative G3 increases the risks of exposure, ingestion and inhalation of contaminants by workers and the community because contaminated groundwater is extracted to the surface for treatment. Safety techniques including alarmed monitoring equipment and fencing would be used to minimize exposure risks.

11.7.6 Implementability

Alternative 4 would be the simplest to implement although handling of the solid waste will add some complexity to the alternative. Alternatives 2A and 2C are slightly more complex to implement because of the cap construction and installation of the geomembrane liner. Long term inspection and maintenance to maintain the integrity of the cap would be required. Long term groundwater monitoring would also be required to assess the effectiveness of the cap in reducing the groundwater contamination.

Alternative G2 would be the simplest of the groundwater remedies to implement. Alternative G3 would require construction of a treatment plant requiring readily available engineering services, treatment, and equipment. All of the treatment technologies are well established and proven. However, monitoring of the groundwater aquifer and treatment plant effluent would be required to assess the effectiveness of the system.

11.7.7 Relative Cost

The no action Alternatives (1 and G1) have no cost because no activities are implemented. Alternative 2C has the lowest capital cost ($4,695,938) of the active soil alternatives followed by Alternative 2A ($5,152,800). Alternative 4 has the highest capital cost ($23,822,000) and the lowest operations and maintenance costs ($0) of the soil alternatives. Alternatives 2A and 2C have similar annual operations and maintenance costs of $75,500 and $65,700, respectively. Alternative 2C has the lowest overall present value cost ($5,711,000) followed by Alternative 2A ($6,323,000). Alternative 4 has the highest overall present value cost of the soil Alternatives ($23,822,000).

Alternative G2 has lower capital, ($63,625) operations and maintenance ($51,000)and overall present value cost ($770,000) compared to Alternative G3 ($629,000 capital) ($416,900 operations and maintenance) ($5,896,000 present value cost). The comparison of total cost of the remedial alternatives is summarized in Table 11-9.

11.7.8 State Acceptance

To be addressed in the ROD.

11.7.9 Community Acceptance

To be addressed in the ROD.

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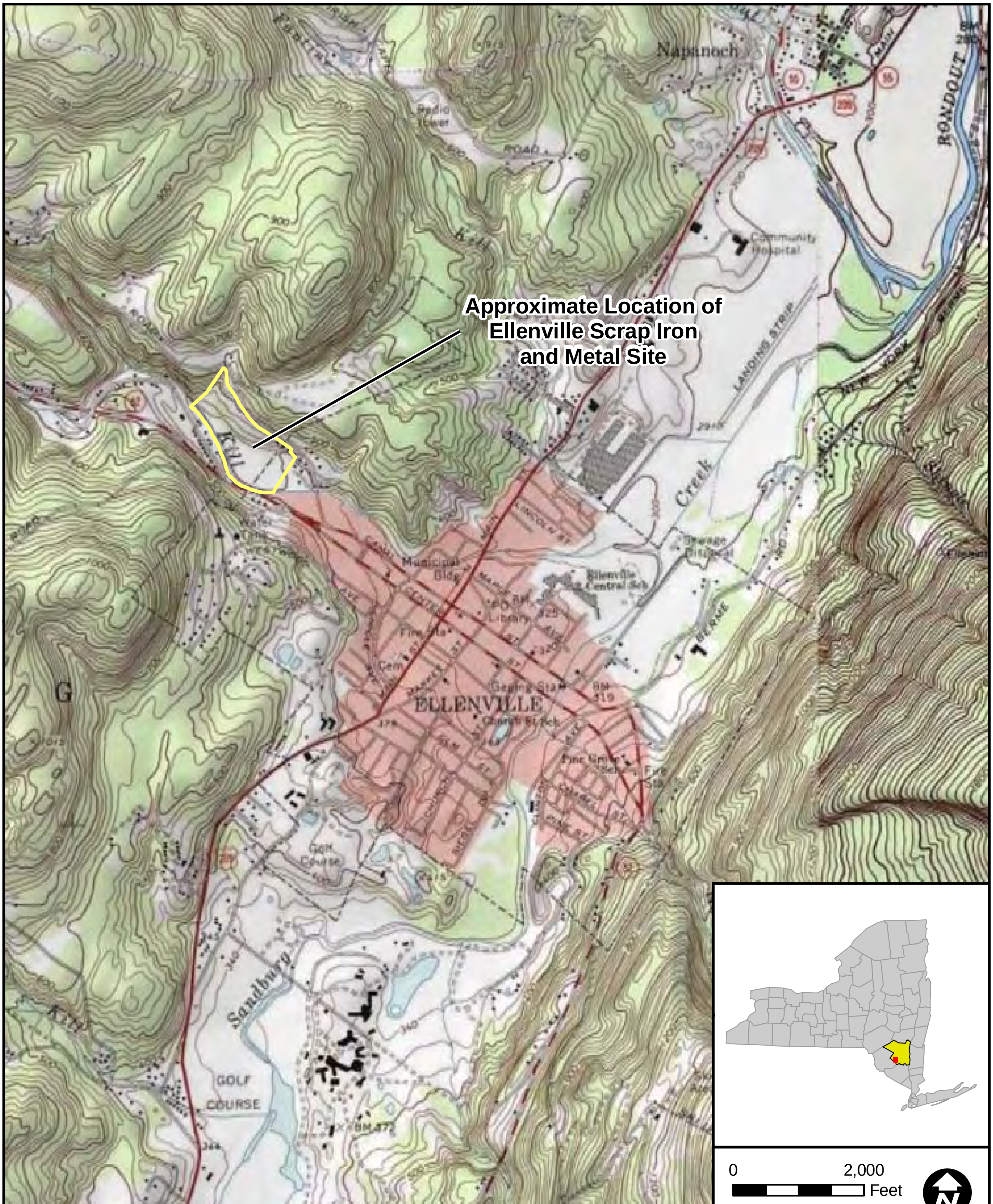
13.0 LIST OF ACRONYMS AND ABBREVIATIONS

AAP	alkaline activated persulfate
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CAMP	Community Air Monitoring Program
C&D	construction and demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeters per second
CPP	Community Participation Plan
DER	Data Evaluation Report
DNAPL	dense non-aqueous phase liquids
DP	direct push
DPE	Dual-phase extraction
EPA	United States Environmental Protection Agency
ft/day	foot per day
ft^2/day	feet squared per day
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
gpm/ft	gallons per minute per foot
GRA	General Response Action
H_2S	hydrogen sulfide
HDPE	High-density polyethylene
HDR	Henningson, Durham & Richardson Architecture and Engineering, P.C. in association with HDR Engineering, Inc.
IA	Integrated Assessment
IRM	Interim Remedial Measures
ISCO	In situ Chemical Oxidation
ISV	In situ Vitrification
K	hydraulic conductivity
LH	Leachate
LNAPL	light non-aqueous phase liquids
LTM	Long Term Monitoring
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
mgd	million gallons per day
MW	Monitoring Well
NAPL	Non-Aqueous Phase Liquid
NPL	National Priorities List
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health

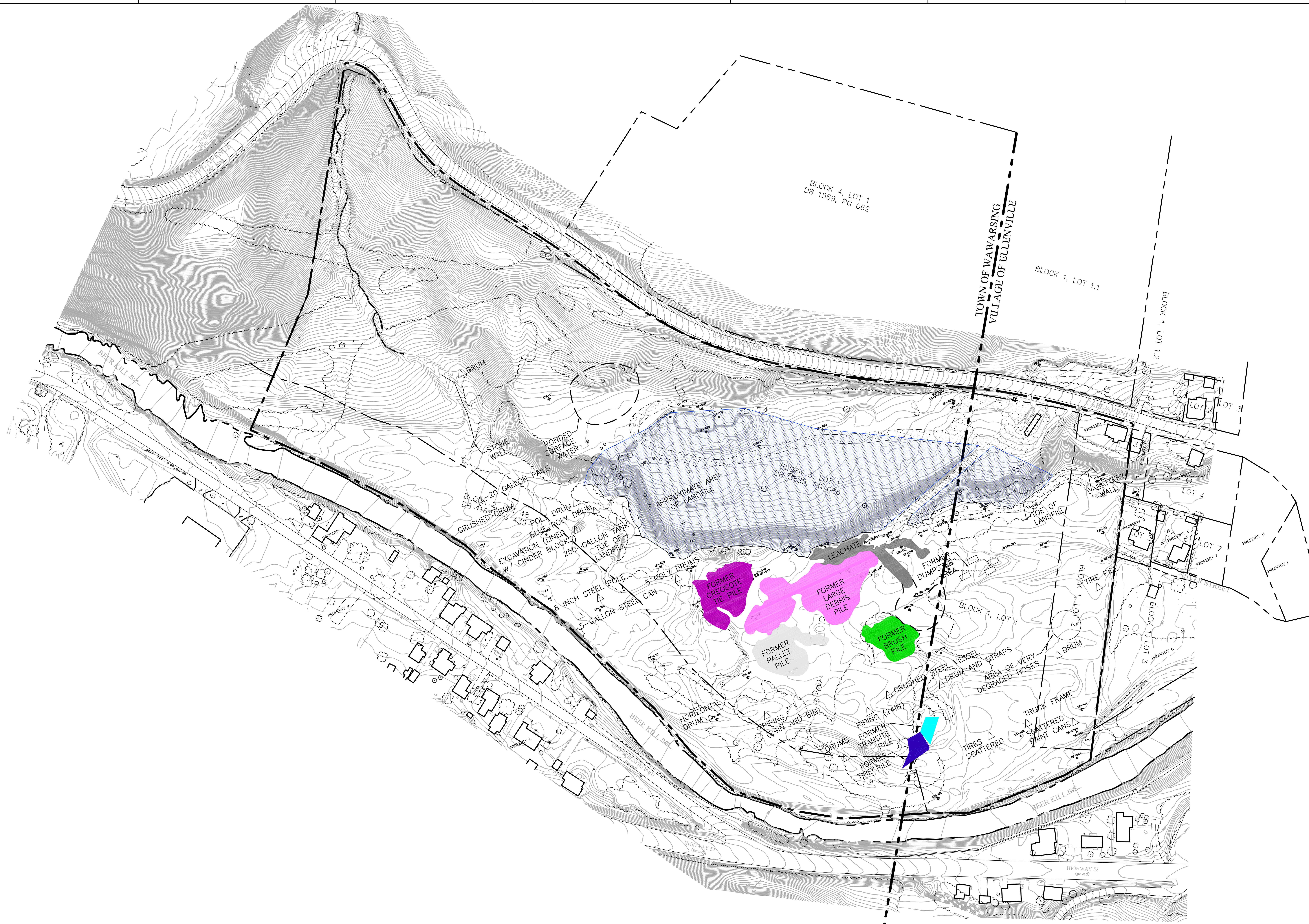
ORC	Oxygen Releasing Compound
OSHA	Occupational Health and Safety Administration
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PERC	tetrachloroethene
POTW	Publicly Owned Treatment Works
PSA	Preliminary Site Assessment
PVC	Polyvinyl Chloride
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
REAC	Response, Engineering, Analytical Contract
RI	Remedial Investigation
ROD	Record of Decision
RSS	Residential Surface Soil
SCO	Soil Cleanup Objective
SCG	Standards Criteria and Guidance
SESCP	Soil Erosion and Sedimentation Control Plan
SG	Soil Gas
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
S/S	Solidification/Stabilization
SS	Surface Soil
START	Superfund Technical Assessment and Response Team
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWSD	surface water sediment
T	Transmissivity
TCLP	Toxic Characteristic Leaching Procedure
TOGS	Technical & Operational Guidance Series
TP	test pit
TSCA	Toxic Substance Control Act
UCHD	Ulster County Public Health Department
ug/l	micrograms per liter
ug/m^3	micrograms per cubic meter
UV	Ultraviolet
VOC	volatile organic compound
XRF	X-Ray Fluorescence

FIGURES



Source: United States Geological Survey Topographic Map

Site Location **Ellenville Scrap Iron and Metal Site (008-RICO-02LX)**	**Job No.**	**Date**	**Figure No.**
	114488	02/18/10	2-1



LEGEND:

- SITE BOUNDARY
- DEBRIS LOCATION
- EXISTING CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- FORMER LARGE DEBRIS PILE
- FORMER BRUSH PILE
- FORMER CREOSOTE TIE PILE
- FORMER PALLET PILE
- FORMER TRANSITE PILE
- FORMER TIRE PILE
- LEACHATE AREA
- DIRT ACCESS ROAD
- APPROXIMATE AREA OF LANDFILL REMEDIAL INVESTIGATION
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- SS-32W SURFACE SOIL SAMPLE COLLECTED BY WESTON (LOCATIONS ARE APPROXIMATE)
- DP-021 DIRECT PUSH LOCATION

NOTES:

1. AREAS OF CONCERN SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)-NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. In Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

SITE MAP

FILENAME	–
SCALE	1"=100'
SHEET	2-2

LEGEND:

- SITE BOUNDARY
- GPS DEBRIS LOCATION
- CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- INFERRED LIMIT OF SOLID WASTE
- DIRT ACCESS ROADS
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- RSS-05 RESIDENTIAL SURFACE SOIL SAMPLE
- SS-32 SURFACE SOIL SAMPLE COLLECTED BY TETRA TECH
- SS-32W SURFACE SOIL SAMPLE COLLECTED BY WESTON (LOCATIONS ARE APPROXIMATE)
- DP-021 DIRECT PUSH LOCATIONS
- HW-001 HYDROPUNCH GROUNDWATER SAMPLE LOCATIONS
- SWSD-03 SEDIMENT SAMPLE LOCATIONS
- LH-01 LEACHATE SAMPLE LOCATIONS
- TP-01C TEST PIT LOCATIONS
- AOC-1 – LANDFILL AREA
- AOC-1A – SOLID WASTE AREA
- AOC-1B – SHEAR/BALER AREA
- AOC-1C – COMPACTOR AREA
- AOC-1D – LEACHATE SEEP AREA
- AOC-2 – DEBRIS PILE AREA
- AOC-3 – DUMPSTER STAGING AREA
- AOC-4 – SCATTERED DEBRIS AREA
- AOC-5 – BATTERY DISPOSAL AREA
- AOC-6 – OFF-SITE RESIDENTIAL AREA

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

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VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

AREAS OF CONCERN

0 50 100 200
0 1" 2"

FILENAME	–
SCALE	1"=100'

SHEET
6-1

DP-029 (1-3ft)	12/4/07
Benzene	0.15
Ethylbenzene	2
Toluene	0.79
Total Xylenes	12.25
4,4'-DDT	0.019
Total PCBs	4.25
Arsenic	26.3
Cadmium	5.4
Chromium	49.9
Copper	200
Lead	3030
Mercury	0.21
Nickel	119
Silver	2.5
Zinc	320

DP-030 (7-9ft)	12/4/07
Total PCBs	0.332
Arsenic	19.2
Chromium	119
Lead	32.5
Manganese	3050

SS-001(1ft)	10/17/07
Benzo(a)anthracene	1.20
Benzo(a)pyrene	1.50
Benzo(b)fluoranthene	2.70
Benzo(k)fluoranthene	1.10
Chrysene	1.20
Indeno(1,2,3-cd)pyrene	0.67
Endrin	0.11
Total PCBs	3.80
Arsenic	19
Cadmium	14.1
Chromium	1570
Copper	825
Lead	1570
Mercury	1.6
Nickel	199
Silver	5.3
Zinc	2590

SS-002(1ft)	10/17/07
Benzo(a)anthracene	1.3
Benzo(a)pyrene	1.6
Benzo(b)fluoranthene	2.7
Benzo(k)fluoranthene	1.1
Chrysene	1.4
Indeno(1,2,3-cd)pyrene	0.79
Total PCBs	1
Cadmium	5.2
Chromium	138
Copper	427
Lead	700
Mercury	0.82
Nickel	128
Zinc	1010

DP-023 (6-8ft)	12/4/07
Chromium	10.6
Lead	14
Zinc	111

TP-09 (1-2ft)	11/7/2009
Acetone	0.079
4,4'-DDD	0.034
4,4'-DDT	0.021
Dieldrin	0.01
Total PCBs	0.58
Chromium	37.8
Copper	142
Lead	318
Nickel	32.4

SS-004(1ft)	10/17/07
Benzo(b)fluoranthene	1.5
Total PCBs	0.51
Cadmium	3.5
Chromium	100
Copper	323
Lead	617
Mercury	0.54
Nickel	104
Zinc	955

SS-046(1ft)	4/9/08
4,4'-DDE	0.0038
Dieldrin	0.0067
Total PCBs	0.16
Chromium	12.5
Lead	36.8

TP-03 (2-4ft)	11/5/2007
Acetone	0.095
Benzo(a)anthracene	33
Benzo(a)pyrene	30
Benzo(b)fluoranthene	30
Benzo(k)fluoranthene	27
Chrysene	33
Dibenzo(a,h)anthracene	4.4
Indeno(1,2,3-cd)pyrene	15
4,4'-DDD	0.061
4,4'-DDE	0.096
Dieldrin	0.045
Total PCBs	1.4
Chromium	43.4
Copper	198
Lead	681
Nickel	60.8

SS-005(1ft)	10/17/07
Benzo(b)fluoranthene	1.4
Total PCBs	0.5
Arsenic	15
Cadmium	5.2
Chromium	122
Copper	589
Lead	830
Mercury	0.48
Nickel	80.2
Zinc	1340

SS-006(1ft)	10/17/07
Benzo(a)anthracene	1.2
Benzo(a)pyrene	1.2
Benzo(b)fluoranthene	2.3
Chrysene	1.3
Total PCBs	1.2
Arsenic	15
Cadmium	6.5
Chromium	171
Copper	938
Lead	1600
Mercury	1.2
Nickel	104
Zinc	1730

SS21W	6/6/00
Total PCBs	1.64
4,4'-DDE	0.019
Dieldrin	0.024
Cadmium	16
Copper	929
Lead	1830
Mercury	0.62
Nickel	94.5
Zinc	720

SS20W	6/6/00
Total PCBs	1.61
4,4'-DDE	0.021
Dieldrin	0.022
Cadmium	18
Copper	4620
Lead	1010
Mercury	0.54
Nickel	66.3
Silver	35.8
Zinc	937

SS-047(1ft)	4/9/08
4,4'-DDE	0.028
Dieldrin	0.038
Total PCBs	1.93
Chromium	57.7
Copper	248
Lead	232
Mercury	0.49
Nickel	52.8
Zinc	323

DP-022	12/3/2007 (2-4ft)	12/3/2007 (13-15ft)
Methylene chloride	0.21	<0.011
Total Xylenes	3.67	<0.011
Total PCBs	0.15	<0.036
Chromium	14.1	12.8
Lead	113	4.1
Mercury	0.25	<0.12
Silver	2.3	2.3
Zinc	132	50.5

TP-10 (2-3ft)	11/7/2007
4,4'-DDD	0.051
4,4'-DDE	0.0066
4,4'-DDT	0.017
Aldrin	0.005
Dieldrin	0.0076
Cadmium	6.1
Chromium	41.3
Copper	758
Lead	1020
Nickel	45

SS-007(1ft)	10/17/07
Benzo(a)anthracene	2
Benzo(a)pyrene	2.1
Benzo(b)fluoranthene	3.4
Benzo(k)fluoranthene	1.2
Chrysene	2
Indeno(1,2,3-cd)pyrene	0.64
Total PCBs	7.6
Arsenic	19.7
Cadmium	17.1
Chromium	192
Copper	2460
Lead	2620
Mercury	0.41
Nickel	369
Silver	8.9
Zinc	3400

DP-028 (8-10ft)	12/4/07
Chromium	10.6
Lead	4

DP-027 (7-9ft)	12/4/07
Total PCBs	0.758
Chromium	15.6
Lead	49.4

DP-026 (0-1ft)	12/4/07
Acetone	0.07
Benzo(a)anthracene	2
Benzo(a)pyrene	2.2
Benzo(b)fluoranthene	1.9
Benzo(k)fluoranthene	2
Chrysene	2.3
Indeno(1,2,3-cd)pyrene	1.1
4,4'-DDD	0.055
4,4'-DDT	0.97
Aldrin	0.0056
delta-BHC	0.058
Endrin	0.015
Total PCBs	12.5
Cadmium	3.6
Chromium	186
Copper	260
Lead	536
Mercury	2.1
Nickel	92.6
Silver	6
Zinc	1490

TP-07 (1-2ft)	11/7/2007
4,4'-DDD	0.0033
4,4'-DDT	0.0048
Chromium	43.1
Copper	347
Lead	203
Nickel	36.3

DP-025 (4-6ft)	12/4/07
2-Butanone	0.15
Acetone	0.24
Benzene	0.22
Ethylbenzene	1.6
Toluene	3.8
Total Xylenes	9.6
Benzo(a)anthracene	3.3
Benzo(a)pyrene	2.9
Benzo(b)fluoranthene	3.1
Benzo(k)fluoranthene	2.4
Chrysene	3.9
Indeno(1,2,3-cd)pyrene	1.1
Phenol	0.98
4,4'-DDD	0.02
4,4'-DDT	0.052
beta-BHC	0.05
Endrin	0.017
Heptachlor	0.1
Total PCBs	20
Cadmium	4.7
Chromium	122
Copper	399
Lead	804
Mercury	1.9
Nickel	71.9
Selenium	16.4
Silver	5.9
Zinc	1580

SS-003(1ft)	10/17/07
Benzo(a)anthracene	1.1
Benzo(a)pyrene	1.2
Benzo(b)fluoranthene	2.2
Chrysene	1.1
Total PCBs	0.86
Cadmium	8.2
Chromium	124
Copper	517
Lead	1240
Mercury	0.87
Nickel	89.3
Zinc	1760

TP-06 (2-4ft)	11/6/2007
Acetone	0.062
Benzo(a)anthracene	45
Benzo(a)pyrene	43
Benzo(b)fluoranthene	38
Benzo(k)fluoranthene	36
Chrysene	47
Indeno(1,2,3-cd)pyrene	28
4,4'-DDD	0.12
4,4'-DDE	0.047
4,4'-DDT	0.029
Dieldrin	0.038
Chromium	28.9
Copper	1230
Lead	766

TP-05 (2-4ft)	11/6/2007
Benzo(a)anthracene	13
Benzo(a)pyrene	15
Benzo(b)fluoranthene	17
Benzo(k)fluoranthene	14
Chrysene	14
Dibenzo(a,h)anthracene	2.6
Indeno(1,2,3-cd)pyrene	8.5
4,4'-DDD	0.069
4,4'-DDE	0.037
4,4'-DDT	0.014
Dieldrin	0.018
Total PCBs	0.29
Barium	399
Chromium	38.4
Copper	126
Lead	699
Nickel	31.6
Silver	2.7

SS06W	6/5/00
Benzo(a)anthracene	11
Benzo(a)pyrene	10
Benzo(b)fluoranthene	9.3
Benzo(k)fluoranthene	7.7
Chrysene	11
Dibenzo(a,h)anthracene	2.1
Indeno(1,2,3-cd)pyrene	5.7
4,4'-DDD	0.01
4,4'-DDE	0.012
4,4'-DDT	0.021
Chromium	12100
Copper	7460
Lead	139
Nickel	481
Zinc	3080

DP-024 (15-17ft)	12/4/07
Chromium	6.4
Lead	10.1

SS07W	6/5/00
Benzo(a)anthracene	30
Benzo(a)pyrene	34
Benzo(b)fluoranthene	40
Benzo(k)fluoranthene	28
Chrysene	31
Dibenzo(a,h)anthracene	7.4
Indeno(1,2,3-cd)pyrene	20
4,4'-DDE	0.05
4,4'-DDT	0.094
Barium	491
Chromium	61.5
Copper	292
Lead	599
Mercury	0.79
Nickel	44
Zinc	893

TP-04 (4-6ft)	11/6/2007
Ethylbenzene	6.7
Toluene	1.2
4,4'-DDT	0.011
Dieldrin	0.016
Total PCBs	1.6
Arsenic	37.4
Cadmium	17
Chromium	1460
Copper	2290
Lead	3840
Manganese	3260
Nickel	573

SS12W	6/5/00
Benzo(a)anthracene	26
Benzo(a)pyrene	29
Benzo(b)fluoranthene	39
Benzo(k)fluoranthene	8.3
Chrysene	27
Dibenzo(a,h)anthracene	4.1
Indeno(1,2,3-cd)pyrene	10
4,4'-DDD	0.032
4,4'-DDE	0.017
Dieldrin	0.0094
alpha-BHC	0.14
Total PCBs	0.39
Barium	544
Chromium	57.5
Copper	308
Lead	541
Mercury	0.35
Nickel	44.1
Zinc	801

SS03W	6/5/00
Benzo(a)anthracene	17
Benzo(a)pyrene	17
Benzo(b)fluoranthene	19
Benzo(k)fluoranthene	13
Chrysene	18
Dibenzo(a,h)anthracene	3.3
Indeno(1,2,3-cd)pyrene	9.1
4,4'-DDE	0.022
Dieldrin	0.014
Total PCBs	0.66
Barium	386
Chromium	128
Copper	206
Lead	530
Mercury	0.56
Nickel	57.9
Zinc	828

TP-02 (2-4ft)	11/5/2007
Benzo(a)anthracene	50
Benzo(a)pyrene	43
Benzo(b)fluoranthene	41
Benzo(k)fluoranthene	38
Chrysene	48
Dibenzo(a,h)anthracene	6
Fluoranthene	110
Indeno(1,2,3-cd)pyrene	23
4,4'-DDD	0.071
4,4'-DDE	0.11
4,4'-DDT	0.066
Dibenzofuran	7.8
Dieldrin	0.067
Cadmium	2.8
Chromium	33.6
Copper	123
Lead	633
Nickel	50.3

SS01W	6/5/00
Benzo(a)anthracene	5.1
Benzo(a)pyrene	4.1
Benzo(b)fluoranthene	5.6
Benzo(k)fluoranthene	2.7
Chrysene	3.7
Dibenzo(a,h)anthracene	0.85
Indeno(1,2,3-cd)pyrene	2.1
4,4'-DDD	0.058
4,4'-DDE	0.022
Endrin	0.031
Total PCBs	0.42
Barium	400
Chromium	138
Lead	469
Mercury	0.71
Nickel	49.7
Zinc	944

TP-08 (4-6ft)	11/7/2007
Acetone	0.068
4,4'-DDE	0.2
4,4'-DDT	0.59
Aldrin	0.0062
Dieldrin	0.49
Endrin	0.5
Total PCBs	55
Arsenic	36.1
Barium	697
Cadmium	16.7
Chromium	184
Copper	4620
Lead	2080
Nickel	134

SS-018(1ft)	10/16/07	4/8/08
Acetone	0.47	0.023
Benzo(a)anthracene	3.7	6.9
Benzo(a)pyrene	3.8	6.6
Benzo(b)fluoranthene	5.9	7
Benzo(k)fluoranthene	1.8	7
Chrysene	4.2	6.6
Dibenzo(a,h)anthracene	0.14	1.4
Indeno(1,2,3-cd)pyrene	1.4	4.8
4,4'-DDD	<24	0.035
Dieldrin	<24	0.037
Total PCBs	0.74	2.1
Barium	184	457
Cadmium	4.2	4.3
Chromium	85.9	130
Copper	<341	308
Lead	<1740	714
Mercury	<0.26	1.9
Nickel	53.1	54
Zinc	832	1000

SS08W	6/5/00
Benzo(a)anthracene	14
Benzo(a)pyrene	15
Benzo(b)fluoranthene	13
Benzo(k)fluoranthene	13
Chrysene	2.3
Dibenzo(a,h)anthracene	7.6
Indeno(1,2,3-cd)pyrene	7.6
4,4'-DDE	0.022
Dieldrin	0.019
Total PCBs	0.68
Barium	675
Chromium	309
Copper	316
Lead	733
Mercury	1
Nickel	64.2
Zinc	1040

DP-019 (6-8ft)	11/16/07
4,4'-DDT	0.0054
Total PCBs	0.18
Chromium	14.4
Lead	12.1

SS11W	6/5/00
Benzo(a)anthracene	17
Benzo(a)pyrene	15
Benzo(b)fluoranthene	18
Benzo(k)fluoranthene	8.8
Chrysene	16
Dibenzo(a,h)anthracene	1.9
Indeno(1,2,3-cd)pyrene	6.1
4,4'-DDD	0.064
4,4'-DDE	0.027
Dieldrin	0.016
alpha-BHC	0.17
Total PCBs	0.34
Chromium	40.4
Copper	122
Lead	612
Mercury	0.62
Zinc	593

SS15W	6/5/00
Dieldrin	0.0095
Total PCBs	2.55
Chromium	44
Copper	124
Lead	359
Mercury	0.31
Nickel	40.5
Zinc	629

SS-008(1ft)	10/17/07
Total PCBs	2.4
Arsenic	13.1
Cadmium	8.6
Chromium	109
Copper	3220
Lead	2600
Mercury	0.49
Nickel	108
Zinc	2500

SS-009(1ft)	10/17/07
Benzo(a)anthracene	4.9
Benzo(a)pyrene	2.2
Benzo(b)fluoranthene	9.5
Benzo(k)fluoranthene	1.4
Chrysene	3
Indeno(1,2,3-cd)pyrene	0.65
Total PCBs	0.86
Arsenic	17.3
Barium	1790
Cadmium	18.6
Chromium	1850
Copper	2190
Lead	1840
Mercury	2.6
Nickel	180
Silver	6.4
Zinc	5080

TP-01(2-4ft)	11/5/2007
Acetone	0.1
Benzo(a)anthracene	2.9
Benzo(a)pyrene	2.7
Benzo(b)fluoranthene	3.1
Benzo(k)fluoranthene	2.5
Chrysene	2.9
Dibenzo(a,h)anthracene	0.48
Indeno(1,2,3-cd)pyrene	1.6
4,4'-DDD	0.16
4,4'-DDE	0.028
4,4'-DDT	0.066
Dieldrin	0.066
Endrin	0.024
Cadmium	6.4
Chromium	97.6
Copper	652
Lead	2810
Nickel	162

SS-012(1ft)	10/25/07
Endrin	0.039
Total PCBs	0.4
Cadmium	5.5
Chromium	14.7
Copper	244
Lead	2480
Mercury	0.41
Zinc	1080

SS-010(1ft)	10/17/07
Acetone	0.075
Benzo(a)anthracene	12
Benzo(a)pyrene	14
Benzo(b)fluoranthene	21
Benzo(k)fluoranthene	7.3
Chrysene	11
Dibenzo(a,h)anthracene	0.51
Indeno(1,2,3-cd)pyrene	5.5
Total PCBs	0.73
Cadmium	4.9
Chromium	308
Copper	744
Lead	853
Mercury	1
Nickel	125
Zinc	1360

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives

Contaminant	(mg/kg)
1,1,1-Trichloroethane	0.68
1,2-Dichlorobenzene	1.1
1,3-Dichlorobenzene	2.4
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1
Acetone	0.05
Benzene	0.06
Carbon tetrachloride	0.76
Chlorobenzene	1.1
Ethylbenzene	1
Tetrachloroethene	1.3
Toluene	0.7
Trichloroethene	0.47
Acenaphthene	20
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	0.8
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	0.33
Pyrene	100
4,4'-DDD	0.0033
4,4'-DDE	0.0033
4,4'-DDT	0.0033
Endosulfan sulfate	2.4
Aldrin	0.005
Dieldrin	0.005
Endrin	0.014
Endosulfan I	2.4
alpha-Chlordane	0.094
beta-BHC	0.036
Endosulfan II	2.4
delta-BHC	0.04
Total PCBs	0.1
Arsenic	13
Barium	350
Beryllium	7.2
Cadmium	2.5
Chromium	30
Copper	50
Cyanide	27
Lead	63
Manganese	1600
Mercury	0.18
Nickel	30
Selenium	3.9
Silver	2
Zinc	109

Table 375-6.8(b):Restricted Use Soil Cleanup Objectives

Contaminant	(mg/kg)
1,1,1-Trichloroethane	100
1,2-Dichlorobenzene	100
1,3-Dichlorobenzene	17
1,4-Dichlorobenzene	9.8
1,4-Dioxane	9.8
Acetone	100
Benzene	2.9
Carbon tetrachloride	1.4
Chlorobenzene	100
Ethylbenzene	30
Tetrachloroethene	5.5
Toluene	100
Trichloroethene	10
Acenaphthene	100
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	1
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	100
Pyrene	100
4,4'-DDD	2.6
4,4'-DDE	1.8
4,4'-DDT	1.7
Aldrin	0.019
beta-BHC	0.072
Chlordane (alpha)	0.91
delta-BHC	100
Dieldrin	0.039
Endosulfan I	4.8
Endosulfan II	4.8
Endosulfan sulfate	4.8
Endrin	2.2
Total PCBs	1
Arsenic	16
Barium	350
Beryllium	14
Cadmium	2.5
Chromium	36
Copper	270
Cyanide	27
Lead	400
Manganese	2000
Mercury	0.81
Nickel	140
Selenium	36
Silver	36
Zinc	2200

LEGEND:

- SITE BOUNDARY
- GPS DEBRIS LOCATION
- CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- INFERRED LIMIT OF SOLID WASTE
- DIRT ACCESS ROADS
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- RSS-05 RESIDENTIAL SURFACE SOIL SAMPLE
- SS-32 SURFACE SOIL SAMPLE COLLECTED BY TETRA TECH
- SS-32W SURFACE SOIL SAMPLE COLLECTED BY WESTON (LOCATIONS ARE APPROXIMATE)
- DP-021 DIRECT PUSH LOCATIONS
- HW-001 HYDROPUNCH GROUNDWATER SAMPLE LOCATIONS
- SWSD-03 SEDIMENT SAMPLE LOCATIONS
- LH-01 LEACHATE SAMPLE LOCATIONS
- TP-01C TEST PIT LOCATIONS
- APPROXIMATE LIMITS OF TEST PIT
- AOC-1 – LANDFILL AREA
- AOC-1A – SOLID WASTE AREA
- AOC-1B – SHEAR/BALER AREA
- AOC-1C – COMPACTOR AREA
- AOC-1D – LEACHATE SEEP AREA

SAMPLE IDENTIFICATION
SAMPLE DEPTH
SAMPLE DATE

TP-03 (2-4ft)	11/5/2007
Acetone	0.095
Benzo(a)anthracene	33
Benzo(a)pyrene	30
Benzo(b)fluoranthene	30
Benzo(k)fluoranthene	27
Chrysene	33
Dibenzo(a,h)anthracene	4.4
Indeno(1,2,3-cd)pyrene	15
4,4'-DDD	0.061
4,4'-DDE	0.096
Dieldrin	0.045
Total PCBs	1.4
Chromium	43.4
Copper	198
Lead	681
Nickel	60.8

SVOC (CONCENTRATIONS GREATER THAN RESIDENTIAL RESTRICTED USE SITE CLEANUP OBJECTIVES)
PEST
PCB
METALS
ANALYTICAL RESULT (mg/kg)
ANALYTICAL PARAMETER

*COLOR INDICATES EXCEEDANCE OF RESTRICTED USE.
*BOLD AND UNDERLINED INDICATES CONCENTRATION GREATER THAN UNRESTRICTED USE CRITERIA.

