SAP Worksheet No. 1 – Title and Approval Page
(UFP-SAP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN
July 2011

Removal Site Evaluation Sampling Investigation
Lower Darby Creek Area Site
Clearview Landfill
Philadelphia, Pennsylvania

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OBJECTIVE

This Sampling and Analysis Plan (SAP) describes the procedures to perform Multi-Increment® Sampling (MIS) in the City Park and Southern Industrial Area (SIA) of the Clearview Landfill (Figure 1). The sampling objective is to further characterize the extent of soil contamination that potentially presents a direct contact threat to workers, trespassers, residents, and recreational users, and threat of a potential release or an actual release of contaminants from the surface and/or subsurface soils. Results from this investigation will assist in establishing the scope for a planned removal action and determining what, if any, additional investigation is necessary.

The proposed areas of MIS sampling are:

- Surface and subsurface soils in the SIA and the forested area down slope (east, southeast) of the SIA extending towards the Eastwick neighborhood, on either side of the City's right-of-way access road. The total acreage of surface soil sampling in the SIA area to be sampled is 4.62 acres and decision units (DUs) range in size from 0.2 to 0.8 acres, while the total acreage of subsurface soil sampling in the SIA area to be sampled is 1.1 acres and decision units (DUs) range in size from 0.1 to 0.34 acres. Currently identified contaminants of concern (COCs) are polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs).

- Surface soils in the northern open field portion of the City Park. The total acreage of the City park area to be sampled is 4.3 acres and DUs range in size from 0.3 to 2 acres. Currently identified COCs are lead, PCBs, and PAHs.

SAMPLING DESIGN AND RATIONALE

As indicated above, the objectives of this sampling event are to further delineate surface soils in both the City Park and SIA as well as subsurface soils (up to 5’ below ground surface [bgs]) within the SIA that are impacted by Site-related COCs, including PCBs, PAHs and lead. The presence of these COCs is likely due to historical disposal activities that occurred during landfill operation or (for the SIA) more recent business operations. There is also potential that surface

soils within the City Park have been impacted by other forces such as deposition of impacted sediments during flood events involving Darby and Cobbs Creeks or more recent human activities.

Surface soil sampling will be focused in areas with the highest potential for direct contact with contaminated soil, where there is little to no vegetation and analytical data from the Remedial Investigation (RI) has indicated the presence of elevated COC concentrations (see Figures 4-29 through 4-31 in the final RI report), and/or other factors could result in direct contact. Subsurface soil sampling will be focused in those areas within the SIA where COC concentrations were the highest at or closest to the top of the water table based on data from the RI (see Figures 4-35 through 4-37 in the final RI report), which indicated that there are elevated concentrations of PCBs and PAHs present in the subsurface (up to 10' bgs) within the SIA that pose a threat of a potential or actual release to the environment), and/or there is limited information regarding the presence of the COCs in the subsurface, but their presence is suspected based on the conceptual site model (CSM). A more detailed CSM for the Clearview Landfill is available in the final RI report (Tetra Tech, 2011).

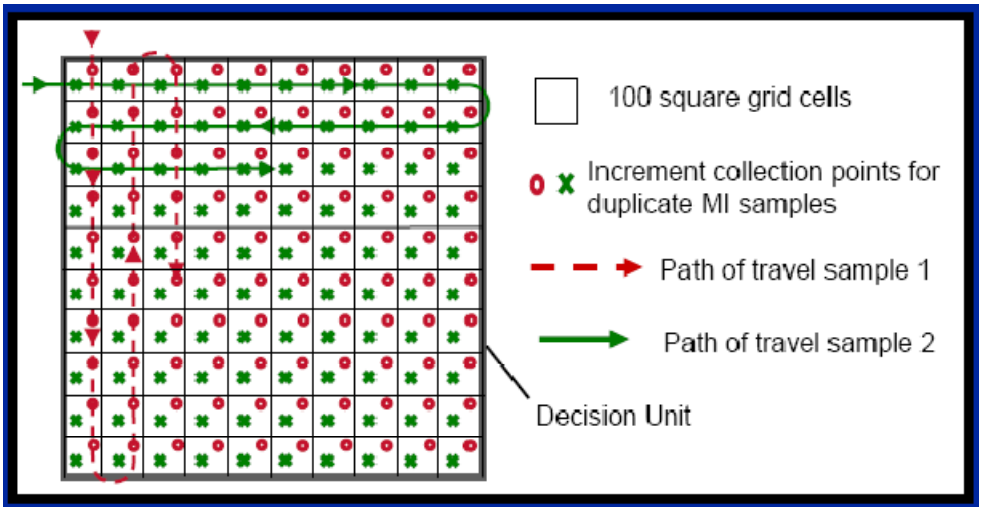
Results from this sampling effort will be utilized to focus and refine the areas to be addressed by removal action, determine if additional investigation is warranted, and compare with historical site data to evaluate other potential areas for investigation or action.

