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ADDENDUM NO. 4
FIELD SAMPLING PLAN
NATURAL ATTENUATION STUDY

FOR THE

BLACKWELL LANDFILL
DUPAGE COUNTY, ILLINOIS

Montgomery Watson File No. 1252008

Prepared For:

Forest Preserve District Of DuPage County
DuPage County, Illinois

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June 1998

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Prepared For:

Forest Preserve District Of DuPage County
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1.0 INTRODUCTION

A Field Sampling Plan (FSP) was previously submitted in August 1996 as part of the Pre-Design Investigation Work Plan for the Blackwell Landfill site. The FSP presented the scope of work, organization, objectives, functional activities, and specific operating procedures associated with planned site investigation activities.

The following three addenda to the FSP have been submitted since August 1996:

- Addendum No. 1 (November 1997) supplemented the August 1996 FSP and provided standard operating procedures for sampling required during the North Stormwater Pipe Investigation and the Surface Water Sampling of Sand Pond at the site.

- Addendum No. 2 (November 1997) provided additional standard operating procedures for sampling during Operation and Maintenance (O&M) of the leachate collection system and gas venting system. Specifically, this addendum provided procedures for sampling leachate in the leachate holding tank, and sampling landfill gas from gas vents at the site.

- Addendum No. 3 (May 1998) addressed the objective, equipment, and sampling protocols to be used during ambient air sampling along the perimeter of Mt. Hoy at the site.

This Addendum No. 4 provides the objective and sampling requirements for the planned natural attenuation study at the site.

2.0 BACKGROUND

Historical site data suggest that natural attenuation is occurring in the upper outwash aquifer. The principal evidence for natural attenuation includes:

- The extent of the affected area in the outwash aquifer has not changed significantly since 1992, so it is not expanding.

- The number and concentrations of VOCs in the affected area of the outwash aquifer have generally decreased since 1992, suggesting that the source has lower concentrations now than earlier.

- The differences in the suites of VOCs in leachate and downgradient groundwater suggest that some organic compounds are degrading. The VOCs detected in leachate are all potentially mobile in groundwater but many are not detected downgradient from the landfill. It appears that the non-chlorinated VOCs (acetone, 2-butanone, 4-methyl-2-pentanone, ethylbenzene, toluene, xylenes and benzene) are being attenuated rapidly because they are not presently detected downgradient of the landfill, even in the closest monitoring wells.

- Chlorinated VOCs that are migrating at low concentrations from the landfill also appear to be degrading in groundwater, but at a slower rate than the non-chlorinated compounds. Degradation is indicated not only by generally lower concentrations in 1997 compared to 1992 and the apparently non-expanding configuration of the affected area during this five-year period, but also by the types of compounds identified. Most of the VOCs that have been detected in downgradient groundwater are typical degradation products of PCE, TCE and/or TCA solvents. For example, PCE and/or TCE commonly degrade via a sequence that may include 1,2-dichloroethene, vinyl chloride and/or chloroethane. The dominance of these typical degradation products as downgradient groundwater contaminants is strong evidence that natural attenuation processes are occurring.

This study will include analysis of groundwater samples for additional natural attenuation parameters, the collection and analysis of soil samples from the upper outwash aquifer, and predictive modeling to evaluate the significance of natural attenuation at the site. The sampling and analysis programs for site groundwater and soil are described in the following section.

3.0 SCOPE OF WORK

3.1 NATURAL ATTENUATION STUDY

Objective

The objective of the natural attenuation study is to provide sufficient site data with which to evaluate whether site contaminants are degrading via natural processes.

Equipment

- Health and Safety Plan;
- Statement of Work/Sampling Plan;
- Latex or nitrile gloves;
- Water level indicator;
- Generator;
- Submersible pump;
- Polyethylene tubing;
- Hydrolab Datasonde 3 flow-through cell;
- HACH field test kits (for alkalinity and ferrous iron);
- Field boring forms;
- Tape measure;
- Soil knife/spatula;
- PID;
- Decontamination equipment (DI water, Alconox, buckets, brushes, etc.);
- Sample containers, sample labels;
- Field observation sheet or field notebook;
- Chain-of-custody forms; and
- Sample coolers with ice.