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)-NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. in Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

A0C-1 - LANDFILL AREA SUMMARY OF SOIL ANALYTICAL RESULTS

0 25 50 100
0 1" 2"

FILENAME –
SCALE 1"=50'
SHEET 6-2

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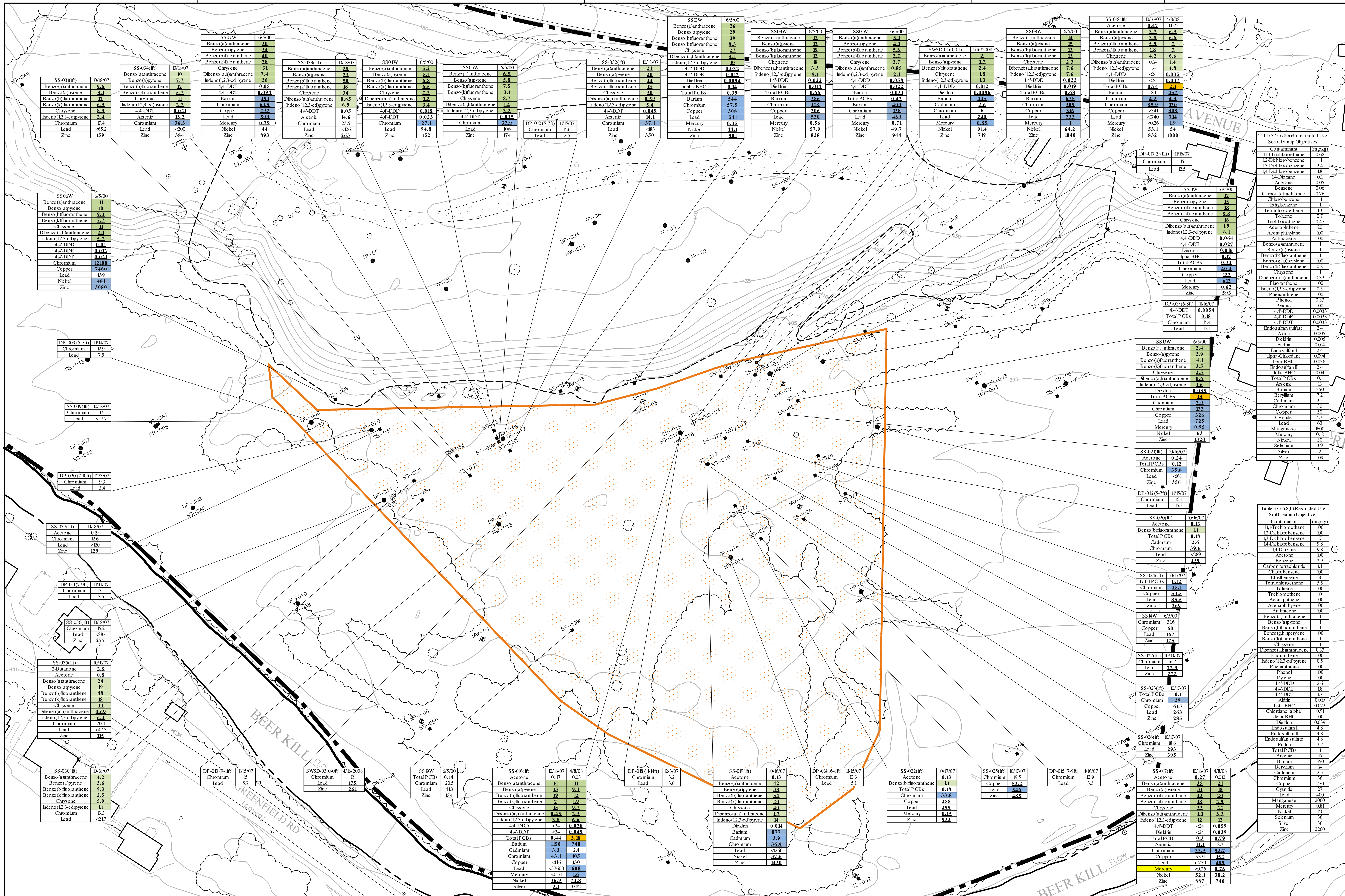

LEGEND:

- SITE BOUNDARY
- GPS DEBRIS LOCATION
- CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- INFERRED LIMIT OF SOLID WASTE
- DIRT ACCESS ROADS
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- RSS-05 RESIDENTIAL SURFACE SOIL SAMPLE
- SS-32 SURFACE SOIL SAMPLE COLLECTED BY TETRA TECH
- SS-32W SURFACE SOIL SAMPLE COLLECTED BY WESTON (LOCATIONS ARE APPROXIMATE)
- DP-021 DIRECT PUSH LOCATIONS
- HW-001 HYDROPUNCH GROUNDWATER SAMPLE LOCATIONS
- SWSD-03 SEDIMENT SAMPLE LOCATIONS
- LH-01 LEACHATE SAMPLE LOCATIONS
- TP-01C TEST PIT LOCATIONS
- AOC-2 – DEBRIS PILE AREA

SAMPLE IDENTIFICATION / SAMPLE DEPTH / SAMPLE DATE

TP-03 (2-4ft)	1/5/2007
Acetone	0.095
Benzo(a)anthracene	33
Benzo(a)pyrene	30
Benzo(b)fluoranthene	30
Benzo(k)fluoranthene	27
Chrysene	33
Dibenzo(a,h)anthracene	4.4
Indeno(1,2,3-cd)pyrene	15
4,4'-DDD	0.061
4,4'-DDE	0.096
Dieldrin	0.045
Total PCBs	1.4
Chromium	43.4
Copper	198
Lead	681
Nickel	60.8

SVOC (CONCENTRATIONS GREATER THAN RESIDENTIAL RESTRICTED USE SITE CLEANUP OBJECTIVES)
PEST
PCB
METALS
ANALYTICAL RESULT (mg/kg)
ANALYTICAL PARAMETER

*COLOR INDICATES EXCEEDANCE OF RESTRICTED USE.
*BOLD AND UNDERLINED INDICATES CONCENTRATION GREATER THAN UNRESTRICTED USE CRITERIA.

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. in Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
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LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

AOC-2 - DEBRIS PILE AREA SUMMARY OF SOIL ANALYTICAL RESULTS

0 25 50 100
1" 2"

FILENAME –
SCALE 1"=50'
SHEET 6-3

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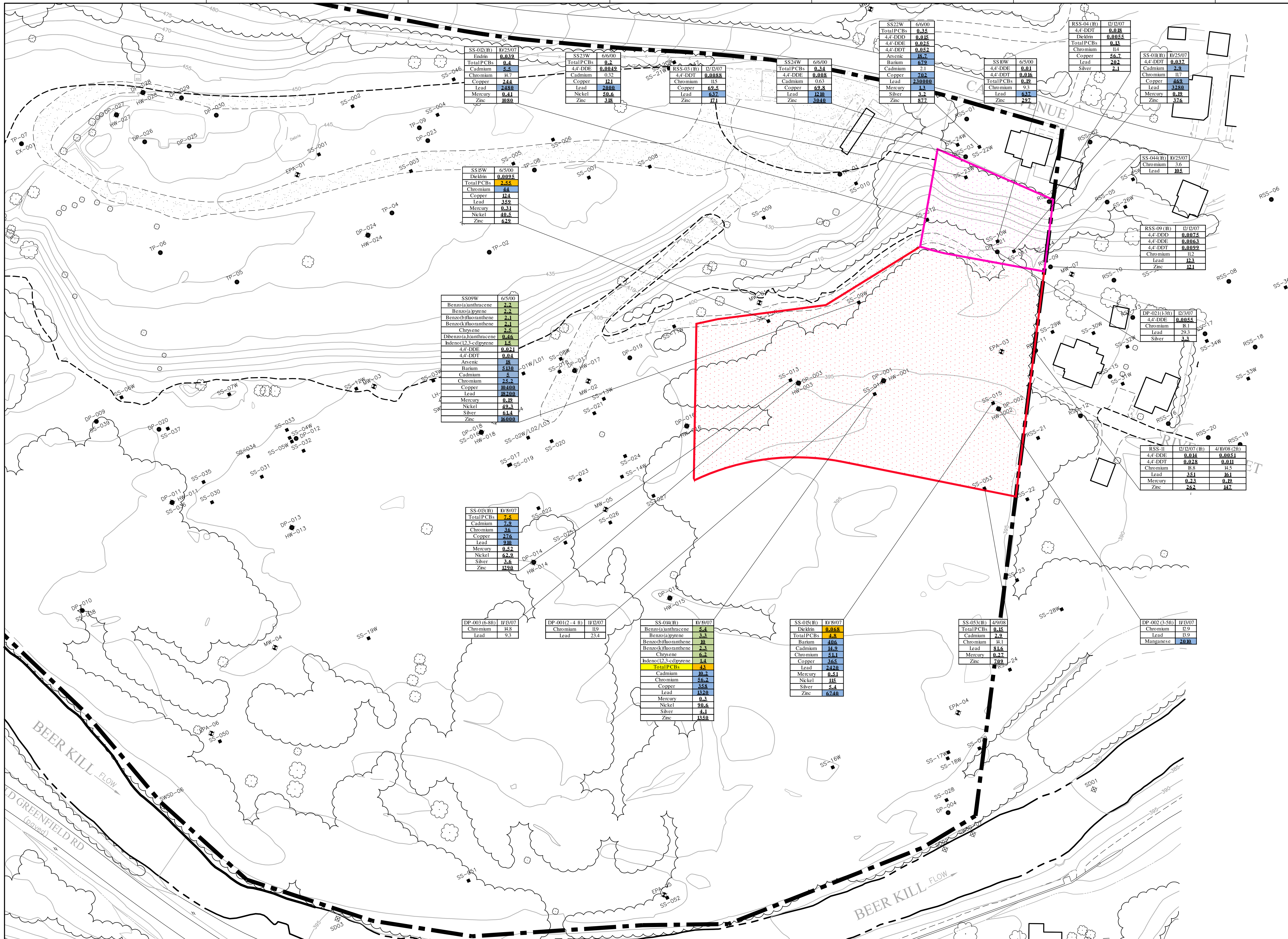

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives	
Contaminant	(mg/kg)
1,1,1-Trichloroethane	0.68
1,2-Dichlorobenzene	1.1
1,3-Dichlorobenzene	2.4
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1
Acetone	0.05
Benzene	0.06
Carbon tetrachloride	0.76
Chlorobenzene	1.1
Ethylbenzene	1
Tetrachloroethene	1.3
Toluene	0.7
Trichloroethene	0.47
Acenaphthene	20
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	0.8
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	0.33
Pyrene	100
4,4'-DDD	0.0033
4,4'-DDE	0.0033
4,4'-DDT	0.0033
Endosulfan sulfate	2.4
Aldrin	0.005
Dieldrin	0.005
Endrin	0.014
Endosulfan I	2.4
alpha-Chlordane	0.094
beta-BHC	0.036
Endosulfan II	2.4
delta-BHC	0.04
Total PCBs	0.1
Arsenic	13
Barium	350
Beryllium	7.2
Cadmium	2.5
Chromium	30
Copper	50
Cyanide	27
Lead	63
Manganese	1600
Mercury	0.18
Nickel	30
Selenium	3.9
Silver	2
Zinc	109

Table 375-6.8(b):Restricted Use Soil Cleanup Objectives	
Contaminant	(mg/kg)
1,1,1-Trichloroethane	100
1,2-Dichlorobenzene	100
1,3-Dichlorobenzene	17
1,4-Dichlorobenzene	9.8
1,4-Dioxane	9.8
Acetone	100
Benzene	2.9
Carbon tetrachloride	1.4
Chlorobenzene	100
Ethylbenzene	30
Tetrachloroethene	5.5
Toluene	100
Trichloroethene	10
Acenaphthene	100
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	1
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	100
Pyrene	100
4,4'-DDD	2.6
4,4'-DDE	1.8
4,4'-DDT	1.7
Aldrin	0.019
beta-BHC	0.072
Chlordane (alpha)	0.91
delta-BHC	100
Dieldrin	0.039
Endosulfan I	4.8
Endosulfan II	4.8
Endosulfan sulfate	4.8
Endrin	2.2
Total PCBs	1
Arsenic	16
Barium	350
Beryllium	14
Cadmium	2.5
Chromium	36
Copper	270
Cyanide	27
Lead	400
Manganese	2000
Mercury	0.81
Nickel	140
Selenium	36
Silver	36
Zinc	2200

LEGEND:

- SITE BOUNDARY
- GPS DEBRIS LOCATION
- CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- INFERRED LIMIT OF SOLID WASTE
- DIRT ACCESS ROADS
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- RSS-05 RESIDENTIAL SURFACE SOIL SAMPLE
- SS-32 SURFACE SOIL SAMPLE COLLECTED BY TETRA TECH
- SS-32W SURFACE SOIL SAMPLE COLLECTED BY WESTON (LOCATIONS ARE APPROXIMATE)
- DP-021 DIRECT PUSH LOCATIONS
- HW-001 HYDROPUNCH GROUNDWATER SAMPLE LOCATIONS
- SWSD-03 SEDIMENT SAMPLE LOCATIONS
- LH-01 LEACHATE SAMPLE LOCATIONS
- TP-01C TEST PIT LOCATIONS
- AOC-3 – DUMPSTER STAGING AREA
- AOC-5 – BATTERY DISPOSAL AREA

SAMPLE IDENTIFICATION
SAMPLE DEPTH
SAMPLE DATE

TP-03 (2-4ft)	11/5/2007
Acetone	0.095
Benzo(a)anthracene	3.3
Benzo(a)pyrene	3.0
Benzo(b)fluoranthene	3.0
Benzo(k)fluoranthene	2.2
Chrysene	3.3
Dibenzo(a,h)anthracene	4.4
Indeno(1,2,3-cd)pyrene	15
4,4'-DDD	0.061
4,4'-DDE	0.096
Dieldrin	0.045
Total PCBs	1.4
Chromium	43.4
Copper	298
Lead	601
Nickel	60.8

SVOC (CONCENTRATIONS GREATER THAN RESIDENTIAL RESTRICTED USE SITE CLEANUP OBJECTIVES)
PEST
PCB
METALS
ANALYTICAL RESULT (mg/kg)
ANALYTICAL PARAMETER

*COLOR INDICATES EXCEEDANCE OF RESTRICTED USE.
*BOLD AND UNDERLINED INDICATES CONCENTRATION GREATER THAN UNRESTRICTED USE CRITERIA.

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR
Henningson, Durham & Richardson, Architecture and Engineering, P.C. in Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

AOC-3 - DUMPSTER STAGING AREA AND AOC-5 - BATTERY DISPOSAL AREA SUMMARY OF SOIL ANALYTICAL RESULTS

0 25 50 100
0 1" 2"
FILENAME –
SCALE 1"=50'
SHEET 6-4

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SS-049(1ft)	4/17/08
Chromium	9.2
Lead	56.1

SWSD-02(0-0ft)	4/15/2008
Lead	51.9

SS-048(1ft)	4/9/08
Chromium	16.8
Lead	62.7

SS-045(1ft)	4/9/08
Chromium	10.7
Lead	13.8

SWSD-01(0-0ft)	4/15/2008
Lead	**175**
Mercury	**0.27**
Zinc	**248**

SS-041(1ft)	10/19/07
Chromium	7.5
Lead	**76.6**

DP-006 (5-7ft)	11/14/07
Chromium	12.7
Lead	4.1

SS-039(1ft)	10/18/07
Chromium	17
Lead	<57.7

DP-009 (5-7ft)	11/14/07
Chromium	12.9
Lead	7.5

DP-005 (5-7ft)	11/14/07
Chromium	12.9
Lead	3.8

SS-043(1ft)	10/19/07
Chromium	8.3
Lead	**86.7**
Manganese	**1640**

DP-007 (5-7ft)	11/14/07
Chromium	12.6
Lead	7.5

SS-042(1ft)	10/19/07
Chromium	7.1
Lead	**343**

DP-008 (7-9ft)	11/14/07
Total PCBs	**0.3**
Chromium	12.2
Lead	4.2

SS-040(1ft)	10/18/07
Chromium	10.4
Lead	<14.7

SS-053(1ft)	4/9/08
Total PCBs	**0.15**
Cadmium	**2.9**
Chromium	14.1
Lead	**81.6**
Mercury	**0.27**
Zinc	**709**

SS 17W	6/5/00
4,4'-DDT	**0.005**
Chromium	11.0
Lead	36.3

SS-029(1ft)	10/19/07
Chromium	8.8
Lead	**66**
Zinc	**110**

SS 18W	6/5/00
4,4'-DDT	**0.0039**
Chromium	10.7
Lead	38.6
Zinc	**635**

DP-010 (5-7ft)	11/14/07
Chromium	16.9
Lead	4

SS-038(1ft)	10/18/07
Chromium	18.4
Lead	<51.5
Zinc	**127**

SS-036(1ft)	10/18/07
Chromium	15.2
Lead	<88.4
Zinc	**277**

DP-011 (7-9ft)	11/14/07
Chromium	13.1
Lead	3.5

SS-050(1ft)	4/9/08
Chromium	12.2
Lead	30.9

SS-051(1ft)	4/9/08
Chromium	9.9
Lead	20.8

SS-052(1ft)	4/9/08
4,4'-DDE	**0.0085**
4,4'-DDT	**0.0075**
Cadmium	**3.5**
Chromium	13.3
Copper	**853**
Lead	**981**
Zinc	**1910**

SS 16W	6/5/00
Benzo(a)anthracene	**1.3**
Benzo(a)pyrene	**1.7**
Benzo(b)fluoranthene	**2**
Benzo(k)fluoranthene	**1.1**
Chrysene	**1.8**
Dibenzo(a,h)anthracene	**1.4**
Indeno(1,2,3-cd)pyrene	**0.88**
4,4'-DDD	**0.01**
4,4'-DDE	**0.043**
4,4'-DDT	**0.23**
Cadmium	**2.6**
Chromium	6.8
Copper	**160**
Lead	**14600**
Zinc	**564**

DP-004 (2-4ft)	11/14/07
Chromium	11.7
Lead	10.9

SS-028(1ft)	10/19/07
Chromium	7
Lead	53.5

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives	
Contaminant	(mg/kg)
1,1,1-Trichloroethane	0.68
1,2-Dichlorobenzene	1.1
1,3-Dichlorobenzene	2.4
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1
Acetone	0.05
Benzene	0.06
Carbon tetrachloride	0.76
Chlorobenzene	1.1
Ethylbenzene	1
Tetrachloroethene	1.3
Toluene	0.7
Trichloroethene	0.47
Acenaphthene	20
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	0.8
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	0.33
Pyrene	100
4,4'-DDD	0.0033
4,4'-DDE	0.0033
4,4'-DDT	0.0033
Endosulfan sulfate	2.4
Aldrin	0.005
Dieldrin	0.005
Endrin	0.014
Endosulfan I	2.4
alpha-Chlordane	0.094
beta-BHC	0.036
Endosulfan II	2.4
delta-BHC	0.04
Total PCBs	0.1
Arsenic	13
Barium	350
Beryllium	7.2
Cadmium	2.5
Chromium	30
Copper	50
Cyanide	27
Lead	63
Manganese	1600
Mercury	0.18
Nickel	30
Selenium	3.9
Silver	2
Zinc	109

Table 375-6.8(b):Restricted Use Soil Cleanup Objectives	
Contaminant	(mg/kg)
1,1,1-Trichloroethane	100
1,2-Dichlorobenzene	100
1,3-Dichlorobenzene	17
1,4-Dichlorobenzene	9.8
1,4-Dioxane	9.8
Acetone	100
Benzene	2.9
Carbon tetrachloride	1.4
Chlorobenzene	100
Ethylbenzene	30
Tetrachloroethene	5.5
Toluene	100
Trichloroethene	10
Acenaphthene	100
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	1
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	100
Pyrene	100
4,4'-DDD	2.6
4,4'-DDE	1.8
4,4'-DDT	1.7
Aldrin	0.019
beta-BHC	0.072
Chlordane (alpha)	0.91
delta-BHC	100
Dieldrin	0.039
Endosulfan I	4.8
Endosulfan II	4.8
Endosulfan sulfate	4.8
Endrin	2.2
Total PCBs	1
Arsenic	16
Barium	350
Beryllium	14
Cadmium	2.5
Chromium	36
Copper	270
Cyanide	27
Lead	400
Manganese	2000
Mercury	0.81
Nickel	140
Selenium	36
Silver	36
Zinc	2200

LEGEND:

- SITE BOUNDARY
- GPS DEBRIS LOCATION
- CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- INFERRED LIMIT OF SOLID WASTE
- DIRT ACCESS ROADS
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- RSS-05 RESIDENTIAL SURFACE SOIL SAMPLE
- SS-32 SURFACE SOIL SAMPLE COLLECTED BY TETRA TECH
- SS-32W SURFACE SOIL SAMPLE COLLECTED BY WESTON (LOCATIONS ARE APPROXIMATE)
- DP-021 DIRECT PUSH LOCATIONS
- HW-001 HYDROPUNCH GROUNDWATER SAMPLE LOCATIONS
- SWSD-03 SEDIMENT SAMPLE LOCATIONS
- LH-01 LEACHATE SAMPLE LOCATIONS
- TP-01C TEST PIT LOCATIONS
- AOC-4 – SCATTERED DEBRIS AREA

SAMPLE IDENTIFICATION
SAMPLE DEPTH
SAMPLE DATE

TP-03 (2-4ft)	11/5/2007	
Acetone	**0.095**	
Benzo(a)anthracene	**33**	SVOC
Benzo(a)pyrene	**30**	SVOC
Benzo(b)fluoranthene	**30**	SVOC
Benzo(k)fluoranthene	**27**	SVOC
Chrysene	**33**	SVOC
Dibenzo(a,h)anthracene	**4.4**	SVOC
Indeno(1,2,3-cd)pyrene	**15**	SVOC
4,4'-DDD	**0.061**	PEST
4,4'-DDE	**0.096**	PEST
Dieldrin	**0.045**	PEST
Total PCBs	**1.4**	PCB
Chromium	**43.4**	METALS
Copper	**198**	METALS
Lead	**601**	METALS
Nickel	**60.8**	ANALYTICAL RESULT (mg/kg)

ANALYTICAL PARAMETER

(CONCENTRATIONS GREATER THAN RESIDENTIAL RESTRICTED USE SITE CLEANUP OBJECTIVES)

*COLOR INDICATES EXCEEDANCE OF RESTRICTED USE.
*BOLD AND UNDERLINED INDICATES CONCENTRATION GREATER THAN UNRESTRICTED USE CRITERIA.

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. in Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

AOC-4 - SCATTERED DEBRIS AREA SUMMARY OF SOIL ANALYTICAL RESULTS

0 50 100 200
0 1" 2"

FILENAME –
SCALE 1"=100'

SHEET 6-5

SS23W	6/6/00
Total PCBs	**0.2**
4,4'-DDE	**0.0049**
Cadmium	0.32
Copper	**121**
Lead	**2000**
Nickel	**50.6**
Zinc	**318**

RSS-03 (1ft)	12/12/07
4,4'-DDT	**0.0088**
Chromium	11.5
Copper	**69.5**
Lead	**637**
Zinc	**171**

SS24W	6/6/00
Total PCBs	**0.34**
4,4'-DDE	**0.008**
Cadmium	0.63
Copper	**69.8**
Lead	**1210**
Zinc	**3040**

RSS-01 (1ft)	12/12/07
Chromium	11
Lead	**1510**

SS22W	6/6/00
Total PCBs	**0.35**
4,4'-DDD	**0.015**
4,4'-DDE	**0.025**
4,4'-DDT	**0.052**
Arsenic	**18.7**
Barium	**679**
Cadmium	2.1
Copper	**702**
Lead	**230000**
Mercury	**1.3**
Silver	**3.2**
Zinc	**877**

RSS-04 (1ft)	12/12/07
4,4'-DDE	**0.018**
4,4'-DDT	**0.0055**
Dieldrin	**0.13**
Chromium	11.4
Copper	**56.7**
Lead	**202**
Silver	**2.1**

RSS-02	12/5/2007 (0-1ft)	4/10/2008 (1-2ft)
4,4'-DDD	<0.0037	0.0017
4,4'-DDE	**0.0061**	**0.0082**
4,4'-DDT	**0.067**	**0.085**
Total PCBs	R	**1.04**
Copper	**181**	**76.2**
Lead	**8970**	**559**
Silver	**2**	<1.1
Zinc	**327**	**576**

SS25W	6/6/00
4,4'-DDD	**0.0079**
4,4'-DDE	**0.38**
4,4'-DDT	**0.47**
Cadmium	<0.08
Lead	**63.6**

RSS-05	12/13/07 (1ft)	4/10/08 (2ft)
4,4'-DDD	**0.0049**	<0.0039
4,4'-DDT	**0.0045**	**0.0043**
Chromium	11.2	11.2
Lead	**260**	**130**
Zinc	**128**	**91.8**

SS26W	6/6/00
Total PCBs	**0.38**
4,4'-DDE	**0.013**
4,4'-DDT	**0.027 R**
Dieldrin	**0.0054**
Cadmium	<0.1
Copper	**90**
Lead	**246**
Zinc	**243**

RSS-07 (1ft)	12/13/07
Chromium	9
Lead	59.9

RSS-06 (1ft)	12/13/07
Chromium	8.9
Lead	58.6

RSS-08 (1ft)	12/12/07
Chromium	6.2
Lead	17.4

SS36W	6/6/00
Cadmium	<0.08
Lead	50.2

SS37W	6/6/00
Cadmium	<0.08
Lead	**104**
4,4'-DDE	**0.02**
4,4'-DDT	**0.02**

SS39W	6/6/00
Cadmium	<0.08
Lead	**121**
Zinc	**124**
4,4'-DDT	**0.0044**

SS35W	6/6/00
Cadmium	<0.09
Lead	**74.1**
Zinc	**164**
4,4'-DDE	**0.0039**

SS38W	6/6/00
Cadmium	<0.07
Lead	**136**
4,4'-DDE	**0.0071**
4,4'-DDT	**0.0046**

RSS-18	12/11/07 (1ft)	4/10/08 (2ft)
Benzo(b)fluoranthene	**1.3**	<0.02
4,4'-DDT	**0.0072**	**0.0033**
Chromium	9.7	NA
Lead	**5280**	NA
Mercury	**0.33**	NA
Zinc	**148**	NA

SS33W	6/6/00
Cadmium	<0.08
Lead	**133**
Zinc	**126**

RSS-17 (1ft)	12/11/07
Chromium	9.6
Lead	**200**
Mercury	**0.4**
Zinc	**128**

SS34W	6/6/00
4,4'-DDE	**0.0042**
4,4'-DDT	**0.0049**
Cadmium	<0.09
Lead	**386**
Mercury	**0.91**
Zinc	**215**

RSS-19 (1ft)	12/11/07
Chromium	8.5
Lead	**64.7**
Mercury	**0.24**

RSS-14 (1ft)	12/11/07
4,4'-DDT	**0.0039**
Chromium	11.8
Lead	**528**
Mercury	**0.3**
Zinc	**294**

RSS-10 (1ft)	12/12/07
Chromium	8.1
Lead	34.2

SS-044(1ft)	10/25/07
Chromium	3.6
Lead	**105**

RSS-09 (1ft)	12/12/07
4,4'-DDD	**0.0075**
4,4'-DDE	**0.0063**
4,4'-DDT	**0.0099**
Chromium	11.2
Lead	**123**
Zinc	**121**

RSS-13	12/11/07 (1ft)	4/10/08 (2ft)
4,4'-DDT	**0.0062**	**0.0032**
Chromium	11.1	11.5
Lead	**1010**	**373**
Mercury	**0.26**	**0.41**
Zinc	**410**	**302**