Training on MIS will be provided on-site by the U.S. Environmental Protection Agency (EPA) Remedial Project Manager (RPM) for the Site. Surface soil sampling will be performed with the EPA Region 3 MIS sampling tool (MIST) or other similar sampling device. This tool will likely be able to sample the surface soil samples within all the areas of interest; however, other sampling tools and strategies may be employed, as necessary. Subsurface soil sampling will be conducted using a Geoprobe® or other appropriate piece of equipment that can retrieve soil samples up to 5 feet below ground surface (bgs).

Multiple cores of soils will be collected from the areas of concern which are referred to as decision units (DUs). Each DU will vary in size and dimension, depending on historical site data, topography, and existing site conditions (e.g., ground cover, obstructions, etc.) Within each DU, a specified number of incremental samples will be collected to a pre-determined depth of approximately 3 inches (or 7.5 centimeter [cm]) for surface soil samples and up to 5 feet bgs

for subsurface soil samples. Surface and subsurface soil increments will be 2.5 to 3.0 cm in diameter. This is consistent with previous MIS events and will ensure that at least 1 kilogram (kg) of soil is obtained, but not significantly more (USACE 2007). The targeted number of increments per DU is 100. The entire mass of these increments will be composited to make up a single sample.

Prior to mobilization, the boundaries of each DU will be loaded into a portable GPS unit. The boundaries of each DU will then be flagged and used as a guide for samplers to follow during sample collection. A grid pattern will be followed by the samplers within each DU to collect samples. This should be performed in a serpentine pattern ending at the opposite corner of the DU from where the sampling started (see Figure below). The figure also illustrates the pattern taken for collecting replicate samples from each DU. Two replicates will be collected in addition to the first sample in 10% of the DUs, for a total of three (3) MIS samples. A flag will be used to mark the first increment location within the grid so it is not repeated when collecting the replicate. Random starting points for each MIS will be selected in the field using a six –side die or other comparable method.



From "*Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents.*" *ERDC/CRREL TR-07-10. July.2007*

The increments will be collected by a two-person field team with one person holding a clean plastic, sealable bag, and the second person collecting the increment samples and placing them in the bag (one bag per each DU MIS sample). Any gross organic matter, such as decomposing vegetation that may be present will be removed prior to placing the MI sample into

the plastic bag. The goal is to collect at least 1 kg, but no more than 3 kg of soil for each MIS sample.

Site Clearance

Clearing and grubbing of underbrush, shrubs and small trees will be necessary to access certain portions of the site for surface and subsurface soil sampling. Chipping and shredding of cleared vegetation (which might include small trees and other woody vegetation) may also be necessary. Coordination with the site owner and/or tenants may also be necessary to have them move vehicles, equipment, and storage out of the way to allow sampling.

Sampling Locations

City Park Area

One (1) MIS surface soil sample will be collected from each of 4 proposed DUs within the northern end of the City Park area at a depth of 3 inches (Figure 2). The DUs will be selected based upon areas with little to no vegetative cover (as direct contact with contaminated soils is most likely in these areas) and/or locations of previously collected surface soil samples (during the RI) where elevated levels of PCBs, PAHs, and lead were detected. A targeted number of 100 increments will be collected within each DU (note that the individual increment locations shown in Figures 2 through 4 are approximate in both number and location). In addition, two replicate soil samples from one of the DUs (i.e., triplicate samples) will be collected. Each MIS and replicate will be collected separately. The sampling tool will be decontaminated between each MIS (not each increment/aliquot). Variability and other basic statistical evaluations will be calculated for the MIS replicates and will serve as an element of field sampling quality assurance/quality control (QA/QC). A total of six (6) MIS surface soil samples will be collected.

Southern Industrial Area

One (1) MIS surface soil sample from each of 10 proposed DUs within the SIA will be collected at a depth of 3 inches (Figure 3). The DUs will be selected based upon locations of previously collected surface soil samples (during the RI) where elevated levels of PCBs and PAHs were detected. A targeted number of 100 increments will be collected within each DU. Of 10 MIS

surface soil samples, two additional replicate samples (i.e., triplicate samples) will be collected from one of the DUs. Therefore, a total of fourteen (14) MIS surface soil samples will be collected.

In addition to surface soil samples, MIS subsurface soil samples will be collected from 6 proposed DUs within the SIA (Figure 4). The DUs will be selected based upon locations of previously collected subsurface soil samples (during the RI) where elevated levels of PCBs and PAHs were detected and other criteria discussed above. Five (5) MIS subsurface soil samples will be collected from each DU; each MIS sample will be comprised of a minimum of thirty (30) increments. These subsurface increment samples will be collected using a Geoprobe® at one foot intervals (from 0 to 1', 1' to 2', 2' to 3', 3' to 4', and 4' to 5'). Subsamples of each 1-foot core interval will be collected using one of the following methods, 1) a core sampler (or syringe) will be used to extract a series of plugs from each portion of each 1-foot interval or 2) a wedge running the entire length of each 1-foot interval will be removed. These subsamples will be placed into five separate plastic bags (0-1', 1'-2', etc.). Each 1-foot interval will have a dedicated sampling device. A total of thirty (30) MIS surface soil samples will be collected. Prior to subsampling of the core intervals, several cores within the DU will be collected and evaluated for recovery to determine if sample intervals should be modified due to factors such as soil compression, frequent refusal prior to target depth, etc.