3.2 GROUNDWATER SAMPLING AND ANALYSIS

Groundwater sampling and analysis associated with the natural attenuation study will consist of both field and laboratory testing. Sampling of existing monitoring wells will be concurrent with the routine quarterly monitoring event which follows approval of this addendum. Field protocols will be consistent with the August 1996 Work Plan for Pre-Design Investigation Activities (FSP, Volume III of IV, and QAPP, Volume IV of IV) and subsequent addenda. New or modified field protocols are addressed in this addenda. New or modified analytical procedures are addressed in QAPP Addendum No. 7 (June 1998).

Groundwater samples will be collected from seven selected monitoring wells screened in the upper outwash aquifer (G-130, G-118S, G-129, G-128S, G-127, G-107S, and G-122), and five screened in the bedrock aquifer (G-132D, G-134, G-138, G-139, and G-140D).

The locations of these wells are shown on Figures 1 and 2, respectively. All of these wells are sampled during routine quarterly monitoring, with the exception of G-128S.

Sufficient sample volume will be collected from each well for the analysis of selected natural attenuation parameters, which are summarized on Table 1. Table 2 lists the laboratory requirements (bottle type, preservation, holding times, etc.) for these parameters.

Alkalinity and ferrous iron (iron II) will be measured using HACH™ field test kits, in accordance with manufacturers' instructions. In addition to these parameters, temperature, pH, specific conductivity, redox potential, dissolved oxygen, and turbidity are measured during quarterly groundwater sampling. These parameters will be measured using the Hydrolab Datasonde 3 flow-through cell, as described in QAPP Addendum No. 5 (February 1998).

3.3 SOIL SAMPLING AND ANALYSIS

Subsurface soil samples will be collected from the upper outwash aquifer at three locations; within the affected area, at the downgradient edge of the affected area, and downgradient of the affected area. The sample locations will be chosen such that , to the extent possible, they are in proximity with monitoring wells sampled as part of the natural attenuation study. Sample locations will also be selected on the basis of accessibility and the inferred position of the leading edge of the affected area. Soil sample depth will be within the screen interval depth of the "nearby" monitoring well.

Soil borings will be advanced to the sample interval using hollow stem auger methods. A split spoon sample, or samples, will then be collected within the target depth interval. Retrieved samples will be placed into the appropriate containers with minimum headspace. The containers will be maintained at a temperature of approximately 4°C during storage and transport to the analytical laboratory.

Chemical, physical and microbiological analyses will be performed on the soil samples submitted to the off-site laboratory. These chemical parameters are summarized in Table 1. Table 2 lists the laboratory requirements (bottle type, preservation, holding times, etc.) for these parameters.

3.4 QUALITY CONTROL SAMPLING

Quality control samples, including duplicates/splits, matrix spike/matrix spike duplicates (MS/MSDs), and field blanks will be collected and analyzed in accordance with the QAPP and QAPP addenda. Table 3 summarizes the expected number of investigative and quality control samples associated with the natural attenuation study.

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TABLE 1

Summary of Matrices, Analysis Parameters, Reporting Limits, and Analytical Laboratory Responsibilities
Natural Attenuation Study Blackwell Landfill NPL Site
DuPage County, Illinois