SS30W	6/6/00
4,4'-DDE	**0.0063**
4,4'-DDT	**0.0076**
Cadmium	<0.08
Lead	**202**
Mercury	**0.27**
Zinc	**222**

SS29W	6/6/00
Cadmium	<0.07
Lead	53.8

RSS-11	12/12/07 (1ft)	4/10/08 (2ft)
4,4'-DDE	**0.014**	**0.0051**
4,4'-DDT	**0.028**	**0.011**
Chromium	18.8	14.5
Lead	**351**	**161**
Mercury	**0.23**	**0.19**
Zinc	**262**	**147**

RSS-15 (1ft)	12/11/07
Chromium	8.8
Copper	**751**
Lead	**291**
Mercury	**0.4**
Silver	**2.9**
Zinc	**133**

RSS-12 (1ft)	12/12/07
Chromium	19.3
Lead	**248**
Zinc	**138**

RSS-21(1ft)	4/18/08
Chromium	10.8
Lead	**75.8**

RSS-22 (1ft)	4/18/08
Chromium	8.6
Lead	32.9

RSS-23 (1ft)	4/18/08
Chromium	9.5
Lead	**113**
Zinc	**167**

SS28W	6/6/00
4,4'-DDE	**0.0097**
4,4'-DDT	**0.031**
Cadmium	**13.8**
Lead	**1080**
Zinc	**4090**

RSS-24 (1ft)	4/18/08
Chromium	8.6
Lead	34.1

SS-029(1ft)	10/19/07
Chromium	8.8
Lead	**66**
Zinc	**110**

SS31W	6/6/00
Cadmium	0.39
Lead	**11100**
Zinc	**2550**

SS32W	6/6/00
4,4'-DDE	**0.033**
4,4'-DDT	**0.027**
Arsenic	**20.3**
Cadmium	<0.08
Lead	**316**
Zinc	**385**

RSS-16 (1ft)	12/11/07
Chromium	6.2
Lead	**50.2**

RSS-20 (1ft)	12/11/07
Chromium	8.1
Lead	**86.1**
Mercury	**0.45**

Table 375-6.8(a) Unrestricted Use Soil Cleanup Objectives

Contaminant	(mg/kg)
1,1,1-Trichloroethane	0.68
1,2-Dichlorobenzene	1.1
1,3-Dichlorobenzene	2.4
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1
Acetone	0.05
Benzene	0.06
Carbon tetrachloride	0.76
Chlorobenzene	1.1
Ethylbenzene	1
Tetrachloroethene	1.3
Toluene	0.7
Trichloroethene	0.47
Acenaphthene	20
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	0.8
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	0.33
Pyrene	100
4,4'-DDD	0.0033
4,4'-DDE	0.0033
4,4'-DDT	0.0033
Endosulfan sulfate	2.4
Aldrin	0.005
Dieldrin	0.005
Endrin	0.014
Endosulfan I	2.4
alpha-Chlordane	0.094
beta-BHC	0.036
Endosulfan II	2.4
delta-BHC	0.04
Total PCBs	0.1
Arsenic	13
Barium	350
Beryllium	7.2
Cadmium	2.5
Chromium	30
Copper	50
Cyanide	27
Lead	63
Manganese	1600
Mercury	0.18
Nickel	30
Selenium	3.9
Silver	2
Zinc	109

Table 375-6.8(b) Restricted Use Soil Cleanup Objectives

Contaminant	(mg/kg)
1,1,1-Trichloroethane	100
1,2-Dichlorobenzene	100
1,3-Dichlorobenzene	17
1,4-Dichlorobenzene	9.8
1,4-Dioxane	9.8
Acetone	100
Benzene	2.9
Carbon tetrachloride	1.4
Chlorobenzene	100
Ethylbenzene	30
Tetrachloroethene	5.5
Toluene	100
Trichloroethene	10
Acenaphthene	100
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	1
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Indeno(1,2,3-cd)pyrene	0.5
Phenanthrene	100
Phenol	100
Pyrene	100
4,4'-DDD	2.6
4,4'-DDE	1.8
4,4'-DDT	1.7
Aldrin	0.019
beta-BHC	0.072
Chlordane (alpha)	0.91
delta-BHC	100
Dieldrin	0.039
Endosulfan I	4.8
Endosulfan II	4.8
Endosulfan sulfate	4.8
Endrin	2.2
Total PCBs	1
Arsenic	16
Barium	350
Beryllium	14
Cadmium	2.5
Chromium	36
Copper	270
Cyanide	27
Lead	400
Manganese	2000
Mercury	0.81
Nickel	140
Selenium	36
Silver	36
Zinc	2200

TP-03 (2-4ft)	11/5/2007
Acetone	**0.095**
Benzo(a)anthracene	**31**
Benzo(a)pyrene	**30**
Benzo(b)fluoranthene	**30**
Benzo(k)fluoranthene	**27**
Chrysene	**33**
Dibenzo(a,h)anthracene	**4.4**
Indeno(1,2,3-cd)pyrene	**15**
4,4'-DDD	**0.061**
4,4'-DDE	**0.096**
Dieldrin	**0.045**
Total PCBs	**1.4**
Chromium	**43.4**
Copper	**198**
Lead	**601**
Nickel	**60.8**

*COLOR INDICATES EXCEEDANCE OF RESTRICTED USE.
*BOLD AND UNDERLINED INDICATES CONCENTRATION GREATER THAN UNRESTRICTED USE CRITERIA.

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".
2. LOT LINES FOR PROPERTIES H AND I ARE EXTRAPOLATED.

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. In Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

AOC-6 - OFF-SITE RESIDENTIAL AREA SUMMARY OF SOIL ANALYTICAL RESULTS

0 25 50 100
0 1" 2"

FILENAME –
SCALE 1"=50'
SHEET 6-6

C:\pwworking\pit\d0288839\00C-06-01-06-DRAFT FS.dwg, AOC-6, 7/6/2010 3:11:10 PM, jjoseph, Previous paper size (22.00 x 34.00 inches), 1:1

EPA-7	5/6/2008	10/21/2008	10/14/2009	1/12/10
Aluminum	4900	<222	NA	1,300
Antimony	<20	<66.7	<2	<20
Arsenic	<8	<11.1	<1	<8
Barium	<100	8.8	15.3	<100
Beryllium	<3	<5.6	<1	<3
Cadmium	<3	<5.6	<1	<3
Calcium	14000	9700	NA	11,000
Chromium	15	<11.1	2.9	17
Cobalt	<20	<55.6	<1	<20
Copper	10	<27.8	<2	<10
Iron	**9200**	49.1	NA	**2,600**
Lead	17	<11.1	NA	<8
Magnesium	4000	2310	<1	3,300
Manganese	**400**	19.6	9.2	65
Mercury	<0.2	<0.2	NA	NA
Nickel	<20	1.2	2.8	<20
Potassium	1800	642	NA	920
Silver	<5	<11.1	<1	<5
Sodium	16000	14800	NA	**21,000**
Vanadium	<20	<55.6	<5	<20
Zinc	42	7.1	3.2	24
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5

HW-027(10ft)	12/5/07
Aluminum	143000
Antimony	<60
Arsenic	129
Barium	**1180**
Beryllium	**9.7**
Cadmium	**15.5**
Calcium	57300
Chromium	**190**
Cobalt	157
Copper	**260**
Iron	**280000**
Lead	**205**
Magnesium	**48000**
Manganese	**34700**
Mercury	**0.78**
Nickel	**310**
Potassium	8470
Silver	5.1
Sodium	**33000**
Vanadium	194
Zinc	994
Tetrachloroethene	<0.5

HW-028(13 ft)	12/5/07
Aluminum	367000
Antimony	<60
Arsenic	403
Barium	**2680**
Beryllium	**26**
Cadmium	**55.8**
Calcium	100000
Chromium	**520**
Cobalt	383
Copper	**1130**
Iron	**684000**
Lead	**821**
Magnesium	**112000**
Manganese	**41500**
Mercury	**2.7**
Nickel	**827**
Potassium	21900
Silver	5.8
Sodium	**42000**
Vanadium	480
Zinc	**3080**
Tetrachloroethene	<0.5

HW-024(20ft)	12/5/07
Aluminum	935000
Antimony	<60
Arsenic	456
Barium	**4930**
Beryllium	**58.4**
Cadmium	**234**
Calcium	219000
Chromium	**1470**
Cobalt	1000
Copper	**2900**
Iron	**1810000**
Lead	**3140**
Magnesium	**310000**
Manganese	**91800**
Mercury	**9.6**
Nickel	**2350**
Potassium	46400
Silver	6
Sodium	**63000**
Vanadium	1090
Zinc	**9610**
Tetrachloroethene	0.52

HW-018(15ft)	12/5/07
Aluminum	441000
Antimony	<60
Arsenic	211
Barium	**5310**
Beryllium	**25.6**
Cadmium	**83.3**
Calcium	148000
Chromium	**899**
Cobalt	361
Copper	**772**
Iron	**797000**
Lead	**1850**
Magnesium	**181000**
Manganese	**39700**
Mercury	**2**
Nickel	**1030**
Potassium	30000
Silver	9.6
Sodium	**38100**
Vanadium	537
Zinc	**5590**
Tetrachloroethene	2.3

HW-017(20ft)	11/16/2007
Aluminum	894000
Antimony	<60
Arsenic	392
Barium	**7950**
Beryllium	**55.5**
Cadmium	**72.8**
Calcium	1370000
Chromium	**3940**
Cobalt	919
Copper	**4350**
Iron	<223000
Lead	**2220**
Magnesium	**421000**
Manganese	**57100**
Mercury	<0.2
Nickel	**2830**
Potassium	40000
Silver	<10
Sodium	17600
Vanadium	1140
Zinc	**8510**
Tetrachloroethene	<0.5

MW-2	10/3/98
Aluminum	70200
Antimony	<3.5
Arsenic	42.4
Barium	544
Beryllium	**4.2**
Cadmium	5
Calcium	220000
Chromium	**96.4**
Cobalt	70.7
Copper	**306**
Iron	**149000**
Lead	**131**
Magnesium	**99000**
Manganese	**8300**
Mercury	0.44
Nickel	**171**
Potassium	20400
Silver	<0.50
Sodium	**86800**
Vanadium	97
Zinc	649
Tetrachloroethene	**8**

HW-016(15ft)	11/19/07
Aluminum	359000
Antimony	<60
Arsenic	164
Barium	**5330**
Beryllium	**17.9**
Cadmium	**23.1**
Calcium	94500
Chromium	**1020**
Cobalt	333
Copper	**1490**
Iron	<726000
Lead	**327**
Magnesium	**130000**
Manganese	**59500**
Mercury	**0.98**
Nickel	**879**
Potassium	20200
Silver	**55.6**
Sodium	15500
Vanadium	392
Zinc	**2440**
Tetrachloroethene	0.14

MW-1	10/3/98
Aluminum	126000
Antimony	<3.5
Arsenic	9
Barium	232
Beryllium	0.64
Cadmium	<0.40
Calcium	179000
Chromium	20.4
Cobalt	12.2
Copper	26.7
Iron	**25800**
Lead	13.9
Magnesium	32800
Manganese	**1670**
Mercury	<0.10
Nickel	30.2
Potassium	13300
Silver	7.7
Sodium	**49700**
Vanadium	16.4
Zinc	113
Tetrachloroethene	1

MW-6	10/3/98
Aluminum	1890
Antimony	<3.5
Arsenic	<2.8
Barium	27.6
Beryllium	0.27
Cadmium	<0.40
Calcium	36900
Chromium	3.3
Cobalt	1.3
Copper	9
Iron	**3190**
Lead	<1.7
Magnesium	9670
Manganese	91.1
Mercury	<0.10
Nickel	3.3
Potassium	1030
Silver	<0.50
Sodium	9370
Vanadium	2.2
Zinc	171
Tetrachloroethene	<10

EPA-3	05/08/2008	10/21/2008	10/14/09	1/14/2010
Aluminum	230	223	NA	4,800
Antimony	<20	**3.4**	**3.6**	<20
Arsenic	<8	11.1	**95.5**	22
Barium	<100	187	476	310
Beryllium	<3	<5.6	0.61	<3
Cadmium	<3	<5.6	0.43	<3
Calcium	75000	78300	NA	77,000
Chromium	<5	<11.1	**90**	**280**
Cobalt	<20	<55.6	11.4	<20
Copper	<10	<27.8	7.4	18
Iron	**510**	**517**	NA	14,000
Lead	<8	<11.1	1.9	<8
Magnesium	20000	20200	NA	20,000
Manganese	**850**	**916**	**4500**	**10,000**
Mercury	<0.2	<0.2	NA	NA
Nickel	<20	1.3	85.6	**180**
Potassium	<500	980	NA	1,800
Silver	<5	1.2	<5	<5
Sodium	**21000**	**20800**	NA	20,000
Vanadium	<20	<55.6	2.7	<20
Zinc	<20	8.6	12.6	50
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5

MW-7	10/3/98
Aluminum	11500
Antimony	<3.5
Arsenic	4.9
Barium	111
Beryllium	0.7
Cadmium	<0.40
Calcium	72700
Chromium	21.7
Cobalt	8.2
Copper	30.8
Iron	**25700**
Lead	9.9
Magnesium	14200
Manganese	**761**
Mercury	<0.10
Nickel	24.5
Potassium	4240
Silver	<0.50
Sodium	**33500**
Vanadium	18
Zinc	103
Tetrachloroethene	<10

HW-005(12ft)	11/14/07
Aluminum	226000
Antimony	<60
Arsenic	119
Barium	**3020**
Beryllium	**14.1**
Cadmium	**9.2**
Calcium	49300
Chromium	**648**
Cobalt	203
Copper	**387**
Iron	**484000**
Lead	**276**
Magnesium	**70600**
Manganese	**32400**
Mercury	**0.86**
Nickel	**582**
Potassium	13200
Silver	30.9
Sodium	9730
Vanadium	273
Zinc	1490
Tetrachloroethene	<0.5

MW-3	10/3/98
Aluminum	4150
Antimony	<3.5
Arsenic	4
Barium	148
Beryllium	0.26
Cadmium	1.4
Calcium	178000
Chromium	12.9
Cobalt	4.7
Copper	33.7
Iron	**12500**
Lead	**25.8**
Magnesium	**55100**
Manganese	**3340**
Mercury	<0.10
Nickel	22.8
Potassium	14100
Silver	1.1
Sodium	**91600**
Vanadium	6.6
Zinc	100
Tetrachloroethene	**22**

HW-011(15ft)	11/16/07
Aluminum	723000
Antimony	**279**
Arsenic	390
Barium	**10000**
Beryllium	**36.7**
Cadmium	**20.6**
Calcium	137000
Chromium	**1690**
Cobalt	687
Copper	**1490**
Iron	**1470000**
Lead	**767**
Magnesium	**236000**
Manganese	**99100**
Mercury	<0.2
Nickel	**1570**
Potassium	38100
Silver	**79.4**
Sodium	11900
Vanadium	747
Zinc	**4780**
Tetrachloroethene	<0.5

HW-002(10ft)	11/13/07
Aluminum	308000
Antimony	**25.6**
Arsenic	**219**
Barium	**2270**
Beryllium	**16.1**
Cadmium	**28.5**
Calcium	308000
Chromium	**4350**
Cobalt	361
Copper	**1480**
Iron	**956000**
Lead	**1010**
Magnesium	**163000**
Manganese	**25900**
Mercury	**1.2**
Nickel	**1230**
Potassium	29000
Silver	41.8
Sodium	**31900**
Vanadium	590
Zinc	**5330**
Tetrachloroethene	0.53

HW-001(6ft)	11/12/07
Aluminum	436000
Antimony	**46.6**
Arsenic	**557**
Barium	**4880**
Beryllium	**23.6**
Cadmium	**39.2**
Calcium	360000
Chromium	**1170**
Cobalt	493
Copper	**1310**
Iron	**1130000**
Lead	**1010**
Magnesium	**216000**
Manganese	**38600**
Mercury	**1.6**
Nickel	**1270**
Potassium	32400
Silver	**44.6**
Sodium	**30900**
Vanadium	649
Zinc	**4250**
Tetrachloroethene	0.29

HW-003(13ft)	11/13/07
Aluminum	774000
Antimony	**51.8**
Arsenic	395
Barium	**9670**
Beryllium	**39.7**
Cadmium	**113**
Calcium	384000
Chromium	**2160**
Cobalt	935
Copper	**2860**
Iron	**2010000**
Lead	**4050**
Magnesium	**357000**
Manganese	**101000**
Mercury	**7.1**
Nickel	**2340**
Potassium	57300
Silver	**97.8**
Sodium	**36000**
Vanadium	1220
Zinc	**17800**
Tetrachloroethene	0.47

HW-013(19ft)	11/19/07
Aluminum	978000
Antimony	<60
Arsenic	420
Barium	**21600**
Beryllium	**44.2**
Cadmium	**148**
Calcium	177000
Chromium	**2040**
Cobalt	912
Copper	**2010**
Iron	<1820000
Lead	**2070**
Magnesium	**301000**
Manganese	**265000**
Mercury	**1.8**
Nickel	**2400**
Potassium	46600
Silver	**122**
Sodium	19900
Vanadium	877
Zinc	**10100**
Tetrachloroethene	0.072

MW-4	10/3/98
Aluminum	1840
Antimony	<3.5
Arsenic	<2.8
Barium	48.7
Beryllium	0.14
Cadmium	<0.40
Calcium	10400
Chromium	4.8
Cobalt	0.85
Copper	8.2
Iron	**4030**
Lead	<1.7
Magnesium	2270
Manganese	33.3
Mercury	<0.10
Nickel	4.3
Potassium	1180
Silver	<0.50
Sodium	9580
Vanadium	3.3
Zinc	38.8
Tetrachloroethene	<10

EPA-6	5/7/2008	10/22/2008	10/13/09	1/13/10
Aluminum	2100	5940	NA	360
Antimony	<20	2.8	<2	<20
Arsenic	<8	5	16.9	13
Barium	120	136	101	<100
Beryllium	<3	0.26	<1	<3
Cadmium	<3	0.16	<1	<3
Calcium	23000	23500	NA	18,000
Chromium	<5	<11.1	0.79	6.2
Cobalt	<20	1.5	<0.3	<20
Copper	<10	12.5	<2	<10
Iron	**3500**	**8340**	NA	**5,200**
Lead	11	<11.1	NA	<8
Magnesium	5000	5070	<1.4	4,400
Manganese	**360**	**417**	299	**350**
Mercury	<0.2	<0.2	NA	NA
Nickel	<20	6.9	0.97	<20
Potassium	1600	2710	NA	520
Silver	<5	<11.1	<1	<5
Sodium	7300	8280	NA	6,800
Vanadium	<20	<55.6	<5	<20
Zinc	<20	25.8	2.4	<20
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5

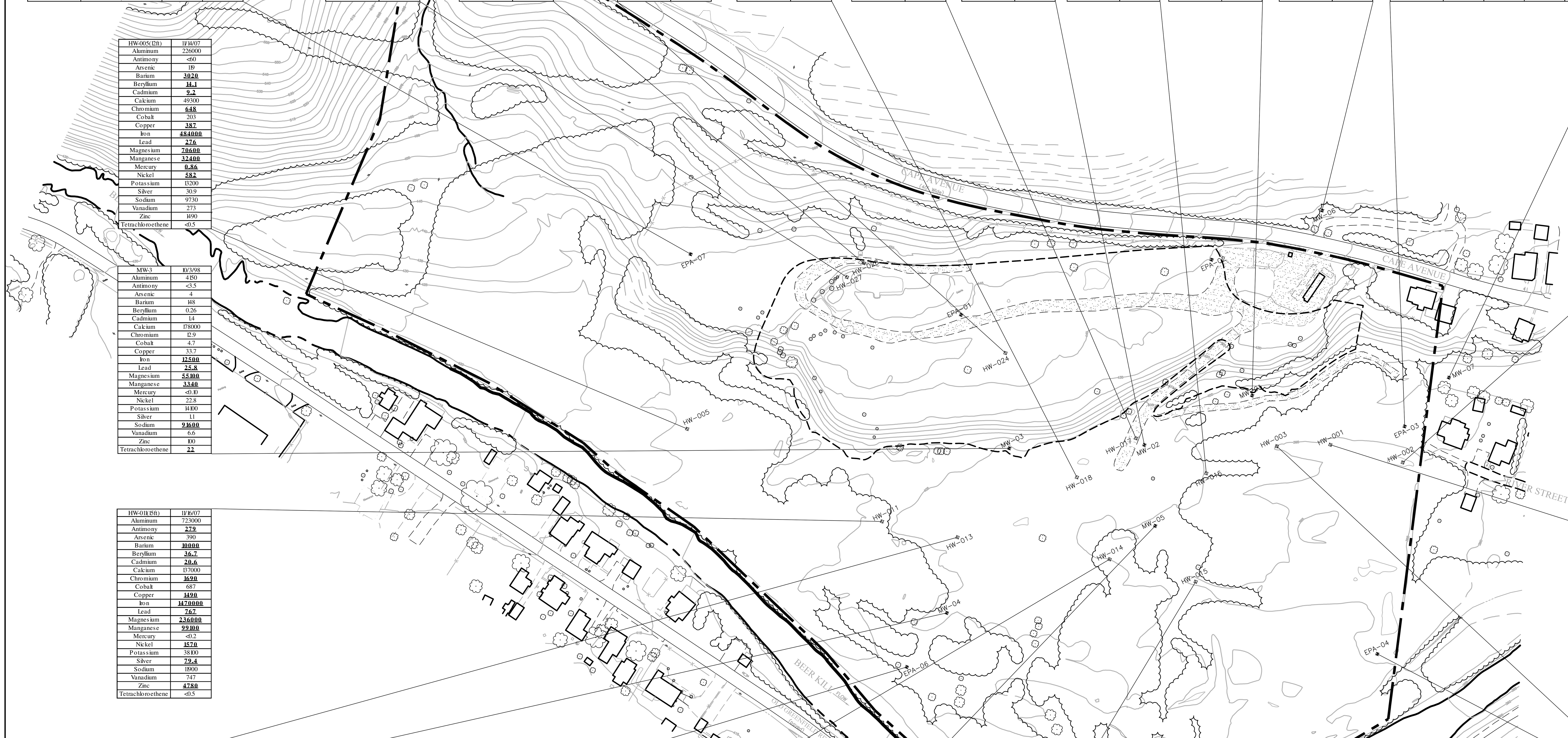
HW-014(15ft)	11/19/07
Aluminum	890000
Antimony	<60
Arsenic	216
Barium	**15400**
Beryllium	**62.7**
Cadmium	**99.6**
Calcium	301000
Chromium	**2270**
Cobalt	1030
Copper	**3040**
Iron	<2040000
Lead	**1720**
Magnesium	**291000**
Manganese	**94100**
Mercury	**3.7**
Nickel	**2230**
Potassium	43600
Silver	**122**
Sodium	**21300**
Vanadium	825
Zinc	**8510**
Tetrachloroethene	<0.5

MW-5	10/3/98
Aluminum	40000
Antimony	<3.5
Arsenic	23.2
Barium	260
Beryllium	1.9
Cadmium	0.46
Calcium	157000
Chromium	**60.6**
Cobalt	40.3
Copper	77.4
Iron	**93900**
Lead	**51.2**
Magnesium	**58700**
Manganese	**1380**
Mercury	<0.10
Nickel	97.3
Potassium	10500
Silver	<0.50
Sodium	**37300**
Vanadium	56.5
Zinc	332
Tetrachloroethene	<10

HW-015(15ft)	11/19/07
Aluminum	328000
Antimony	<60
Arsenic	147
Barium	**4170**
Beryllium	**14.7**
Cadmium	**24.3**
Calcium	187000
Chromium	**1370**
Cobalt	309
Copper	**795**
Iron	<741000
Lead	**355**
Magnesium	**148000**
Manganese	**24200**
Mercury	**1.3**
Nickel	**855**
Potassium	24900
Silver	**53.1**
Sodium	**34300**
Vanadium	348
Zinc	**3130**
Tetrachloroethene	2

EPA-5	5/8/2008	10/22/2008	10/14/09	1/13/2010
Aluminum	5200	175	NA	<100
Antimony	<20	3	<1	<20
Arsenic	<8	<11.1	1.8	<8
Barium	190	147	152	150
Beryllium	<3	<5.6	<1	<3
Cadmium	<3	<5.6	<1	<3
Calcium	52000	47300	NA	48,000
Chromium	8.4	<11.1	1.9	<5
Cobalt	<20	<55.6	<1	<20
Copper	<10	<27.8	<2	<10
Iron	**11000**	**2930**	NA	**2,600**
Lead	20	<11.1	NA	<8
Magnesium	15000	13200	<1	14,000
Manganese	**870**	**649**	**542**	**800**
Mercury	<0.2	<0.2	NA	NA
Nickel	<20	1.4	1.7	<20
Potassium	2000	504	NA	<500
Silver	<5	0.91	<1	<5
Sodium	9300	9010	NA	9,300
Vanadium	<20	<55.6	<5	<20
Zinc	21	2.5	1.6	<20
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5

EPA-4	05/07/2008	10/21/2008	10/13/09	1/13/2010
Aluminum	8700	1620	NA	130
Antimony	<20	2.8	<2	<20
Arsenic	<8	<11.1	0.99	<8
Barium	200	247	116	120
Beryllium	<3	<5.6	<1	<3
Cadmium	<3	<5.6	<1	<3
Calcium	50000	53200	NA	35,000
Chromium	29	<11.1	1.9	<5
Cobalt	<20	<55.6	0.48	<20
Copper	12	4.5	<2	<10
Iron	**16000**	**6620**	NA	**1,400**
Lead	**29**	<11.1	0.7	<8
Magnesium	9100	9550	NA	5,500
Manganese	**1100**	**1320**	**767**	**620**
Mercury	<0.2	<0.2	NA	NA
Nickel	24	3.4	1.9	<20
Potassium	5200	3850	NA	1,900
Silver	<5	0.83	<5	<5
Sodium	**26000**	**27400**	NA	**23,000**
Vanadium	<20	<55.6	<5	<20
Zinc	69	13.7	3.6	<20
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5



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LEGEND:

- SITE BOUNDARY
- HW-001 HYDROPUNCH LOCATION
- MW-01 PRE-EXISTING MONITORING WELLS LOCATIONS
- EPA-03 REMEDIAL INVESTIGATION MONITORING WELLS LOCATIONS
- µg/l MICROGRAMS PER LITER
- ft FEET
- < NOT DETECTED (DETECTION LIMIT LISTED)
- DIRT ACCESS ROAD

SAMPLE IDENTIFICATION
SAMPLE OR SCREEN DEPTH
SAMPLE DATE

HW-002(10ft)	11/13/07
Aluminum	308000
Antimony	**25.6**
Arsenic	**219**
Barium	**2270**
Beryllium	**16.1**
Cadmium	**28.5**
Calcium	308000
Chromium	**4350**
Cobalt	361
Copper	**1480**
Iron	**956000**
Lead	**1010**
Magnesium	**163000**
Manganese	**25900**
Mercury	**1.2**
Nickel	**1230**
Potassium	29000
Silver	418
Sodium	**31900**
Vanadium	590
Zinc	**5330**
Tetrachloroethene	0.53

ANALYTICAL RESULT µg/l (BOLD AND UNDERLINED INDICATES CONCENTRATION GREATER THAN CLASS GA GROUNDWATER STANDARDS)

ANALYTICAL PARAMETER

New York State Ambient water Quality Standards and Guidance Values, June 1998

Contaminant	UG/L
Aluminum	-
Antimony	3
Arsenic	25
Barium	1000
Beryllium	3
Cadmium	5
Calcium	-
Chromium	50
Cobalt	-
Copper	200
Iron	300
Lead	25
Magnesium	35000
Manganese	300
Mercury	0.7
Nickel	100
Potassium	-
Silver	50
Sodium	200000
Vanadium	-
Zinc	2000
Tetrachloroethene	5

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. in Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

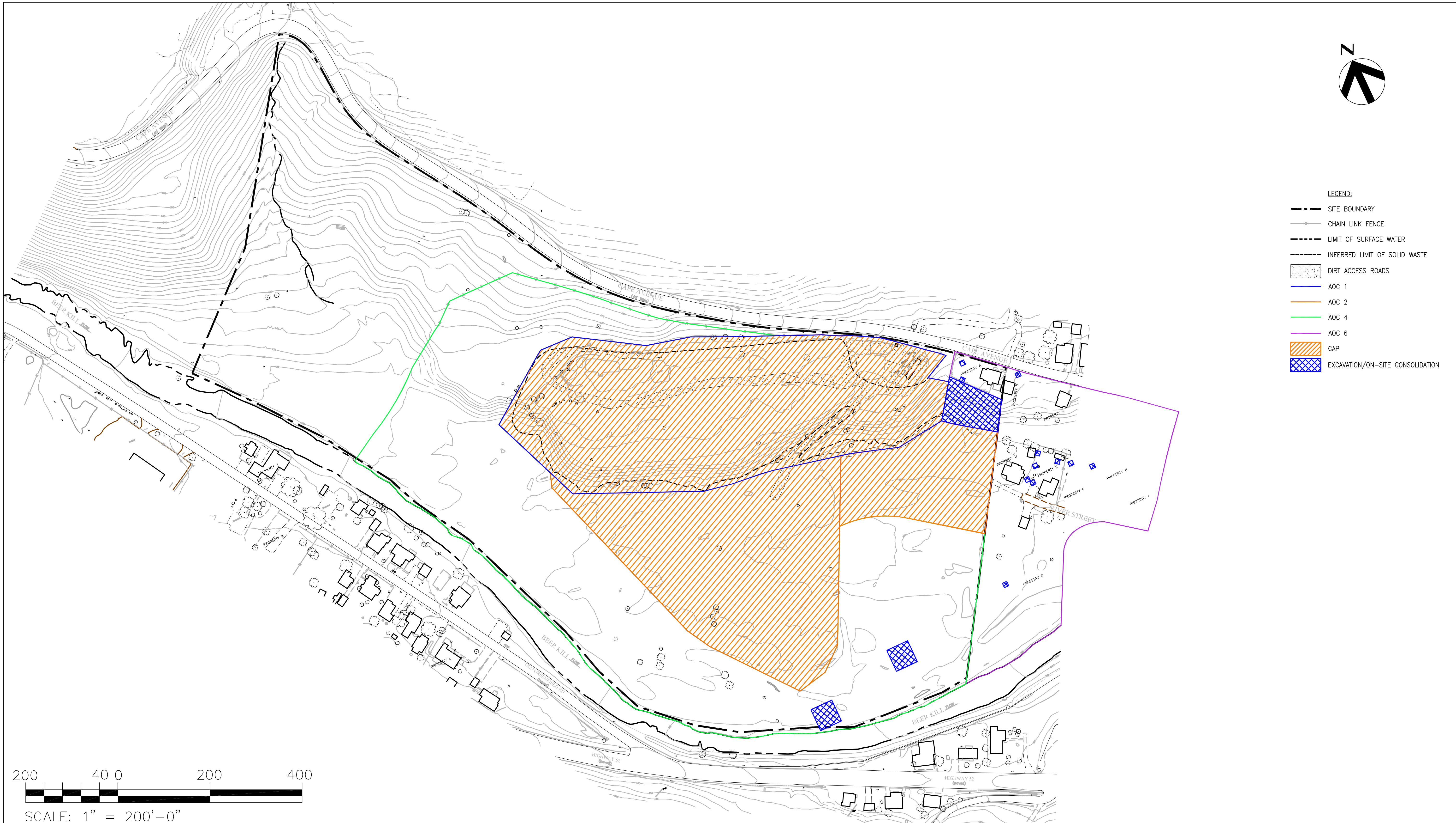
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

AOC 7 - SITE WIDE GROUNDWATER SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

0 50 100 200
1" 2"

FILENAME –
SCALE 1"=100'

SHEET
6-7



SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

HDR

HENNINGSON, DURHAM & RICHARDSON, ARCHITECTURE AND ENGINEERING, P.C. IN ASSOCIATION WITH HDR ENGINEERING, INC.