A total of 15 discrete soil samples will be collected during the sampling event. An additional five (5) MIS and two (2) replicate samples may be collected if necessary. Discrete soil samples will be collected from targeted areas within the DUs. The purpose of the discrete samples will be to obtain contamination concentration information from certain core intervals that demonstrate staining or other unique factors that may be indicative of elevated levels of contamination and to obtain samples along the outer edges of the DUs that are suspected to likely represent the edge of contamination. Discrete samples will be collected by using a 5-point composite from within the soil core. Discrete samples will be processed and analyzed by the laboratory in the same manner as the MIS.

During the field investigation, Tetra Tech will conduct photographic and written logbook documentation activities in accordance with Tetra Tech Standard Operating Procedures (SOP) SA 6.3, "Field Documentation" (Tetra Tech 2009), and Tetra Tech's Sampling and Analysis Plan

(SAP) for the RI (Tetra Tech 2011). Tetra Tech will use a unique identifier for each MIS sample collected.

MIS sample identifiers will be designated in accordance with the following format:

- For surface soils: "LDCA-MIS-DU#-#," with "LDCA" referring to "Lower Darby Creek Area," "MIS" referring to multi-increment sampling," "DU#" referring to the DU number where the samples are collected, and the last number representing the sample number.

- For subsurface soils: the last "####" will refer to the depth from which the samples are collected, e.g. 0001 refers to 0-1', 0102 refers to 1'-2', etc.

- For discrete samples: "LDCA-DS-DU#-#", with "DS" referring to discrete sample, "DU#" referring to the DU number where the samples are collected , and the last numbers 1 to 15 for each discrete sample collected. The location and depth of each discrete sample will be recorded with a handheld global positioning system (GPS) device.

Table 1 summarizes the samples to be collected during the MIS sampling, and the acreage of each DU.

ANALYTICAL PARAMETERS AND METHODS

The MIS samples will be triple bagged and shipped to a laboratory assigned by EPA Region 3's Office of Analytical Services and Quality Assurance (OASQA) branch that is proficient in preparing and analyzing samples as prescribed in SW-846 Method 8330b as modified by the attached laboratory instructions for preparation and analysis of additional QC samples. The EPA-assigned laboratory will prepare (i.e., dry, sieve, grind, and sub-sample) the MIS samples in accordance with the SW-846 Method 8330b as modified per the laboratory instructions. After preparation, the MIS samples will be analyzed for PAHs using SW-846 High Performance Liquid Chromatography (HPLC) Method 8310 or 8270C with extraction method 3550B; for PCBs using SW-846 Gas Chromatograph/Electron Capture Detector (GC/ECD) Method 8082A with extraction method 3562B or 3550B; and for lead using SW-846 ICP-Mass Spectrometry (ICP-MS) Method 6020A with extraction method 3050B. Table 2 summarizes the analytical methods for each parameter.

The EPA Region 3 Screening Levels (RSLs) are set as Project Action Limits (PALs). In some instances, the standard Method Detection Limits (MDLs) are higher than the EPA RSLs; the laboratory contracted to analyze the samples will be required to achieve MDLs that are as close to the PALs/RSLs as possible or below. The RSLs and MDLs for PAHs, PCBs, and lead are listed in Table 3.

QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

Sample quality and integrity are maintained in accordance with the approved Quality Assurance Project Plan (QAPP) for Remedial Investigation and Feasibility Study (RI/FS) at the Lower Darby Creek Area (LDCA) site (Tetra Tech 2002) and SAP for the RI (Tetra Tech 2011). Since this SAP does not include all elements specified in the Uniform Federal Policy (UFP) QAPP Manual, Table 4 is prepared to provide cross-reference sections, indicating where each specified UFP QAPP element can be found.

Decontamination

Non-dedicated sampling equipment such as coring tools or syringes, and the MIST will be decontaminated in accordance with Tetra Tech Standard Operation Procedure (SOP) SA 7.1, “Decontamination of Field Equipment and IDW Handling” (Tetra Tech 2009) between the collection of each MIS sample, but not between each increment sampling point within the same DU. Decontamination of non-dedicated sampling equipment will consist of wash with a tap water and Alconox, and rinse with distilled water and acetone to remove residual contaminants followed by a final distilled water rinse. The resulting decontamination liquid will be disposed of on-site at each DU where it is originally generated. Rinseate blank samples will be collected from decontaminated sampling equipment at a rate of 1 per 20 soil samples.

Laboratory procedures

The MIS and discrete soil samples will be shipped to a laboratory (assigned by EPA Region 3) that is certified to perform SW-846 EPA Method 8330b by one of the four Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) accreditation bodies. Specific laboratory quality control (QC) is addressed in SW-846 Method 8330b, and the

attached method modifications and instructions. All QC elements will pertain only to those analytes that are the targeted COCs for this investigation.