Analysis	Method*	Compounds	Reporting Limits	Laboratory	Data Use
GROUNDWATER					
TOC	9060	TOC	1 mg/l	Teklab, Inc.	Attenuation
BOD	SMWW 405.1	BOD	1 mg/l	First Environmental Labs	Attenuation
Nitrate (total) as N	353.3 Mod	Nitrate as N	0.05 mg/l	First Environmental Labs	Attenuation
Nitrite	354.1	Nitrite	0.005 mg/l	First Environmental Labs	Attenuation
Sulfide	376.2	Sulfide	0.05 mg/l	First Environmental Labs	Attenuation
Methane	ASTM D-1945/D-3588	Methane	0.02 mg/l	Keystone Labs	Attenuation
Ethane	ASTM D-1945/D-3588	Ethane	0.03 mg/l	Keystone Labs	Attenuation
Ethene	ASTM D-1945/D-3588	Ethene	0.03 mg/l	Keystone Labs	Attenuation
SOILS					
Total Solids	160.3	Solids	0.1%	Keystone Labs	Attenuation
TOC	9060	TOC	100 mg/kg	Keystone Labs	Attenuation
Nitrate as N	SMWW 4500-D	Nitrate	5 mg/kg	Keystone Labs	Attenuation
Sulfate	6010	Sulfur as Sulfate	100 mg/kg	Keystone Labs	Attenuation
pH	9045	pH	NA	Keystone Labs	Attenuation
Total Heterotrophs	SMWW 9215B	Total Heterotrophs	200 CFU	Keystone Labs	Attenuation
Aerobic HC Degraders	SMWW 9215B	Aerobic HC Degraders	200 CFU	Keystone Labs	Attenuation
Acridine Orange Counts	SMWW 9216 B	Direct total bacteria cell counts	100 cells/ml	MiL, Inc.	Attenuation

* - unless otherwise noted method reference is from USEPA
QAPP - Quality Assurance Project Plan
TOC - Total Organic Carbon
BOD - Biological Oxygen Demand
N - Nitrogen
Mod - Modified
mg/l - milligrams per liter
mg/kg - milligrams per kilogram
ASTM - American Standards Testing Method

SMWW - Standard Methods for the analysis of Water and Wastewater
NA - Not applicable
HC - Hydrocarbon
CFU - Colony Forming Units
MiL, Inc. - Microbe Inotech Laboratory, Inc.
COD - Chemical Oxygen Demand
TDS - Total Dissolved Solids
TSS - Total Suspended Solids
OC - Organochlorine
Attenuation - refers to parameters to assess natural attenuation

TABLE 2

Sample Quantities, Containers, Preservatives, and Packaging Requirements
Natural Attenuation Study Blackwell Landfill NPL Site
DuPage County, Illinois

Matrix	Analysis	Bottles/Jars	Preservation	Holding Time	Volume	Shipping	Packaging
Note: this table only includes matrices and analyses not included in the 1996 QAPP Table 1-2.							
Groundwater							
	TOC	125 ml HDPE	Cool to 4 C, HCl or H2SO4 to pH<2	28 days	Fill to shoulder of bottle	Shipped daily by overnight carrier	Vermiculite
	BOD	2 L HDPE	Cool to 4 C, H2SO4 to pH<2	48 hours	Fill to shoulder of bottle	Shipped daily by overnight carrier	Vermiculite
	Nitrate as N	250 ml HPDE	Cool to 4 C, H2SO4 to pH<2	28 days	Fill to shoulder of bottle	Shipped daily by overnight carrier	Vermiculite
	Nitrite	125 ml HDPE	Cool to 4 C	48 hours	Fill to shoulder of bottle	Shipped daily by overnight carrier	Vermiculite
	Sulfide	1 L HPDE	Cool to 4 C, 4 ml ZnAc plus NaOH to pH> 9	7 days	Fill to shoulder of bottle	Shipped daily by overnight carrier	Vermiculite
	Methane, ethane, and ethene	3-40 VOA vials	Cool to 4 C, HCl to pH<2	7 days	Fill completely, no headspace	Shipped daily by overnight carrier	Vermiculite
Soil							
	Total Solids	One 4-oz glass jar	Cool to 4 C	7 days	Full	Shipped daily by overnight carrier	Vermiculite
	TOC	One 4-oz glass jar	Cool to 4 C	28 days	Full	Shipped daily by overnight carrier	Vermiculite
	Nitrate as N	One 4-oz glass jar	Cool to 4 C	28 days	Full	Shipped daily by overnight carrier	Vermiculite
	Sulfate	One 4-oz glass jar	Cool to 4 C	28 days	Full	Shipped daily by overnight carrier	Vermiculite
	Total Heterotrophs	One 8-oz glass jar	Cool to 4 C	24 hours	Full	Shipped daily by overnight carrier	Vermiculite