ELLENVILLE SCRAP IRON AND METAL SITE VILLAGE OF ELLENVILLE, TOWN OF WAWARSING ULSTER COUNTY, NEW YORK	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. EP-W-09-009 WORK ASSIGNMENT NO. 008-RICO-02LX	ALTERNATIVE 2A - CAPPING/ON-SITE CONSOLIDATION	DATE 07-12-2010 FIGURE 9-1

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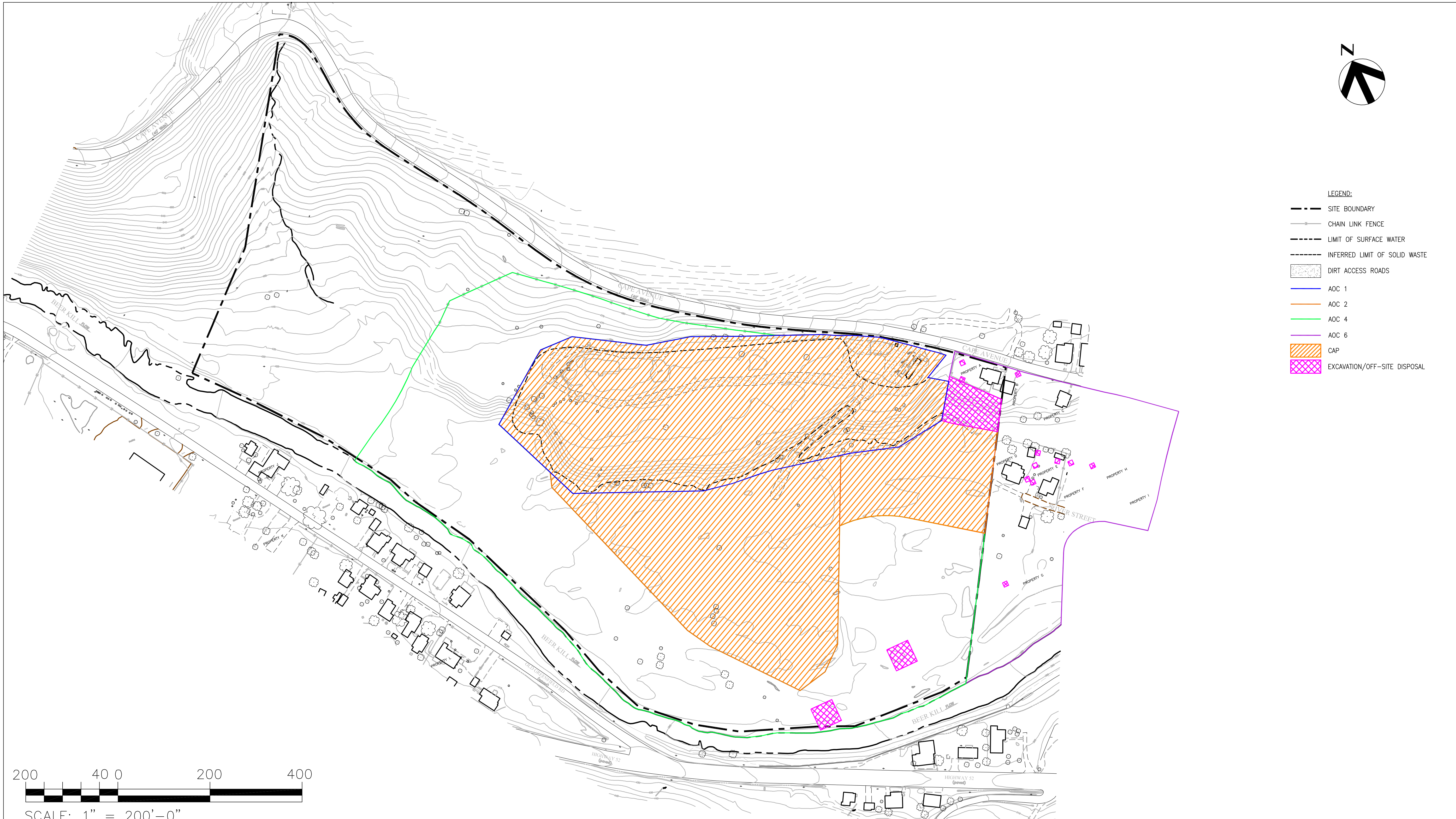

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

HDR

HENNINGSON, DURHAM & RICHARDSON, ARCHITECTURE AND ENGINEERING, P.C. IN ASSOCIATION WITH HDR ENGINEERING, INC.

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE,
TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

ALTERNATIVE 2B - CAPPING/OFF-SITE DISPOSAL

DATE
07-12-2010

FIGURE
9-2

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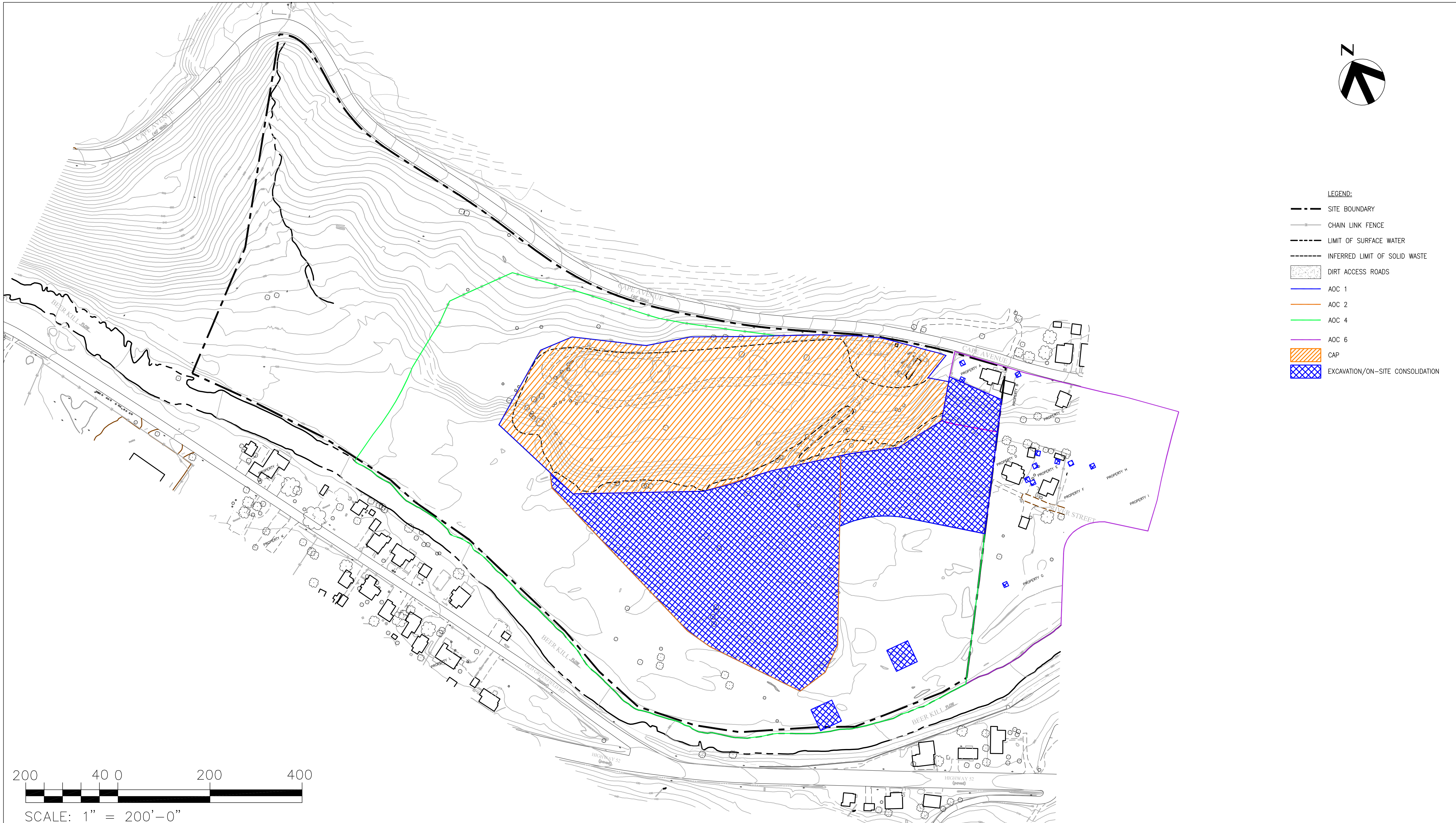


SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

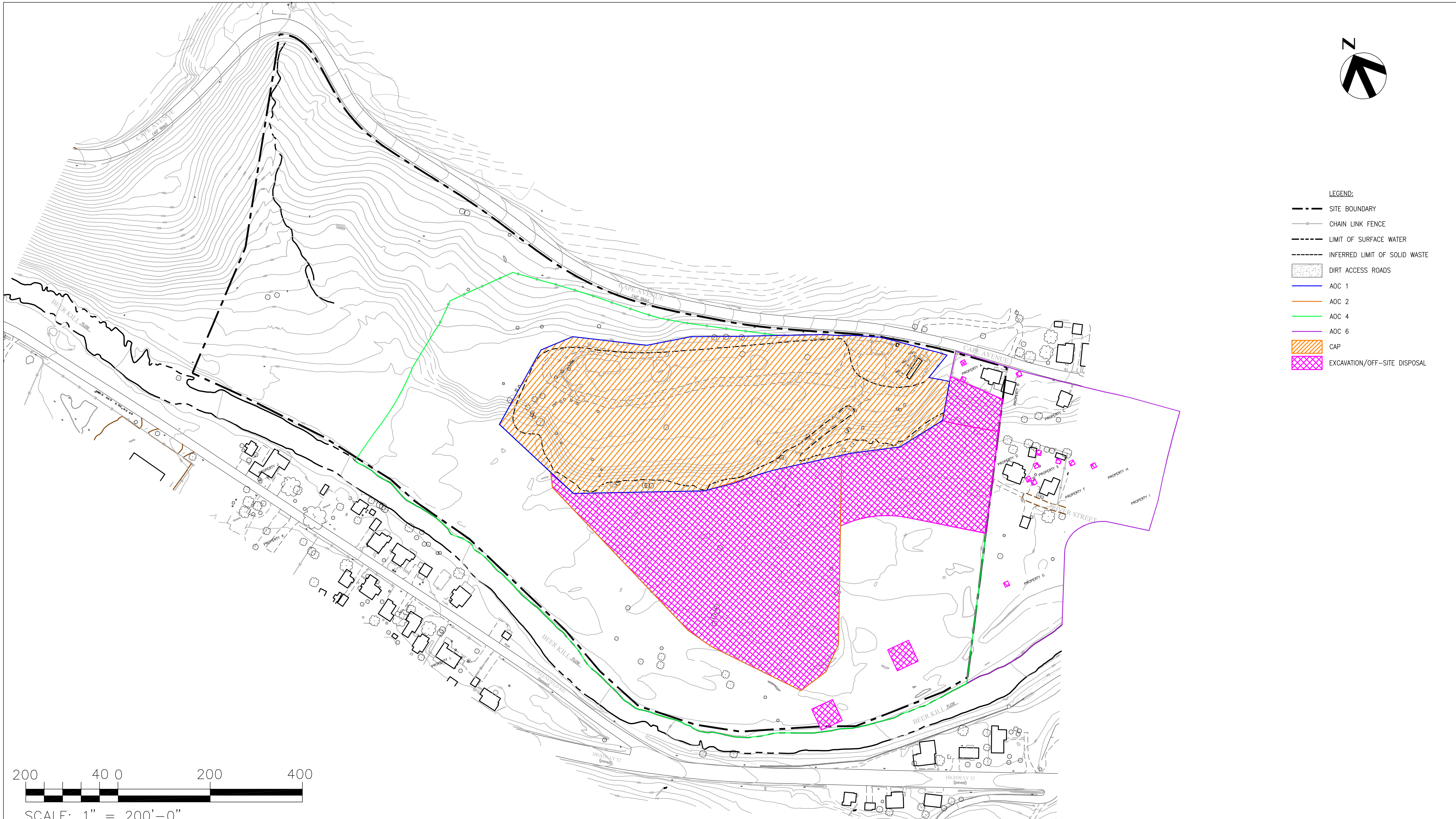
HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

HDR
HENNINGSON, DURHAM & RICHARDSON, ARCHITECTURE AND ENGINEERING, P.C. IN ASSOCIATION WITH HDR ENGINEERING, INC.

ELLENVILLE SCRAP IRON AND METAL SITE VILLAGE OF ELLENVILLE, TOWN OF WAWARSING ULSTER COUNTY, NEW YORK	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. EP-W-09-009 WORK ASSIGNMENT NO. 008-RICO-02LX	ALTERNATIVE 2C - CAPPING/ON-SITE CONSOLIDATION	DATE 07-12-2010 FIGURE 9-3



SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

HDR
HENNINGSON, DURHAM & RICHARDSON, ARCHITECTURE AND ENGINEERING, P.C. IN ASSOCIATION WITH HDR ENGINEERING, INC.

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE,
TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

ALTERNATIVE 2D -
CAPPING/OFF-SITE DISPOSAL

DATE
07-12-2010

FIGURE
9-4

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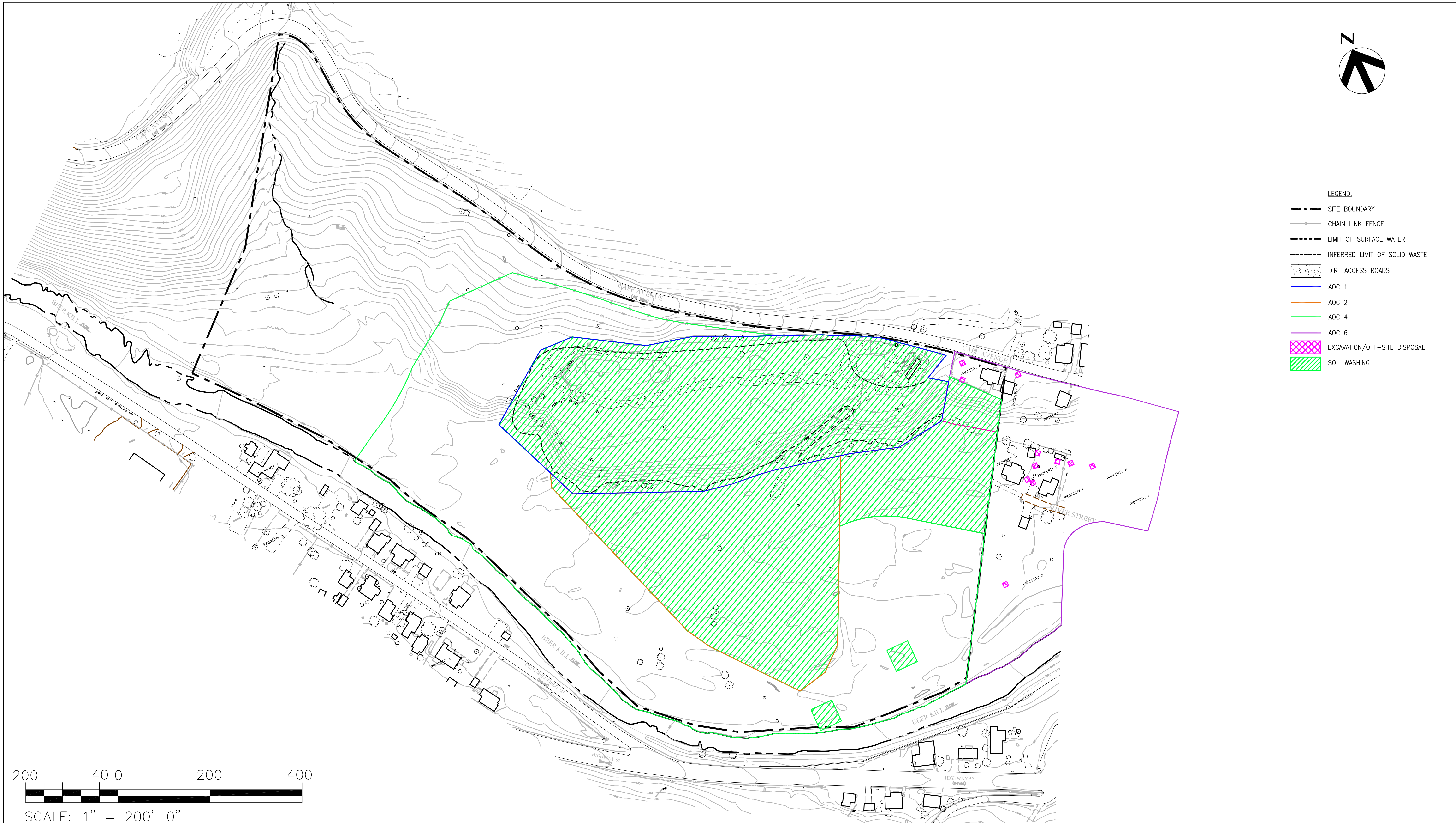


SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)-NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

HDR

HENNINGSON, DURHAM & RICHARDSON, ARCHITECTURE AND ENGINEERING, P.C. IN ASSOCIATION WITH HDR ENGINEERING, INC.

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE,
TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

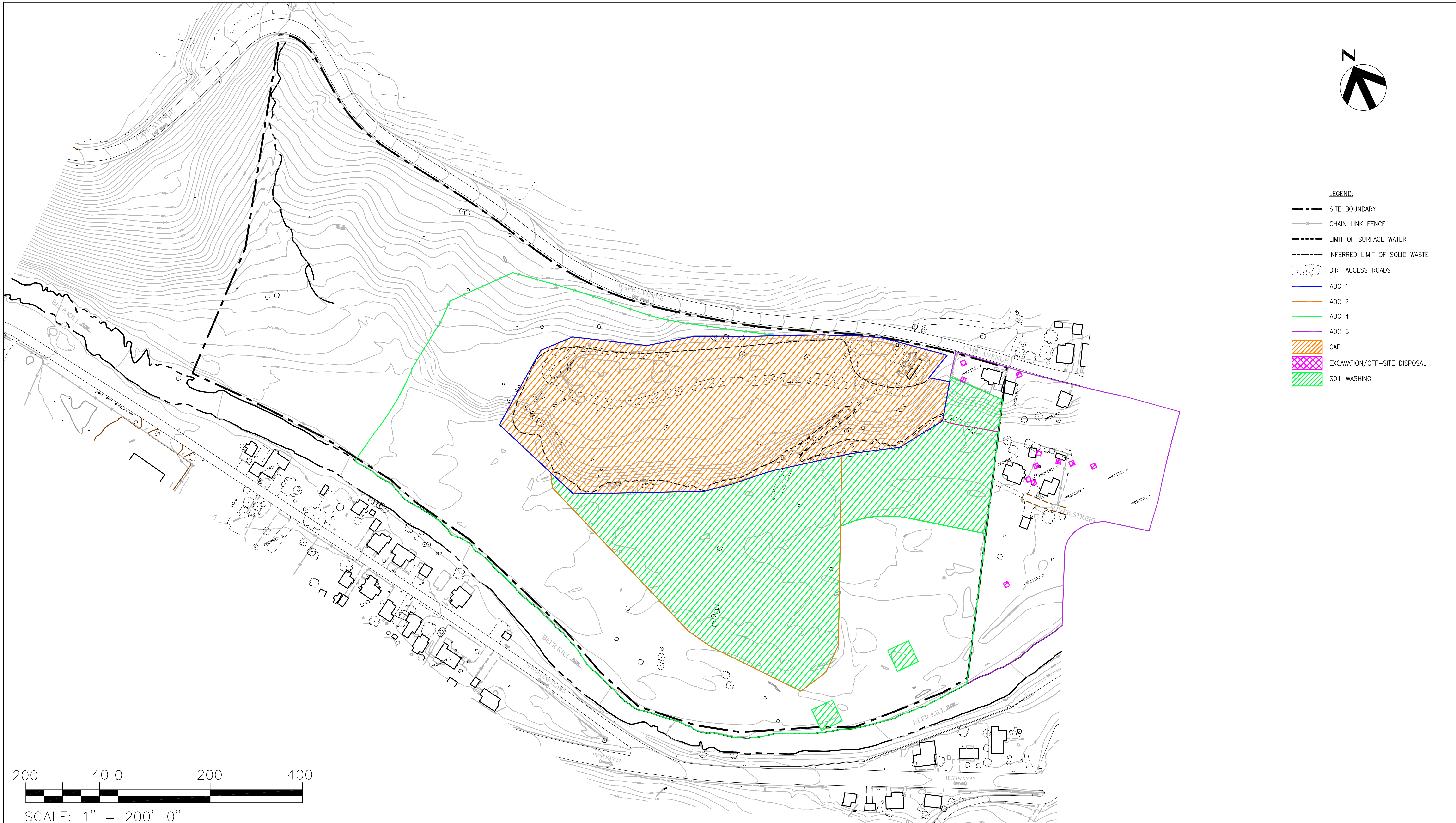
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

ALTERNATIVE 3A - SOIL WASHING OFF-SITE DISPOSAL

DATE 07-12-2010

FIGURE 9-5

C:\pwworking\pit\d0268639\00C-09-01-07-DRAFT - FS-Alternatives.dwg, ALT 3A, 7/6/2010 3:28:34 PM, jjoseph, 11 x 17, 1:1



SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

HDR

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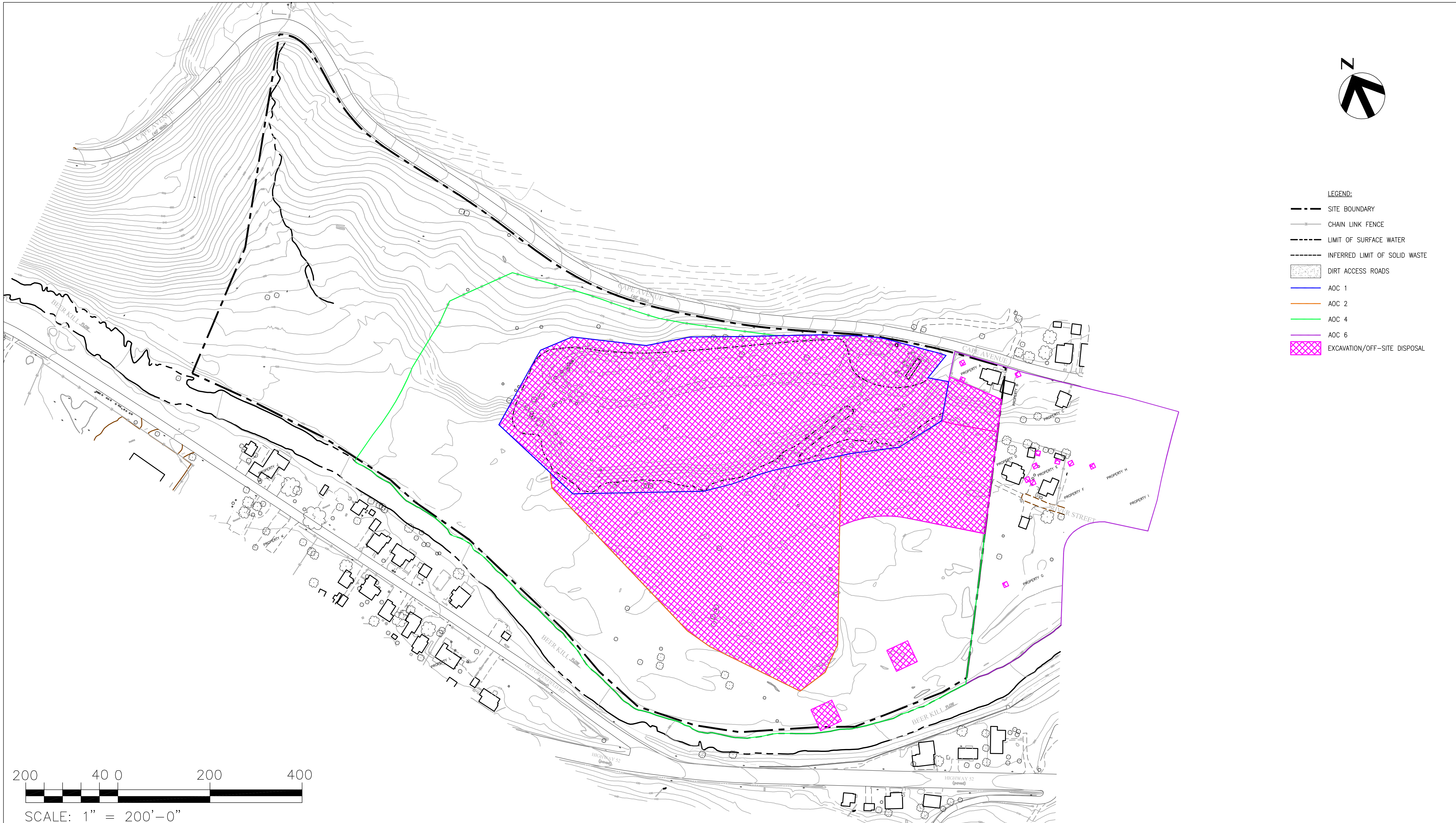
ELLENVILLE SCRAP IRON AND METAL SITE VILLAGE OF ELLENVILLE, TOWN OF WAWARSING ULSTER COUNTY, NEW YORK	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. EP-W-09-009 WORK ASSIGNMENT NO. 008-RICO-02LX	ALTERNATIVE 3B - CAPPING/SOIL WASHING/OFF-SITE DISPOSAL	DATE 07-12-2010 FIGURE 9-6



SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)—NORTH AMERICAN DATUM (NAD83:FEET)

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

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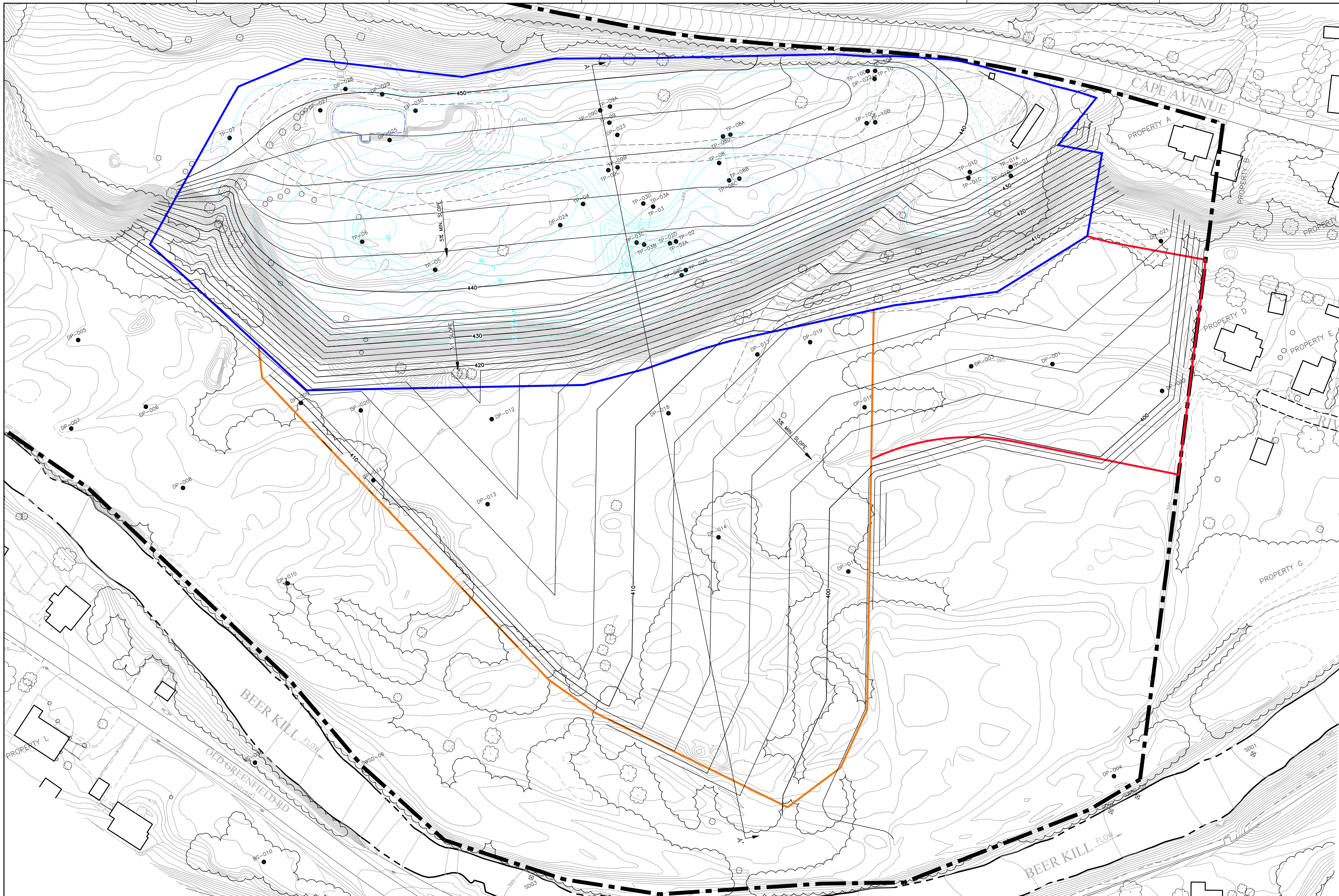
ELLENVILLE SCRAP IRON AND METAL SITE VILLAGE OF ELLENVILLE, TOWN OF WAWARSING ULSTER COUNTY, NEW YORK	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. EP-W-09-009 WORK ASSIGNMENT NO. 008-RICO-02LX	ALTERNATIVE 4 - OFF-SITE DISPOSAL	DATE 07-12-2010 FIGURE 9-7



LEGEND:

- SITE BOUNDARY
- DIRT ACCESS ROAD
- EXISTING TREE LINE
- EXISTING CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- 490 TOPOGRAPHIC CONTOUR MAJOR (FEET AMSL)
- TOPOGRAPHIC CONTOUR MINOR (FEET AMSL)
- 420 PROPOSED MAJOR CONTOUR (10 FEET)
- PROPOSED MINOR CONTOUR (2 FEET)
- 10 SOLID WASTE THICKNESS CONTOURS (FEET)
- DP-021 DIRECT PUSH LOCATIONS
- TP-01C TEST PIT LOCATIONS
- APPROXIMATE LIMITS OF TEST PIT
- AOC-1 – LANDFILL AREA
- AOC-2 – DEBRIS PILE AREA
- AOC-3 – DUMPSTER STAGING AREA

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

2. CROSS SECTION A–A' IS PROVIDED AS FIGURE 11–3.

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. in Association with HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
2	07/12/2010	FINAL ISSUE
1	05/07/2010	DRAFT ISSUE

PROJECT MANAGER	E.S.
LEAD DESIGN PROF.	T.M.C.
DESIGN ENGINEER	J.J.
DRAWN BY	J.W.
PROGRAM MANAGER	B.W.
QUALITY ASSURANCE MGR.	R.M.
PROJECT NUMBER	114488

ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

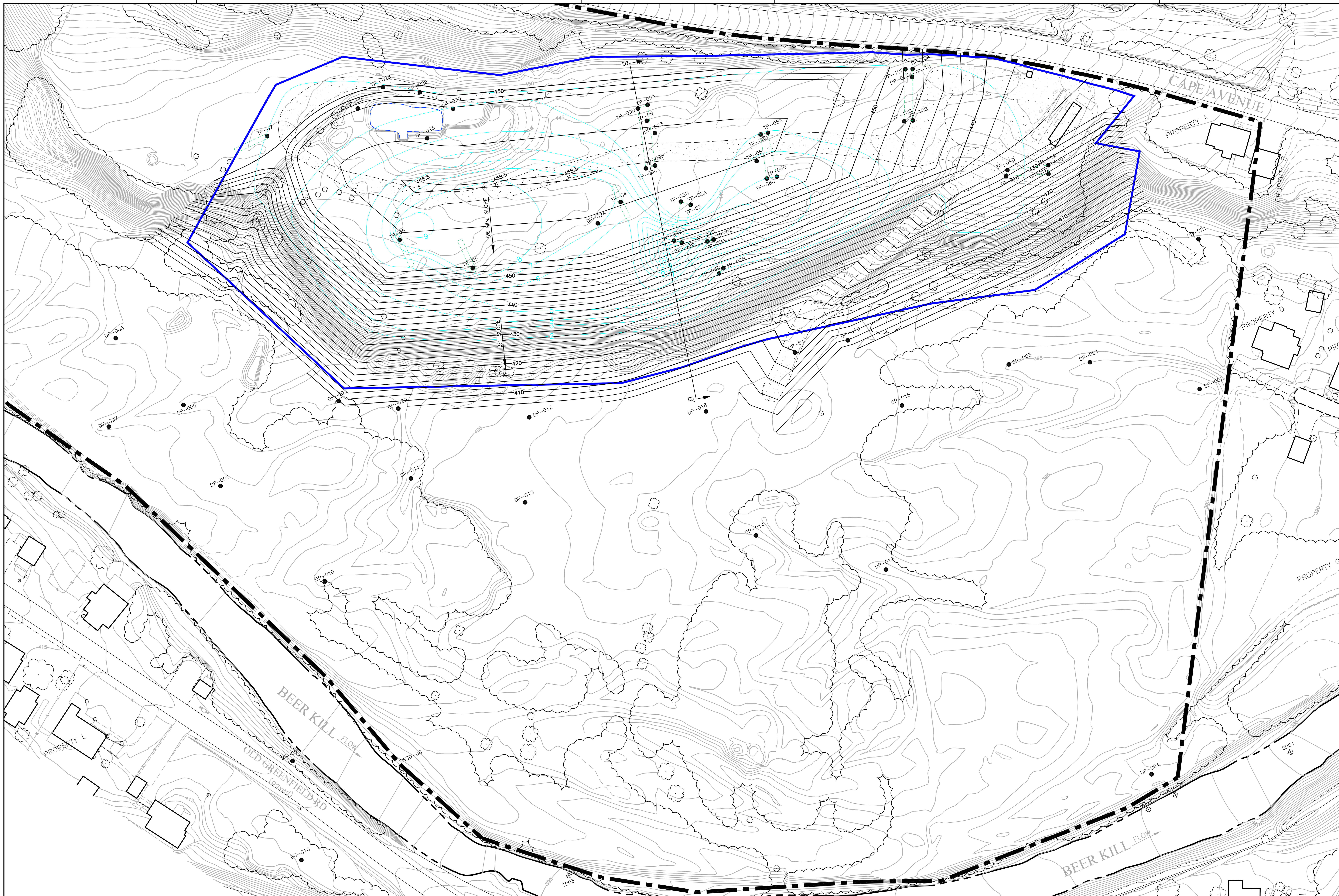
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

ALTERNATIVE 2A CONCEPTUAL FINAL GRADING PLAN

0 25 50 100
0 1" 2"

FILENAME –
SCALE 1"=50'

SHEET 11-1



LEGEND:

- SITE BOUNDARY
- DIRT ACCESS ROAD
- EXISTING TREE LINE
- EXISTING CHAIN LINK FENCE
- LIMIT OF SURFACE WATER
- 490 TOPOGRAPHIC CONTOUR MAJOR (FEET AMSL)
- TOPOGRAPHIC CONTOUR MINOR (FEET AMSL)
- 420 PROPOSED MAJOR CONTOUR (10 FEET)
- PROPOSED MINOR CONTOUR (2 FEET)
- 10 SOLID WASTE THICKNESS CONTOURS (FEET)
- DP-021 DIRECT PUSH LOCATIONS
- TP-01C TEST PIT LOCATIONS
- APPROXIMATE LIMITS OF TEST PIT
- AOC-1 – LANDFILL AREA

NOTES:

1. HISTORIC FEATURES SHOWN ARE BASED ON MAP BY WESTON TITLED "FIGURE 3 SAMPLE LOCATION MAP" AND ON MAP BY TETRA TECH EC, INC. TITLED "SITE PLAN".

2. CROSS SECTION B–B' IS PROVIDED AS FIGURE 11–3.

SURVEY NOTES:

SOURCE: SURVEYED BY BANC 3 INC., P.C. ON MARCH 25, 2008 UNDER TETRA TECH, INC. RAC FOR EPA.

HORIZONTAL DATUM: NEW YORK STATE PLANE (EAST)–NORTH AMERICAN DATUM (NAD83:FEET)

HDR

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ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE, TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

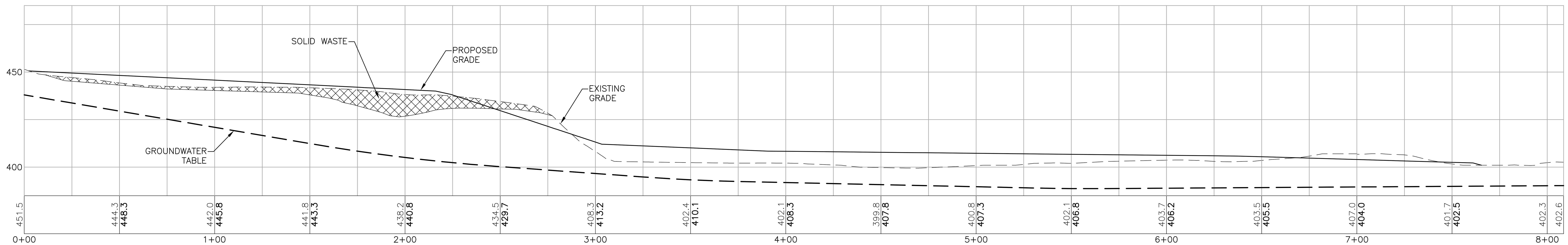
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

ALTERNATIVE 2C CONCEPTUAL FINAL GRADING PLAN

0 25 50 100
0 1" 2"

FILENAME –
SCALE 1"=50'

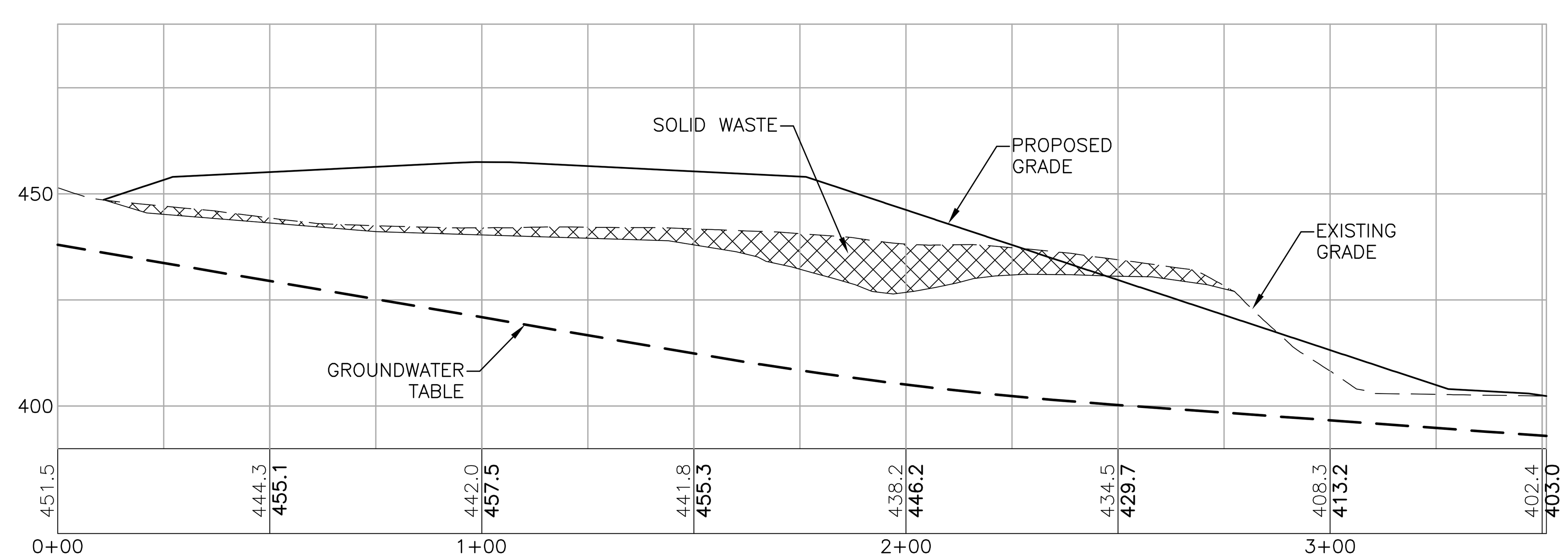
SHEET 11-2



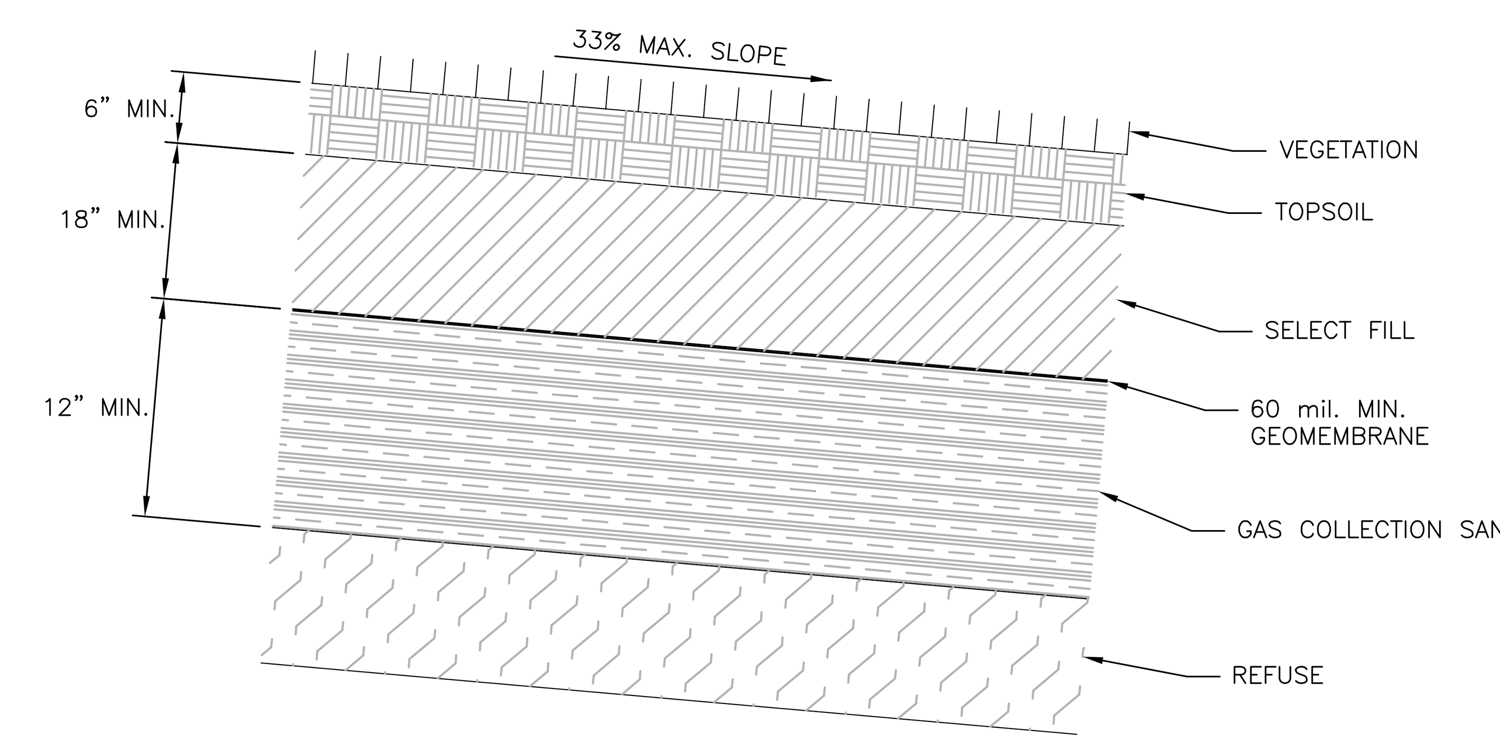
ALTERNATIVE 2A – CROSS SECTION A–A'

LEGEND:

- PROPOSED GRADE
- EXISTING GRADE
- INFERRED EXTENT OF SOLID WASTE
- APPROXIMATE GROUNDWATER ELEVATION



ALTERNATIVE 2C – CROSS SECTION B–B'



TYPICAL CAP DETAIL

SCALE: NOT TO SCALE

HORIZONTAL/VERTICAL GRAPHIC SCALE

30 0 30 60

(IN FEET)
1 inch = 30 ft.

NOTE:

1. GROUNDWATER SURFACE BASED ON MARCH 25, 2008 GROUNDWATER CONTOURS FIGURES 3-3, 3-4, 3-5, AND 3-6 OF THE REMEDIAL INVESTIGATION REPORT (HDR, 2010).

HDR

Henningson, Durham & Richardson, Architecture and Engineering, P.C. In Association with HDR Engineering, Inc.

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ELLENVILLE SCRAP IRON AND METAL SITE
VILLAGE OF ELLENVILLE,
TOWN OF WAWARSING
ULSTER COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. EP-W-09-009
WORK ASSIGNMENT NO. 008-RICO-02LX

CROSS SECTIONS AND DETAILS

0 15 30 60
0 1" 2"

FILENAME –

SCALE 1"=30'

SHEET 11-3

TABLES

Table 6-1 - Area and Volume of Soil With Contaminant Concentrations Greater than Residential Use Soil Cleanup Objectives

Area of Concern	Avg Depth (ft)	Area (sf)	Area (ac)	Volume (cy)	Tons[1]
AOC 1 - Landfill Area (Total)		267,900	6.15	45,466	68,199
AOC 1 - Entrance Area	4	16,988	0.39	2,500	3,750
AOC 1A - Solid Waste	4.6	186,600	4.28	31,466	47,199
AOC 1B - Shear/Baler Area	8	15,300	0.35	4,500	6,750
AOC 1C - Compactor Area	8	5,900	0.14	1,700	2,550
AOC 1D - Leachate Seep Area[2]	3	7,300	0.17	800	1,200
AOC 1 - Remaining Landfill Area	4	35,800	0.82	5,300	7,950
AOC 2 - Debris Pile Area[2]	3	179,800	4.13	20,000	30,000
AOC 3 - Dumpster Staging Area	3	60,200	1.38	6,700	10,050
AOC 4 - Scattered Debris Area	3	5,000	0.11	600	900
AOC 5 - Battery Disposal Area	2	10,300	0.24	800	1,200
AOC 6 - Off Site Residential Area	3	1,100	0.03	100	150

Notes
1 - Assumes 1.5 tons/cy
2 - Leachate seep soils included in AOC 2
ft - Feet
sf - Square Feet
ac - Acre
cy - Cubic Yards

Table 7-1 - Soil Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	Not Applicable	Not Applicable	No action	Required for consideration by NCP.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Deeds for property in the area of influence.	Potentially applicable
Containment	Capping	Impermeable Liner Cap	Impermeable capping systems can range from a one-layer system of vegetated soil to a complex multi-layer system of soils and geosynthetics.	Potentially applicable
		~~Clay and Soil~~	Compacted clay covered with soil over areas of contamination.	Not feasible because the site is undeveloped and older growth vegetation has been established.
		~~Asphalt~~	Spray application of a layer of asphalt over areas of contamination.	Not feasible because the site is undeveloped and older growth vegetation has been established.
		~~Concrete~~	Installation of concrete slab over areas of contamination.	Not feasible because the site is undeveloped and older growth vegetation has been established.
	Cap Enhancement	Vegetative Permeable Soil Cap	Reduce or eliminate contaminant migration.	Potentially applicable.
Treatment	In Situ Biological Treatment	~~Bioventing~~	Stimulates the natural in situ biodegradation of aerobically degradable compounds in soil by providing oxygen to existing soil microorganisms.	Not effective in treating inorganics and many chlorinated organics found in soil at the site.
		~~Enhanced Bioremediation~~	Process in which indigenous or inoculated micro-organisms degrade (metabolize) organic contaminants found in soil, converting the contaminants to innocuous end products.	Not feasible because of subsurface conditions, presence of fill.
		Phytoremediation	Process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment.	Potentially applicable.

Legend/Notes

~~Bioventing~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-1 - Soil Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	~~In Situ Physical/Chemical Treatment~~	~~Chemical Oxidation~~	Process where powerful oxidizing chemicals are injected into the subsurface to chemically convert contaminants to less toxic compounds.	Not applicable to inorganic contaminants found in the soil at the site.
		~~Electrokinetic Separation~~	Process consists of the application of a low-intensity direct current through the soil via ceramic electrodes installed in and around soil contamination areas, most effective in clays because of the negative surface charge of clay particles.	Not feasible because of presence of sands and gravel in much of the overburden soils.
		~~Fracturing~~	Enhancement technology designed to increase the efficiency of other in situ technologies in certain types of subsurface conditions (i.e., very low permeability soils / rock).	Not feasible because of presence of higher permeability material.
		~~Soil Flushing~~	Process where contaminants are extracted from the soil by passing uncontaminated water (or water containing an additive to enhance contaminant solubility) through in-place soils, contaminants leach into the water, which is then extracted and treated.	Not feasible because of heterogeneous soils, as are present on-Site, are difficult to treat via soil flushing.
		~~Soil Vapor Extraction~~	Vacuum is applied to the subsurface soil to induce air flow through the soil medium and remove volatile (and some semivolatile) contaminants.	Limited VOC contaminants and wide spread metal contaminants.
		~~Solidification/Stabilization~~	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Not applicable may result in a increase in soil volume and the solidified material may hinder future site use.

Legend/Notes

~~Soil Flushing~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-1 - Soil Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	~~In Situ Thermal Treatment~~	~~Thermal Treatment~~	Heats soil to enhance SVE in the followings ways: VOC and SVOC volatility are increased by heating; the soil permeability is increased by drying; water vapor converted to steam can facilitate stripping of volatile contaminants in the overburden; and heating may cause a decrease in contaminant viscosity which improves contaminant mobility.	Not effective in treating inorganics found at the site.
	~~Ex Situ Physical/Chemical Treatment (assuming excavation)~~	~~Biopiles~~	Controlled staging of excavated soils and mixing with soil amendments to enhance contaminant reduction.	Not effective in treating inorganics found at the site.
		~~Composting~~	Controlled biological process by which organic contaminants (e.g., VOCs, PAHs) are converted by microorganisms (under aerobic and anaerobic conditions) to innocuous, stabilized byproducts.	Not applicable; off-gas control may be required for VOC and SVOC contamination; inorganics will not be degraded; a volumetric increase in material results because of the addition of amendment material; end products must be handled (spreading or disposed of); and substantial dedicated space may be required.
		~~Landfarming~~	Contaminated soil is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Not effective in treating inorganics found at the site.
		~~Slurry Phase Biological Treatment~~	An aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The excavated soil is first processed to physically separate debris, stones, and rubble. The soil is then mixed with water to form a slurry. The solids are maintained in suspension in a reactor vessel and mixed with nutrients and oxygen. When biodegradation is complete, the soil slurry is dewatered.	Not effective for treatment of metals and VOCs, requires screening soils prior to treatment, and is potential cost-intensive due to dewatering of fines after treatment.

Legend/Notes

~~Landfarming~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-1 - Soil Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	Ex Situ Physical/Chemical Treatment (assuming excavation)	~~Chemical Extraction~~	Contaminated soils are mixed in an extractor vessel, thereby dissolving the contaminants, extracted solution is then placed in a separator unit, where the contaminants and extractant are separated for treatment and/or potential reuse as fill material.	Not applicable because of limitations of the technology that includes: traces of solvents may remain in the treated solids; the technology may not be effective on higher molecular weight organic and/or very hydrophilic substances; after acid extraction, any residual acid in the treated soil may require neutralization; and achieving stringent SCOs may prove uneconomical.
		~~Chemical Reduction /Oxidation~~	Reduction/oxidation chemically converts soil contaminants to less toxic compounds that are more stable, less mobile, and/or inert.	Not effective in treating inorganics found at the site (no hazardous waste are assumed to be present).
		~~Dehalogenation~~	Halogen contaminated soil (i.e., chlorinated VOCs) is excavated, screened, and processed with a crusher and pug mill, and mixed with reagents.	Not effective in treating inorganics found at the site.
		~~Separation~~	Separation techniques concentrate contaminated solids through physical and chemical means. Ex situ separation can be performed by many processes including gravity separation, sieving/physical separation, and magnetic separation.	Not effective in treating inorganics found at the site.
		Soil Washing	Water-based process for scrubbing soils ex-situ to remove contaminant.	Potentially applicable
		~~Solidification/Stabilization~~	Soil contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Not applicable because of limitations such as soil geology and contaminant conditions may affect the long-term immobilization of contaminants; processes may result in a significant increase in volume (up to double the original volume); and organics are generally not immobilized.

Legend/Notes

~~Separation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-1 - Soil Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	~~Ex Situ Thermal Treatment~~	~~Hot Gas Decontamination~~	Process involves staging the impacted soil in a dedicated vessel and raising the temperature of the contaminated material for a specified period of time.	Not effective in treating inorganics found at the site.
		~~Incineration~~	Excavated soil is transported off-site for incineration.	Not applicable, generally used for hazardous wastes.
		~~Pyrolysis~~	Chemical decomposition is induced in organic materials by heat in the absence of oxygen.	Not effective for treating inorganics.
		~~Thermal Desorption~~	Physical separation process where excavated soils are heated to volatilize water/moisture and organic contaminants.	Not effective in removing inorganic contaminants.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Contaminated material is removed and transported to a permitted off-site treatment and/or disposal facilities.	Potentially applicable.
		Excavation/On-Site Consolidation[1]	Contaminated material is removed and consolidated on-site.	Potentially applicable.

Legend/Notes

~~Thermal Desorption~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-2 - Groundwater Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	Not Applicable	Not Applicable	No action	Required for consideration by NCP
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Deeds for property in the area of influence.	Potentially applicable
~~Containment~~	~~Physical Barriers~~	~~Slurry Wall~~	Trench around areas of contamination is filled with a soil (or cement) bentonite slurry.	Not applicable because of site specific hydrogeology and foot print of the source area would likely require an extensive barrier system limiting the practicability of implementing this technology at the site.
		~~Grout Curtain~~	Pressure injection of grout in a regular pattern of drilled holes.	Not applicable because of site specific hydrogeology and foot print of the source area would likely require an extensive barrier system limiting the practicability of implementing this technology at the site.
		~~Vibrating Beam~~	Vibrating force to advance beams into the ground with injection of slurry as beam is withdrawn.	Not feasible because of very shallow depth to bedrock.
		~~Block Displacement~~	In conjunction with vertical barriers, injection of slurry in notched injection holes.	Not feasible because of very shallow depth to bedrock.
	~~Deep Well Injection~~	~~Geologic Sequestrating~~	Waste disposal technology that uses injection wells to place treated or untreated liquid waste into geologic formations that have no potential to allow migration of contaminants.	Not feasible because of Site geology and proximity to the Beer Kill.
Treatment	In Situ Biological Treatment	~~Enhanced Bioremediation~~	Process that attempts to accelerate the natural biodegradation process by introducing nutrients, electron acceptors, and/or competent contaminant-degrading microorganisms to the subsurface.	Not applicable because of limitation such as time to remediate plume may take years; heterogeneous or low permeability subsurface environments can present difficulties in delivering reagent throughout entire contamination zone; air injection may result in vapor generation that can accumulate in buildings; limited degradation of metals/inorganics; limited degradation of chlorinated VOCs; and, a vapor collection and treatment system is likely to be required.

Legend/Notes

~~Geologic Sequestrating~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-2 - Groundwater Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	In Situ Biological Treatment(Cont'd)	Long Term Monitoring	Process where natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are allowed to reduce contaminant concentrations to acceptable levels.	Potentially applicable
		~~Phytoremediation~~	Set of processes that uses plants to remove, transfer, stabilize and destroy organic/inorganic contamination in groundwater.	Limited to shallow groundwater and may not implementable given the depth to groundwater at the Site.
Treatment (Cont'd)	~~In Situ Physical/Chemical Treatment~~	~~Air Sparging~~	Injected air traverses horizontally and vertically in channels through the soil column, creating a subsurface "air stripper" that removes contaminants by volatilization.	Not feasible because of site-specific geology / hydrogeology, as well as its limited effectiveness with addressing inorganics.
		~~Bioslurping~~	Combines the two remedial approaches of bioventing and vacuum-enhanced free-product recovery.	Not applicable because separate phase product was not observed in groundwater at the site.
		~~Chemical Oxidation~~	Chemically converts contaminants to less toxic compounds that are more stable, less mobile, and/or inert.	Not effective in treating inorganics found at the site.
		~~Directional Wells~~	Drilling techniques can be modified to position wells horizontally, or at an angle, to reach contaminants not accessible by direct vertical drilling.	Not feasible because of Site geology.
		~~Dual Phase Extraction~~	Technology that utilizes a high vacuum system to remove various combinations of contaminated groundwater, separate-phase product (NAPL), and soil vapor from the subsurface.	Not applicable because separate phase product (NAPL) was not observed in groundwater at the site.

Legend/Notes

~~Directional Wells~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-2 - Groundwater Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	In Situ Physical/Chemical Treatment	~~Thermal Treatment~~	Steam is forced into an aquifer through injection wells to vaporize volatile and semivolatile contaminants.	Not feasible because of Site geology.
		~~Hydrofracturing Enhancements~~	Includes the injection of pressurized water through wells to form cracks in low permeability and over-consolidated soils.	Not applicable because of Site geology.
		~~In-Well Air Stripping~~	Air is injected into a vertical well that has been screened at two depths.	Not effective for the removal of metals or in aquifers with low permeability.
		Passive/Reactive Treatment Wells	A permeable reactive wall is installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall.	Potentially applicable.
	Ex Situ Biological Treatment	~~Bioreactors~~	Contaminants in extracted groundwater are put into contact with microorganisms in attached or suspended growth biological reactors.	The dilute nature of the contamination (including metals, SVOCs) in on-site groundwater will not likely support an adequate microbial population density.
		Constructed Wetlands	The constructed wetlands-based treatment technology uses natural geochemical and biological processes inherent in an artificial wetland ecosystem to accumulate and fixate / remove metals and other contaminants from influent waters.	Potentially applicable.

Legend/Notes

~~Bioreactors~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-2 - Groundwater Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (Cont'd)	Ex Situ Physical/Chemical Treatment	~~Adsorption~~	Contaminants are adsorbed onto the media, reducing their concentration in the bulk liquid phase.	Not effective in treating inorganics found at the site.
		~~Advanced Oxidation Processes~~	Including ultraviolet (UV) radiation, ozone, and/or hydrogen peroxide are used to destroy organic contaminants as impacted water is pumped into a treatment vessel.	Not feasible because of high energy requirements.
		~~Air Stripping~~	Mass transfer of volatile contaminants from water to air.	Not feasible because of limitations to the applicability and effectiveness of the air stripping include: potential for inorganic or biological fouling, requiring pretreatment; ineffectiveness for the removal of metals and some SVOCs; relatively high energy demands; and off gases generally require collection and treatment.
		Groundwater Pumping/Pump & Treat	Consists of pumping groundwater from an aquifer to remove dissolved phase contaminants and/or achieve hydraulic containment of contaminated groundwater to prevent migration.	Potentially applicable.
Removal	On-Site Discharge	Beer Kill	Extracted water discharged to the Beer Kill.	Potentially applicable.
		Infiltration Basin	Extracted water discharged into infiltration Basin.	Potentially applicable.
	Off-Site Discharge	POTW	Extracted water discharged to POTW.	Potentially applicable.

Legend/Notes

~~Air Stripping~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 7-3 - Solid Waste Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent on continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.
Containment	Capping	Multilayer Impermeable Cap	Can range from a one-layer system of vegetated soil to a complex multi-layer system of soils and geosynthetics.	Potentially applicable .
		~~Clay and Soil~~	Compacted clay covered with soil over areas of contamination.	Not feasible because the site is undeveloped and older growth vegetation has been established.
		~~Asphalt~~	Spray application of a layer of asphalt over areas of contamination.	Not feasible because the site is undeveloped and older growth vegetation has been established.
		~~Geosynthetic Cap~~	Constructed to form a surface barrier between soil contamination and the above-grade environment.	Not feasible because the site is undeveloped and older growth vegetation has been established.
	Cap Enhancement	Vegetative Permeable Soil Cap	Reduces soil moisture via plant uptake and evapotranspiration.	Potentially applicable.
Treatment	Separation	Separation	Techniques concentrate solid waste through physical means to reduce the volume of material requiring treatment/disposal.	Potentially applicable.
	~~Incineration~~	~~Incineration~~	Excavated solid waste is transported off-site for incineration.	Not feasible generally used for hazardous wastes.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Extracted solid waste is removed and transported to permitted off-site treatment and/or disposal facilities.	Potentially applicable.
		Excavation/On-Site Consolidation[1]	Contaminated material is removed and consolidated on-site.	Potentially applicable.

Legend/Notes

~~Incineration~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 8-1 - Soil Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 1 - Landfill Area					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent on continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
Containment	Capping	Impermeable Liner Cap	Effective at minimizing human exposure to contaminants. Effective when contaminants are above the water table.	Easily implementable, well established, reliable, and low complexity. Restricts future land use.	Low capital. Medium O&M. Relatively low overall cost.
	~~Cap Enhancements~~	~~Vegetative Permeable Soil Cap~~	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater. Not an effective barrier for landfill gas.	Easily implementable, well established, reliable, and low complexity. Does not meet state solid waste regulations.	Low capital. Medium O&M. Relatively low overall cost.
Treatment	~~In Situ Biological Treatment~~	~~Phytoremediation~~	Low reliability and may have limited effectiveness on site contaminants.	Limited to shallow soils. Difficult to maintain on landfill side slopes.	Low capital. Low O&M. Relatively low overall cost.
	Ex Situ Physical/Chemical Treatment	Excavation/Soil Washing/Disposal[2]	May have limited effectiveness depending on site specific soil characteristics. Debris and drums will be removed from site.	Readily implementable well established complex technology that reliable reduces the volume of soil requiring disposal.	High capital. Low O&M. Medium overall cost.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.

Legend/Notes

~~Phytoremediation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

2 - Requires a relatively large volume to achieve economies of scale. Process option must be selected for multiple AOCs to be viable.