The Measurement Performance Criteria (MPC) for the Relative Percent Difference (RPD) and Relative Standard Deviation (RSD) range for the field and lab replicate samples is 15 – 30%. Tables 5 thru 7 summarize the field and laboratory QC samples to be collected and analyzed.

Data

EPA Region 3 Central Regional Laboratory's quality assurance (QA) staff will perform data validation in accordance with the EPA CLP national functional guidelines for data review with EPA Region 3 modifications to an IM2 inorganic and an M3 organic data validation level.

DELIVERABLES

Information and data obtained from the sampling event will be compiled in a trip report. The trip report will include data collection methods, sampling locations, data summary tables, logbook notes, and maps.

PROJECT SCHEDULE

The field investigation has been scheduled for the week of July 18, 2011 and is anticipated to be completed within fifteen working days. Tetra Tech expects to receive validated analytical data within 21 days after the laboratory receives the samples. Tetra Tech will provide a draft trip report to EPA within 45 days after validated data are available.

REFERENCES

Tetra Tech. 2008 "Soil Sampling." SOP SA 1.3

Tetra Tech. 2009 "Decontamination of Field Equipment and IDW Handling." SOP SA 7.1.

Tetra Tech. 2009 "Field Documentation." SOP SA 6.3.

Tetra Tech EM. 2010 "Sampling and Analysis Plan for MULTI-INCREMENT SAMPLING INVESTIGATION, Fort Eustis, Virginia"

Tetra Tech. 2011 "Sampling and Analysis Plan for Remedial Investigation."

Tetra Tech. 2011 “Remedial Investigation Report for Lower Darby Creek Area Site, Clearview Landfill, Operable Unit 1 (OU-1), Philadelphia and Delaware Counties, Pennsylvania.”

U.S. Army Corps of Engineers. July 2007. “Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents.” ERDC/CRREL TR-07-10.

U.S. Environmental Protection Agency (EPA). 2008b. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) Final Update IV. October 3.

TABLE 1

SAMPLING SUMMARY

Location	Sample ID	Type
DU-1 City Park (between GP-019 & 020)	LDCA-MIS-DU1-01	MIS Surface Soil
DU-2 City Park (GP-021)	LDCA-MIS-DU2-01	MIS Surface Soil
DU-3 City Park (GP-022 thru 024)	LDCA-MIS-DU3-01	MIS Surface Soil
DU-4 City Park (GP-032 & 033)	LDCA-MIS-DU4-01 LDCA-MIS-DU4-02 LDCA-MIS-DU4-03	MIS Surface Soil
DU-5 SIA (GP-037)	LDCA-MIS-DU5-01	MIS Surface Soil
DU-6 SIA (GP-034)	LDCA-MIS-DU6-01	MIS Surface Soil
DU-7 SIA (north of GP-034)	LDCA-MIS-DU7-01 LDCA-MIS-DU7-02 LDCA-MIS-DU7-03	MIS Surface Soil
DU-8 SIA (GP-035)	LDCA-MIS-DU8-01	MIS Surface Soil
DU-9 SIA (GP-215)	LDCA-MIS-DU9-01	MIS Surface Soil
DU-10 SIA (GP-244)	LDCA-MIS-DU10-01	MIS Surface Soil
DU-11 SIA (GP-250 & 253)	LDCA-MIS-DU11-01	MIS Surface Soil
DU-12 SIA (GP- 248)	LDCA-MIS-DU12-01	MIS Surface Soil
DU-13 SIA (GP-237)	LDCA-MIS-DU13-01 LDCA-MIS-DU13-02 LDCA-MIS-DU13-03	MIS Surface Soil
DU-14 SIA (GP-238)	LDCA-MIS-DU14-01	MIS Surface Soil

Location	Sample ID	Type
DU-15 SIA (GP-215 & 245)	LDCA-MIS-DU15-0001	MIS Subsurface Soil
	LDCA-MIS-DU15-0102	
	LDCA-MIS-DU15-0203	
	LDCA-MIS-DU15-0304	
	LDCA-MIS-DU15-0405	
DU-16 SIA (GP-243)	LDCA-MIS-DU16-0001	MIS Subsurface Soil
	LDCA-MIS-DU16-0102	
	LDCA-MIS-DU16-0203	
	LDCA-MIS-DU16-0304	
	LDCA-MIS-DU16-0405	
DU-17 SIA (north of GP-034)	LDCA-MIS-DU17-0001	MIS Subsurface Soil
	LDCA-MIS-DU17-0102	
	LDCA-MIS-DU17-0203	
	LDCA-MIS-DU17-0304	
	LDCA-MIS-DU17-0405	
DU-18 SIA (west of GP-035)	LDCA-MIS-DU18-0001	MIS Subsurface Soil
	LDCA-MIS-DU18-0102	
	LDCA-MIS-DU18-0203	
	LDCA-MIS-DU18-0304	
	LDCA-MIS-DU18-0405	
DU-19 SIA (east of GP-035)	LDCA-MIS-DU19-0001	MIS Subsurface Soil
	LDCA-MIS-DU19-0102	
	LDCA-MIS-DU19-0203	
	LDCA-MIS-DU19-0304	
	LDCA-MIS-DU19-0405	
DU-20 SIA (north of GP-034)	LDCA-MIS-DU20-0001	MIS Subsurface Soil
	LDCA-MIS-DU20-0102	
	LDCA-MIS-DU20-0203	
	LDCA-MIS-DU20-0304	
	LDCA-MIS-DU20-0405	
Field Determined DUs City Park and SIA	LDCA-DS-DUXX-1 to LDCA-DS-DUXX-15	Discrete Surface and Subsurface Soil