TABLE 2

Sample Quantities, Containers, Preservatives, and Packaging Requirements
Natural Attenuation Study Blackwell Landfill NPL Site
DuPage County, Illinois

Matrix	Analysis	Bottles/Jars	Preservation	Holding Time	Volume	Shipping	Packaging
	Aerobic HC Degraders	One 8-oz glass jar	Cool to 4 C	5 days	Full	Shipped daily by overnight carrier	Vermiculite
	Acridine Orange Counts	One 8-oz glass jar	Cool to 4 C	24 hours	Full	Shipped daily by overnight carrier	Vermiculite
	Soil pH	One 8-oz glass jar	Cool to 4 C	24 hours	Full	Shipped daily by overnight carrier	Vermiculite

Notes:
- Holding time begins at the time the sample is collected.
- The packaging material should completely cushion the sample bottles - bottom, sides and top.

TOC - Total Organic Carbon
ml - milliliter
HDPE - High density polyethylene
C - Celsius
HCl - Hydrochloric acid
H2SO4 - Sulfuric acid
BOD - Biological Oxygen Demand
L - Liter
N - Nitrogen
ZnAc - Zinc Acetate
NaOH- Sodium Hydroxide
COD - Chemical Oxygen Demand
TDS - Total Dissolved Solids
TSS - Total Suspended Solids
OC - Organochlorine
oz - ounce
HC -Hydrocarbon

TABLE 3

Sample Types and Estimated Sample Quantities
Natural Attenuation Study Blackwell Landfill NPLSite
DuPage County, Illinois

Matrix	Laboratory	No. of Samples	Field Duplicates	Field Blank	MS/MSD	Total No. of Samples	Laboratory Parameters	Field Parameters
Groundwater								
	Teklab	12	2	0	0	14	TOC	Alkalinity, and ferrous iron (Iron II)
	First	12	2	2	0	16	BOD	
	First	12	2	2	1	17	Nitrate as N	
	First	12	2	2	1	17	Nitrite	
	First	12	2	2	1	17	Sulfide	
	Keystone	12	2	2	1	17	Methane	
	Keystone	12	2	2	1	17	Ethane	
	Keystone	12	2	2	1	17	Ethene	
Soil								
	Keystone	3	1	0	0	4	Solids	
	Keystone	3	1	0	0	4	TOC	
	Keystone	3	1	0	1	5	Nitrate as N	
	Keystone	3	1	0	1	5	Sulfate	
	Keystone	3	1	0	0	4	pH	
	Keystone	3	1	0	0	4	T. Heterotrophs	
	Keystone	3	1	0	0	4	HC Degraders	
	MiL, Inc.	3	1	0	0	4	Acridine Orange counts	