Table 8-1 - Soil Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 2 - Debris Pile Area					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent of continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
Containment	Capping	Impermeable Liner Cap	Effective at minimizing human exposure to contaminants. Effective when contaminants are above the water table.	Easily implementable, well established, reliable, and low complexity. Restricts future land use.	Low capital. Medium O&M. Relatively low overall cost.
	Cap Enhancements	Vegetative Permeable Soil Cap	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater.	Easily implementable, well established, reliable, and low complexity.	Low capital. Medium O&M. Relatively low overall cost.
Treatment	~~In Situ Biological Treatment~~	~~Phytoremediation~~	Low reliability and may have limited effectiveness on site contaminants.	Limited to shallow soils. Surface debris in soil may affect plant growth.	Low capital. Low O&M. Relatively low overall cost.
	Ex Situ Physical/Chemical Treatment	Excavation/Soil Washing/Disposal[2]	May have limited effectiveness depending on site specific soil characteristics. Effective for removing debris from soil.	Readily implementable well established complex technology that reliable reduces the volume of soil requiring disposal.	High capital. Low O&M. Medium overall cost.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.
		Excavation/On-Site Consolidation[1]	Effective and reliable.	Readily implementable as soil can be relocated to existing landfill area.	Low capital. Low O&M. Low overall cost.

Legend/Notes

~~Phytoremediation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

2 - Requires a relatively large volume to achieve economies of scale. Process option must be selected for multiple AOCs to be viable.

Table 8-1 - Soil Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 3 - Dumpster Staging Area					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent of continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
Containment	Capping	Impermeable Liner Cap	Effective at minimizing human exposure to contaminants. Effective when contaminants are above the water table.	Easily implementable, well established, reliable, and low complexity. Restricts future land use.	Low capital. Medium O&M. Relatively low overall cost.
	~~Cap Enhancements~~	~~Vegetative Permeable Soil Cap~~	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater.	Easily implementable, well established, reliable, and low complexity.	Low capital. Medium O&M. Relatively low overall cost.
Treatment	~~In Situ Biological Treatment~~	~~Phytoremediation~~	Low reliability and may have limited effectiveness on site contaminants (PCBs).	Limited to shallow soils.	Low capital. Low O&M. Relatively low overall cost.
	Ex Situ Physical/Chemical Treatment	Excavation/Soil Washing/Disposal[2]	May have limited effectiveness depending on site specific soil characteristics.	Readily implementable well established complex technology that reliable reduces the volume of soil requiring disposal.	High capital. Low O&M. Medium overall cost (dependent on volume).
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.
		Excavation/On-Site Consolidation[1]	Effective and reliable.	Readily implementable as soil can be relocated to existing landfill area.	Low capital. Low O&M. Low overall cost.

Legend/Notes

~~Phytoremediation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

2 - Requires a relatively large volume to achieve economies of scale. Process option must be selected for multiple AOCs to be viable.

Table 8-1 - Soil Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 4 - Scattered Debris Area					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent of continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
~~Containment~~	~~Capping~~	~~Impermeable Liner Cap~~	Effective at minimizing human exposure to contaminants.	Harder to implement for discrete small areas. Restricts future land use.	Low capital. Medium O&M. Relatively overall cost increase for small areas.
	~~Cap Enhancements~~	~~Vegetative Permeable Soil Cap~~	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater.	Discrete small areas increase implementability issues and decrease practicality. Restricts future land use.	Low capital. Medium O&M. Relatively overall cost increases for small areas.
Treatment	~~In Situ Biological Treatment~~	~~Phytoremediation~~	Low reliability and may have limited effectiveness on site contaminants (PCBs).	Discrete small areas increase implementability issues and decrease practicality. Restricts future land use. Limited to shallow soils.	Low capital. Medium O&M. Relatively overall cost increases for small areas.
	Ex Situ Physical/Chemical Treatment	Excavation/Soil Washing/Disposal[2]	May have limited effectiveness depending on site specific soil characteristics.	Readily implementable well established complex technology that reliable reduces the volume of soil requiring disposal.	High capital. Low O&M. Medium overall cost.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.
		Excavation/On-Site Consolidation[1]	Effective and reliable.	Readily implementable as soil can be relocated to existing landfill area.	Low capital. Low O&M. Low overall cost.

Legend/Notes

~~Phytoremediation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

2 - Requires a relatively large volume to achieve economies of scale. Process option must be selected for multiple AOCs to be viable.

Table 8-1 - Soil Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 5 - Battery Disposal Area					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent of continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
~~Containment~~	~~Capping~~	~~Impermeable Liner Cap~~	Effective at minimizing human exposure to contaminants.	Easily implementable, well established, reliable, and low complexity. Restricts future land use.	Low capital. Medium O&M. Relatively overall cost increase for small areas.
	~~Cap Enhancements~~	~~Vegetative Permeable Soil Cap~~	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater.	Easily implementable, well established, reliable, and low complexity. Restricts future land use.	Low capital. Medium O&M. Relatively overall cost increase for small areas.
Treatment	~~In Situ Biological Treatment~~	~~Phytoremediation~~	Low reliability and may have limited effectiveness on site contaminants (PCBs).	Difficult to implement on steep slopes. Limited to shallow soils.	Low capital. Low O&M. Relatively low overall cost.
	Ex Situ Physical/Chemical Treatment	Excavation/Soil Washing/Disposal[2]	May have limited effectiveness depending on site specific soil characteristics.	May be difficult to implement due to slope stability issues adjacent to residential structures.	High capital. Low O&M. Medium overall cost.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	May be difficult to implement due to slope stability issues adjacent to residential structures.	Low capital. Low O&M. High disposal and overall cost.
		Excavation/On-Site Consolidation[1]	Effective and reliable.	May be difficult to implement due to slope stability issues adjacent to residential structures.	Low capital. Low O&M. Low overall cost.

Legend/Notes

~~Phytoremediation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

2 - Requires a relatively large volume to achieve economies of scale. Process option must be selected for multiple AOCs to be viable.

Table 8-1 - Soil Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 6 - Off-Site Residential Area					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.	None.
~~Institutional Controls~~	~~Access Restrictions~~	~~Deed Restrictions~~	Does not reduce contamination. Effectiveness dependent of continued future implementation.	Not implementable as restricts current land use.	Negligible cost.
~~Containment~~	~~Capping~~	~~Impermeable Liner Cap~~	Effective at minimizing human exposure to contaminants.	Not implementable given current land use.	Low capital. Medium O&M. Relatively overall cost increase for small areas.
	~~Cap Enhancements~~	~~Vegetative Permeable Soil Cap~~	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater.	Not implementable given current land use.	Low capital. Medium O&M. Relatively overall cost increase for small areas.
~~Treatment~~	~~In Situ Biological Treatment~~	~~Phytoremediation~~	Low reliability and may have limited effectiveness on site contaminants (PCBs).	Difficult to implement on steep slopes. Limited to shallow soils.	Low capital. Low O&M. Relatively low overall cost.
	~~Ex Situ Physical/Chemical Treatment~~	~~Excavation/Soil Washing/Disposal~~	May have limited effectiveness depending on site specific soil characteristics.	Difficult to implement given current land use.	High capital. Low O&M. Medium overall cost.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.
		Excavation/On-Site Consolidation[1]	Effective and reliable.	Readily implementable as soil can be relocated to existing landfill area.	Low capital. Low O&M. Low overall cost.

Legend/Notes

~~Phytoremediation~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

2 - Requires a relatively large volume to achieve economies of scale. Process option must be selected for multiple AOCs to be viable.

Table 8-2 - Groundwater Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
AOC 7 - Groundwater					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent on continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
~~Containment~~	~~Physical Barriers~~	~~Slurry Wall~~	Effective at minimizing human exposure to contaminants.	Readily implementable.	High Capital. High O&M. High overall cost.
Treatment	In Situ Biological Treatment	Long Term Monitoring	Low reliability and may have limited effectiveness on site contaminants.	Medium realiability.	Medium Capital. High O&M. Relatively low overall cost.
	~~In Situ Physical/Chemical Treatment~~	~~Passive/Reactive Treatment Wells~~	Low reliability and may have limited effectiveness on site contaminants.	Not efficient or effective technology for addressing groundwater contaminants given the physical characteristics of the site and concentrations and configuration of the groundwater plume.	High Capital. Medium O&M. Medium overall cost.
	Ex Situ Biological Treatment	Constructed Wetlands	Low reliability and may have limited effectiveness on site contaminants.	Limited to shallow soils. Difficult to maintain on landfill side slopes, may be appropriate in limited areas near seeps.	Low capital. Low O&M. Relatively low overall cost.
	Ex Situ Physical/Chemical Treatment	Groundwater Pumping/Pump & Treat	Low reliability and may have limited effectiveness on site contaminants.	Very hard to implement.	High Capital. High O&M. High disposal and overall cost.
Discharge	On-Site Discharge	Surface Water	Effective and reliable discharge method. Does not eliminate contamination.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.
		Infiltration Basin	Effective and reliable.	Readily implementable.	Low capital. Low O&M. Low overall cost.
	Off-Site Discharge	POTW	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.

Legend/Notes

~~Slurry Wall~~ - Process options that are screened out from further evaluation.

Table 8-3 - Solid Waste Process Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Soild Waste					
No Action	Not Applicable	Not Applicable	Does not achieve remedial action objectives.	Not acceptable to local community or state government.	None.
Institutional Controls	Access Restrictions	Deed Restrictions	Does not reduce contamination. Effectiveness dependent on continued future implementation.	Legal requirements and long term monitoring. Restricts future land use.	Negligible cost.
Containment	Capping	Multilayer Impermeable Cap	Effective at minimizing human exposure to contaminants. Effective when contaminants are above the water table.	Easily implementable, well established, reliable, and low complexity. Restricts future land use.	Low capital. Medium O&M. Relatively low overall cost.
	~~Cap Enhancement~~	~~Vegetative Permeable Soil Cap~~	Effective at minimizing human exposure to contaminants. Potential for contaminants to leach into groundwater. Not an effective barrier for landfill gas.	Easily implementable, well established, reliable, and low complexity. Does not meet state solid waste regulations.	Low capital. Medium O&M. Relatively low overall cost.
Treatment	Separation	Separation	Effective and reliable.	Easily implementable.	Low capital. Medium O&M. Relatively low overall cost.
Removal	Excavation/Off-Site Disposal	Excavation/Off-Site Disposal	Effective and reliable. Permanently removes contaminants from site.	Readily implementable.	Low capital. Low O&M. High disposal and overall cost.
		Excavation/On-Site Consolidation[1]	Effective and reliable.	Readily implementable as soil can be relocated to existing landfill area.	Low capital. Low O&M. Low overall cost.

Legend/Notes

~~Cap Enhancement~~ - Process options that are screened out from further evaluation.

1 - Assumes relocating impacted soil to landfill area and capping of landfill area.

Table 9-1 - Range of Process Options

		General Response Action			Containment	Treatment		Removal			Discharge		
		Remedial Technology / **Process Option**	No Action	Institutional Controls	Cap Impermeable	Long Term Monitoring	Groundwater Pumping/Pump & Treat	Excavation Soil Washing	Excavation On-Site Consolidation	Excavation Off-Site Disposal	On-Site Discharge Surface Water	On-Site Discharge Infiltration Basin	Off-Site Discharge POTW
Medium	**AOC**												
Soil	1	Landfill Area			M			M		M			
	2	Debris Pile Area			M			M	M	M			
	3	Dumpster Staging Area			M			M	M	M			
	4	Scattered Debris Area						M	M	M			
	5	Battery Disposal Area						M	M	M			
	6	Off-Site Residential Area							M	M			
Groundwater	7	Site Wide Groundwater				M	M				M	M	M
Solid Waste	1	Landfill Area			M				M	M			
	2	Debris Pile Area			M				M	M			

Notes:
M-Meets RAOs, Implementability and Cost Effective

Table 9-2 - Alternatives of Process Options

<table>
<tr><th></th><th></th><th colspan="6">Area of Concern</th></tr>
<tr><th>Alternative</th><th>General Response Action</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td>1</td><td>No Action</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2A</td><td>Containment</td><td colspan="3">Impermeable Cap</td><td colspan="3">On-Site Consolidation</td></tr>
<tr><td>2B</td><td></td><td colspan="3">Impermeable Cap</td><td colspan="3">Off-Site Disposal</td></tr>
<tr><td>2C</td><td></td><td>Cap</td><td colspan="5">On-Site Consolidation</td></tr>
<tr><td>2D</td><td></td><td>Cap</td><td colspan="5">Off-Site Disposal</td></tr>
<tr><td>3A</td><td>Treatment</td><td colspan="5">Separation/Soil Washing</td><td>Off-Site Disposal</td></tr>
<tr><td>3B</td><td></td><td>Cap</td><td colspan="4">Separation/Soil Washing</td><td>Off-Site Disposal</td></tr>
<tr><td>4</td><td>Removal</td><td colspan="6">Off-Site Disposal</td></tr>
</table>

Table 10-1 - Soil Alternatives Screening Analysis

Alternative	1 - No Action	2A - Cap/On-Site Consolidation	2B - Cap/Off-Site Disposal	2C - Cap/On-Site Consolidation
Alternative Description	• Alternative included as a basis for comparison with other remedial alternatives.	• Impermeable multilayer Cap is installed over AOCs 1, 2 and 3. • Impacted soils are excavated from AOCs 4, 5 and 6 and relocated to AOCs 1, 2, and/or 3.	• Impermeable multilayer cap is installed over AOCs 1, 2 and 3. • Impacted soils are excavated from AOCs 4, 5 and 6 and transported off-site for disposal.	• Impermeable multilayer cap is installed over AOC 1. • Impacted soils are excavated from AOCs 2 through 6 and relocated to AOC 1.
Effectiveness	• Will not meet any of the RAOs for the site.	• Provides direct contact protection from impacted soils. • Eliminates surface contaminant migration and dust generation. • Reduces, but may not eliminate, the source of groundwater contamination by minimizing groundwater infiltration. • On-site consolidation permanently removes soil contaminants from AOCs 4, 5 and 6. • Cap has high reliability and can be easily maintained/repaired.	• Provides direct contact protection from impacted soils. • Eliminates surface contaminant migration and dust generation. • Reduces, but may not eliminate, the source of groundwater contamination by minimizing groundwater infiltration. • Off-site disposal permanently removes soil contaminants from AOCs 4, 5 and 6. • Cap has high reliability and can be easily maintained/repaired.	• Provides direct contact protection from impacted soils. • Eliminates surface contaminant migration and dust generation. • Reduces, but may not eliminate, the source of groundwater contamination by minimizing groundwater infiltration. • On-site consolidation permanently removes soil contaminants from AOCs 2 through 6. • Cap has high reliability and can be easily maintained/repaired. • Area extent of impacted soils is relatively small compared to Alternatives 2A and 2B.
Implementability	• Will not meet applicable regulatory guidance or requirements.	• Well established technology. • Regarding of the site will be required to improve slope stability and promote storm water runoff. • Requires implementation of mitigate dust generation measures during construction. • Established technology with relatively low complexity.	• Well established technology. • Regarding of the site will be required to improve slope stability and promote storm water runoff. • Requires implementation of meditative dust generation measures during construction. • Established technology with relatively low complexity.	• Well established technology. • Regarding of the site will be required to improve slope stability and promote storm water runoff. • Requires implementation of mitigate dust generation measures during construction. • Established technology with relatively low complexity.
Relative Short Term Costs*	1	3	4	2
Relative Long Term Costs*	1	7	7	4

* - Relative ranking where 1 is the most favorable (i.e., least amount of expense) and 8 is the least favorable (i.e., greatest amount of expense)

Table 10-1 - Soil Alternative Screening Analysis

Alternative	2D - Cap/Off-Site Disposal	3A - Soil Washing/Off-Site Disposal	3B - Cap/Soil Washing/Off-Site Disposal	4 - Off-Site Disposal
Alternative Description	• Impermeable multilayer cap is installed over AOC 1. • Impacted soils are excavated from AOCs 2 through 6 and transported off-site for disposal.	• Solid waste is excavated and separated from soil in AOC 1. • Solid waste is transported off-site for disposal. • Impacted soils are excavated from AOCs 1 through 5 and treated via soil washing. • Impacted soils are excavated from AOC 6 and transported off-site for disposal.	• Impermeable multilayer cap is installed over AOC 1. • Impacted soils are excavated from AOCs 2 through 5 and treated via soil washing. • Impacted soils are excavated from AOC 6 and transported off-site for disposal.	• Excavation and removal of soil from all AOCs with concentrations greater than the residential SCOs.
Effectiveness	• Provides direct contact protection from impacted soils. • Eliminates surface contaminant migration and dust generation. • Reduces, but may not eliminate, the source of groundwater contamination by minimizing groundwater infiltration. • Off-site disposal permanently removes soil contaminants from AOCs 2 through 6. • Cap has high reliability and can be easily maintained/repaired. • Aerial extent of impacted soils is relatively smaller compared to Alternative 2A and 2B.	• Effective in removing metal contaminants from soil. • May have limited effectiveness in removing SVOC (PCBs) contaminants from soil. • Effectiveness influenced by site specific soil characteristics. • Small volume of concentrated impacted soils requires off-site disposal.	• Effective in removing metal contaminants from soil. • May have limited effectiveness in removing SVOC (PCBs) contaminants from soil. • Effectiveness influenced by site specific soil characteristics. • Small volume of concentrated impacted soils requires off-site disposal.	• Contaminants are ultimately transformed into innocuous byproducts (ammonia, carbon dioxide, ethene, ethane, chloride, and water) and not transferred to another media or location within the environment. • End products are non-toxic. • Collection, handling and treatment of contaminated water and/or vapor is not required. • Remediation period is significantly shorter than natural attenuation.
Implementability	• Well established technology. • Regarding of the site will be required to improve slope stability and promote storm water runoff. • Requires implementation of mitigate dust generation measures during construction. • Established technology with relatively low complexity.	• Well established technology with a high degree of complexity. • Excavation can be completed with conventional earth moving equipment. • Complex waste mixtures may make formulating wash fluid difficult. • Additional treatment required to address wash waters.	• Well established technology with a high degree of complexity. • Excavation can be completed with conventional earth moving equipment. • Complex waste mixtures may make formulating wash fluid difficult. • Additional treatment required to address wash waters.	• Excavation can be completed with conventional earth moving equipment.
Relative Short Term Costs*	7	6	5	8
Relative Long Term Costs*	4	1	4	1

* - Relative ranking where 1 is the most favorable (i.e., least amount of expense) and 8 is the least favorable (i.e., greatest amount of expense)

HDR

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative 1 No Action	Alternative 2A Cap/On-Site Consolidation	Alternative 2C Cap/On-Site Consolidation	Alternative 4 Off-Site Disposal
OVERALL PROTECTIVENESS				
Human Health and Protection				
Direct Contact/Ingestion	No reduction in risk.	Cap reduces direct contact risk. Soil consolidation removes risk for portions of site.	Cap reduces direct contact risk. Soil consolidation removes risk for portions of site.	Eliminates risk by removing source of risk.
Inhalation	No reduction in risk.	Cap reduces risk by providing barrier to vapor migration.	Cap reduces risk be providing barrier to vapor migration.	Eliminates risk by removing source of risk.
Impact to Groundwater	No reduction in risk.	Significantly reduces risk of future contaminant contributions to groundwater.	Significantly reduces risk of future contaminant contributions to groundwater.	Eliminates risk by removing source of risk.
Environmental Protection	Allows continued contamination of groundwater	Migration of contaminants is curtailed by cap. Contaminated soil remains on-site.	Migration of contaminants is curtailed by cap. Contaminated soil remains on-site.	Presently removes contaminated soil from site.
COMPLIANCE WITH ARARS				
Chemical Specific ARARs	Does not meet SCOs.	Would meet SCOs.	Would meet SCOs.	Would meet SCOs.
Action Specific ARARs	Not relevant as there is no action.	Will meet state landfill closure requirements.	Will meet state landfill closure requirements.	Not relevant as no action after contaminated soil removed.
Other Criteria and Guidance	Allows continued contamination of groundwater.	Protects against direct contact and ingestion of soils with contaminant conceneterations greater than NYS Part 375 Residential Use SCOs. Limits infiltation through soils with concentrations greater than NYS Part 375 Impact to Groundwater SCOs.	Protects against direct contact and ingestion of soils with contaminant conceneterations greater than NYS Part 375 Residential Use SCOs. Limits infiltation through soils with concentrations greater than NYS Part 375 Impact to Groundwater SCOs.	None applicable as risks eliminated by removing contaminated soil.
LONG TERM EFFECTIVENESS AND PERMANANCE				
Magnitude of remaining risk				
Direct Contact/Ingestion	Source of risk has not been removed. Existing risk will remain.	Risk eliminated as long as cap is maintained. Because source is only contained, inherent hazard of waste remains.	Risk eliminated as long as cap is maintained. Because source is only contained, inherent hazard of waste remains.	Risk eliminated by removing contaminated soil.
Inhalation	Source of risk has not been removed. Existing risk will remain.	Risk eliminated as long as cap is maintained. Because source is only contained, inherent hazard of waste remains.	Risk eliminated as long as cap is maintained. Because source is only contained, inherent hazard of waste remains.	Risk eliminated by removing contaminated soil.
Impact to Groundwater	Source of risk has not been removed. Existing risk will remain.	Risk eliminated as long as cap is maintained. Because source is only contained, inherent hazard of waste remains.	Risk eliminated as long as cap is maintained. Because source is only contained, inherent hazard of waste remains.	Risk eliminated by removing contaminated soil.

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative 1 No Action	Alternative 2A Cap/On-Site Consolidation	Alternative 2C Cap/On-Site Consolidation	Alternative 4 Off-Site Disposal
Adequacy and Reliability of Controls	No controls over remaining contamination. No reliability.	Cap controls soils. Reliability of cap is high if maintained. Risk also controlled by institutional controls if enforced.	Cap controls soils. Reliability of cap is high if maintained. Risk also controlled by institutional controls. Institutional controls may have limited effectiveness.	Risks controlled via removal of impacted soil from site. Off-site disposal is very reliable as impacted soil is permanently removed from the site.
Need for 5-Year Review	Review would be required to ensure adequate protection of human health and the environment.	Review would be required to ensure adequate protection of human health and the environment. Impacted soil would remain on-site.	Review would be required to ensure adequate protection of human health and the environment. Impacted soil would remain on-site.	5-year review not needed.
REDUCTION AND TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT				
Treatment Processes Used	None.	None.	None.	None.
Amount Destroyed or Treated	None.	None.	None.	None.
Reduction of Toxicity, Mobility, or Volume	None.	None.	None.	None.
Irreversible Treatment	None.	None.	None.	None.
Type and Quantity of Residuals Remaining After Treatment	No residuals remain.	None.	None.	None.
Statutory Preference for Treatment	Does not satisfy.	Does not satisfy.	Does not satisfy.	Does not satisfy.

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative 1 No Action	Alternative 2A Cap/On-Site Consolidation	Alternative 2C Cap/On-Site Consolidation	Alternative 4 Off-Site Disposal
SHORT TERM EFFECTIVENESS				
Community Protection	Risk to community not increased by remedy implementation.	Temporary increase in dust production and soil erosion through soil excavation/relocation and cap installation.	Temporary increase in dust production and soil erosion through soil excavation/relocation and cap installation.	Temporary increase in dust production and soil erosion through soil excavation.
Worker Protection	No significant risk to workers.	Protection required from dermal contact and inhalation of contaminated dust during soil excavation/relocation and cap installation.	Protection required from dermal contact and inhalation of contaminated dust during soil excavation/relocation and cap installation.	Protection required from dermal contact and inhalation of contaminated dust during soil excavation.
Environmental Impacts	Continued impacts form existing conditions.	Temporary increase in dust production and soil erosion through soil excavation/relocation and cap installation.	Temporary increase in dust production and soil erosion through soil excavation/relocation and cap installation.	Temporary increase in dust production and soil erosion through soil excavation.
Time Until Action is Complete	Not applicable.	Cap installed in 9 months.	Cap installed in 6 months.	Excavation completed in 6 months.
IMPLEMENTABILITY				
Ability to construct and Operate	No construction or operation.	Simple to operate and construct. Would require significant soil handling.	Simple to operate and construct. Would require significant soil handling.	Simple to implement. Would require significant soil handling.
Ease of Doing More Action if Needed	If monitoring indicates more action is necessary, may need to go through FS/ROD process again.	Simple to extend cap and/or excavations based on pre-design or post excavation data.	Simple to extend cap and/or excavations based on pre-design or post excavation data.	Simple to extend cap and/or excavations based on pre-design or post excavation data.
Ability to Monitor Effectiveness	No monitoring.	Simple to perform routine inspections of cap. Monitoring will give notice before significant exposure occurs.	Simple to perform routine inspections of cap. Monitoring will give notice before significant exposure occurs.	Confirmatory sampling program will confirm effectiveness of remedy.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approval necessary.	No approval necessary. Assume action completed under state remediation group and no solid waste permits required.	No approval necessary. Assume action completed under state remediation group and no solid waste permits required.	No approval necessary.
Ability of Services and Capacities	No services or capacities required.	No special services or capacities required.	No special services or capacities required.	No special services or capacities required.

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative 1 No Action	Alternative 2A Cap/On-Site Consolidation	Alternative 2C Cap/On-Site Consolidation	Alternative 4 Off-Site Disposal
Availability of Equipment, Specialties, and Materials	None required.	HDPE liner and liner welding specialist required. No other special material or equipment required.	HDPE liner and liner welding specialist required. No other special material or equipment required.	None required.
Availability of Technologies	None required.	Cap technology readily available.	Cap technology readily available.	None required.
COST				
Capital Cost	$ -	$ 5,152,800	$ 4,695,938	$ 23,822,000
First Year Annual O&M Cost	$ -	$ 75,500	$ 65,700	$ -
Present Worth Cost	$ -	$ 513,000	$ 436,500	$ -

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative G1 No Action	Alternative G2 Long Term Monitoring	Alternative G3 Pump and Treat
OVERALL PROTECTIVENESS			
Human Health and Protection			
Direct Contact/Ingestion	No reduction in risk.	Reduces risk of ingestion through institutional controls.	Reduces risk of ingestion through institutional controls.
Inhalation	No reduction in risk.	Some reduction in risk through monitoring.	Some added risk to workers by bringing contaminated water to the surface.
Impact to Groundwater	Not applicable.	Not applicable.	Not applicable.
Environmental Protection	Allows continued migration of groundwater.	Allows continued migration of groundwater.	Reduces risk by extracting contaminated groundwater.
COMPLIANCE WITH ARARS			
Chemical Specific ARARs	Does not meet groundwater standards	Would meet groundwater standard in 30 year time period.	Would meet groundwater standard in 10 to 20 year time period.
Action Specific ARARs	Not relevant as there is no action.	None.	Would meet SPDES requirements.
Other Criteria and Guidance	Allows continued migration of contaminated groundwater.	Monitoring to protect against ingestion of groundwater with contaminant concentrations greater than the NYSDEC Class GA Groundwater Quality Standards.	Protects against ingestion of groundwater with contaminant concentrations greater than the NYSDEC Class GA Groundwater Quality Standards.
LONG TERM EFFECTIVENESS AND PERMANANCE			
Magnitude of remaining risk			
Direct Contact/Ingestion	Future risk increases as plume migrates off-site. Eventually risks may decrease due to natural attenuation.	Future risk increases as plume migrates off-site. Eventually risks may decrease due to natural attenuation.	Some risk remains during pumping. Plume size will shrink over time reducing risk.
Inhalation	Future risk increases as plume migrates off-site. Eventually risks may decrease due to natural attenuation.	Future risk increases as plume migrates off-site. Eventually risks may decrease due to natural attenuation.	Some risk remains during pumping. Plume size will shrink over time reducing risk.
Impact to Groundwater	Not applicable.	Not applicable.	Not applicable.

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative G1 No Action	Alternative G2 Long Term Monitoring	Alternative G3 Pump and Treat
Adequacy and Reliability of Controls	No controls over remaining contamination. No reliability.	Institutional controls to control use of groundwater may not be reliable.	Groundwater extraction provides adequate control of contaminated groundwater. Pump and treat system is reliable technology.
Need for 5-Year Review	Review would be required to ensure adequate protection of human health and the environment.	Review would be required to ensure adequate protection of human health and the environment.	Review would be required to ensure adequate protection of human health and the environment.
REDUCTION AND TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT			
Treatment Processes Used	None.	None.	Ion exchange for inorganic contaminant removal and GAC for organic contaminant removal.
Amount Destroyed or Treated	None.	None.	Organic contaminants destroyed when carbon is regenerated.
Reduction of Toxicity, Mobility, or Volume	None.	None.	Reduced volume and toxicity of groundwater.
Irreversible Treatment	None.	None.	Ion exchange and carbon adsorption are generally irreversible. Regeneration of carbon is irreversible.
Type and Quantity of Residuals Remaining After Treatment	No residuals remain.	None.	Carbon and ion exchange resin require regeneration.
Statutory Preference for Treatment	Does not satisfy.	Does not satisfy.	Satisfies.

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative G1 No Action	Alternative G2 Long Term Monitoring	Alternative G3 Pump and Treat
SHORT TERM EFFECTIVENESS			
Community Protection	Risk to community not increased by remedy implementation.	Risk to community not increased by remedy implementation.	Risk to community not increased by remedy implementation.
Worker Protection	No significant risk to workers.	No significant risk to workers.	Protection required for dermal contact, vapor, or ingestion from extracted contaminated groundwater during operation.
Environmental Impacts	Continued impacts from existing conditions.	Would be some migration of contaminant plume as part of attenuation process.	Aquifer draw down during extraction.
Time Until Action is Complete	Not applicable.	Long term monitoring for 30 years.	Active remedial action complete in 20 years. Long term monitoring continues for 30 years.
IMPLEMENTABILITY			
Ability to construct and Operate	No construction or operation.	Simple to install additional monitoring wells.	Treatment plant fairly straight forward to construct with some complex equipment installation. Operation requires trained personnel.
Ease of Doing More Action if Needed	If monitoring indicates more action is necessary, may need to go through FS/ROD process again.	Simple to expand monitoring well network.	Simple to expand groundwater extraction system. Some flexibility of plant to handle varying volumes or concentrations. May be difficult to expand at significantly higher volumes or concentrations than expected.
Ability to Monitor Effectiveness	No monitoring. Failure to detect contamination means ingestion of contaminated groundwater.	Simple to perform routine groundwater sampling events.	Simple to perform routine groundwater sampling events.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approval necessary.	No approval necessary.	SPDES permit required. Should be easy to obtain.
Ability of Services and Capacities	No services or capacities required.	No special services or capacities required.	No special services or capacities required.