Table 1 (Continued)

Location	Size in Acres	Distance (ft.) between increments

		based on 100 increments
DU-1 City Park	0.28	7.5
DU-2 City Park	0.29	7.5
DU-3 City Park	2.10	30
DU-4 City Park	1.64	30
DU-5 SIA (surface soils)	0.50	13.3
DU-6 SIA (surface soils)	0.47	13.3
DU-7 SIA (surface soils)	0.48	13.3
DU-8 SIA (surface soils)	0.69	13.3
DU-9 SIA (surface soils)	0.31	10
DU-10 SIA (surface soils)	0.19	8.5
DU-11 SIA (surface soils)	0.75	16
DU-12 SIA (surface soils)	0.21	9
DU-13 SIA (surface soils)	0.79	17.8
DU-14 SIA (surface soils)	0.22	8.9
DU-15 SIA (subsurface soils)	0.30	20
DU-16 SIA (subsurface soils)	0.34	20
DU-17 SIA (subsurface soils)	0.10	11
DU-18 SIA (subsurface soils)	0.10	11
DU-19 SIA (subsurface soils)	0.12	11
DU-20 SIA (subsurface soils)	0.10	11

TABLE 2

ANALYTICAL SUMMARY

#/Sample Type	Sample Preparation	Analysis	Analytical Method	Container /Volume	Preservative	Holding Time
6/Multi-increment sample	Dry, sieve, and grind as specified in SW-846 Method 8330b and attached laboratory modifications	Lead by ICP-MS	SW-846 Method 3050B SW-846 Method 6020A	Triple-bagged Plastic bag/ ≥ 1 kg	Ice	14 days
44/Multi-increment sample	Dry, sieve, and grind as specified in SW-846 Method 8330b and attached laboratory modifications	TCL PAHs	SW-846 Method 3550B SW-846 Method 8270C or 8310	Triple-bagged Plastic bag/ ≥ 1 kg	Ice	14 days
44/Multi-increment sample	Dry, sieve, and grind as specified in SW-846 Method 8330b and attached laboratory modifications	TCL PCBs	SW-846 Method 3562 or 3550B SW-846 Method 8082A	Triple-bagged Plastic bag/ ≥ 1 kg	Ice	14 days
15/Discrete Grab Sample	Dry, sieve, and grind as specified in SW-846 Method 8330b and attached laboratory modifications	Lead by ICP-MS	SW-846 Method 3050B SW-846 Method 6020A	32-oz glass jar	Ice	14 days
15/Discrete Grab Sample	Dry, sieve, and grind as specified in SW-846 Method 8330b and attached laboratory modifications	TCL PAHs	SW-846 Method 3550B SW-846 Method 8270C or 8310	32-oz glass jar	Ice	14 days

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15/Discrete Grab Sample	Dry, sieve, and grind as specified in SW-846 Method 8330b and attached laboratory modifications	TCL PCBs	SW-846 Method 3562 or 3550B SW-846 Method 8082A	32-oz glass jar	Ice	14 days

Notes: ICP-AES = Inductively coupled plasma – Mass Spectrometry
kg = kilogram
PAH = polyaromatic hydrocarbons
PCBs = Polychlorinated biphenyls
SW-846 = "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" Revision 6, February 2007.
TCL = Target Compound List

TABLE 3
EPA REGIONAL SCREENING LEVELS, METHOD DETECTION LIMITS AND CONTRACT REQUIRED QUANTITATION LIMITS

PARAMETER PAHs	RSL (µg/kg)	MDL (µg/kg)	CRQL (µg/kg)
Acenaphthene	3.4E+06	1260	170
Acenaphthylene	1.7E+06	1541	170
Anthracene	1.7E+07	442	170
Benzo(a)anthracene	150	8.71	170
Benzo(b)fluoranthene	150	12.06	170
Benzo(k)fluoranthene	1,500	11.41	170
Benzo(g,h,i)perylene	1.7E+06	50.9	170
Benzo(a)pyrene	15	15.41	170
Chrysene	15,000	100	170
Dibenzo(a,h)anthracene	15	20.1	170
Fluoranthene	2.3E+06	141	170
Fluorene	2.3E+06	141	170
Indeno(1,2,3-cd)pyrene	150	28.8	170
Naphthalene	3,600	1206	170
Phenanthrene	1.7E+06	429	170
Pyrene	1.7E+06	181	170

PCBs	RSL (µg/kg)	MDL (µg/kg)	CRQL (µg/kg)
Aroclor 1016	3,900	10	33
Aroclor 1221	140	10	33
Aroclor 1232	140	10	33
Aroclor 1242	220	10	33
Aroclor 1248	220	10	33
Aroclor 1254	220	10	33
Aroclor 1260	220	10	33