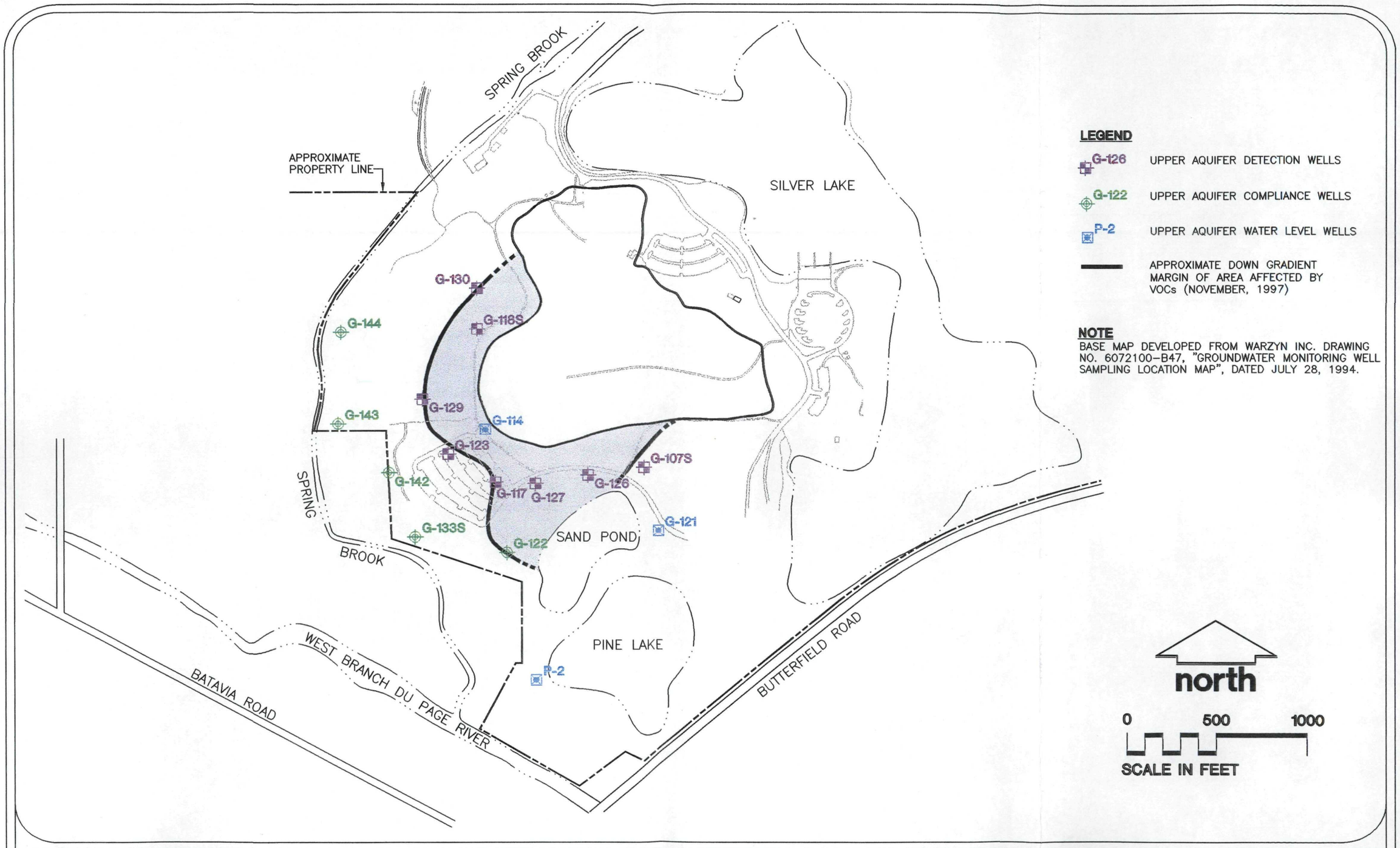
TABLE 3

Sample Types and Estimated Sample Quantities
Natural Attenuation Study Blackwell Landfill NPLSite
DuPage County, Illinois

Matrix	Laboratory	No. of Samples	Field Duplicates	Field Blank	MS/MSD	Total No. of Samples	Laboratory Parameters	Field Parameters

Notes:
- Unless otherwise noted, samples will be considered low concentration, and will be packaged and shipped accordingly.
- Full names and addresses of laboratories may be found in Section 1.3 of this addendum.
  - First - First Environmental Laboratory, Inc.
  - Teklab - Teklab, Inc.
  - Keystone - Keystone Laboratory, Inc.
  - MiL - Microbe Inotech Laboratory, Inc.
- Refer to Table 7-1 for method references. Refer to Table 1-2 of 1996 QAPP and Table 1-3 of this addendum for sample volume and preservative requirements.
- TDS aliquot to be field filtered.

No. - Number
MS/MSD - Matrix Spike/ Matrix Spike Duplicate
TOC - Total Organic Carbon
BOD - Biological Oxygen Demand
N - Nitrogen
T. - Total
HC - Hydrocarbon
COD - Chemical Oxygen Demand
TDS - Total Dissolved Solids
TSS - Total Suspended Solids
OC Pest - Organochlorine Pesticides