Table 11-1 Individual Evaluation of Final Alternatives

Criteria	Alternative G1 No Action	Alternative G2 Long Term Monitoring	Alternative G3 Pump and Treat
Availability of Equipment, Specialties, and Materials	None required.	None required.	Needs readily available specialists to supply and install treatment plant equipment. Need treatment plant operators.
Availability of Technologies	None required.	None required.	Ion exchange and carbon treatment are well established technologies. Will require pilot test.
COST			
Capital Cost	$ -	$ 63,625	$ 629,000
First Year Annual O&M Cost	$ -	$ 51,000	$ 416,900
Present Worth Cost	$ -	$ 157,500	$ 165,000

Table 11-2 Cost Estimate for Alternative 1

Alternative 1
NO ACTION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 1 consists of no action.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Mobilization and Demobilization**					
1.1	Construction Equipment Mob/Demob	0	LS	$ 11,000	$ -	Excavators, loader, dozer, trailer, Frac tanks, etc.
1.2	Construction Trailer and Facilities	0	LS	$ 15,000	$ -	Trailer tie downs and 12-month rental.
1.3	Temporary Communication & Utilities	0	LS	$ 5,400	$ -	Power, phone, internet, water, chem. toilet, etc.
1.4	Field Equipment and Supplies	0	LS	$ 6,500	$ -	Copier, fax, scanner, paper, gasoline, signage, etc.
1.5	Equipment Storage Facility	0	LS	$ 4,200	$ -	Sea box or sprung structure.
1.6	Water Truck (Dust Control)	0	Month	$ 550	$ -	12-month rental.
1.7	Waste Water Storage (Frac Tack)	0	Month	$ 1,250	$ -	2 tanks for 12-months.
1.8	Submittals/Implementation Plans	0	LS	$ 25,000	$ -	QAPP, HASP, shop dwgs and work plans
1.9	Post Construction Submittals	0	LS	$ 15,000	$ -	Manifests, asbuilts, warrantees,
	Sub-Total				**$ -**	
2	**Site Preparation**					
2.1	Construction Entrance	0	EA	$ 10,000	$ -	50-foot 2 inch stone pad underlain with geotextile.
2.2	Equipment Staging Area	0	EA	$ 7,500	$ -	Stone area for truck turnaround and equipment staging
2.3	Access Road	0	LF	$ 25.00	$ -	20-foot wide, 6-inch thick gravel road underlain with geotextile.
2.4	Decontamination Pad	0	EA	$ 10,000	$ -	Lined stone decon pad with sump.
2.5	Construction/Security Fencing	0	LF	$ 5.50	$ -	Fencing to restrict pedestrian and vehicle access to site.
2.6	Silt Fencing	0	LF	$ 4.50	$ -	Erosion protection around all disturbed areas.
2.7	Diversion Berm	0	LF	$ 12.00	$ -	Diversion berm or super sacks to provide flood protection.
2.8	Sediment Barriers	0	LF	$ 7.50	$ -	Hay bales or heavy duty silt fence in areas of greater erosion.
2.9	Clearing and Grubbing	0	AC	$ 1,250	$ -	Cut and chip tress and vegetation on site.
2.10	Truck Loading Area	0	EA	$ 11,000	$ -	Stone area to stage trucks during soil loadout.
	Sub-Total				**$ -**	
3	**Earthwork, Off-Site Disposal**					
3.1	Excavation	0	CY	$ 15.00	$ -	Excavate impacted soil.
3.2	Stockpile	0	EA	$ 750	$ -	Temporary staging of impacted soils.
3.3	Loadout	0	CY	$ 15.00	$ -	Loading of trucks for off-site disposal.
3.4	Transportation & Disposal	0	Ton	$ 100.00	$ -	Trucking and Landfill Tipping fees
3.5	Backfill	0	Ton	$ 25.00	$ -	Importing certified clean fill.
3.6	Topsoil	0	CY	$ 40.00	$ -	Importing clean soil to support vegetation.
	Sub-Total				**$ -**	
4	**Earthwork, On-Site Consolidation**					
4.1	Excavation	0	CY	$ 15.00	$ -	Excavate impacted soil.
4.2	Stockpile	0	EA	$ 750	$ -	Temporary staging of impacted soils.
4.3	Hauling	0	CY	$ 8.00	$ -	Relocating soil on-site.
4.4	Placement	0	CY	$ 5.00	$ -	Placement, grading and compaction of soil.
4.5	Backfill	0	Ton	$ 20.00	$ -	Importing certified clean fill.
4.6	Topsoil	0	CY	$ 40.00	$ -	Importing clean soil to support vegetation.
	Sub-Total				**$ -**	
5	**Cap Construction**					
5.1	Waste Placement (Total Cut and Fill)	0	CY	$ 15.00	$ -	Placement, grading and compaction of solid waste.
5.2	Subgrade Preparation	0	AC	$ 3,250	$ -	Fine grading of waste surface.
5.3	Gas Collection Layer	0	Ton	$ 24.00	$ -	12-inch gas collection sand layer.
5.4	Geomembrane	0	SF	$ 1.50	$ -	60 mil HDPE liner.
5.5	Protective Soil Layer	0	CY	$ 20.00	$ -	18-inch structural fill layer.
5.6	Topsoil	0	CY	$ 40.00	$ -	6-ich topsoil layer.
5.7	Gas Vents	0	EA	$ 100.00	$ -	4-inch dia. Sch. 80 PVC 'J' Vents
5.8	Grass Lined Swale	0	LF	$ 10.00	$ -	Low-flow drainage channel.
5.9	Perimeter Concrete Drainage Channel	0	LF	$ 20.00	$ -	High-flow drainage channel
5.10	Energy Dissipater Pad	0	EA	$ 15,000	$ -	Concrete pad for steep slope drainage channel.
5.11	Drainage Basin	0	LS	$ 25,000	$ -	Retention basing for cap storm water runoff.
5.12	Rip-Rap Discharge Pad	0	EA	$ 7,500	$ -	Inlet protection for basin.

Table 11-2 Cost Estimate for Alternative 1

Alternative 1
NO ACTION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 1 consists of no action.

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
	5.13	Access Road	0	LF	$ 25.00	$ -	20-foot wide, 6-inch thick gravel road underlain with geotextile.
		Sub-Total				**$ -**	
6		**Sampling and Analysis**					
	6.1	Post Excavation Sampling	0	EA	$ 250	$ -	Total VOCs, PCBs, and metals analysis.
	6.2	Backfill Source Sampling	0	EA	$ 500	$ -	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
	6.3	Waste Characterization Sampling	0	EA	$ 1,500	$ -	Total/TCLP VOCs, SVOCs, Metals, PCBs, RCRA charact.
	6.4	Decon Water Sampling	0	EA	$ 550	$ -	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
		Sub-Total				**$ -**	
7		**Site Restoration**					
	7.1	Perimeter Chain Link Fence	0	LF	$ 20.00	$ -	6-foot chain link fabric fence.
	7.2	Access Gate	0	EA	$ 5,000	$ -	20-foot sliding vehicle gate.
	7.3	Hydro Seeding	0	SF	$ 0.10	$ -	Establish vegetation on disturbed areas.
	7.4	Erosion Control Fabric	0	SF	$ 0.15	$ -	Coconut mat erosion blanket.
	7.5	Turf Reinforcement Mat	0	LF	$ 0.25	$ -	Turf reinforcement mat for cap side slopes.
	7.6	Remove Soil Erosion & Sediment Controls	0	LS	$ 15,000	$ -	Labor, equipment, and disposal.
		Sub-Total				**$ -**	
8		**H&S, Community Air Monitoring**					
	8.1	Perimeter Air monitoring	0	Mo.	$ 7,000	$ -	Tripod station with Dust and PID monitors.
	8.2	H&S Monitoring	0	Mo.	$ 2,500	$ -	Meters for monitoring work zone.
	8.3	PPE and Field Supplies	0	LS	$ 15,000	$ -	Boots, glasses, hard hat, gloves, etc.
		Sub-Total				**$ -**	
		Sub-Total				**$ -**	Sub-Total All Construction Costs.
		Contingency	25%			$ -	10% scope + 15% bid
		Sub-Total				**$ -**	
		Project Management	5%			$ -	
		Remedial Design	8%			$ -	
		Construction Management	6%			$ -	
		Institutional Controls					
		Institutional Controls Plan	0	EA	$ 10,000	$ -	Environmental easement/deed restriction, legal fees.
		Site Management Plan	0	LS	$ 20,000	$ -	Describe controls, inspection and monitoring program.
		Site Information Database	0	LS	$ 7,500	$ -	Setup data management system.
		Sub-Total				**$ -**	
		TOTAL CAPITAL COST				**$ -**	

ANNUAL O&M COST:

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
1		**Annual Inspection and Sampling**					
	1.1	Site Inspection and Report	0	LS	$ 15,000	$ -	Total VOCs, PCBs, and metals analysis.
	1.2	Groundwater Sampling	0	LS	$ 10,000	$ -	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
		Sub-Total				**$ -**	
2		**Maintenance**					
	2.1	Mowing	0	LS	$ 8,000	$ -	Grass mowing of cap.
	2.2	Cap Maintenance and Repair	0	LS	$ 15,000	$ -	Erosion repair, debris removal, fence repair, etc.
		Sub-Total				**$ -**	

Table 11-2 Cost Estimate for Alternative 1

Alternative 1
NO ACTION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 1 consists of no action.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
	Sub-Total				**$ -**	Sub-Total O&M Costs.
	Contingency	25%			$ -	10% scope + 15% bid
	Sub-Total				**$ -**	
	Project Management	5%			$ -	
	Technical Support	8%			$ -	
	Institutional Controls					
	Site Information Database	0	LS	$ 7,500	$ -	Update and maintain database.
	TOTAL ANNUAL O&M COST				**$ -**	

PERIODIC COSTS:

Item No.	Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1	**Five Year Review**						
1.1	Review and Report	5	0	LS	$ 15,000	$ -	Every 5 years through year 30.
1.2	Update Institutional Controls	5	0	LS	$ 10,000	$ -	Every 5 years through year 30.
	Sub-Total					**$ -**	
2	**Long Term Maintenance**						
2.1	Clearing	5	0	LS	$ 8,000	$ -	Overgrown tree removal.
2.2	Drainage Basin Rehabilitation	5	0	LS	$ 15,000	$ -	Remove sedimentation buildup.
2.3	Minor Cap Repair	5	0	LS	$ 10,000	$ -	Small soil erosion repair.
	Sub-Total					**$ -**	
3	**Long Term Maintenance**						
3.1	Major Cap Repair	10	0	LS	$ 20,000	$ -	Soil and liner cap repair.
3.2	Access Road Repair	10	0	LF	$ 15	$ -	Regrade and resurface with stone.
3.3	Perimeter Fence Repair	10	0	LF	$ 20	$ -	Repair and replace limited portion of fence.
3.4	Drainage Channel Repair	10	0	LS	$ 10,000	$ -	Remove sedimentation, repair concrete.
	Sub-Total					**$ -**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0		$ -	
2	**Annual O&M Cost**	1-30	0	$ -	
3	**Periodic Costs**				
3.1	Year 5	5	0	$ -	
3.2	Year 10	10	0	$ -	
3.3	Year 15	15	0	$ -	
3.4	Year 20	20	0	$ -	
3.5	Year 25	25	0	$ -	
3.6	Year 30	30	0	$ -	
	Sub-Total			**$ -**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ -**	

Table 11-3 Cost Estimate for Alternative 2A

Alternative 2A
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2A consists of installing an impermeable cap in AOCs 1, 2 and 3. Soil in AOCs 4, 5, and 6 with concentrations greater than the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Mobilization and Demobilization**					
1.1	Construction Equipment Mob/Demob	1	LS	$ 11,000	$ 11,000	Excavators, loader, dozer, trailer, Frac tanks, etc.
1.2	Construction Trailer and Facilities	1	LS	$ 15,000	$ 15,000	Trailer tie downs and 12-month rental.
1.3	Temporary Communication & Utilities	1	LS	$ 5,400	$ 5,400	Power, phone, internet, water, chem. toilet, etc.
1.4	Field Equipment and Supplies	1	LS	$ 6,500	$ 6,500	Copier, fax, scanner, paper, gasoline, signage, etc.
1.5	Equipment Storage Facility	1	LS	$ 4,200	$ 4,200	Sea box or sprung structure.
1.6	Water Truck (Dust Control)	12	Month	$ 550	$ 6,600	12-month rental.
1.7	Waste Water Storage (Frac Tack)	12	Month	$ 1,250	$ 15,000	2 tanks for 12-months.
1.8	Submittals/Implementation Plans	1	LS	$ 25,000	$ 25,000	QAPP, HASP, shop dwgs and work plans
1.9	Post Construction Submittals	1	LS	$ 15,000	$ 15,000	Manifests, asbuilts, warranties,
	Sub-Total				**$ 103,700**	
2	**Site Preparation**					
2.1	Construction Entrance	1	EA	$ 10,000	$ 10,000	50-foot 2 inch stone pad underlain with geotextile.
2.2	Equipment Staging Area	1	EA	$ 7,500	$ 7,500	Stone area for truck turnaround and equipment staging
2.3	Access Road	1,000	LF	$ 25.00	$ 25,000	20-foot wide, 6-inch thick gravel road underlain with geotextile.
2.4	Decontamination Pad	1	EA	$ 10,000	$ 10,000	Lined stone decon pad with sump.
2.5	Construction/Security Fencing	2,500	LF	$ 5.50	$ 13,750	Fencing to restrict pedestrian and vehicle access to site.
2.6	Silt Fencing	2,500	LF	$ 4.50	$ 11,250	Erosion protection around all disturbed areas.
2.7	Diversion Berm	1,500	LF	$ 12.00	$ 18,000	Diversion berm or super sacks to provide flood protection.
2.8	Sediment Barriers	500	LF	$ 7.50	$ 3,750	Hay bales or heavy duty silt fence in areas of greater erosion.
2.9	Clearing and Grubbing	10	AC	$ 1,250	$ 12,500	Cut and chip tress and vegetation on site.
2.10	Truck Loading Area	1	EA	$ 11,000	$ 11,000	Stone area to stage trucks during soil loadout.
	Sub-Total				**$ 122,750**	
3	**Earthwork, Off-Site Disposal**					
3.1	Excavation	0	CY	$ 15.00	$ -	Excavate impacted soil.
3.2	Stockpile	0	EA	$ 750	$ -	Temporary staging of impacted soils.
3.3	Loadout	0	CY	$ 15.00	$ -	Loading of trucks for off-site disposal.
3.4	Transportation & Disposal	0	Ton	$ 100.00	$ -	Trucking and Landfill Tipping fees
3.5	Backfill	0	CY	$ 20.00	$ -	Importing certified clean fill.
3.6	Topsoil	0	CY	$ 40.00	$ -	Importing clean soil to support vegetation.
	Sub-Total				**$ -**	
4	**Earthwork, On-Site Consolidation**					
4.1	Excavation	1,500	CY	$ 15.00	$ 22,500	Excavate impacted soil.
4.2	Stockpile	3	EA	$ 750	$ 2,250	Temporary staging of impacted soils.
4.3	Hauling	1,500	CY	$ 8.00	$ 12,000	Relocating soil on-site.
4.4	Placement	1,500	CY	$ 5.00	$ 7,500	Placement, grading and compaction of soil.
4.5	Backfill	1,000	CY	$ 20.00	$ 20,000	Importing certified clean fill.
4.6	Topsoil	500	CY	$ 40.00	$ 20,000	Importing clean soil to support vegetation.
	Sub-Total				**$ 84,250**	
5	**Cap Construction**					
5.1	Waste Placement (Total Cut and Fill)	23,000	CY	$ 15.00	$ 345,000	Placement, grading and compaction of solid waste.
5.2	Subgrade Preparation	12	AC	$ 3,250	$ 39,000	Fine grading of waste surface.
5.3	Gas Collection Layer	19,000	CY	$ 24.00	$ 456,000	12-inch gas collection sand layer.
5.4	Geomembrane	510,000	SF	$ 1.50	$ 765,000	60 mil HDPE liner.
5.5	Protective Soil Layer	28,500	CY	$ 20.00	$ 570,000	18-inch structural fill layer.
5.6	Topsoil	9,500	CY	$ 40.00	$ 380,000	6-ich topsoil layer.

Table 11-3 Cost Estimate for Alternative 2A

Alternative 2A
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2A consists of installing an impermeable cap in AOCs 1, 2 and 3. Soil in AOCs 4, 5, and 6 with concentrations greater than the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
	5.7	Gas Vents	100	EA	$ 100.00	$ 10,000	4-inch dia. Sch. 80 PVC 'J' Vents
	5.8	Grass Lined Swale	2,500	LF	$ 10.00	$ 25,000	Low-flow drainage channel.
	5.9	Perimeter Concrete Drainage Channel	2,500	LF	$ 20.00	$ 50,000	High-flow drainage channel
	5.10	Energy Dissipater Pad	2	EA	$ 15,000	$ 30,000	Concrete pad for steep slope drainage channel.
	5.11	Drainage Basin	1	LS	$ 25,000	$ 25,000	Retention basin for cap storm water runoff.
	5.12	Rip-Rap Discharge Pad	2	EA	$ 7,500	$ 15,000	Inlet protection for basin.
	5.13	Access Road	1,600	LF	$ 25.00	$ 40,000	20-foot wide, 6-inch thick gravel road underlain with geotextile.
		Sub-Total				**$ 2,750,000**	
6		**Sampling and Analysis**					
	6.1	Post Excavation Sampling	300	EA	$ 250	$ 75,000	Total VOCs, PCBs, and metals analysis.
	6.2	Backfill Source Sampling	5	EA	$ 500	$ 2,500	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
	6.3	Waste Characterization Sampling	0	EA	$ 1,500	$ -	Total/TCLP VOCs, SVOCs, Metals, PCBs, RCRA charact.
	6.4	Decon Water Sampling	2	EA	$ 550	$ 1,100	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
		Sub-Total				**$ 78,600**	
7		**Site Restoration**					
	7.1	Perimeter Chain Link Fence	3,000	LF	$ 20.00	$ 60,000	6-foot chain link fabric fence.
	7.2	Access Gate	1	EA	$ 5,000	$ 5,000	20-foot sliding vehicle gate.
	7.3	Hydro Seeding	500,000	SF	$ 0.10	$ 50,000	Establish vegetation on disturbed areas.
	7.4	Erosion Control Fabric	100,000	SF	$ 0.15	$ 15,000	Coconut mat erosion blanket.
	7.5	Turf Reinforcement Mat	100,000	LF	$ 0.25	$ 25,000	Turf reinforcement mat for cap side slopes.
	7.6	Remove Soil Erosion & Sediment Controls	1	LS	$ 15,000	$ 15,000	Labor, equipment, and disposal.
		Sub-Total				**$ 170,000**	
8		**H&S, Community Air Monitoring**					
	8.1	Perimeter Air monitoring	12	Mo.	$ 7,000	$ 84,000	Tripod station with Dust and PID monitors.
	8.2	H&S Monitoring	12	Mo.	$ 2,500	$ 30,000	Meters for monitoring work zone.
	8.3	PPE and Field Supplies	1	LS	$ 15,000	$ 15,000	Boots, glasses, hard hat, gloves, etc.
		Sub-Total				**$ 129,000**	
		Sub-Total				**$ 3,438,300**	Sub-Total All Construction Costs.
		Contingency	25%			$ 860,000	10% scope + 15% bid
		Sub-Total				**$ 4,298,300**	
		Project Management	5%			$ 215,000	
		Remedial Design	8%			$ 344,000	
		Construction Management	6%			$ 258,000	
		Institutional Controls					
		Institutional Controls Plan	1	EA	$ 10,000	$ 10,000	Environmental easement/deed restriction, legal fees.
		Site Management Plan	1	LS	$ 20,000	$ 20,000	Describe controls, inspection and monitoring program.
		Site Information Database	1	LS	$ 7,500	$ 7,500	Setup data management system.
		Sub-Total				**$ 37,500**	
		TOTAL CAPITAL COST				**$ 5,152,800**	

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Table 11-3 Cost Estimate for Alternative 2A

Alternative 2A
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2A consists of installing an impermeable cap in AOCs 1, 2 and 3. Soil in AOCs 4, 5, and 6 with concentrations greater than the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

ANNUAL O&M COST:

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
1		**Annual Inspection and Sampling**					
	1.1	Site Inspection and Report	1	LS	$ 15,000	$ 15,000	Total VOCs, PCBs, and metals analysis.
	1.2	Groundwater Sampling	1	LS	$ 10,000	$ 10,000	analysis.
		Sub-Total				**$ 25,000**	
2		**Maintenance**					
	2.1	Mowing	1	LS	$ 8,000	$ 8,000	Grass mowing of cap.
	2.2	Cap Maintenance and Repair	1	LS	$ 15,000	$ 15,000	Erosion repair, debris removal, fence repair, etc.
		Sub-Total				**$ 23,000**	
	Sub-Total					**$ 48,000**	Sub-Total O&M Costs.
		Contingency	25%			$ 12,000	10% scope + 15% bid
	Sub-Total					**$ 60,000**	
	Project Management		5%			$ 3,000	
	Technical Support		8%			$ 5,000	
	Institutional Controls						
		Site Information Database	1	LS	$ 7,500	$ 7,500	Update and maintain database.
	TOTAL ANNUAL O&M COST					**$ 75,500**	

PERIODIC COSTS:

Item No.		Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1		**Five Year Review**						
	1.1	Review and Report	5	1	LS	$ 15,000	$ 15,000	Every 5 years through year 30.
	1.2	Update Institutional Controls	5	1	LS	$ 10,000	$ 10,000	Every 5 years through year 30.
		Sub-Total					**$ 25,000**	
2		**Long Term Maintenance**						
	2.1	Clearing	5	1	LS	$ 8,000	$ 8,000	Overgrown tree removal.
	2.2	Drainage Basin Rehabilitation	5	1	LS	$ 15,000	$ 15,000	Remove sedimentation buildup.
	2.3	Minor Cap Repair	5	1	LS	$ 10,000	$ 10,000	Small soil erosion repair.
		Sub-Total					**$ 33,000**	
3		**Long Term Maintenance**						
	3.1	Major Cap Repair	10	1	LS	$ 20,000	$ 20,000	Soil and liner cap repair.
	3.2	Access Road Repair	10	1,000	LF	$ 15	$ 15,000	Regrade and resurface with stone.
	3.3	Perimeter Fence Repair	10	500	LF	$ 20	$ 10,000	Repair and replace limited portion of fence.
	3.4	Drainage Channel Repair	10	1	LS	$ 10,000	$ 10,000	Remove sedimentation, repair concrete.
		Sub-Total					**$ 55,000**	

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Table 11-3 Cost Estimate for Alternative 2A

Alternative 2A
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2A consists of installing an impermeable cap in AOCs 1, 2 and 3. Soil in AOCs 4, 5, and 6 with concentrations greater than the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0		$ 5,152,800	
2	**Annual O&M Cost**	1-30	75,500	$ 936,883	
3	**Periodic Costs**				
3.1	Year 5	5	58,000	$ 47,940	
3.2	Year 10	10	113,000	$ 77,199	
3.3	Year 15	15	58,000	$ 32,751	
3.4	Year 20	20	113,000	$ 52,741	
3.5	Year 25	25	58,000	$ 22,375	
3.6	Year 30	30	113,000	$ 36,031	
	Sub-Total			**$ 233,006**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ 6,323,000**	

Table 11-4 Cost Estimate for Alternative 2C

Alternative 2C
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2C consists of installing an impermeable cap on AOC 1. Soil in AOCs 1 through 6 with concentrations greater then the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Mobilization and Demobilization**					
1.1	Construction Equipment Mob/Demob	1	LS	$ 11,000	$ 11,000	Excavators, loader, dozer, trailer, Frac tanks, etc.
1.2	Construction Trailer and Facilities	1	LS	$ 15,000	$ 15,000	Trailer tie downs and 12-month rental.
1.3	Temporary Communication & Utilities	1	LS	$ 5,400	$ 5,400	Power, phone, internet, water, chem toilet, etc.
1.4	Field Equipment and Supplies	1	LS	$ 6,500	$ 6,500	Copier, fax, scanner, paper, gasoline, signage, etc.
1.5	Equipment Storage Facility	1	LS	$ 4,200	$ 4,200	Sea box or sprung structure.
1.6	Water Truck (Dust Control)	12	Month	$ 550	$ 6,600	12-month rental.
1.7	Waste Water Storage (Frac Tack)	12	Month	$ 1,250	$ 15,000	2 tanks for 12-months.
1.8	Submittals/Implementation Plans	1	LS	$ 25,000	$ 25,000	QAPP, HASP, shop dwgs and work plans
1.9	Post Construction Submittals	1	LS	$ 15,000	$ 15,000	Manifests, asbuilts, warranties,
	Sub-Total				**$ 103,700**	
2	**Site Preparation**					
2.1	Construction Entrance	1	EA	$ 10,000	$ 10,000	50-foot 2 inch stone pad underlain with geotextile.
2.2	Equipment Staging Area	1	EA	$ 7,500	$ 7,500	Stone area for truck turnaround and equipment staging
2.3	Access Road	1,000	LF	$ 25.00	$ 25,000	20-foot wide, 6-inch thick gravel road underlain with geotextile.
2.4	Decontamination Pad	1	EA	$ 10,000	$ 10,000	Lined stone decon pad with sump.
2.5	Construction/Security Fencing	2,500	LF	$ 5.50	$ 13,750	Fencing to restrict pedestrian and vehicle access to site.
2.6	Silt Fencing	2,500	LF	$ 4.50	$ 11,250	Erosion protection around all disturbed areas.
2.7	Diversion Berm	1,500	LF	$ 12.00	$ 18,000	Diversion berm or super sacks to provide flood protection.
2.8	Sediment Barriers	500	LF	$ 7.50	$ 3,750	Hay bales or heavy duty silt fence in areas of greater erosion.
2.9	Clearing and Grubbing	10	AC	$ 1,250	$ 12,500	Cut and chip tress and vegetation on site.
2.10	Truck Loading Area	1	EA	$ 11,000	$ 11,000	Stone area to stage trucks during soil loadout.
	Sub-Total				**$ 122,750**	
3	**Earthwork, Off-Site Disposal**					
3.1	Excavation	0	CY	$ 15.00	$ -	Excavate impacted soil.
3.2	Stockpile	0	EA	$ 750	$ -	Temporary staging of impacted soils.
3.3	Loadout	0	CY	$ 15.00	$ -	Loading of trucks for off-site disposal.
3.4	Transportation & Disposal	0	Ton	$ 100.00	$ -	Trucking and Landfill Tipping fees
3.5	Backfill	0	CY	$ 20.00	$ -	Importing certified clean fill.
3.6	Topsoil	0	CY	$ 40.00	$ -	Importing clean soil to support vegetation.
	Sub-Total				**$ -**	
4	**Earthwork, On-Site Consolidation**					
4.1	Excavation	28,200	CY	$ 15.00	$ 423,000	Excavate impacted soil.
4.2	Stockpile	56	EA	$ 750	$ 42,300	Temporary staging of impacted soils.
4.3	Hauling	28,200	CY	$ 8.00	$ 225,600	Relocating soil on-site.
4.4	Placement	28,200	CY	$ 5.00	$ 141,000	Placement, grading and compaction of soil.
4.5	Backfill	5,000	CY	$ 20.00	$ 100,000	Reduced volume - excavation used as drainage basin.
4.6	Topsoil	5,000	CY	$ 40.00	$ 200,000	Importing clean soil to support vegetation.
	Sub-Total				**$ 1,131,900**	
5	**Cap Construction**					
5.1	Waste Placement (Total Cut and Fill)	1,000	CY	$ 15.00	$ 15,000	Placement, grading and compaction of solid waste.
5.2	Subgrade Preparation	6.15	AC	$ 3,250	$ 19,988	Fine grading of waste surface.
5.3	Gas Collection Layer	10,000	CY	$ 24.00	$ 240,000	12-inch gas collection sand layer.
5.4	Geomembrane	270,000	SF	$ 1.50	$ 405,000	60 mil HDPE liner.
5.5	Protective Soil Layer	15,000	CY	$ 20.00	$ 300,000	18-inch structural fill layer.
5.6	Topsoil	5,000	CY	$ 40.00	$ 200,000	6-ich topsoil layer.
5.7	Gas Vents	55	EA	$ 100.00	$ 5,500	4-inch dia. Sch. 80 PVC 'J' Vents
5.8	Grass Lined Swale	1,000	LF	$ 10.00	$ 10,000	Low-flow drainage channel.
5.9	Perimeter Concrete Drainage Channel	1,500	LF	$ 20.00	$ 30,000	High-flow drainage channel
5.10	Energy Dissipater Pad	2	EA	$ 15,000	$ 30,000	Concrete pad for steep slope drainage channel.

Table 11-4 Cost Estimate for Alternative 2C

Alternative 2C
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2C consists of installing an impermeable cap on AOC 1. Soil in AOCs 1 through 6 with concentrations greater then the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
	5.11	Drainage Basin	1	LS	$ 10,000	$ 10,000	Retention basin for cap storm water runoff.
	5.12	Rip-Rap Discharge Pad	2	EA	$ 7,500	$ 15,000	Inlet protection for basin.
	5.13	Access Road	700	LF	$ 25.00	$ 17,500	20-foot wide, 6-inch thick gravel road underlain with geotextile.
		Sub-Total				**$ 1,297,988**	
6	**Sampling and Analysis**						
	6.1	Post Excavation Sampling	600	EA	$ 250	$ 150,000	Total VOCs, PCBs, and metals analysis.
	6.2	Backfill Source Sampling	50	EA	$ 500	$ 25,000	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
	6.3	Waste Characterization Sampling	0	EA	$ 1,500	$ -	Total/TCLP VOCs, SVOCs, Metals, PCBs, RCRA charact.
	6.4	Decon Water Sampling	2	EA	$ 550	$ 1,100	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
		Sub-Total				**$ 176,100**	
7	**Site Restoration**						
	7.1	Perimeter Chain Link Fence	3,000	LF	$ 20.00	$ 60,000	6-foot chain link fabric fence.
	7.2	Access Gate	1	EA	$ 5,000	$ 5,000	20-foot sliding vehicle gate.
	7.3	Hydro Seeding	500,000	SF	$ 0.10	$ 50,000	Establish vegetation on disturbed areas.
	7.4	Erosion Control Fabric	100,000	SF	$ 0.15	$ 15,000	Coconut mat erosion blanket.
	7.5	Turf Reinforcement Mat	100,000	LF	$ 0.25	$ 25,000	Turf reinforcement mat for cap side slopes.
	7.6	Remove Soil Erosion & Sediment Controls	1	LS	$ 15,000	$ 15,000	Labor, equipment, and disposal.
		Sub-Total				**$ 170,000**	
8	**H&S, Community Air Monitoring**						
	8.1	Perimeter Air monitoring	12	Mo.	$ 7,000	$ 84,000	Tripod station with Dust and PID monitors.
	8.2	H&S Monitoring	12	Mo.	$ 2,500	$ 30,000	Meters for monitoring work zone.
	8.3	PPE and Field Supplies	1	LS	$ 15,000	$ 15,000	Boots, glasses, hard hat, gloves, etc.
		Sub-Total				**$ 129,000**	
	Sub-Total					**$ 3,131,438**	Sub-Total All Construction Costs.
		Contingency	25%			$ 783,000	10% scope + 15% bid
	Sub-Total					**$ 3,914,438**	
	Project Management		5%			$ 196,000	
	Remedial Design		8%			$ 313,000	
	Construction Management		6%			$ 235,000	
	Institutional Controls						
		Institutional Controls Plan	1	EA	$ 10,000	$ 10,000	Environmental easement/deed restriction, legal fees.
		Site Management Plan	1	LS	$ 20,000	$ 20,000	Describe controls, inspection and monitoring program.
		Site Information Database	1	LS	$ 7,500	$ 7,500	Setup data management system.
		Sub-Total				**$ 37,500**	
	TOTAL CAPITAL COST					**$ 4,695,938**	

ANNUAL O&M COST:

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
1	**Annual Inspection and Sampling**						
	1.1	Site Inspection and Report	1	LS	$ 12,000	$ 12,000	Total VOCs, PCBs, and metals analysis.
	1.2	Groundwater Sampling	1	LS	$ 10,000	$ 10,000	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
		Sub-Total				**$ 22,000**	

Table 11-4 Cost Estimate for Alternative 2C

Alternative 2C
CAPPING/ON-SITE CONSOLIDATION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 2C consists of installing an impermeable cap on AOC 1. Soil in AOCs 1 through 6 with concentrations greater then the residential SCOs will be excavated and relocated to AOC 1 prior to capping (on-site consolidation).