METALS	RSL (mg/kg)	MDL (mg/kg)	CRQL (mg/kg)
Lead	400	0.5	0.5

Notes: µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
RSL = Regional Screening Level
MDL = Method Detection Limit shown for SW-846 8310 (PAHs), 8082A (PCBs) and 6020A (lead)
CRQL = Contract Required Quantitation Limits (CLP)

Table 4

QUALITY ASSURANCE CROSS-REFERENCE TABLE

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents		
		RI/FS QAPP	RI SAP (2011)	Removal Site Evaluation SAP
Project Management and Objectives				
2.1 Title and Approval Page	- Title and Approval Page	Page 2	Page 1	Page 1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	Page 3	Page 2	Page 2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	Page 5	Worksheet 3	See RI SAP (2011).
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	Page 6	Worksheets 5, 6	See RI SAP (2011).
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	Page 7	Worksheets 9, 10	Pages 2-5

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents		
		RI/FS QAPP	RI SAP (2011)	Removal Site Evaluation SAP
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	Page 7	Worksheet 11	Pages 22-26
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	Not Applicable	Worksheet 13	See RI SAP (2011).
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	Section 5 of RI/FS Work Plan	Worksheets1 4, 16	Page 9
Measurement/Data Acquisition				
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration,	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance,	Section 5 of RI/FS Work Plan	Worksheet 14	Pages 2, 7-9

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents		
		RI/FS QAPP	RI SAP (2011)	Removal Site Evaluation SAP
Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	Testing, and Inspection Table			
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance,Testing,and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing and Inspection Table	Page 14	Worksheet 15	Pages 14 - 16
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal	Pages 13, 14	Worksheets 17-19	Pages 7, 11, 12
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/ Confirmatory Analysis Decision Tree	Page 14	Worksheet 20	Page 21
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	Page 16	Worksheet 30	Pages 9, 14 - 16

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents		
		RI/FS QAPP	RI SAP (2011)	Removal Site Evaluation SAP
3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control				
Assessment/Oversight				
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	Page 17	Worksheet 32	See RI SAP (2011).
4.2 QA Management Reports	- QA Management Reports Table	Page 20	Worksheet 33	See RI SAP (2011).
4.3 Final Project Report				
Data Review				
5.1 Overview				
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	Page 21	Worksheets 34, 35	See RI SAP (2011).
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		Not Applicable	Not Applicable	Not Applicable

Table 5

Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations[1]	No. of Field Replicates	No. of MS/ Laboratory Duplicate[2]	No. of Equip. Blanks	Total No. of Samples to Lab
Soil	PCBs	20 (MIS) 15 (Discrete)	4	1	2	65
	PAHs	20 (MIS) 15 (Discrete)	4	1	2	65
	Lead	4 (MIS) 15 (Discrete)	2	1	1	23

1. For 6 of the sampling locations where PCBs and PAHs will be analyzed, the total number of samples actually collected will be 30.
2. The laboratory will be instructed which sample to use as the MS/MSD. Further, the laboratory will take one sample from three separate DUs (as directed), and collect 5 sub samples before and after grinding.

Table 6

Measurement Performance Criteria Table – Field QC Samples

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Rinsate Blank	PAHs, PCBs, Lead	1 per 20 multi-increment samples	Bias / Contamination	No target compounds >QL (except common laboratory contaminants which should be <2XQL)	S&A
Field Replicate	PAHs, PCBs, Lead	1 per 10 multi-increment samples	Precision / Comparability	Values > 5X CRQL: ±30 Relative Percent Difference (RPD) Values < 5X CRQL: absolute difference between the two samples must be ≤CRQL	S&A
Matrix Spike/Laboratory Duplicate	PAHs, PCBs, Lead	1 per 20 environmental samples	Precision / Accuracy	Organics: Statistically determined by the laboratory. Inorganics: 75 – 125% Recovery (%R), RPD ≤ 20%	S&A

Table 7

Laboratory QC Samples Tables

Matrix	**Soil**
Analytical Group	**PCB**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	SW-846 8082A
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	65

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Prior to initial analysis and changing of reagents	No peak observed within the retention time of any analyte that would prevent determination of that analyte.	Determine source of contamination, eliminate it, and re-perform blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No peak observed within the retention time of any analyte that would prevent determination of that analyte.
Calibration Standard	One every 12 hours prior to sample analysis and one per 20 samples analyzed	Response factors within 20 percent of initial calibration	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL
Laboratory Control Sample (LCS)	One per 20 samples analyzed	%R requirements in method tables.	Recalculate, check spike solutions, or recalibrate if necessary.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	%R requirements in method tables.