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Chicago, Illinois

FIGURE 1
UPPER AQUIFER WELL AND PIEZOMETER LOCATIONS
BLACKWELL LANDFILL NPL SITE
DU PAGE COUNTY, ILLINOIS

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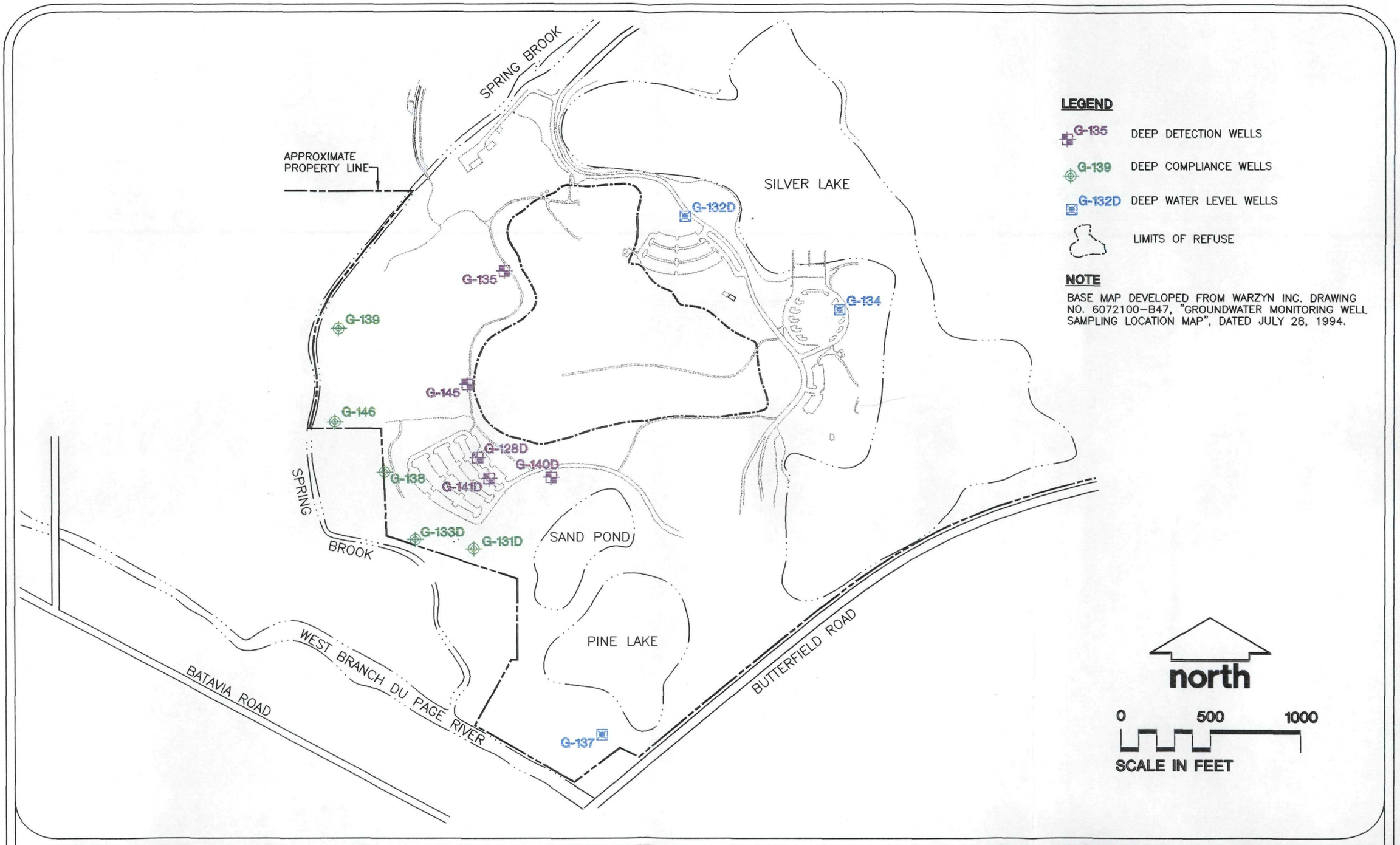

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FIGURE 2
BEDROCK AQUIFER WELL LOCATIONS
BLACKWELL LANDFILL NPL SITE
DU PAGE COUNTY, ILLINOIS

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