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
2		**Maintenance**					
	2.1	Mowing	1	LS	$ 7,200	$ 7,200	Grass mowing of cap.
	2.2	Cap Maintenance and Repair	1	LS	$ 12,000	$ 12,000	Erosion repair, debris removal, fence repair, etc.
		Sub-Total				**$ 19,200**	
		Sub-Total				**$ 41,200**	Sub-Total O&M Costs.
		Contingency	25%			$ 10,000	10% scope + 15% bid
		Sub-Total				**$ 51,200**	
		Project Management	5%			$ 3,000	
		Technical Support	8%			$ 4,000	
		Institutional Controls					
		Site Information Database	1	LS	$ 7,500	$ 7,500	Update and maintain database.
		TOTAL ANNUAL O&M COST				**$ 65,700**	

PERIODIC COSTS:

Item No.		Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1		**Five Year Review**						
	1.1	Review and Report	5	1	LS	$ 15,000	$ 15,000	Every 5 years through year 30.
	1.2	Update Institutional Controls	5	1	LS	$ 10,000	$ 10,000	Every 5 years through year 30.
		Sub-Total					**$ 25,000**	
2		**Long Term Maintenance**						
	2.1	Clearing	5	1	LS	$ 6,000	$ 6,000	Overgrown tree removal.
	2.2	Drainage Basin Rehabilitation	5	1	LS	$ 12,000	$ 12,000	Remove sedimentation buildup.
	2.3	Minor Cap Repair	5	1	LS	$ 8,000	$ 8,000	Small soil erosion repair.
		Sub-Total					**$ 26,000**	
3		**Long Term Maintenance**						
	3.1	Major Cap Repair	10	1	LS	$ 15,000	$ 15,000	Soil and liner cap repair.
	3.2	Access Road Repair	10	700	LF	$ 15	$ 10,500	Regrade and resurface with stone.
	3.3	Perimeter Fence Repair	10	500	LF	$ 20	$ 10,000	Repair and replace limited portion of fence.
	3.4	Drainage Channel Repair	10	1	LS	$ 8,000	$ 8,000	Remove sedimentation, repair concrete.
		Sub-Total					**$ 43,500**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.		Cost Type	Year	Total Cost	Present Value	Notes
1		**Capital Cost**	0		$ 4,695,938	
2		**Annual O&M Cost**	1-30	65,700	$ 815,274	
3		**Periodic Costs**				
	3.1	Year 5	5	51,000	$ 42,154	
	3.2	Year 10	10	94,500	$ 64,560	
	3.3	Year 15	15	51,000	$ 28,799	
	3.4	Year 20	20	94,500	$ 44,106	
	3.5	Year 25	25	51,000	$ 19,675	
	3.6	Year 30	30	94,500	$ 30,133	
		Sub-Total			**$ 199,294**	
		TOTAL PRESENT VALUE OF ALTERNATIVE			**$ 5,711,000**	

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Table 11-5 Cost Estimate for Alternative 4

Alternative 4
OFF-SITE DISPOSAL

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 4 consists of excavation and off-site disposal of soil in AOCs 1 through 6 with concentrations greater then the residential SCOs.

Item No.		Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:							
1		**Mobilization and Demobilization**					
	1.1	Construction Equipment Mob/Demob	1	LS	$ 11,000	$ 11,000	Excavators, loader, dozer, trailer, Frac tanks, etc.
	1.2	Construction Trailer and Facilities	1	LS	$ 15,000	$ 15,000	Trailer tie downs and 12-month rental.
	1.3	Temporary Communication & Utilities	1	LS	$ 5,400	$ 5,400	Power, phone, internet, water, chem toilet, etc.
	1.4	Field Equipment and Supplies	1	LS	$ 6,500	$ 6,500	Copier, fax, scanner, paper, gasoline, signage, etc.
	1.5	Equipment Storage Facility	1	LS	$ 4,200	$ 4,200	Sea box or sprung structure.
	1.6	Water Truck (Dust Control)	12	Month	$ 550	$ 6,600	12-month rental.
	1.7	Waste Water Storage (Frac Tack)	12	Month	$ 1,250	$ 15,000	2 tanks for 12-months.
	1.8	Submittals/Implementation Plans	1	LS	$ 25,000	$ 25,000	QAPP, HASP, shop dwgs and work plans
	1.9	Post Construction Submittals	1	LS	$ 15,000	$ 15,000	Manifests, asbuilts, warranties,
		Sub-Total				**$ 103,700**	
2		**Site Preparation**					
	2.1	Construction Entrance	1	EA	$ 10,000	$ 10,000	50-foot 2 inch stone pad underlain with geotextile.
	2.2	Equipment Staging Area	1	EA	$ 7,500	$ 7,500	Stone area for truck turnaround and equipment staging
	2.3	Access Road	1,000	LF	$ 25.00	$ 25,000	20-foot wide, 6-inch thick gravel road underlain with geotextile.
	2.4	Decontamination Pad	1	EA	$ 10,000	$ 10,000	Lined stone decon pad with sump.
	2.5	Construction/Security Fencing	2,500	LF	$ 5.50	$ 13,750	Fencing to restrict pedestrian and vehicle access to site.
	2.6	Silt Fencing	2,500	LF	$ 4.50	$ 11,250	Erosion protection around all disturbed areas.
	2.7	Diversion Berm	1,500	LF	$ 12.00	$ 18,000	Diversion berm or super sacks to provide flood protection.
	2.8	Sediment Barriers	500	LF	$ 7.50	$ 3,750	Hay bales or heavy duty silt fence in areas of greater erosion.
	2.9	Clearing and Grubbing	10	AC	$ 1,250	$ 12,500	Cut and chip tress and vegetation on site.
	2.10	Truck Loading Area	1	EA	$ 11,000	$ 11,000	Stone area to stage trucks during soil loadout.
		Sub-Total				**$ 122,750**	
3		**Earthwork, Off-Site Disposal**					
	3.1	Excavation	74,000	CY	$ 15.00	$ 1,110,000	Excavate impacted soil.
	3.2	Stockpile	148	EA	$ 750	$ 111,000	Temporary staging of impacted soils.
	3.3	Loadout	74,000	CY	$ 15.00	$ 1,110,000	Loading of trucks for off-site disposal.
	3.4	Transportation & Disposal	111,000	Ton	$ 100.00	$ 11,100,000	Trucking and Landfill Tipping fees
	3.5	Backfill	60,000	CY	$ 20.00	$ 1,200,000	Importing certified clean fill.
	3.6	Topsoil	10,000	CY	$ 40.00	$ 400,000	Importing clean soil to support vegetation.
		Sub-Total				**$ 15,031,000**	
4		**Earthwork, On-Site Consolidation**					
	4.1	Excavation	0	CY	$ 15.00	$ -	Excavate impacted soil.
	4.2	Stockpile	0	EA	$ 750	$ -	Temporary staging of impacted soils.
	4.3	Hauling	0	CY	$ 8.00	$ -	Relocating soil on-site.
	4.4	Placement	0	CY	$ 5.00	$ -	Placement, grading and compaction of soil.
	4.5	Backfill	0	CY	$ 20.00	$ -	Reduced volume - excavation used as drainage basin.
	4.6	Topsoil	0	CY	$ 40.00	$ -	Importing clean soil to support vegetation.
		Sub-Total				**$ -**	
5		**Cap Construction**					
	5.1	Waste Placement (Total Cut and Fill)	0	CY	$ 15.00	$ -	Placement, grading and compaction of solid waste.
	5.2	Subgrade Preparation	0.00	AC	$ 3,250	$ -	Fine grading of waste surface.
	5.3	Gas Collection Layer	0	CY	$ 24.00	$ -	12-inch gas collection sand layer.
	5.4	Geomembrane	0	SF	$ 1.50	$ -	60 mil HDPE liner.
	5.5	Protective Soil Layer	0	CY	$ 20.00	$ -	18-inch structural fill layer.
	5.6	Topsoil	0	CY	$ 40.00	$ -	6-ich topsoil layer.
	5.7	Gas Vents	0	EA	$ 100.00	$ -	4-inch dia. Sch. 80 PVC 'J' Vents
	5.8	Grass Lined Swale	0	LF	$ 10.00	$ -	Low-flow drainage channel.
	5.9	Perimeter Concrete Drainage Channel	0	LF	$ 20.00	$ -	High-flow drainage channel
	5.10	Energy Dissipater Pad	0	EA	$ 15,000	$ -	Concrete pad for steep slope drainage channel.

Table 11-5 Cost Estimate for Alternative 4

Alternative 4
OFF-SITE DISPOSAL

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 4 consists of excavation and off-site disposal of soil in AOCs 1 through 6 with concentrations greater then the residential SCOs.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
5.11	Drainage Basin	0	LS	$ 10,000	$ -	Retention basin for cap storm water runoff.
5.12	Rip-Rap Discharge Pad	0	EA	$ 7,500	$ -	Inlet protection for basin.
5.13	Access Road	0	LF	$ 25.00	$ -	20-foot wide, 6-inch thick gravel road underlain with geotextile.
	Sub-Total				**$ -**	
6	**Sampling and Analysis**					
6.1	Post Excavation Sampling	1,200	EA	$ 250	$ 300,000	Total VOCs, PCBs, and metals analysis.
6.2	Backfill Source Sampling	50	EA	$ 500	$ 25,000	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
6.3	Waste Characterization Sampling	148	EA	$ 1,500	$ 222,000	Total/TCLP VOCs, SVOCs, Metals, PCBs, RCRA charact.
6.4	Decon Water Sampling	2	EA	$ 550	$ 1,100	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
	Sub-Total				**$ 548,100**	
7	**Site Restoration**					
7.1	Perimeter Chain Link Fence	0	LF	$ 20.00	$ -	6-foot chain link fabric fence.
7.2	Access Gate	0	EA	$ 5,000	$ -	20-foot sliding vehicle gate.
7.3	Hydro Seeding	500,000	SF	$ 0.10	$ 50,000	Establish vegetation on disturbed areas.
7.4	Erosion Control Fabric	100,000	SF	$ 0.15	$ 15,000	Coconut mat erosion blanket.
7.5	Turf Reinforcement Mat	0	LF	$ 0.25	$ -	Turf reinforcement mat for cap side slopes.
7.6	Remove Soil Erosion & Sediment Controls	1	LS	$ 15,000	$ 15,000	Labor, equipment, and disposal.
	Sub-Total				**$ 80,000**	
8	**H&S, Community Air Monitoring**					
8.1	Perimeter Air monitoring	12	Mo.	$ 7,000	$ 84,000	Tripod station with Dust and PID monitors.
8.2	H&S Monitoring	12	Mo.	$ 2,500	$ 30,000	Meters for monitoring work zone.
8.3	PPE and Field Supplies	1	LS	$ 15,000	$ 15,000	Boots, glasses, hard hat, gloves, etc.
	Sub-Total				**$ 129,000**	
	Sub-Total				**$ 16,014,550**	Sub-Total All Construction Costs.
	Contingency	25%			$ 4,004,000	10% scope + 15% bid
	Sub-Total				**$ 20,018,550**	
	Project Management	5%			$ 1,001,000	
	Remedial Design	8%			$ 1,601,000	
	Construction Management	6%			$ 1,201,000	
	Institutional Controls					
	Institutional Controls Plan	0	EA	$ 10,000	$ -	Environmental easement/deed restriction, legal fees.
	Site Management Plan	0	LS	$ 20,000	$ -	Describe controls, inspection and monitoring program.
	Site Information Database	0	LS	$ 7,500	$ -	Setup data management system.
	Sub-Total				**$ -**	
	TOTAL CAPITAL COST				**$ 23,822,000**	

ANNUAL O&M COST:

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
1	**Annual Inspection and Sampling**					
1.1	Site Inspection and Report	0	LS	$ 12,000	$ -	Total VOCs, PCBs, and metals analysis.
1.2	Groundwater Sampling	0	LS	$ 10,000	$ -	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
	Sub-Total				**$ -**	
2	**Maintenance**					
2.1	Mowing	0	LS	$ 7,200	$ -	Grass mowing of cap.
2.2	Cap Maintenance and Repair	0	LS	$ 12,000	$ -	Erosion repair, debris removal, fence repair, etc.
	Sub-Total				**$ -**	
	Sub-Total				**$ -**	Sub-Total O&M Costs.

Table 11-5 Cost Estimate for Alternative 4

Alternative 4
OFF-SITE DISPOSAL

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative 4 consists of excavation and off-site disposal of soil in AOCs 1 through 6 with concentrations greater then the residential SCOs.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
	Contingency	25%			$ -	10% scope + 15% bid
	Sub-Total				**$ -**	
	Project Management	5%			$ -	
	Technical Support	8%			$ -	
	Institutional Controls					
	Site Information Database	0	LS	$ 7,500	$ -	Update and maintain database.
	TOTAL ANNUAL O&M COST				**$ -**	

PERIODIC COSTS:

Item No.	Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1	**Five Year Review**						
1.1	Review and Report	5	0	LS	$ 15,000	$ -	Every 5 years through year 30.
1.2	Update Institutional Controls	5	0	LS	$ 10,000	$ -	Every 5 years through year 30.
	Sub-Total					**$ -**	
2	**Long Term Maintenance**						
2.1	Clearing	5	0	LS	$ 6,000	$ -	Overgrown tree removal.
2.2	Drainage Basin Rehabilitation	5	0	LS	$ 12,000	$ -	Remove sedimentation buildup.
2.3	Minor Cap Repair	5	0	LS	$ 8,000	$ -	Small soil erosion repair.
	Sub-Total					**$ -**	
3	**Long Term Maintenance**						
3.1	Major Cap Repair	10	0	LS	$ 15,000	$ -	Soil and liner cap repair.
3.2	Access Road Repair	10	0	LF	$ 15	$ -	Regrade and resurface with stone.
3.3	Perimeter Fence Repair	10	0	LF	$ 20	$ -	Repair and replace limited portion of fence.
3.4	Drainage Channel Repair	10	0	LS	$ 8,000	$ -	Remove sedimentation, repair concrete.
	Sub-Total					**$ -**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0		$ 23,822,000	
2	**Annual O&M Cost**	1-30	0	$ -	
3	**Periodic Costs**				
3.1	Year 5	5	0	$ -	
3.2	Year 10	10	0	$ -	
3.3	Year 15	15	0	$ -	
3.4	Year 20	20	0	$ -	
3.5	Year 25	25	0	$ -	
3.6	Year 30	30	0	$ -	
	Sub-Total			**$ -**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ 23,822,000**	

Table 11-6 Cost Estimate for Alternative G1

Alternative G1
NO ACTION

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G1 consists of no action.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Long Term Monitoring**					
1.1	Monitoring Well Installation - Overburden	0	EA	$ 3,000	$ -	
1.2	Monitoring Well Installation - Bedrock	0	EA	$ 5,000	$ -	
	Sub-Total				**$ -**	
2	**Off-Site Treatment/Disposal**					
2.1	Waste Characterization	0	EA	$ 750	$ -	
2.2	Off-Site Transport of Soil Cuttings	0	LS	$ 1,000	$ -	
2.3	Off-Site Disposal of Soil Cuttings	0	LS	$ 1,000	$ -	
2.4	Development Water Testing	0	LS	$ 550	$ -	
2.5	Development Water Discharge	0	GAL	$ 1.50	$ -	
	Sub-Total				**$ -**	
	Sub-Total				**$ -**	Sub-Total All Construction Costs.
	Contingency	25%			$ -	10% scope + 15% bid
	Sub-Total				**$ -**	
	Project Management	5%			$ -	
	Oversight	8%			$ -	
	Institutional Controls					
	Institutional Controls Plan	0	EA	$ 10,000	$ -	Environmental easement/deed restriction, legal fees.
	Site Information Database	0	LS	$ 7,500	$ -	Setup data management system.
	Sub-Total				**$ -**	
	TOTAL CAPITAL COST				**$ -**	

ANNUAL O&M COST:

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
1	**Annual Inspection and Sampling**					
1.1	Data Reduction, Evaluation and Reporting	0	LS	$ 25,000	$ -	
1.2	Groundwater Sample Analysis	0	EA	$ 550	$ -	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
1.3	Groundwater Sampling	0	EA	$ 551	$ -	
	Sub-Total				**$ -**	
	Sub-Total				**$ -**	Sub-Total O&M Costs.
	Contingency	25%			$ -	10% scope + 15% bid
	Sub-Total				**$ -**	
	Project Management	5%			$ -	
	Technical Support	8%			$ -	
	Institutional Controls					
	Site Information Database	0	LS	$ 5,000	$ -	Update and maintain database.
	TOTAL ANNUAL O&M COST				**$ -**	

Table 11-6 Cost Estimate for Alternative G1

Alternative G1
NO ACTION

COST ESTIMATE SUMMARY

Site:	Ellenville Scrap Iron and Metal Site	**Description:**	Alternative G1 consists of no action.
Location:	Ulster County, New York		
Phase:	Feasibility Study (-30% - +50%)		
Base Year:	2010		
Date:	July 12, 2010		

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

PERIODIC COSTS:

Item No.	Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1	**Five Year Review**						
1.1	Review and Report	5	0	LS	$ 15,000	$ -	Every 5 years through year 30.
1.2	Update Institutional Controls	5	0	LS	$ 10,000	$ -	Every 5 years through year 30.
	Sub-Total					**$ -**	
2	**Well Abandonment**						
2.1	Well Abandonment	30	0	LS	$ 500	$ -	
	Sub-Total					**$ -**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0		$ -	
2	**Annual O&M Cost**	1-30	0	$ -	
3	**Periodic Costs**				
3.1	Year 5	5	0	$ -	
3.2	Year 10	10	0	$ -	
3.3	Year 15	15	0	$ -	
3.4	Year 20	20	0	$ -	
3.5	Year 25	25	0	$ -	
3.6	Year 30	30	0	$ -	
	Sub-Total			**$ -**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ -**	

HDR

Table 11-7 Cost Estimate for Alternative G2

Alternative G2
LONG TERM MONITORING

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G2 consists of natural attenuation and long term monitoring.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Long Term Monitoring**					
1.1	Monitoring Well Installation - Overburden	3	EA	$ 3,000	$ 9,000	
1.2	Monitoring Well Installation - Bedrock	4	EA	$ 5,000	$ 20,000	
	Sub-Total				**$ 29,000**	
2	**Off-Site Treatment/Disposal**					
2.1	Waste Characterization	1	EA	$ 750	$ 750	
2.2	Off-Site Transport of Soil Cuttings	1	LS	$ 1,000	$ 1,000	
2.3	Off-Site Disposal of Soil Cuttings	1	LS	$ 1,000	$ 1,000	
2.4	Development Water Testing	1	LS	$ 550	$ 550	
2.5	Development Water Discharge	350	GAL	$ 1.50	$ 525	
	Sub-Total				**$ 3,825**	
	Sub-Total				**$ 32,825**	Sub-Total All Construction Costs.
	Contingency	25%			$ 8,000	10% scope + 15% bid
	Sub-Total				**$ 40,825**	
	Project Management	5%			$ 2,000	
	Oversight	8%			$ 3,300	
	Institutional Controls					
	Institutional Controls Plan	1	EA	$ 10,000	$ 10,000	Environmental easement/deed restriction, legal fees.
	Site Information Database	1	LS	$ 7,500	$ 7,500	Setup data management system.
	Sub-Total				**$ 17,500**	
	TOTAL CAPITAL COST				**$ 63,625**	

ANNUAL O&M COST:

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
1	**Annual Inspection and Sampling**					
1.1	Data Reduction, Evaluation and Reporting	1	LS	$ 25,000	$ 25,000	
1.2	Groundwater Sample Analysis	14	EA	$ 550	$ 7,700	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
1.3	Groundwater Sampling	15	EA	$ 551	$ 8,265	
	Sub-Total				**$ 32,700**	
	Sub-Total				**$ 32,700**	Sub-Total O&M Costs.
	Contingency	25%			$ 8,000	10% scope + 15% bid
	Sub-Total				**$ 40,700**	
	Project Management	5%			$ 2,000	
	Technical Support	8%			$ 3,300	
	Institutional Controls					
	Site Information Database	1	LS	$ 5,000	$ 5,000	Update and maintain database.
	TOTAL ANNUAL O&M COST				**$ 51,000**	

Table 11-7 Cost Estimate for Alternative G2

Alternative G2
LONG TERM MONITORING

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G2 consists of natural attenuation and long term monitoring.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

PERIODIC COSTS:

Item No.	Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1	**Five Year Review**						
1.1	Review and Report	5	1	LS	$ 15,000	$ 15,000	Every 5 years through year 30.
1.2	Update Institutional Controls	5	1	LS	$ 10,000	$ 10,000	Every 5 years through year 30.
	Sub-Total					**$ 25,000**	
2	**Well Abandonment**						
2.1	Well Abandonment	30	15	LS	$ 500	$ 7,500	
	Sub-Total					**$ 7,500**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0		$ 63,625	
2	**Annual O&M Cost**	1-30	51,000	$ 632,861	
3	**Periodic Costs**				
3.1	Year 5	5	25,000	$ 20,664	
3.2	Year 10	10	25,000	$ 17,079	
3.3	Year 15	15	25,000	$ 14,117	
3.4	Year 20	20	25,000	$ 11,668	
3.5	Year 25	25	25,000	$ 9,644	
3.6	Year 30	30	32,500	$ 10,363	
	Sub-Total			**$ 73,173**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ 770,000**	

HDR

Table 11-8 Cost Estimate for Alternative G3

Alternative G3
PUMP AND TREAT

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G3 consists of pump and treat and long term monitoring.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
CAPITAL COSTS:						
1	**Treatability Study**					
1.1	Aquifer Pump Test	1	LS	$ 5,500	$ 5,500	Excavators, loader, dozer, trailer, Frac tanks, etc.
1.2	Pilot Test	1	LS	$ 15,000	$ 15,000	Trailer tie downs and 12-month rental.
	Sub-Total				**$ 20,500**	
2	**Mobilization and Demobilization**					
2.1	Construction Equipment & Facilities	1	LS	$ 5,500	$ 5,500	
2.2	Submittals/Implementation Plans	1	LS	$ 20,000	$ 20,000	QAPP, HASP, shop dwgs and work plans
2.3	Post Construction Submittals	1	LS	$ 15,000	$ 15,000	Asbuilts, warranties, etc.
	Sub-Total				**$ 40,500**	
3	**Monitoring, Sampling, Testing and Analysis**					
3.1	Monitoring Well Installation - Overburden	7	EA	$ 3,000	$ 21,000	
3.2	Monitoring Well Installation - Bedrock	5	EA	$ 5,000	$ 25,000	
3.3	Extraction Well Installation	3	EA	$ 5,000	$ 15,000	
3.4	Pump, Transducer, Concrete Vault	3	LS	$ 1,000	$ 3,000	
3.5	Waste Characterization	1	EA	$ 2,000	$ 2,000	
3.6	Off-Site Transport of Soil Cuttings	1	LS	$ 1,500	$ 1,500	
3.7	Off-Site Disposal of Soil Cuttings	1	LS	$ 1,500	$ 1,500	
2.8	Development Water Testing	1	LS	$ 1,000	$ 1,000	
2.9	Development Water Discharge	1,000	GAL	$ 1.50	$ 1,500	
	Sub-Total				**$ 71,500**	
4	**Conveyance Piping**					
3.1	Trenching, Bedding, Pipe	1,000	LF	$ 25	$ 25,000	3-inch HDPE doulble walled pipe.
3.2	Backfill, Surface Restoration	1,000	LF	$ 15	$ 15,000	
	Sub-Total				**$ 40,000**	
4	**Treatment System**					
4.1	Equalization Tank	1	EA	$ 7,500	$ 7,500	
4.2	Pumps	1	EA	$ 2,500	$ 2,500	
4.3	Bag Filter	2	EA	$ 1,500	$ 3,000	
4.4	GAC Units	2	EA	$ 10,000	$ 20,000	
4.5	Ion Exchange Units	2	EA	$ 12,000	$ 24,000	
4.6	Interconnection Piping	1	LS	$ 12,000	$ 12,000	
4.7	Meters and Insrumentation	1	LS	$ 16,000	$ 16,000	
4.8	PLC and SCADA	1	LS	$ 22,000	$ 22,000	
4.9	Effluent Discharge Pipe	250	LF	$ 40	$ 10,000	
	Sub-Total				**$ 117,000**	

Table 11-8 Cost Estimate for Alternative G3

Alternative G3
PUMP AND TREAT

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G3 consists of pump and treat and long term monitoring.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
5	**Treatment Plant Building**					
5.1	Concrete Foundation	1	LS	$ 15,000	$ 15,000	
5.2	Steel Building	1	LS	$ 45,000	$ 45,000	
5.3	HVAC System	1	LS	$ 20,000	$ 20,000	
5.4	Windows and Doors	1	LS	$ 16,000	$ 16,000	
5.5	Electical Power and Lighting	1	LS	$ 18,000	$ 18,000	
	Sub-Total				**$ 114,000**	
6	**Efflunet Infiltration Gallery**					
6.1	Wet Well	3	EA	$ 5,000	$ 15,000	8-foot diameter, 15 feet deep.
	Sub-Total				**$ 15,000**	
7	**System Start-up and Proveout**					
7.1	System Start-up	1	LS	$ 25,000	$ 25,000	
	Sub-Total				**$ 25,000**	
	Sub-Total				**$ 423,000**	Sub-Total All Construction Costs.
	Contingency	25%			$ 106,000	10% scope + 15% bid
	Sub-Total				**$ 529,000**	
	Project Management	5%			$ 26,000	
	Remedial Design	8%			$ 42,000	
	Construction Management	6%			$ 32,000	
	Institutional Controls					
	Institutional Controls Plan	0	EA	$ 10,000	$ -	Environmental easement/deed restriction, legal fees.
	Site Management Plan	0	LS	$ 20,000	$ -	Describe controls, inspection and monitoring program.
	Site Information Database	0	LS	$ 7,500	$ -	Setup data management system.
	Sub-Total				**$ -**	
	TOTAL CAPITAL COST				**$ 629,000**	

Table 11-8 Cost Estimate for Alternative G3

Alternative G3
PUMP AND TREAT

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G3 consists of pump and treat and long term monitoring.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

ANNUAL O&M COST:

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes
1	**Operation**					
1.1	Electrical Usage	315,000	KW-Hr	$ 0.12	$ 37,800	
1.2	Carbon Usage	10,000	Lb	$ 1.20	$ 12,000	Carbon regeneration
1.3	Chemical Usage	1	LS	$ 35,000	$ 35,000	Exchange resin recharge
1.4	Plant Operator	2,080	HR	$ 30.00	$ 62,400	
1.5	Effluent Sampling	60	EA	$ 550	$ 33,000	
1.6	Reporting	12	Month	$ 3,500	$ 42,000	
	Sub-Total				**$ 222,200**	
2	**Maintenance**					
2.1	Repair/Replacement of Equipment	1	LS	$ 20,000	$ 20,000	
2.2	Well Repair and Maintenance	1	LS	$ 5,000	$ 5,000	
	Sub-Total				**$ 25,000**	
3	**Long Term Monitoring**					
3.1	Data Reduction, Evaluation and Reporting	1	LS	$ 40,000	$ 40,000	
3.2	Groundwater Sample Analysis	14	EA	$ 550	$ 7,700	Total VOCs, SVOCs, Metals, PCBs, Pest/Herbs, analysis.
3.3	Groundwater Sampling	15	EA	$ 551	$ 8,265	
	Sub-Total				**$ 47,700**	
	Sub-Total				**$ 294,900**	Sub-Total O&M Costs.
	Contingency	25%			$ 74,000	10% scope + 15% bid
	Sub-Total				**$ 368,900**	
	Project Management	5%			$ 18,000	
	Technical Support	8%			$ 30,000	
	Institutional Controls					
	Site Information Database	0	LS	$ 7,500	$ -	Update and maintain database.
	TOTAL ANNUAL O&M COST				**$ 416,900**	

Table 11-8 Cost Estimate for Alternative G3

Alternative G3
PUMP AND TREAT

COST ESTIMATE SUMMARY

Site: Ellenville Scrap Iron and Metal Site
Location: Ulster County, New York
Phase: Feasibility Study (-30% - +50%)
Base Year: 2010
Date: July 12, 2010

Description: Alternative G3 consists of pump and treat and long term monitoring.

Item No.	Description	Quantity	Unit	Unit Cost	Total	Notes

PERIODIC COSTS:

Item No.	Description	Year	Quantity	Unit	Unit Cost	Total	Notes
1	**Five Year Review**						
1.1	Review and Report	5	1	LS	$ 15,000	$ 15,000	Every 5 years through year 30.
1.2	Update Institutional Controls	5	1	LS	$ 10,000	$ 10,000	Every 5 years through year 30.
	Sub-Total					**$ 25,000**	
2	**Treatment Plant**						
2.1	Demobalize Treatment Plant	20	1	LS	$ 50,000	$ 50,000	
2.2	Well Abandonment	20	1	LS	$ 15,000	$ 15,000	
	Sub-Total					**$ 65,000**	

PRESENT VALUE ANALYSIS: Rate of Return: 7% Interest Rate: 3%

Item No.	Cost Type	Year	Total Cost	Present Value	Notes
1	**Capital Cost**	0		$ 629,000	
2	**Annual O&M Cost**	1-30	416,900	$ 5,173,329	
3	**Periodic Costs**				
3.1	Year 5	5	25,000	$ 20,664	
3.2	Year 10	10	25,000	$ 17,079	
3.3	Year 15	15	25,000	$ 14,117	
3.4	Year 20	20	90,000	$ 42,006	
3.5	Year 25	25		$ -	
3.6	Year 30	30		$ -	
	Sub-Total			**$ 93,866**	
	TOTAL PRESENT VALUE OF ALTERNATIVE			**$ 5,896,000**	

Table 11-9 Comparison of Total Cost of Remedial Alternatives

Site: Ellenville Scrap Iron and Metal Site
Base Year: 2010
Location: Ulster County, New York
Date: July 12, 2010
Phase: Feasibility Study (-30% - +50%)

Description	Alternative 1 No Action	Alternative 2A Capping/On-Site Consolidation	Alternative 2C Capping/ On-Site Consolidation	Alternative 4 Off-Site Disposal	Alternative G1 No Action	Alternative G2 Long Term Montoring	Alternative G3 Pump and Treat
Total Project Duration (Years)	0	30	30	1	0	30	20
Capital Cost	$0	$ 5,152,800	$ 4,695,938	$ 23,822,000	$0	$ 63,625	$ 629,000
Annual O&M Cost	$0	$ 75,500	$ 65,700	$0	$0	$ 51,000	$ 416,900
Total Periodic Cost	$0	$ 513,000	$ 436,500	$0	$0	$ 157,500	$ 165,000
Total Present Value of Alternatives	**$0**	**$ 6,323,000**	**$ 5,711,000**	**$ 23,822,000**	**$0**	**$ 770,000**	**$ 5,896,000**