MS/MSD	One per 20 samples analyzed	%R requirements in method tables.	Recalculate, check spike solutions, or recalibrate if necessary.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	%R requirements in method tables.
Instrument Standard (IS)	Each time quantitiation is accomplished using an internal standard	Retention time < 30 seconds; EICP area within 50% of last CCV (12 hours) for each IS.	Check calculations, spike solution, and instrument performance. Take Corrective Action to technical acceptance criteria. Narrate.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Retention time < 30 seconds; EICP area within 50% of last CCV (12 hours) for each IS.

http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/8082a.pdf

Matrix	**Soil**

Analytical Group	**PAHs**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	SW-846 8310
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	65

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per 20 samples analyzed	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
MS/MSD	One per 20 samples analyzed	Refer to Sections 8.5 and 8.7 of Method 8000.	Check calculations, spiking solutions, and instrument performance and then reanalyze sample.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Precision	Refer to Sections 8.5 and 8.7 of Method 8000.
Laboratory Control Sample (LCS)	One per 20 samples analyzed	Refer to Sections 8.5 and 8.7 of Method 8000.	Check calculations, spiking solutions, and instrument performance and then reanalyze sample.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Precision	Refer to Sections 8.5 and 8.7 of Method 8000.
IS	3- 5 per sample	Retention time $\pm$ 20 seconds; EICP area within 70-130% of last CCV (12 hours) for each IS.	Check calculations, spike solution, and instrument performance. Take Corrective Action to technical acceptance criteria. Narrate.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Retention time $\pm$ 20 seconds; EICP area within 70-130% of last CCV (12 hours) for each IS.

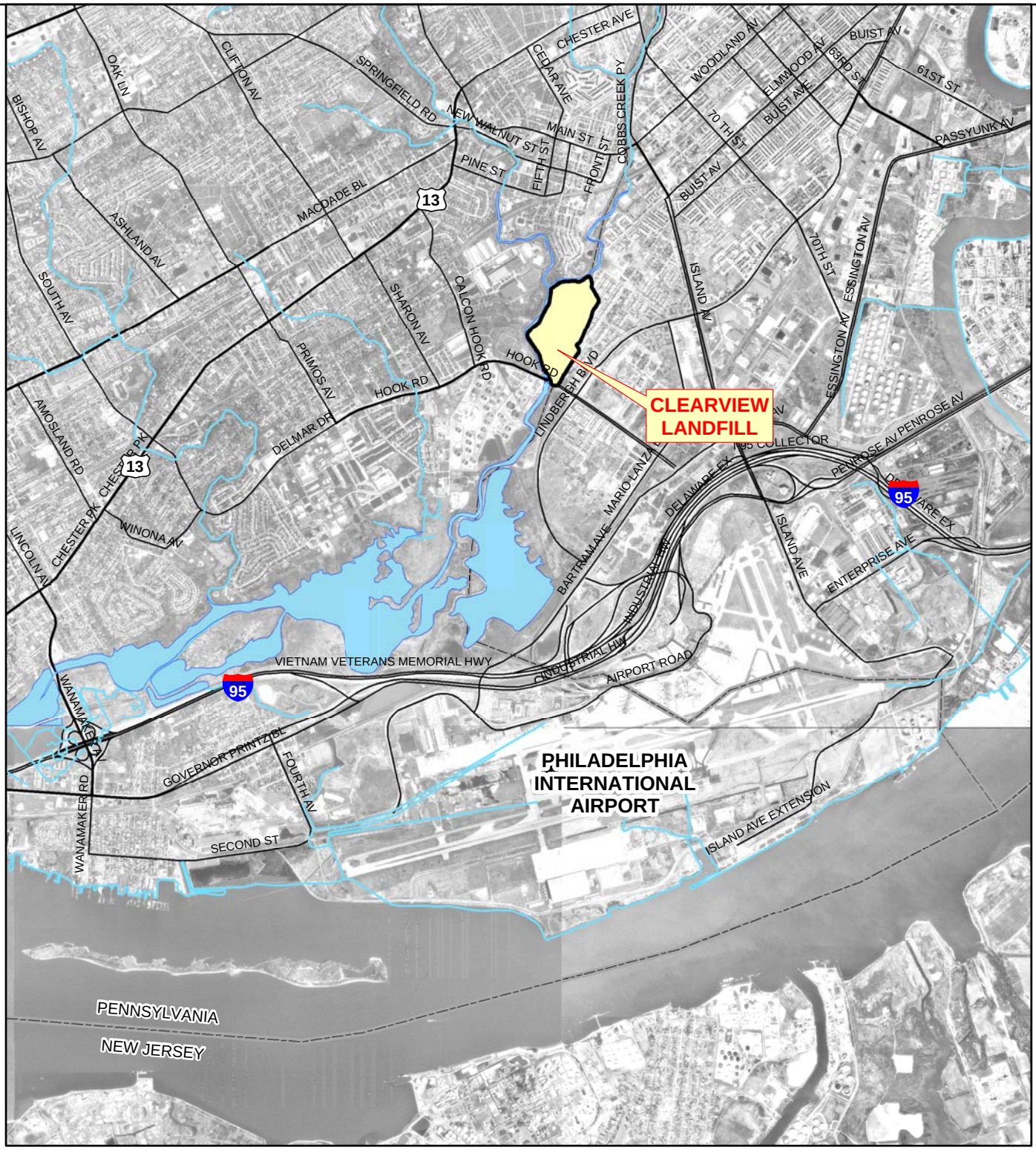
http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/8000b.pdf

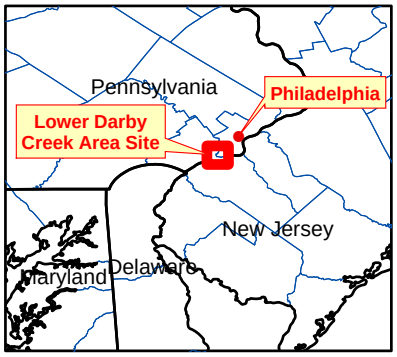
http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/8310.pdf

Matrix	**Soil**
Analytical Group	**Lead**
Concentration Level	Low
Sampling SOP	SA-1.1
Analytical Method	SW-846 6020A
Sampler's Name	TBD
Field Sampling Organization	TtNUS
Analytical Organization	TBD
No. of Samples	23

QC Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One per 20 samples analyzed	No target compounds >CRQL except common lab contaminants which should be <2xCRQL	Re-clean, retest, re-extract, reanalyze blank. Reanalyze all sample associated with unacceptable blank.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds >CRQL except common lab contaminants which should be <2xCRQL
MS/MSD	One per 20 samples analyzed	Maximum limit is ± 25% of spiked value and 20 RPD.	Check calculations, spiking solutions, and instrument performance and then reanalyze sample.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Precision	Maximum limit is ± 25% of spiked value and 20 RPD.
Laboratory Control Sample (LCS)	One per 20 samples analyzed	Maximum limit is ± 20% of spiked value.	Check calculations, spiking solutions, and instrument performance and then reanalyze sample.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Precision	Maximum limit is ± 20% of spiked value.
IS	3- 5 per sample	Retention time ± 20 seconds; EICP area within 70-130% of last CCV (12 hours) for each IS.	Check calculations, spike solution, and instrument performance. Take Corrective Action to technical acceptance criteria. Narrate.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Retention time ± 20 seconds; EICP area within 70-130% of last CCV (12 hours) for each IS.

http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/6020a.pdf





N
W E
S

Figure 1
Location of the Lower Darby Creek Area Site.

1 inch = 4,000 feet

0 1,500 3,000 6,000 Feet

N:\Projects\T40000\T47111 LowerDarby\Data\GIS\RI_Report_December_2006\1-1_General_LocationREVd.mxd

GP018
Delaware Co.
Philadelphia Co.
GP019
GP042
GP020
GP033
1
4
GP041
GP021
2
GP032
3
GP022
GP023
GP024
GP025

Grid in PA State Plane South (ft)

N:\Projects\T40000\T47111 LowerDarby\Documents\Time Critical Removal\Decision Unit Maps\SS_City_Park_North_Decision Units.mxd

County Boundary
Historical Extent of Clearview Landfill
Decision Unit Boundary
Geoprobe Location
MIS Sampling Point

60 30 0 60 120 Feet

1:720 1 inch = 60 feet

N
W E
S

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Figure 2
Surface Soil Decision Units
North City Park
Clearview Landfill
Philadelphia, Pennsylvania

GP229
11
GP253
GP251
GP250
GP249
GP231
GP248
GP234
GP233
12
GP236
14
13
GP237
10
GP238
GP241
GP239
GP242
GP243
GP244
7
GP240
GP067
GP246
GP245
8
GP035
GP034
6
9
GP215
GP046
5
GP037
GP247
GP009
GP036
GP039
GP050
Delaware Co.
Philadelphia Co.
Darby Creek

Grid in PA State Plane South (ft)

County Boundary
Historical Extent of Clearview Landfill
Geoprobe Location
MIS Sampling Point

80 40 0 80 160 Feet
1:960 1 inch = 80 feet

N
W E
S

Figure 3
Surface Soil Decision Units
Southern Industrial Area
Clearview Landfill
Philadelphia, Pennsylvania

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N:\Projects\T40000\T47111 LowerDarby\Documents\Time Critical Removal\Decision Unit Maps\SS_City_Park_North_Decision Units.mxd

GP253
GP251
GP250
GP249
GP231
GP248
GP234
GP233
GP236
GP237
GP238
GP241
GP239
GP242
GP243
16
GP244
17
GP240
20
GP246
GP245
15
18
GP034
GP035
GP215
19
Delaware Co.
Philadelphia Co.
Darby Creek
GP037
GP247

Grid in PA State Plane South (ft)

- Geoprobe Location
- County Boundary
- Historical Extent of Clearview Landfill
- Decision Unit Boundary
- MIS Sampling Point

60 30 0 60 120 Feet

1:720 1 inch = 60 feet

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N W E S

Figure 4
Subsurface Soil Decision Units
Southern Industrial Area
Clearview Landfill
Philadelphia, Pennsylvania

N:\Projects\T40000\T47111 LowerDarby\Documents\Time Critical Removal\Decision Unit Maps\SS_City_Park_North_Decision Units.mxd